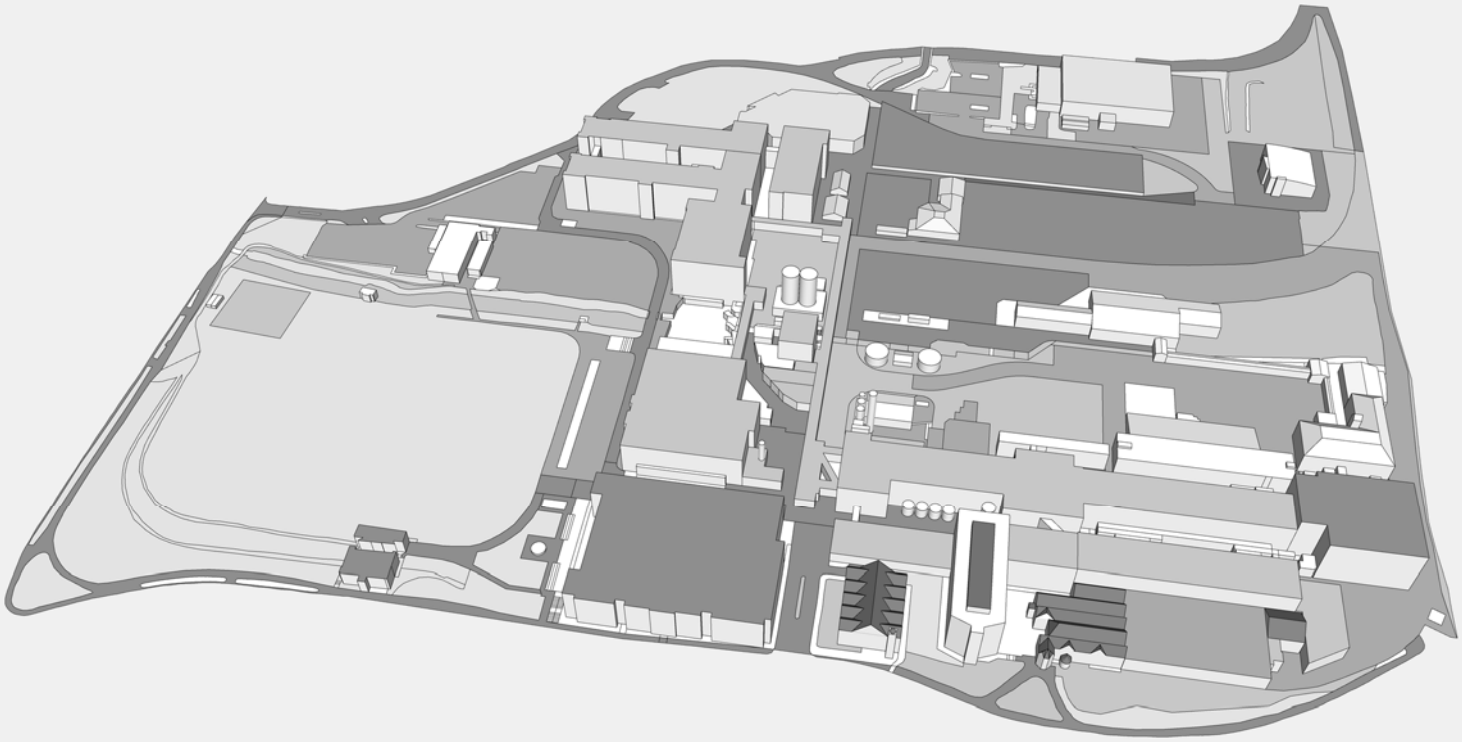

Mondelez UK Confectionery Production Ltd, Bournville Chocolate Works

Application for Environmental Permit Variation

July 2022

Permit Reference: EPR/LP3734FJ

Mondelēz International
SNACKING MADE RIGHT

Project Environmental Solutions

Mondelez UK Confectionery Production Ltd, Bournville Chocolate Works

Application for Environmental Permit Variation LP3734FJ

July 2022

Document Structure

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Quality control sheet

Project details

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Non-technical Summary

OVERVIEW OF ACTIVITIES

The Mondelez UK Confectionery Production Limited (referred to hereafter as Mondelez) Bournville chocolate works installation manufactures a range of chocolate based confectionery products for retail markets. The products manufactured are based upon milk chocolate crumb, cocoa liquors, cocoa butters and liquid chocolate mass produced outside the installation. These key raw materials are combined with additional ingredients (centres and inclusions) in recipes to produce brand named products which are wrapped and packed before distribution off site. The site has operated continuously since 1880.

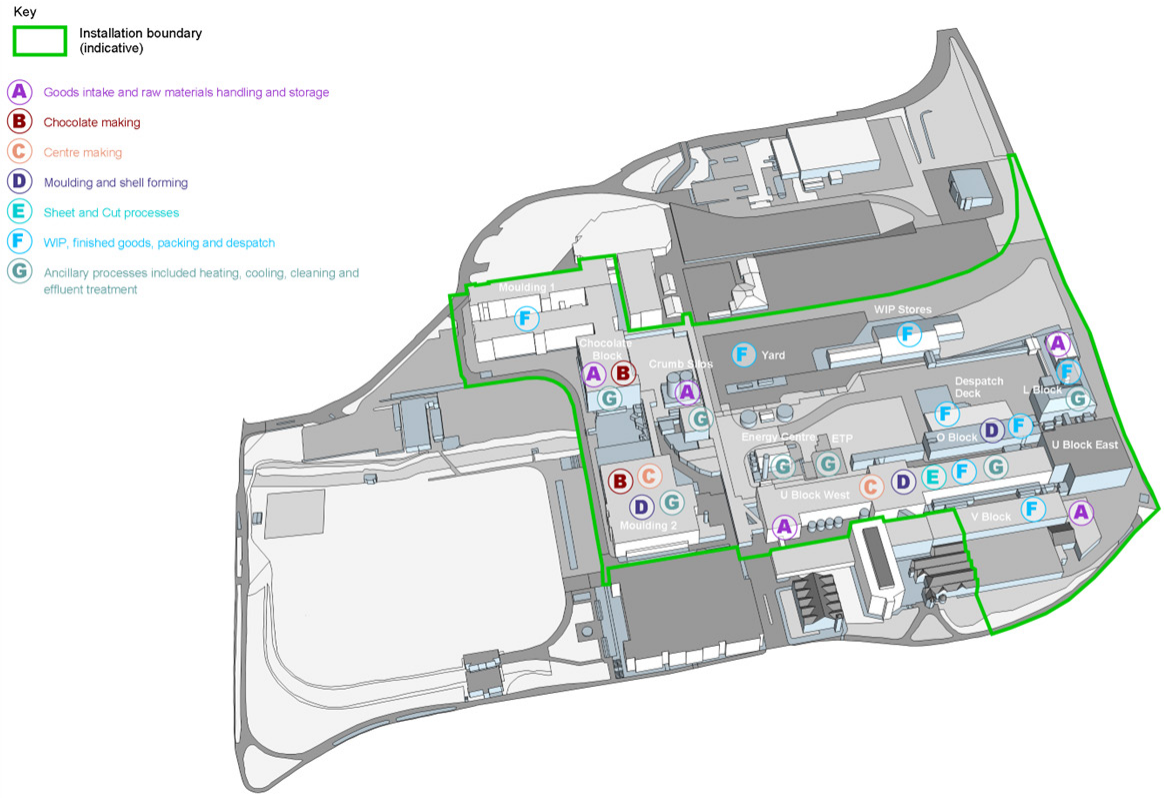
SUMMARY OF CHANGES

This permit variation application is being made in order that an updated and rationalised permit for the installation can be issued, incorporating a number of changes that have been made to site activities and operations as well as further planned changes.

Key updates are as follows:

- Amendment to installation boundary (partial low risk surrender) to remove a currently permitted area which now forms part of the Cadbury World visitor attraction.
- Installation of effluent balance tanks and chemical dosing (pH correction) and amendments to the inventory of point source emissions to sewer.
- Manufacturing process changes, including changes to refrigeration plant.
- Boiler de-rating.
- Changes to EMS.
- Other minor changes including relocation of the flavour store and expansion of the research and development (R&D) facility.
- Submission of generally updated information, including a revised and updated technical description and inventory of point source emissions to air, water and sewer.

Figure NTS-1 Illustration showing main activity areas



IMPACT ASSESSMENT

Emissions from the process to air and water and their potential effects on the environment, including local human and ecological sensitive receptors have been reviewed. It is concluded that there are no significant negative environmental impacts predicted to arise because of changes to the activities covered within the scope of this permit variation application.

A noise impact assessment has been undertaken. The assessment uses background noise levels and source noise levels measured off and on site. The data collected from these surveys has been used to construct a detailed 3D noise propagation model of the installation to predict the cumulative levels of operational noise at the nearest noise sensitive receptors in accordance with appropriate methodology and guidance. The noise model includes all new noise sources (i.e. chiller plant) covered by the scope of the permit variation application, as well as pre-existing noise sources.

The assessment shows that noise from the site during the day is expected to result in a low impact. The assessment shows that noise from the site has the potential to cause adverse impact at night, and therefore mitigation methods using the best available techniques (BAT) have been recommended. These enhanced noise mitigations have already been, or will be, implemented at the Bournville site.

A noise management plan has been prepared and is submitted with this application.

Improvements have been undertaken to effluent management on site to improve compliance with the site Trade Effluent Discharge consent. Three separate discharge points have now been re-routed to a single point with provision for effluent buffering and pH correction. The existing three discharge points are retained for use in emergency / abnormal circumstances and a new emission point to sewer is added to the permit. The quantity and quality of the discharge has not changed (other than in respect of buffering and pH correction) and therefore no further assessment is required.

The changes to site operations and activities covered by this variation application have the potential to affect accident and incident scenarios. Therefore, a review of accident scenarios associated with the proposed changes has been undertaken. An EMS is in operation at the site, which includes measures to identify, manage and mitigate potential environment risks associated with accident scenarios.

Mondelez wish to surrender a small area of the installation as a 'low risk surrender'. The land to be surrendered is occupied by a 7-storey building known as Cocoa Block East. At the time of the original permit application (in 2004) part of this building was used to store finished goods. This building is no longer used for this purpose and is now associated with the Cadbury World visitor attraction. There are no Schedule 1 listed activities, nor directly associated activities, currently undertaken within this area. No potentially contaminative substances have been used or stored within Cocoa Block since the time the original permit was issued and there are no records of any accidents or incidents which may have resulted in land contamination occurring in this area.

SITE OPERATIONAL CONTROLS

The Bournville Chocolate Works installation is operated in accordance with an Environmental Management System (EMS), which includes controls to minimise point source and fugitive emissions to air, water and land. A planned maintenance and inspection programme is in place to optimise the operation of plant.

Section I: Application Forms

Form A

Form C2

Form C3

Form E2

Form F1

Section II: Technical Description

This section of the application provides an updated and consolidated Technical Description of activities undertaken within the Bournville Chocolate Works installation, including the changes addressed within this permit variation application.

The Information provided in this section should be viewed in parallel with:

- Section I: Application Forms
- Section III: Supporting Information

1. Introduction and overview

1.1 The Mondelez UK Confectionery Production Limited (referred to hereafter as Mondelez) Bournville Chocolate Works installation manufactures a range of chocolate based confectionery products for retail markets. The products manufactured are based upon milk chocolate crumb[1], cocoa liquors, cocoa butters and liquid chocolate mass produced outside the installation. These key raw materials are combined with additional ingredients (centres and inclusions) in recipes to produce brand named products which are wrapped and packed before distribution off site. The site has operated continuously since 1880.

1.2 The installation is currently regulated under Environmental Permitting (England and Wales) Regulations 2016 (EPR) Schedule 1, Part 2, Chapter 6, Section 6.8 A(1)(d)(i) and Section 1.1 B(a) in Part 1 to Schedule 1 of the PPC Regulations by installation permit reference EPR/LP3734FJ/V004 issued on 14/08/14.

1.3 This permit variation application aims to provide an updated and rationalised permit for the installation to incorporate a number of changes made to site activities and operations as well as further planned changes.

1.4 Key updates are as follows:

- Amendment to installation boundary (partial low risk surrender) to remove a currently permitted area which now forms part of the Cadbury World visitor attraction.
- Installation of effluent balance tanks and chemical dosing (pH correction) and amendments to the inventory of point source emissions to water and sewer.
- Manufacturing process changes, including changes to refrigeration plant.
- Boiler de-rating.
- Changes to EMS.
- Other minor changes including relocation of the flavour store and expansion of the research and development (R&D).
- Submission of generally updated information, including a revised and updated technical description and inventory of point source emissions to air, water and sewer.

1.5 These are addressed in turn in the following sections.

1 Chocolate Crumb – raw material manufactured outside of the installation from sweetened condensed milk and cocoa liquor

2. Installation boundary changes

2.1 The current installation boundary includes a 7-storey building known as Cocoa Block East. At the time of the original permit application (in 2004) part of this building was used to store finished goods. This building is no longer used for this purpose and is now associated with the Cadbury World visitor attraction. There are no Schedule 1 listed activities, nor directly associated activities, undertaken within this area.

2.2 The design Site Protection and Monitoring Programme[2] (SPMP), submitted in June 2005, includes a plan showing the location of potentially contaminative substances located within the Mondelez Bournville installation. This plan, reproduced within the Surrender Site Condition Report (Appendix 2), indicates that there were no potentially contaminative substances located within Cocoa Block East at the time the original permit was issued. No such substances have been used in Cocoa Block East in the intervening period and there are no records of any accidents or incidents which may have resulted in land contamination occurring in this area. Therefore, Mondelez wishes to surrender this small area of the installation as a low risk surrender. More detailed information is provided in the Surrender Site Condition Report provided as Appendix 2 to this application.

2 Enviros Consulting Ltd, Bournville PPC Installation: Design of Site Protection and Monitoring Programme, June 2005

3. Effluent pre-treatment

3.1 Improvements have been made to effluent management on site in order to improve compliance with the site Trade Effluent Discharge consent. Previously, process effluent was discharged via three separate locations (referred to in the permit as emissions points S590, S591 and S630). Each of these separate effluent streams have now been re-routed via above ground stainless steel pipes with flanged joints, to a common effluent balance tank which provides the facility to balance effluent flow and composition.

Figure A Stainless steel effluent pipes on pipe bridge

3.2 Continuous monitoring of pH and flow is carried out with chemicals dosed as required to adjust pH to comply with discharge consent conditions. pH correction is provided via chemical dosing from bulk caustic and acid tanks prior to discharge to public sewer in accordance with a revised Trade Effluent Discharge Consent issued by Severn Trent Water. The capacity of the pH correction plant is 35 m^3/hour, 840 m^3/day effluent.

3.3 The existing three discharge points will be retained for use in emergency / abnormal circumstances (e.g. maintenance undertaken within the new pH correction facility) and a new emission point to sewer is proposed to be added to the permit for normal operational discharges via the effluent pre-treatment plant.

3.4 The operation of this plant requires the addition of a new listed activity – Section 5.4 Part A (1) (a) (ii) – Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving physico-chemical treatment.

3.5 A full description of effluent pre-treatment and handling activities is provided in the Technical Description (Section II:4 below) and a summary of point source emissions to sewer is provided in Section III, Question C3:2. The revised drainage plan with emissions points is shown in Figure 4.

4. Process / refrigeration changes

4.1 A number of manufacturing projects have recently been completed or are ongoing. These changes are described in more detail below:

U Block

- **New ammonia plant.** A new ammonia-based chiller plant was installed on the roof of U Block in 2015. This new plant provides chilled water for various processing lines as well as space cooling in specific areas. The new plant, comprising four individual chiller units, was installed following discussions with the Environment Agency, although no formal permit variation application was requested or submitted at this time. The chillers are of a modern design with high efficiency components including energy efficient control logic, featuring high efficiency, low noise compressor drive motors and low noise, variable speed fans to maximise system efficiency at part load conditions. Components are specified to minimise the risk of refrigerant leakage, reduce refrigerant charge, simplify maintenance and prolong plant life expectancy. This includes use of welded steel pipework construction and an integrated ammonia gas detection system.

- **U Block production line.** A new moulding and packing line was installed in U Block in 2022 following removal of an existing chocolate Easter egg making line. This line provides additional capacity for a process and product which was already being manufactured at Bournville. As part of this project a new chiller was added to the roof of U Block to replace obsolete cooling equipment. This chiller operates completely separately from the 2015 ammonia plant referred to above. The new chiller is specified with an extra low noise sound attenuator package and utilises R1234ze refrigerant gas which has a lower global warming potential (GWP) than the existing[3]. The new unit is more energy efficient overall due to the more modern design and newer components.

O Block

- **Process improvements (O Block).** New packaging machinery has been installed on the third floor of O Block to replace obsolete equipment and improve packing efficiency and capacity for the chocolate buttons line.

3 A GWP value of 7 is reported

Moulding 2 (M2)

- **Process improvements.** Manufacturing improvements associated with Line 3 chocolate making are being undertaken. These improvements are designed to increase production efficiency and capacity within Line 3 and includes replacement of aged and obsolete conches (dated *c.*1960) with new conching equipment.

- **New refrigeration plant.** Associated with the Line 3 conch replacement project, one new chiller has been installed on the roof of M2 building in 2021. This new equipment has replaced two obsolete cooling systems, including associated pipework and cooling towers. The previously used systems were asset expired and relatively inefficient and difficult to maintain. The new chiller is specified with an extra low noise sound attenuator package and utilises R1234ze refrigerant gas which has a lower global warming potential than the existing. The new unit is more energy efficient overall due to the more modern design and newer components.

Choc Block

- **New refrigeration plant.** The previous Choc Block chillers required replacement (due to their age) and therefore a new chiller unit was installed on the roof of the Choc Block building in 2021. The new chiller is specified with an extra low noise sound attenuator package and utilises R1234ze refrigerant gas which has a lower global warming potential than the existing. The new unit is more energy efficient due to the more modern design and newer components.

5. De-rating of combustion plant

5.1 As a result of incremental improvements in site energy efficiency and other production changes since the steam raising boilers at Bournville were installed, site steam demand and installed steam generation capacity are now substantially mismatched. Therefore, it is proposed that the existing 3 no. boilers, each with a net thermal input capacity of 12.2 MW, will be derated to approximately 6.25 MW each. The minimum steam outputs will remain unchanged.

5.2 The steam output will be reduced by resetting combustion characteristics and removing the top points of the commissioning curve. This restriction will be locked by a commissioning code held by the OEM (original equipment manufacturer), and will therefore meet the requirements specified in applicable regulatory guidance in terms of the software constraints[4].

5.3 As a result of this change, the Part B activity relating to this combustion plant (Section 1.1 B(a)) will be removed from the permit as the aggregated rated thermal input will fall below 20 megawatts.

4 RGN 2 Understanding the Meaning of Regulated Facility – Appendix 1 Interpretation of Schedule 1 to the Regulations.

5.4 There will be no impact on the Medium Combustion Plant Directive (MCPD) status of the site as a result of this de-rating. The boilers will retain the same burners and the equipment will not be classed as new plant by virtue of the cost of this change being less than 50% of the cost of a new comparable MCP.

5.5 No new air emissions modelling has been carried out as the de-rating will lead to an overall reduction in mass emissions of combustion products (e.g. NOx[5] and CO). Furthermore, the boiler stack is very high for size of plant, even before derating, and the original modelled process contributions (PCs) were not significant.

6. Other changes

EMS

6.1 Mondelez has an established environmental management system (EMS), which is aligned with but is no longer certified to ISO 14001. This forms part of an integrated Health, Safety and Environmental (HSE) Management System which comprises a series of corporate-level documented 'standards' (common to all Mondelez sites), supplemented by site-specific documented procedures which describe how the Mondelez standards are implemented at a site level. A summary of the management systems in operation at Mondelez Bournville is provided in response to Form C2 Question 3d.

Flavour store

6.2 The flavour store is being relocated from O Block to C Block. The new store is fit for purpose and incorporates applicable BAT requirements including impermeable surfacing, bunding for potentially polluting liquids and separation of incompatible substances. There will be no change to routes taken to move these ingredients on site (i.e. routes from goods intake to the store and from the store to points of use remain unchanged). A description of this new facility is provided in the Technical Description (see below) and an updated plan showing the location of activities on site is provided in Figure 2.

Research and development (R&D) facility

6.3 Within the Bournville site is a chocolate pilot plant (R&D facility), which is located within U block and described in the original application. Additional R&D facilities were added to the basement of M1 building in 2015 / 16. This facility incorporates 3 no. pilot plant-scale cocoa bean roasters[6] with 4 no. new air emissions points associated with this. These have been included in the revised air emissions inventory (provided in resource for Form C3, Question 2).

5 Boiler OEM has advised that a nominal 42% reduction in NOx mass emissions could be achieved.
6 Cocoa beans are not roasted within the Bournville Chocolate Works installation for production purposes

6.4 A further planned project associated with the R&D function will involve installation of new pilot plant-scale equipment for electrical and steam-based cooking of cocoa powder. Steam will be vented out of the vessel, which returns to atmospheric pressure, resulting in a further single new emissions point.

Inventory of emissions to air, water and sewer

6.5 The inventory of air emissions points has been reviewed, updated and rationalised to reflect current operations (Section Table C2:2-1 provided in response to Form C3, Q.2 and Figure 3).

6.6 The inventory of emissions to sewer has been updated in order to reflect emissions points following installation of the effluent treatment plant.

6.7 The inventory of emissions to water has been updated in order to remove the last remaining discharge point for process water (referred to in the permit as W21). This discharge comprised refrigeration cooling water, and is not use as the equipment generating this discharge is no longer operational on site. However, a review of site drainage has identified nineteen discharge points for uncontaminated surface water runoff (rainwater from roofs and roadways) to Bourn (Griffins) Brook[7]. These discharge points are not new but have not previously been listed in the permit. These are shown on Figure 4.

Technical description

6.8 A general update, where relevant, of the process description is provided below; the confectionery manufacturing process is largely unchanged since the original permit application, however though the addition of an activities map (Figure B below) the wide range of activities which take place, often in multiple locations around the installation, are highlighted. This is provided to demonstrate the necessary flexibility in terms of where and how the processes are undertaken within the manufacturing blocks.

7. Regulatory Context

Transition of listed activity

7.1 The installation is currently regulated under Environmental Permitting (England and Wales) Regulations 2016 (EPR) Schedule 1, Part 2, Chapter 6, Section 6.8 A(1)(d)(i) and Section 1.1 B(a) in Part 1 to Schedule 1 of the PPC Regulations by installation permit reference EPR/LP3734FJ/V004 issued on 14/08/14.

7 Note that this Brook is referred to in the permit, OS mapping data, Environment Agency sources and is known locally as either Bourn or Griffins Brook. Both Bourn and Griffins is the same waterbody and therefore, for the purposes of this application, it is referred to as 'Bourn (Griffins) Brook'.

7.2 There has been an alteration to regulatory sub-paragraphs under Section 6.8, Schedule 1 of the ERP, which introduces a new activity which was not available at the time that the original PPC permit was issued. Whilst this makes no material difference to the status of the site or charges applicable, it is however considered more factually accurate.

7.3 As such it is proposed that the listed activity is redefined as Schedule 1, Part 2, Chapter 6, Section 6.8 A(1)(d)(iii), relating to the use of animal and vegetable raw materials (other than milk only) combined into products. Milk chocolate crumb is deemed to be a milk product and thus an animal based raw material[8]. Milk solids represent approximately 22%, by weight in milk chocolate. Of the total finished goods production capacity of the installation, some 150,000 tonnes per annum, approximately 105,000 tonnes is milk chocolate. Therefore, overall some 23,100 tonnes or 15.4% of production is based on animal raw materials.

Where A is the percentage of animal raw materials (in this case 15.4%), the site specific threshold under Section 6.8 A(1)(d)(iii) is:

(aa) 75 tonnes per day where A is equal to 10 or more; or

(bb) 300-(22.5 x A).

The site production levels remain comfortably above the applicable threshold of 75 tonnes per day, demonstrating that an Environmental Permit is still required for the site.

Addition of new listed activity

7.4 The operation of the new effluent pre-treatment plant undertaking pH dosing of effluent prior to discharge to sewer requires the addition of a new listed activity under Schedule 1, Part 2, Chapter 5, Section 5.4 Part A (1) (a) (ii) – Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving physico-chemical treatment.

Removal of listed activity

7.5 The boiler plant at Bournville currently comprises 3. No dual fuel gas / gas oil boilers, each with a net thermal input of 12.2 MW. It is proposed that these boilers are de-rated to approximately 6.25 MW each. As a result of this change the Part B activity relating to this combustion plant (Section 1.1 B(a)) will be removed from the permit as the rated thermal input will fall below 20 megawatts in aggregate.

7.6 The combustion plant is designated as existing Medium Combustion Plant (MCP) and, with each unit having a capacity exceeding 5 MW thermal input (MWth) has a target compliance deadline of 1st January 2025. Refer to Appendix 5 for further information.

8 Environment Agency (2019) Regulatory Guidance Series, No RGN 2 Understanding the meaning of regulated facility, Appendix 1 – Interpretation of Schedule 1 to the Regulations, version 4.0.

8. Process description

Introduction

8.1 The manufacturing processes undertaken within the installation can be grouped and presented under the series of discrete headings:

- Goods intake and raw materials handling and storage (A)
- Chocolate making (B)
- Centre making (C)
- Moulding and shell forming (D)
- Sheet and Cut processes (E)
- WIP, finished goods, packing and despatch (F)
- Ancillary processes included heating, cooling and cleaning (G)

8.2 The letter reference in parenthesis above relates to Figure B below, which shows where these processes take place within the installation illustratively. Reference should also be made to the revised Figure 2 which shows the definitive installation boundary and activities carried out.

Figure B Locations of process activities carried out across the installation

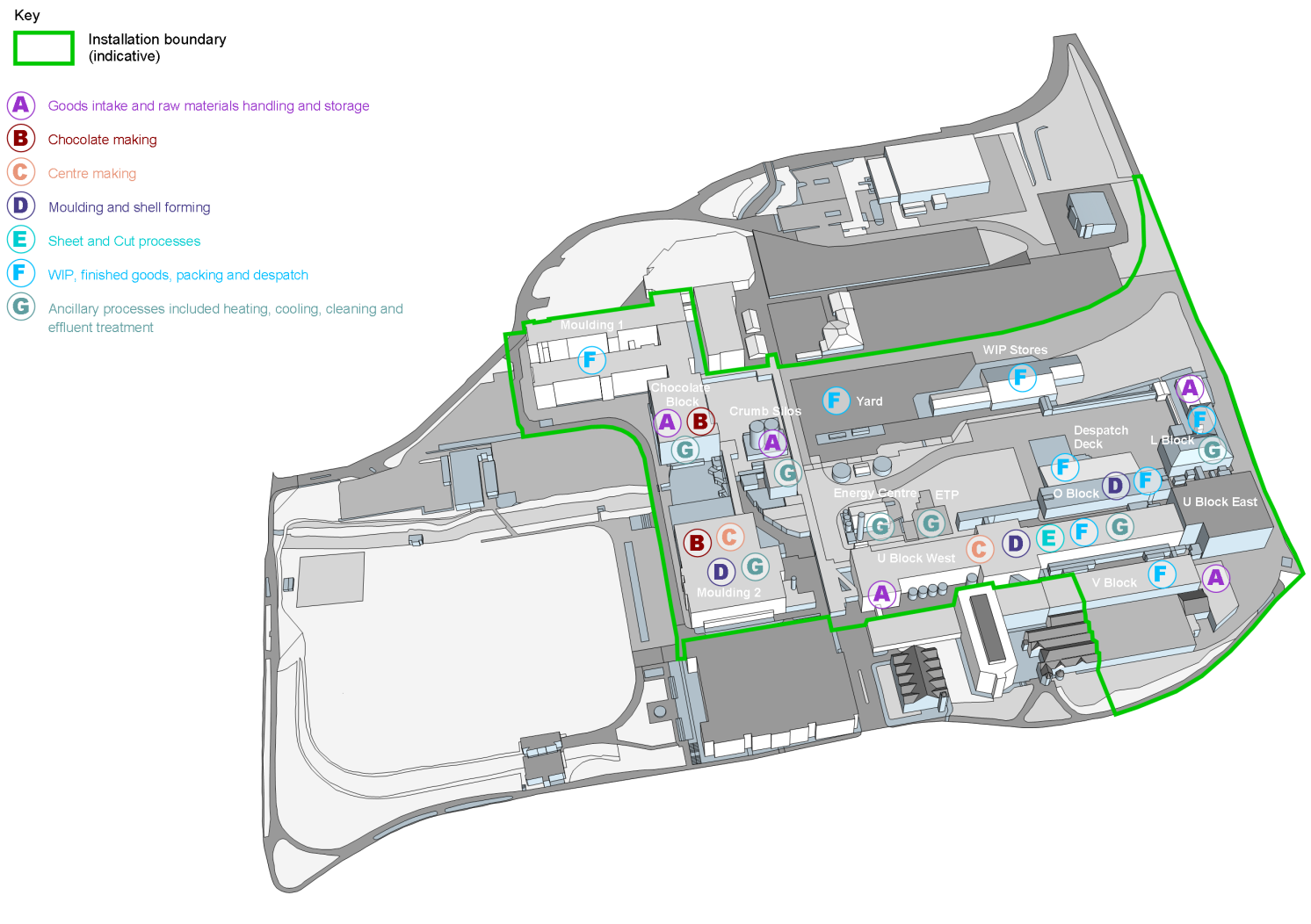
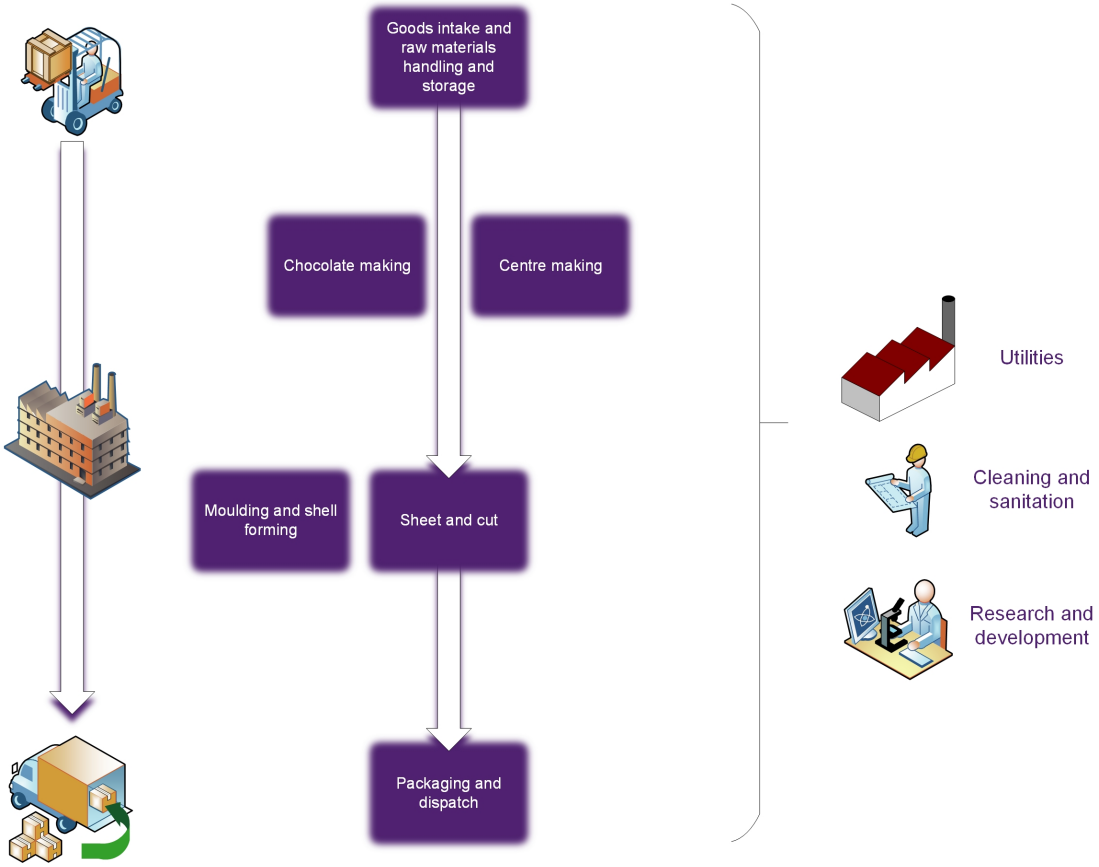


Figure C Schematic process flow diagram providing an overview of processes



Goods intake and raw materials handling and storage

8.3 Fully computerised booking systems are used to control the delivery and acceptance of incoming goods, as well as the despatch of outgoing goods.

8.4 Chocolate crumb is the principal dry raw material used on site. This is delivered to Bournville by road tanker from other Mondelez sites. The crumb is offloaded at dedicated points by screw conveyors that transfer this ingredient onto pneumatic conveying lines for further conveyance to dedicated bulk storage silos. The unloading points are within bunded areas which have sufficient capacity to contain any material escaping. The main crumb silo (500Te) and the receiving cyclones on the pneumatic distribution system have explosion suppression and reverse jet (bag) filters installed. Unloading into the main silo and to the receiving cyclones is automatically controlled from level devices on the vessels. There is pressure protection on the pneumatic conveying system to prevent over pressurisation.

8.5 Sugar is also delivered to the installation by road tanker. The sugar is offloaded at dedicated points by pneumatic conveyers and transferred directly from the tanker into dedicated bulk storage silos. The coupling direct to tanker reduces any loss from the system to the environment. The silos and receiving cyclones are installed with explosion vents, and reverse jet filters.

8.6 Other key dry raw materials e.g. whey powder and semi-bulk crumb are delivered to the installation in bulk bags (nominally 1 tonne). Product is transferred by sealing the outlet of the bag to a vibrating hopper that assists the discharge onto a pneumatic line that conveys the raw material to a dedicated cyclone/storage vessel. The receiving cyclone is installed with explosion suppression and a reverse jet filter. There is pressure protection on the pneumatic conveying system to prevent over pressurisation.

8.7 The principal bulk wet raw materials include bulk liquid cocoa butter blends, cocoa mass and emulsifiers. These are delivered to the installation in road tankers and are offloaded at a number of bunded reception points. The ingredients are offloaded from the road tankers by coupling pipe work direct to the tanker outlet and by using either gravity or pumps to discharge the material under control to bulk storage**.** Unloading into the bulk storage vessels and distribution to intermediate vessels is automatically controlled from level devices on the vessels. Where appropriate, there is pressure protection on the pumping and pipework systems to prevent over pressurisation. To prevent solidification and maintain ingredients at the required process temperature, all the pipe work and storage vessels are heated, typically using hot water jacketing.

8.8 The flammable/specialist ("Flavour Store") store contains flavours and ingredients, where they are stored in readiness for transfer to production areas. Materials are isolated/segregated as appropriate. As described previously, a project is currently underway to relocate the flavour store from 'O' Block to a newly refurbished facility in 'C' Block. Principal process controls and risks reduction measures incorporated into the new area include:

- The flavour store is located internally with drains connected to the ETP / foul sewer and isolated from storm / surface water drains and the Bourn (Griffins) Brook.
- All containers are clearly labelled and the area is regularly inspected to ensure containers are fit for purpose and are stored safely.
- Storage area fitted with sprinkler and drain to manage stored liquid, and sprinkler water if required.
- Store is arranged in cells to allow material segregation.
- Materials safety data sheets and spill kits are available.

BAT Summary – Goods intake and raw materials handling and storage

The following process and emission controls are in place on powdered material intake and handling systems:

- The pressure of pneumatic conveying is monitored and protection systems are in place to prevent over pressurisation.
- Intake couplings for bulk deliveries are direct, to reduce potential of spillage and as appropriate are within bunded areas.
- Reverse jet (bag) filters (RJF) are typically fitted on silos to prevent loss to atmosphere (see also response to Form C3 Q2: Point Source Emissions to Air). The differential pressure is typically monitored across filters to ensure that RJFs operate effectively.
- Pressure detection is in place on explosion suppression systems to identify and respond to potential events (explosion panels or release of fire suppressant powder).
- Pressure protection and level detection are in place on bulk wet raw material handling systems.
- Pressure detection is in place on explosion vents to identify potential hazard events and enable the process to be stopped.
- The following process controls are in place on the reception, storage and distribution of bulk liquid ingredients (e.g. cocoa butter blends, fats, cocoa mass):
    - Pipeline pressures are measured to prevent over pressurisation.
    - The temperature on key services are measured to ensure system integrity.
    - Level measurement/control is installed on key vessels (such as weigh cells and level probes) to prevent overfilling.

Chocolate making

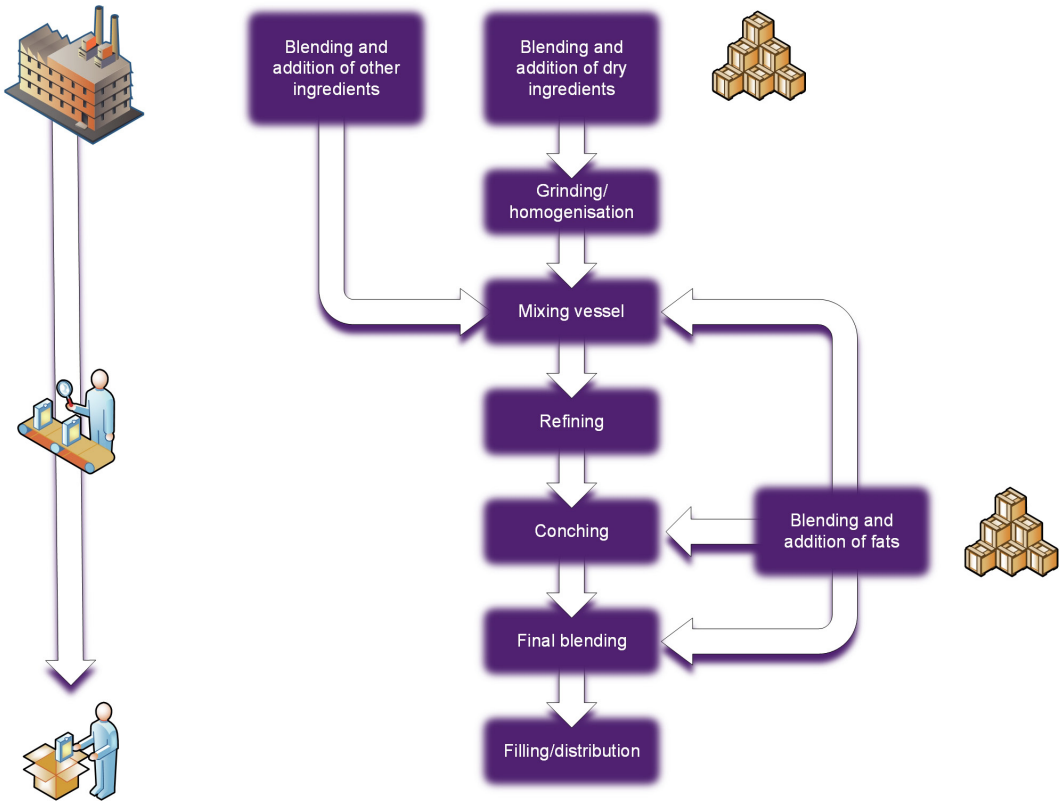
8.9 Chocolate making at the Bournville Chocolate Works installation is the process of converting base ingredients (such as chocolate crumb, sugar, cocoa mass, cocoa butter blends and emulsifiers) into various finished chocolate recipes.

8.10 The main process operations are:

- Receipt of the raw materials (ingredients).
- Raw materials i.e. crumb are ground to an homogenous size.
- Addition of fat to produce a paste.
- Refining and ‘conching’ (liquification of refined flake and final recipe additions)
- Final blending (cocoa butter and additions).
- Distribution of finished chocolate to storage tanks and downstream processes.

A number of different types of chocolate are made within the installation in batch processes (e.g. milk chocolate, dark chocolate). The raw ingredients are weighed and mixed in a heated oil jacketed vessel. The chocolate paste mixture is then refined through a series of water-cooled refiners to produce a chocolate flake. This flake is then 'conched' in a series of jacketed (hot and cold) mixing vessels before being pumped to storage. The chocolate is then pumped through a blender where final agents are added to adjust the viscosity and then pumped back to storage. When required the chocolate is pumped from storage direct to downstream processes (or via mobile containers) within the installation or by tanker to processes outside of the installation (e.g. manufacturing activities at other Mondelez, or other third party sites). All storage tanks are hot water jacketed as is all molten chocolate pipe work, to control product temperature, which ensures that consistent characteristics of the chocolate are maintained as it is presented to the user plants.

Figure D Schematic process flow diagram for chocolate making



Liquid Chocolate is transferred from chocolate making area to a holding tank for the central chocolate distribution system, by road tanker. Liquid chocolate is loaded and unloaded in fully bunded areas. The tankers are sealed and if required stored in a dedicated area of the site with the tank kept at the correct temperature by electrical heaters.

BAT Summary – Chocolate Making

The following process and emission controls are in place for the control of products and ingredient (waste minimisation):

- The ingredients supply to the processing plants is automatically controlled, via PLC.
- All of the ingredients are contained and delivered to the processing stages in enclosed systems.
- The processing stages are automatically controlled, via PLC with minimum operator intervention. The process is set up to give the correct recipe (including fat content), viscosity and particle size through the control of critical parameters such as temperature, work input, weighing and dosing rates.
- The storage of finished chocolate and its distribution to the user plants (such as moulding and shell forming) is automatically controlled via PLC. All chocolate product is contained and delivered to the user plants in enclosed systems, to reduce the generation of by-product and unnecessary manual cleaning.
- Where appropriate, vessels are fitted with level controls and load cells (e.g. finished chocolate storage vessels), to maximise efficiency of raw material usage and reduce risk of overfilling.
- Wet and dry ingredients are weighed into batching/process vessels according to predetermined recipes, under (typically PLC linked) load cell control. Load cells are subject to calibration.
- Pumping of chocolate is controlled from a PLC. Fat blends are dosed into blenders using calibrated metering pumps. During final filling operations mobile containers (for distribution within the installation for use) are placed underneath level probes to control filling and reduce risk of spillage.

The following process and emission controls are in place with regard to dust control and extraction:

- Prior to mixing, certain dry ingredients (e.g. chocolate crumb) pass through a size reduction process, typically using ‘nibblers’ to breakdown the crumb prior to refining. On these systems:
    - Pressure detection is installed on explosion suppression systems to identify and respond to potential events (explosion panels or release of fire suppressant powder).
    - Choke switches/pressure switches are installed to prevent blockages/leaks.
    - The temperatures of the mills are monitored to prevent combustion.
    - Reverse jet bag filters are fitted to prevent losses to atmosphere; product entrained in the bag filter and dislodged by the reverse jet action is returned to the silo / vessel for re-use.
- Alternatively, depending on the plant/product, size reduction can be via a mesh of specified size. Regular mesh inspection is carried out to ensure that required

product specification is achieved. Grinding or 'nibbling' of oversize particles caught on the mesh takes place in a closed system until the desired particle size is achieved, thus there are no requirements for dedicated extraction equipment.

The following Energy and Utility Efficiency Controls are in place:

- Temperature controls (e.g. jackets fitted with temperature probes) are in place on temperature critical vessels, to maximise energy efficiency.
- All steam usage in this process is by indirect heat exchange; condensate returns to the boiler-house, and is recovered for re-use in boiler feed. Water for temperature controlled water jackets is heated indirectly using steam through a regulating valve in an enclosed system. Water temperature is monitored and controlled, to maximise energy efficiency and to ensure that product is kept at optimum temperatures, reducing potential wastage. Oil used for heated oil jackets (e.g. on main mixing vessel) is indirectly heated using electric heaters in an enclosed system, with the temperature monitored and controlled.
- During refining, where the chocolate paste is refined into chocolate flake, refiner temperatures are controlled from individual temperature controllers using chilled glycol/water, to ensure that process energy efficiency is optimised and wastage minimised. See also Utilities section.
- During the conching phase (where chocolate flake is conched into liquid chocolate) temperature in conches is controlled using either hot or chilled water depending on operating status of conches. Water is indirectly heated using steam through a regulating valve in an enclosed system. Chilled water is supplied from central site services. Water temperature is monitored and controlled.

Centre making

8.11 A number of centres and centre bases are made in batch processes within the installation, in a series of sub-processes, for subsequent incorporation into shell and moulded or sheet and cut processes. The principal variations are outlined below:

- **Centre Bases.** Standard and inverted sugar syrups are made in the installation. These are later incorporated into other centre recipes, where they may undergo mixing and further cooking.
    - **Standard Syrups:** Sugar and glucose are combined with water and undergo cooking. Following cooling, they are pumped to storage vessels for subsequent mixing.
    - **Invert Syrup:** Sugar and water are combined with hydrochloric acid. Addition of acid is necessary to create an acidic environment allowing hydrolysis of sucrose into fructose and dextrose, without the need for the enzyme invertase. Following cooling, inorganic salts (e.g. sodium chloride and sodium carbonate) are added if required by the recipe, and the syrup undergoes further cooking. The product is then pumped to storage vessels for subsequent mixing or for use.

- **Centres.** Both cooked and uncooked centres are produced, for direct use in other processes within the installation. The three principal types are caramel, creme and truffle type centres.

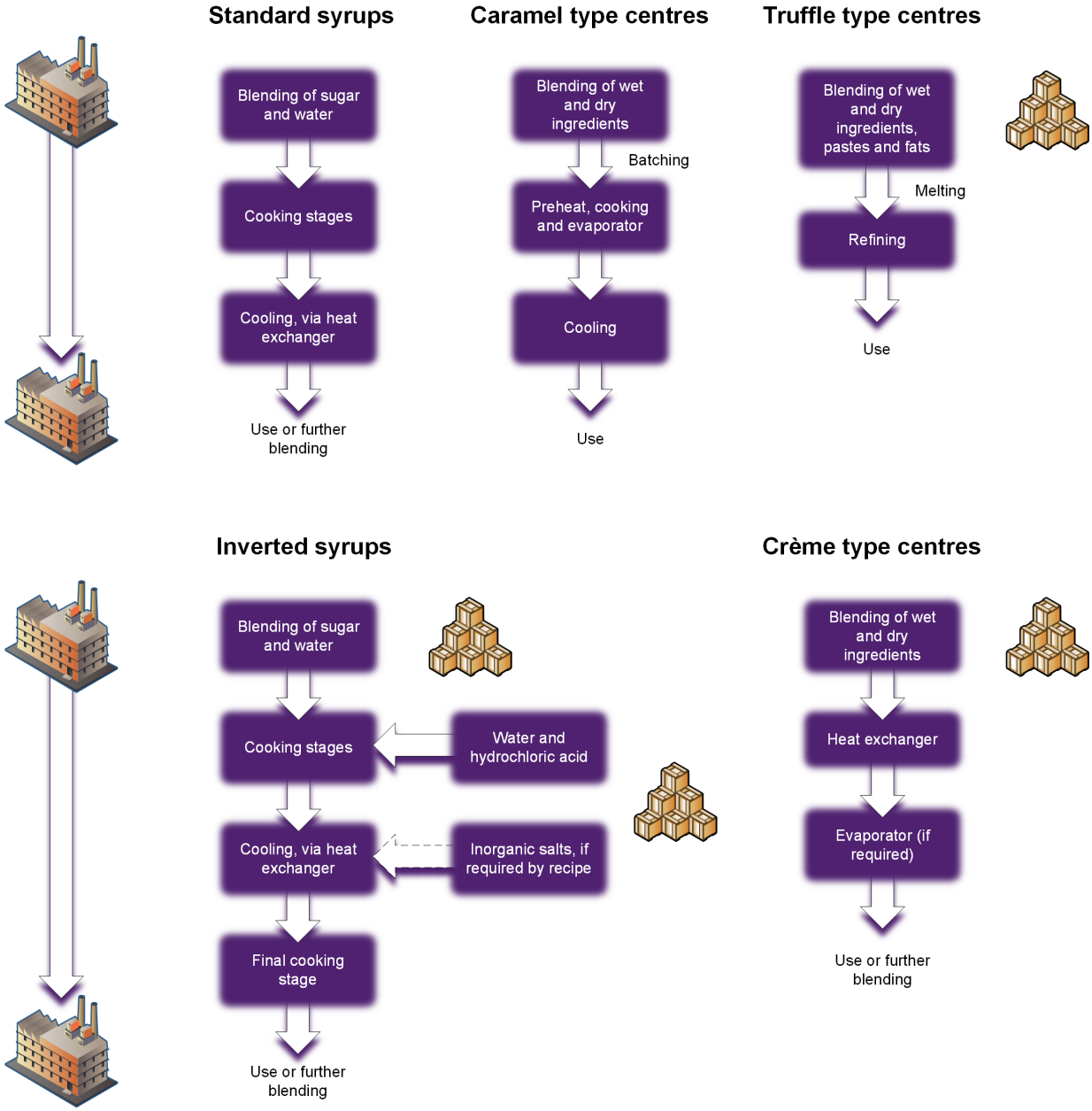
    - **Caramel type centres.** Various wet and dry ingredients (glucose, whey powder, vegetable fats and blends of standard and inverted syrups) are batched to form a mix, which is then cooked using steam heat exchangers and cooled using scraped surface heat exchangers, before being pumped to a holding tank ready for depositing into moulds etc.

    - **Truffle type centres.** Various dry ingredients (e.g. milk powders, sugars, cocoa powders) are combined with vegetable fats and nut pastes in a melting stage, from where they are pumped to vessels for refining (using mechanical agitation) and subsequently pumped to heat jacketed storage vessels.

    - **Creme type centres.** Various creme type fillings are made principally by combining sugar, glucose and water, to which other wet and dry ingredients can be added if required (e.g. pectins, flavours, invert syrups etc.). The mixes pass through heat exchangers and evaporators (if required), followed by cooling stages. Invert and standard syrups can then be combined with the base cremes if required, to created finished cremes for direct incorporation into product moulds etc.

8.12 As illustrated in Figure E below, the manufacturing process is undertaken in a series of stages, with some of these stages being applicable or not applicable depending on the specific nature of the product.

Figure E Schematic process flow diagram for centre making processes



BAT Summary – Centre Making

The following process and emission controls are in place for the control of products and ingredient (waste minimisation):

- Batch weighers, using load cells to calculate loss in weight, are used to ensure efficient use of raw materials, and avoidance of waste through incorrect blending of ingredients. For manual addition, batch alarm calls are typically used to alert operators to add pre-weighed ingredients, thus reducing the likelihood for generation of out-of-specification products.
- Bulk sugar, transferred pneumatically from site storage silos to local hoppers is done under automatic top-up control from load cells sending signals to central feed system under PLC control, to reduce risk of overfilling and ensure that a continuous feed is available to maximise production efficiency.
- Ingredients used in the manufacture of creme based centres, (e.g. starch and pectin) are automatically pumped, under PLC control, directly into the slurry batching / mixer from storage containers to reduce the risk over vessel overfilling, and ensure that ingredient usage is accurately controlled.
- In the manufacture of truffle type centres, ingredient pastes and powders are either manually fed from hoppers in pre-determined quantities, or pumped via batch weighers, directly into the refiners.
- Hydrochloric acid used in invert syrup manufacture is delivered to the process area in a plastic container and held for use in a safety container. This is pumped directly into the cooking vessel, to reduce the risk of spillage.
- Inorganic salts (e.g. sodium chloride and sodium carbonate) used for some invert syrup recipes are delivered to the section in plastic containers, either pre-weighed or manually weighed and fed into the cooking vessels for further cooking according to pre-determined recipes to minimise wastage.
- Pumping of syrups and other liquids into portable vessels for subsequent use elsewhere within the installation is controlled via PLC, to reduce the risk of vessel overfilling and spillage.
- Flavour containers (typically drums) are emptied into a holding vessel prior to addition, to ensure controlled delivery. Flavour addition is typically controlled by a metering pump, to ensure efficient use of raw materials.
- Material for internal rework (i.e. reuse within the process on site) is held in a vessel with a temperature controlled jacket to keep it at the required temperature, facilitating easier re-use. Where ingredients are added under operator control to rework mixers, off-line instrumentation is typically available for checking key parameters.
- Dilute syrups from start-up and shut-down are recycled wherever possible to a storage tank for re-use in the process.

The following Energy and Utility Efficiency Controls are in place:

- All steam usage in this process is by indirect heat exchange; condensate returns to the boiler-house and is recovered for re-use in boiler feed. This also means that no product contact steam (which may contain VOCs or other odorous compounds) is flashed off to atmosphere.

- Temperature controls (e.g. jackets fitted with temperature probes) are in place on temperature critical vessels, to maximise energy efficiency.
- Moisture evaporation of centre mixes takes place by steam heating under vacuum. Steam valves are linked to the control system, to ensure products are heated only to pre-determined set temperature points. Temperature, pressure and product flow through the process are under control to ensure efficient use of energy and to avoid product wastage through generation of out-of-specification materials. Any vapour removed is condensed to eliminate gaseous or vapour emissions.

The following Cooling System Controls are in place:

- After cooking of the caramel and creme based centre mixes, product cooling takes place in scraped surface heat exchangers, throughout which product temperature and coolant temperature are under tight control. The coolant (gycol based) control valve is linked to product exit temperature, for optimum control.

Moulding and shell forming

8.13 The installation produces a number of products involving hollow shells, solid mouldings or filled mouldings (examples include solid bars, bars containing inclusions (e.g. nuts) and chocolate eggs). Certain products may also be produced via a drop deposit process, where chocolate is dropped onto a moving belt to create the required shape, shaken and cooled.

8.14 Production is a fully automated continuous manufacturing process and involves producing chocolate through various cooling and heating processes and depositing the chocolate into a mould (or without mould in the case of the drop deposit process). The principal variations that occur after this point are:

- **Filled Bars/Units.** After deposition and shaking, the moulds are inverted to create a chocolate shell, to which a centre is deposited (typically batched and cooked centres, CO_2 (carbon dioxide) aerated chocolate etc). Further cooling takes place, before a chocolate back is deposited and subjected to vibration to produce the finished effect. The product is then cooled further and removed from the mould by knocking the mould using a pneumatic hammer action. The product is then automatically wrapped.

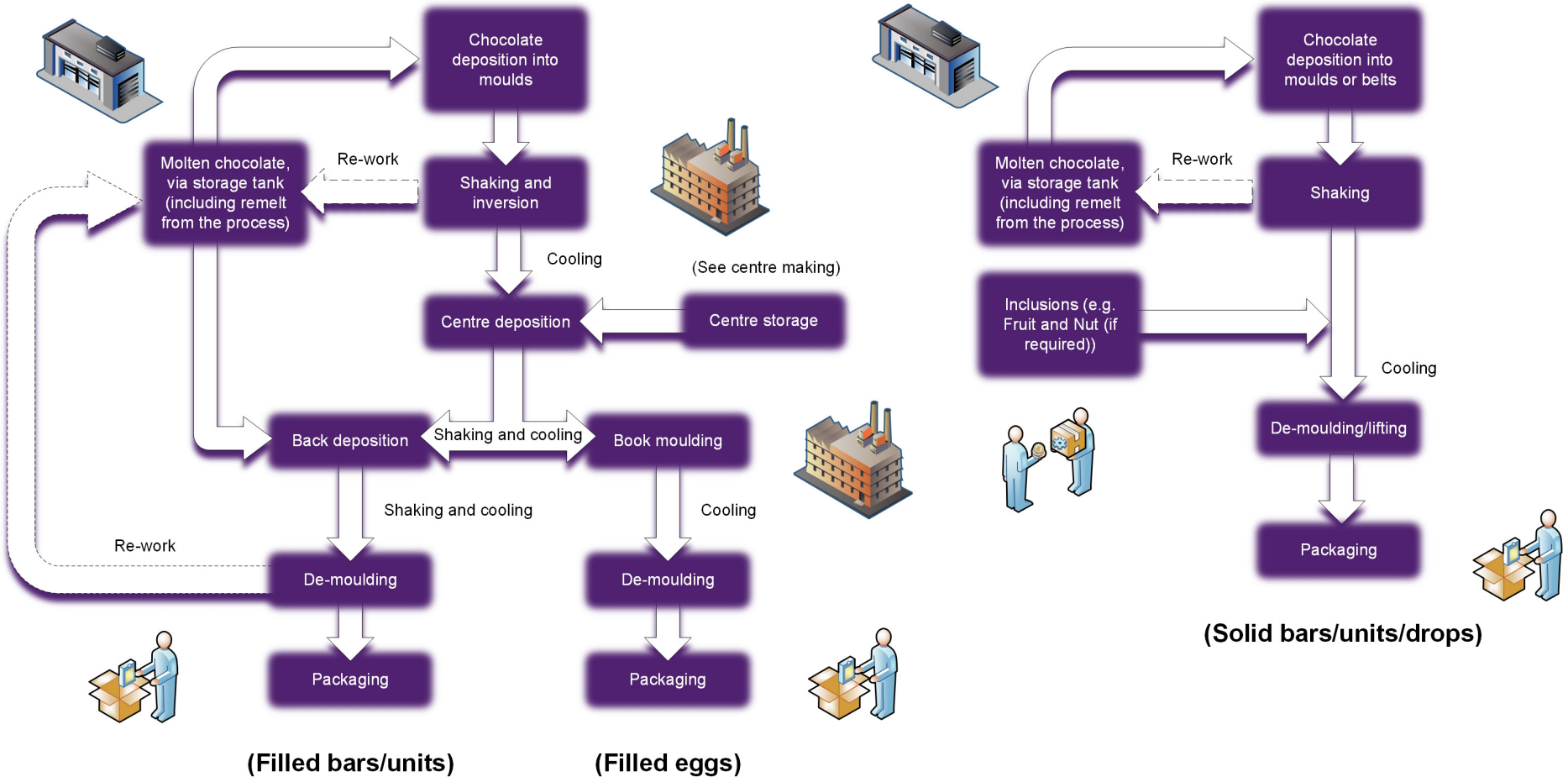
- **Filled Eggs.** After deposition and shaking a batched and cooked centre is deposited in moulds. The two trays of filled shells are then brought together ("book moulded") to form complete filled chocolate eggs. The product is then cooled and removed from the mould by knocking the mould using a pneumatic hammer action. The product is then automatically wrapped.

- **Solid Bars/Units.** After depositing the chocolate and inclusions (e.g. fruit, nuts, jellies and/or popping candies) the bars are shaken. The product is then cooled and removed from the mould by knocking the mould using a pneumatic hammer action. The product is then automatically wrapped.

- **Drop deposit.** Liquid chocolate of the required recipe is dropped directly on to a moving belt, where vibration causes the liquid chocolate to spread to the required circular button shape. The product is then cooled before wrapping and packing.

The above processes are illustrated in Figure F .

Figure F Schematic process flow diagram for moulding and shell forming



BAT Summary – Moulding and shell forming

The following process and emission controls are in place for the control of products and ingredient (waste minimisation):

- Load cells and software (PLC) input control the appropriate levels of recipe addition. Ingredients are metered into the chocolate stream using calibrated vibratory tray feeders or weighbelts.
- Chocolate is metered into plants either via vessels equipped with load cells or via portable tanks that are weighed. Data is managed via the SAP system, which allows complete supply chain mass balance as well as traceability.
- Where appropriate, chocolate storage tanks are monitored using level probes. Load cells monitor the current fill level on vessels, which cuts out the out-feed / in-feed pumps depending on fill level.
- Chocolate flow rates within the process are measured via a flowmeter, calculated from a pump calibration or derived from the plant actual chocolate usage by PLC computation, to ensure efficient use of chocolate and to reduce the risk of spillage.
- Load cells and level sensors (e.g. ultrasonic level detectors) are used to ascertain the current tanks levels and control filling, to reduce the risk of tank overfilling.
- Excess chocolate removed from moulding and back deposition stages is re-worked within the process.
- Moulds are cleaned in the mould wash process before use.
- Packaging materials on reels are supplied to automatic wrapping machines, with roll splicing taking place automatically to minimise the generation of waste packaging materials on roll ends. Packaging rolls are recycled.

The following dust extraction control systems are in place:

- Nuts and other dry inclusions, which may be added depending on the recipe, are fed into the process via a holding tank and hopper system. Any particulate matter / dust is extracted at source using Local Exhaust Ventilation system (refer also to Form C3, Q2: Point Source Emissions to Air).

The following Energy and Utility Efficiency Controls are in place:

- Pre-deposition mould heating is by radiant heat from an electrical element, or convective heat via steam coil. Mould surface temperature is measured via infra-red probe and fed back via the PLC to regulate the heat source, thus maximising energy efficiency and reducing product waste through under or overheating of moulds.
- To ensure efficient use of compressed air (used for some chocolate, centre and back depositors) air pressure is maintained using a series of gauges and the deposit amount dictated by a PLC driven nozzle aperture setting.
- Moulds are inverted, then twisted, hammered or vibrated to cause the units to drop out. The amount of energy applied to the moulds is optimised by the operator via local adjustment or by PLC depending on the ease of 'release' of the product and its physical size.
- Efficient infra-red heating is used to apply intense heat to the top surface of the filled shells, prior to back deposition.

- Temperature controls (e.g. jackets fitted with temperature probes) are in place on temperature critical vessels and tanks, to maximise energy efficiency, often controlled using automated operating valves.
- Hot water is controlled via automated variable valves allowing a carefully controlled mix of hot water (from a Calorifier) and chilled water to keep the chocolate at a controlled temperature. Calorifiers are monitored using temperature and pressure gauges.
- Temperature gauges monitor the water and chocolate temperature through the tempering stages.
- Water flow is monitored using pressure gauges.
- All pipework carrying liquid chocolate are hot water jacketed. Water is indirectly heated using steam through a regulating valve in an enclosed system. Water temperature is monitored and controlled.
- Liquid chocolate is stored in jacketed and agitated steel tanks of various capacities. The service water that supplies these tanks is heated locally by steam, but electrical standby heaters are usually present as a back-up.
- Mixing vessels for combining tempered chocolate with other ingredients are jacketed at a temperature to maintain the specific crystals formed during the tempering process. The water service that supplies the mixer uses steam and glycol since the required temperature is around room temperature, thus ensuring that energy is not expended unnecessarily when ambient conditions are optimal for production. A temperature probe with associated electronic PID feedback loops controls heat and cooling input via automatic valves.

The following cooling system controls are in place:

- At various stages moulds pass through the cooler, designed to solidify the chocolate in a controlled manner. There are typically multiple zones within each cooler, each zone having temperature controlled cold air blown around it (closed loop). The air is typically cooled via glycol flowing through a coil, but can be cooled by means of direct refrigerant expansion. The air temperature is measured via probe(s) in the air stream with cooling effect regulated locally or via plant PLC, to maximise energy efficiency. Glycol or refrigerant is delivered from the central refrigeration plant.

Sheet and cut processes

8.15 The installation produces a number of sheet and cut products, where centres (typically caramel/fudge based or chocolate with dry inclusions) are deposited as a sheet onto a conveyor, cut, then covered in chocolate (enrobed), after which they are cooled prior to packing. The principal variations are:

- **Chocolate based centres,** consisting of dry inclusions, combined with chocolate and other ingredients as required, and then rolled into a sheet. The resulting sheet is slit and cut into units and covered in chocolate.

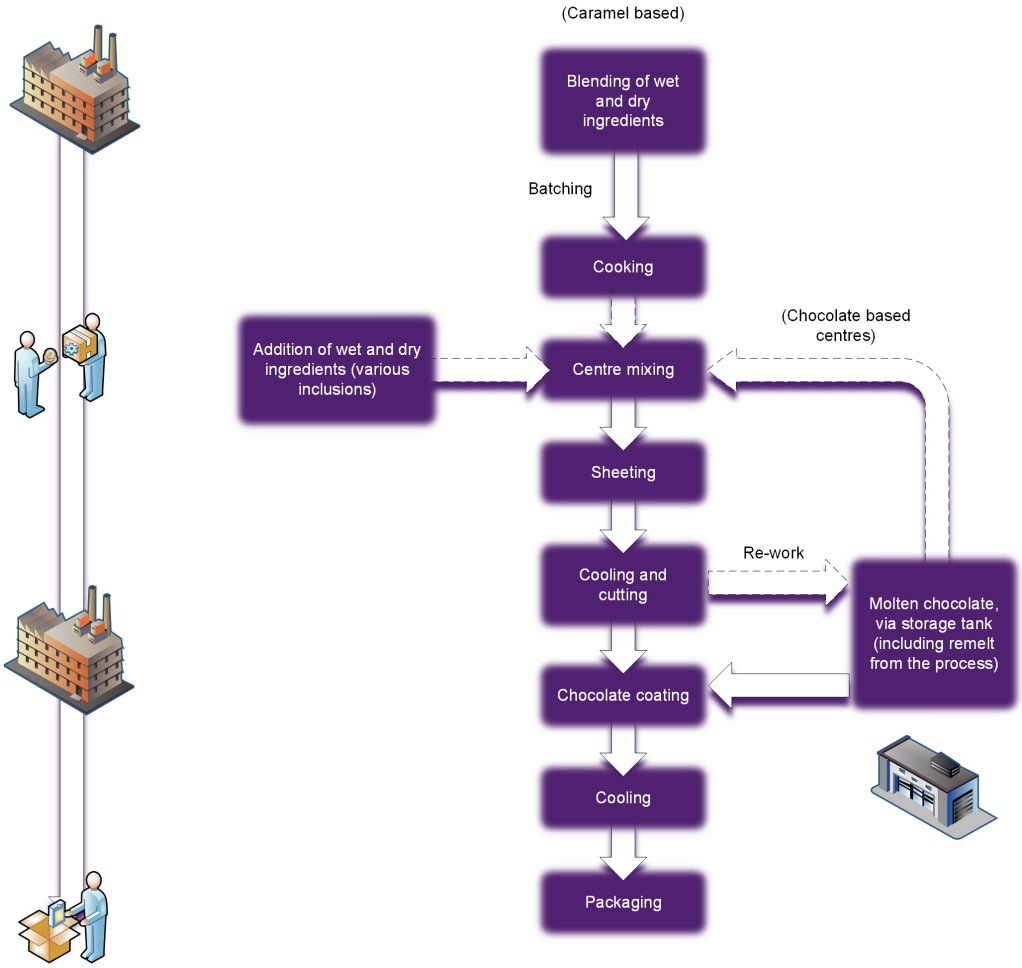
- **Caramel/fudge based centres,** consisting of carbohydrate based wet and dry raw materials, which are then cooked, sheeted and cut. The units are then covered in chocolate.

8.16 The products (known as units) are produced in various sizes, as required. They are then conveyed to wrapping machines and finally put into boxes (outers) or multipack configurations, after which they are palletised for transport or storage.

8.17 As illustrated in Figure G below, the manufacturing process is undertaken in a series of stages, with some of these stages being applicable or not applicable depending on the specific nature of the product. Automatic control systems are used throughout the processes.

Figure G Schematic process flow diagram for sheet and cut processes

Sheet and cut processes



BAT Summary – Sheet and cut processes

The following process and emission controls are in place for the control of products and ingredient (waste minimisation):

- Wet and dry ingredients are introduced into batching/process vessels by weight or volume according to predetermined recipes, using calibrated vibratory tray feeders or through tracking the loss in weight of a silo under load cell control. Typically, dry and wet ingredients are blended on a measured continuous throughput basis, with target quantities derived from PLC computation. Delivery rates of liquid raw materials, (e.g. chocolate or caramel) are under automatic PLC control.
- To maximise process efficiency, and reduce wastage, imperfect finished units and units at an intermediate stage of production are melted within a jacketed tank and fed back into the product stream.
- Where appropriate vessels are fitted with level controls and load cells to maximise efficiency of raw material usage and reduce risk of overfilling.
- Bulk sugar, transferred pneumatically from site storage silos to local hoppers is done under automatic top-up control from load cells sending signals to the central feed system under PLC control, to reduce risk of overfilling and ensure that a continuous feed is available to maximise production efficiency.
- In caramel making, syrups are circulated around a ring-main to the cookers and weigh vessels on demand, to maximise the efficiency of the process.
- Materials (e.g. syrup) are transferred to recipe quantities by loss in weight, to maximise efficiency of material usage.
- Blending of syrups is conducted under pressure with air pressure and temperature under careful control.
- Flavour containers (typically drums) are emptied into a holding vessel prior to addition, to ensure controlled delivery. Flavour addition is at a controlled pumped rate on demand, or via dose metered pumps.
- Chocolate, from temperature controlled storage vessels, is tempered through heat exchangers using hot and chilled water, with heating and cooling stages controlled by temperature probes to maximise efficiency and minimise product wastage by achieving the optimum temper.
- During sheeting, the centre materials are fed below a mechanical roller which ensures the sheet is at the correct product height (un-enrobed) and sufficient width to minimise wastage at the cutting stage. Depending on the product, heating or cooling can be fed internally into the roller to prevent product sticking. The hot/cold water is provided by local services.
- At the chocolate covering stage (enrobing), chocolate temperature is also controlled by temperature probes using hot water or electrical heating and chilled water. The product passes through a curtain of chocolate to be covered. The amount of chocolate remaining on the product is controlled by shaking, with excess being returned to storage tanks for subsequent re-use.
- Excess chocolate is pumped out of the enrober, for re-use within the process. This chocolate is reheated by hot water and returned to the chocolate storage tank ("de-tempering"). Hot water is supplied from a temperature controlled calorifier. Level

controls are in place where appropriate, as are pressure sensors in indirect heat exchangers to detect partial blockages.

The following energy and utility efficiency controls are in place:

- All steam usage in this process is by indirect heat exchange and condensate returns to the boiler-house and is recovered for re-use in boiler feed.
- Energy efficiency is maximised (and blockages avoided) through the use of temperature controlled jackets (water or oil), on temperature critical vessels (stirred and non-stirred).
- Cooking processes (moisture evaporation) take place by steam heating under vacuum. Steam valves are linked to the PLC control system, to ensure products are heated only to pre-determined set temperature points. Temperature, pressure and product flow through the process are under control to ensure efficient use of energy and to avoid product wastage through generation of out-of-spec materials. Pump speeds linked to the control system and flow-meters are used to control product flow. Where necessary, ducting is in place for removal of vapour from product. Vapour from product is flashed off in a separator; the level of product is monitored by a control system to avoid product carryover into extract duct.

The following cooling system controls are in place:

- The product is air cooled prior to pre-extruding onto the belt for sheeting. The air is cooled indirectly by chilled water which in turn is supplied by the local plant room. The cooled product enters a hopper with rollers on the outlet to distribute the product across the main belt to ensure an even feed to the roller, thus maximising efficiency and minimising product wastage. The hopper can be heated with hot water to prevent product sticking to the sides, reducing wastage and increasing intervals between cleaning.
- Where appropriate when sheeting, centres pass between cooled rolls. The temperature of the cooled rolls is under process control to maximise the efficiency of the cooling.
- Prior to slitting, the sheeted centres are cooled by a combination of forced air cooling and gylcol cooled beds. Temperature controls are in place on the air flow and beds. The temperature is controlled automatically to the required set point depending on the product.
- Cooling of the finished chocolate covered units is by a combination of forced air cooling and gycol cooled beds. The final cooler has three zones at different temperature setpoints. The temperature is controlled automatically to the required set point depending on the product.

Ancillary processes - cleaning

8.18 To ensure product quality and safety Mondelez operates a comprehensive cleaning and sanitation programme at the Bournville installation. Depending on the nature of the individual process operations cleaning and sanitation activities can be divided into the following groups:

- Cleaning in place (CIP) systems
- Cleaning out of place (COP) systems
- Mould (and tray) washing
- Other cleaning operations such as general floor cleaning, zone cleans, special cleans etc

8.19 The remainder of this section deals with each of the areas in turn.

Cleaning in place (CIP)

8.20 Cleaning in Place (CIP) systems are present in fixed locations through the process areas of the installation, as required. They are used where water based 'centres' are cooked, blended, pumped or stored. The system enables the inside of pipes or vessels to be physically and microbiologically cleaned without the need for dismantling.

8.21 The raw materials used in the CIP process are:

- Water – from mains.
- Caustic-based cleaning chemical.
- Sanitiser.

8.22 The caustic cleaning chemical is delivered in intermediate bulk containers (IBCs). These IBCs are stored in bunded areas or areas with an effluent drain.

8.23 The sanitiser is delivered to site in 25 litre containers. These containers are stored within the dedicated chemical stores and collected for use on an as required basis. The sanitiser is manually added to storage tanks located at each CIP plant. These tanks are located in bunded areas or areas with an effluent drain.

8.24 Depending on the process, equipment and recipe in use on the manufacturing plant, factors such as chemical concentration, fluid temperature and velocity and cycle time are optimised to ensure a successful clean with minimal water and chemical use in minimal time. Clinical swabs are taken on a regular basis by the on-site laboratory staff to ensure CIP systems are functioning correctly. Pipes and tanks are regularly inspected by operators to ensure the removal of product. If high micro-organism counts or fouling are detected the CIP cycle, or the frequency of CIP, can be adjusted accordingly.

8.25 Typically, a CIP system comprises of:

- **The fluid generation system:** A buffer tank is prepared with the relevant cleaning fluid concentration by adding the chemical to water (either volumetrically to the tank via calibrated pump/dosing unit or controlled via an instrument such as a pH or conductivity sensors). For hot cleaning routines, the fluid is heated to a controlled set point using either a heat exchanger or via direct steam injection.

- **The fluid delivery system:** A high volumetric throughput centrifugal pump delivers the fluid around a ring main. Turbulent flow is important. This is part of the design stage but can be verified knowing the pump rate and the pipe work size. Some plants have flow meters to measure the actual flow.

- **Routing and delivery equipment:** Auto or manual valves divert the CIP fluid to the required items of plant. In the case of tanks, spray balls are used to ensure good fluid distribution.

- **CIP Return:** The fluid used in pipes is often under sufficient pressure to return to the 'generation tank' directly, however in the case of tanks/vessels a scavenging pump is employed to ensure all CIP fluid and collected waste is returned.

- **Recycling:** CIP systems incorporate recycling capability whereby final rinse water from one CIP cycle is used as pre-rinse / flush water for the next CIP cycle.

- **Drain:** All CIP fluids are ultimately discharged to sewer (via the on-site ETP) under consent from Severn Trent Water.

8.26 CIP systems are highly automated and controlled by means of a programmable logic control (PLC) system, with each stage being based on a timed delivery, determined during the plant commissioning period.

Cleaning out of place (COP)

8.27 Cleaning out of Place (COP) refers to manual washing in sinks. Typically, equipment such as depositers, and parts of mixers are physically taken apart and cleaned by hand in washrooms using hot water and detergent / sanitiser.

Mould (and tray) wash

8.28 There are two plants at Bournville used to clean food grade containers, generated from the installation. Containers are either:

- Trays (or plaques) used to store assortments during production and prior to packing (i.e. Work in Progress)

- Moulds used on the moulding and shell forming plants across the site.

8.29 Both plants follow a similar regime of a dry clean by operators, pre-wash, detergent wash, two rinses and air drying before return to production.

BAT Summary – Cleaning and sanitation

The following process and emission controls are in place for the control of products and ingredient (waste minimisation):

- Dry cleaning processes generate waste product which is disposed of as animal feed.
- CIP operations are optimised to reduce product wastage and minimise water and chemical use.

The following process and emission controls are in place for the control of cleaning chemicals and usage:

- Cleaning chemicals are held in drums or IBCs which, depending on the vessel size and location, are stored in bunded areas, or dedicated chemical stores. Local plant day tanks are fed with chemicals; these tanks are located in bunded areas or locations served by foul (effluent drains).
- pH correction of effluents arising from cleaning operations takes place at the site ETP.
- Chemical concentration, fluid temperature and velocity and cycle time are optimised to ensure a successful clean with minimal water and chemical use.
- Calibrated dosing or instrument controls are used to deliver chemicals efficiently.

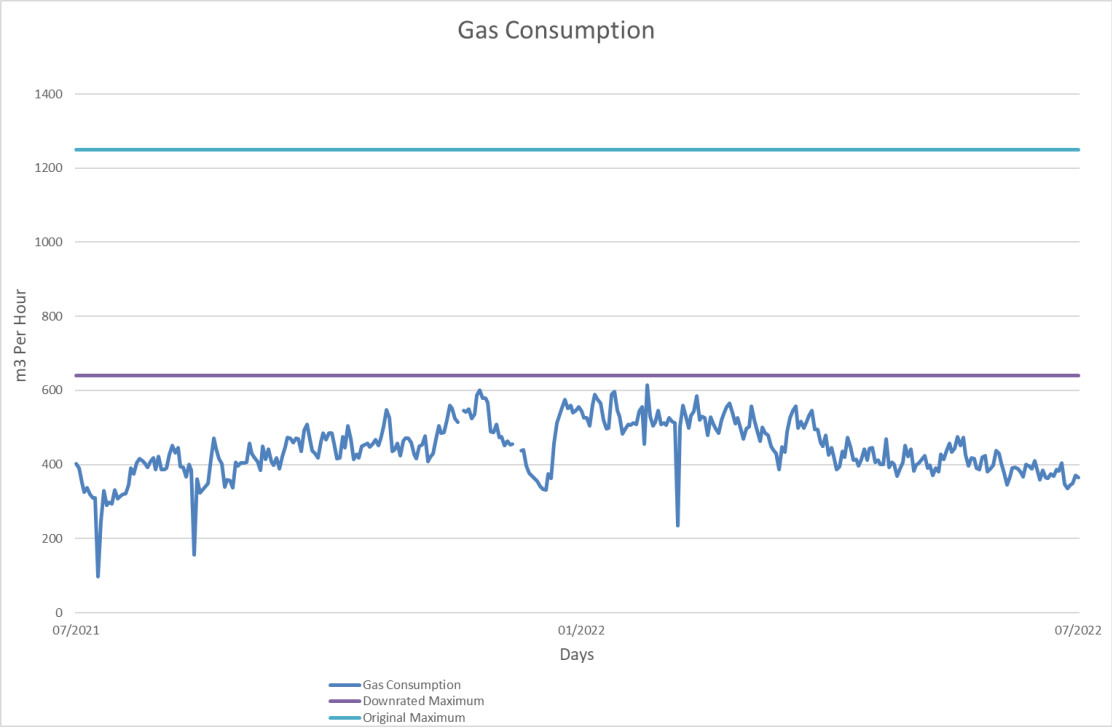
Ancillary processes - heating and cooling

Steam Raising

8.30 Steam is used to heat most site manufacturing processes including process plant cleaning and general factory heating. The steam generation plant has three steam raising boilers, incorporating flue recirculation tubes (economiser). the boilers are of modern design, and were commissioned in 2004 with burner controls upgraded in 2021. The boilers operate on natural gas, on an interruptible contract, with ultra-low sulphur gas oil (<0.1%) (light fuel oil) as a standby fuel.

8.31 Due to wide ranging process improvements, significant energy efficiency gains have been realised across the installation. This has allowed Mondelez to conduct a wide ranging review of process steam demand and business / operational security. This study has identified that there is an excess of installed capacity at the site, and a reduction in that capacity across the three boilers will lead to operational and financial gain. Typical site gas consumption data (recent full year) is shown in Figure H below.

Figure H Site gas consumption compared to installed combustion capacity



8.32 In light of these proposals emissions associated with the proposed new boiler operating regime have been reviewed, with support from the boiler and burner original equipment suppliers. It has been determined by the boiler OEM that the resulting potential environmental effects from operation of the modified boiler plant (with a reduce maximum firing capacity) are reduced relative to the current permitted plant, both in terms of NO_x concentration and mass emissions. Point source emissions are discussed further in response to Form C3 Q2: Point Source Emissions to Air.

8.33 Boiler feedwater systems remain unchanged from the current permit. Potable water is the main source used for boiler feed water. Boiler feed water is softened before use and dosed with scale inhibitor, biocide and oxygen scavenger (each contained in individual tanks). Feedwater The storage tanks are located at the boiler house. Bunded tanks are used, with the wider area drainage going to foul sewer rather than surface water.

8.34 The ultra low sulphur (<0.1%) light fuel oil does not require heating during storage. There are two fuel oil tanks (each of 77,000 litre capacity) contained within a bund.

BAT BOX – Utilities (steam raising systems)

The following process and emission controls are in place for steam raising:

- The boilers are of modern design, and were commissioned in 2004, with burner controls upgraded in 2021.
- The boilers are fitted with economisers, of conventional water tube design with the heated fluid contained in a fully welded tube bank.
- A damper unit is incorporated within the economiser casing, consisting of a single divert blade, which enables part of the exhaust flow to bypass the economizer directly to the exhaust outlet. This has the effect of raising the temperature of final discharge to assist improve dispersion, plume characteristics and reduce potentially damaging condensation in the stack. The damper is under automatic control via an exit flue gas temperature detector.
- The boilers are of a Low NOx (oxides of nitrogen) design, and utilise a direct digital combustion control (DDCC) system (installed in 2021), which is a microprocessor controlled system giving independent control of fuel valves and combustion air damper. This ensures that optimum efficiency, and reduced emissions are achieved.
- The boilers are equipped with an oxygen monitoring and trim control system (which interfaces with the DDCC system), providing indication of oxygen level, flue temperature, efficiency and inlet temperature.
- Variable speed drives are used on the boiler forced draught fans, to maximize energy and consumption efficiency.
- Condensate is returned to the boilers from all departments. Overall 60% of condensate is estimated to be returned.

The following controls are in place on chemical and oil storage and handling:

- These chemicals are stored in 500 L tanks, which are calibrated, clearly labelled and bunded.
- To prevent delivery into the wrong tank the caustic based chemicals and sulphite based ones are provided with different fittings.
- Chemicals are transferred from the delivery tanker using pressure discharge.
- Bunded storage tanks are in use for boiler feedwater treatment bulk chemicals.
- The standby fuel oil tanks are located within a bund that can hold over 110% of the volume of one tank. The intake points for the tanks are contained within a bund and the boiler house is also equipped with an oil spill response kit.

Refrigeration

8.35 The site operates a number of refrigeration plants located throughout the installation, for generation of chilled water/glycol, or chilled air (including air-conditioning).

8.36 The following types of system are in place:

- Air Cooled Chilled Water – for generating chilled water
- Air Cooled Chilled Glycol – for generating chilled glycol

- Air Cooled Direct Expansion – for generating chilled air
- Water Cooled Chilled Water – for generating chilled water
- Water Cooled Chilled Glycol – for generating chilled glycol
- Water Cooled Direct Expansion – for generating chilled air

8.37 The systems use a range of types of refrigerant gases including hydrofluorocarbons (HFCs), ultra low GWP refrigerants (hydrofluoro-olefins, HFO) and ammonia. Within the systems, various compressors are used, of the following types:

- Reciprocating (open).
- Hermetic.
- Semi-hermetic.
- Screw (open).

8.38 The water cooled refrigeration systems use an anti-corrosion inhibitor and biocide for cooling tower water dosing which are delivered in drums in a diluted form, and unloaded onto a bunded area.

8.39 A number of process changes are required in respect of additional refrigeration plant at the installation. These are summarised below (further detail is provided in Section 4 above):

- A new ammonia-based chiller plant located on the roof of U Block (installed in 2015).
- A new chiller (utilizing R1234ze refrigerant gas) installed on the roof of U Block in 2022.
- A new chiller (utilizing R1234ze refrigerant gas) installed on the roof of M2 building in 2021.
- A new chiller (utilizing R1234ze refrigerant gas) installed on the roof of Choc Block in 2021.

8.40 A noise impact assessment, including consideration of potential noise and vibration impacts associated with operation of this new plant, is provided in Appendix 3 and a noise management plan is provided in Appendix 4.

BAT BOX – Utilities (refrigeration systems)

The following process and energy controls are in place for the new refrigeration systems:

- Components are specified to minimise the risk of refrigerant leakage, reduce refrigerant charge, simplify maintenance and prolong plant life expectancy. This includes use of welded steel pipework construction.
- The ammonia plant incorporates an integrated ammonia gas detection system.
- The new chillers are specified with an extra low noise sound attenuator package
- R1234ze refrigerant gas has been selected for certain new plant, which has a lower global warming potential than the existing.
- The new units are more energy efficient due to the more modern design and newer components.
- Specialist contractors are used for system maintenance and top up, including regular leak checks.

Ancillary processes - other

Process water treatment

8.41 Water used on site is provided via the mains water supply, which is used without further treatment (water use data is presented in response to Form C3 Q6d). The mains water supply is used preferentially, and for all uses where there is potential for product contact. In addition, Mondelez also hold a licence to abstract water from Bourn (Griffins) Brook, which passes through the site. Whilst not currently used, the water treatment facility for this water is retained and comprises filtration of water followed by treatment with sodium hypochlorite prior to use.

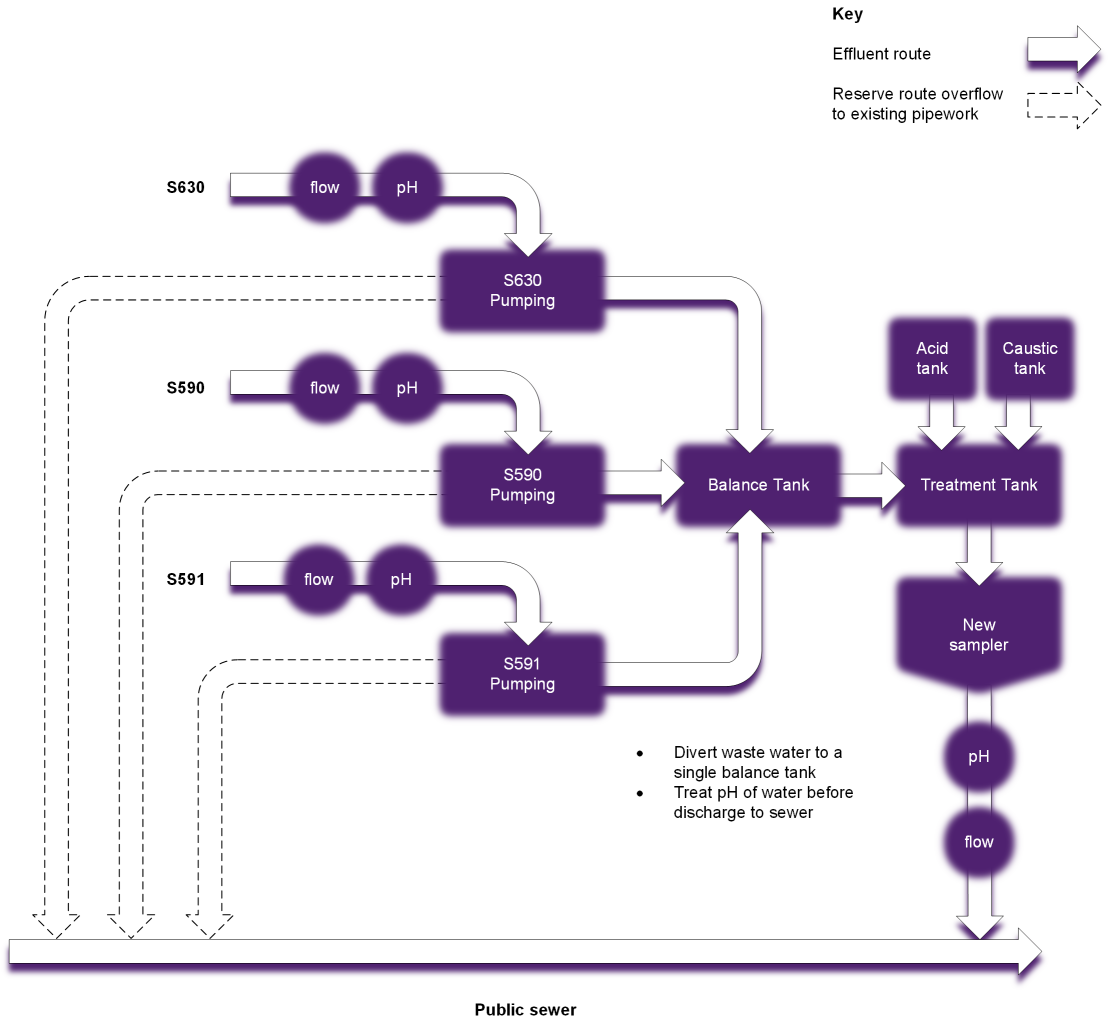
Effluent treatment plant

8.42 Historically three separate effluent streams were discharged to foul sewer for off-site treatment at the Minworth Wastewater Treatment Works (WwTW); these were discharged via emission points S630, S590 and S591. An on-site effluent pre-treatment plant has been installed, which partially treats effluent streams prior to discharge to sewer. The aims of this scheme were to better align to BAT and to:

- provide better control of emissions of effluent from the site,
- provide greater operational flexibility in terms of managing acidic and alkaline discharges;
- improve compliance with site's trade effluent discharge consent; and
- Reduce effluent treatment costs.

8.43 The process operates as shown in Figure I .

Figure I ETP process flow



8.44 Effluent from the factory flows by gravity to newly installed below ground concrete transfer sumps, from where it is automatically pumped via duty / standby pumps to the glass lined steel balance tank (250 m^3 capacity bunded tank) located within the new ETP area. The transfer pumps operate automatically on level control with signals provided by submersible hydrostatic level sensors. There is also a high-high level float type switch installed as a back-up. The pumps provided are submersible vortex impellor type and operate on a duty or duty / assist basis depending on effluent levels within the transfer sump. Effluent will continue to be transferred automatically to the balance tank until a high-high level is reached. The tank cannot be over-filled as, above high-high level, the effluent would be diverted under gravity to the main sewer.

8.45 The effluent level within the balance tank is continuously monitored by means of a low level mounted hydrostatic pressure sensor. When the effluent level within the vessel reaches a certain depth an externally mounted venturi aerator activates to mix the contents of the vessel to balance variations in the effluent pH.

8.46 When a preset system start level is reached the effluent will then be allowed to transfer effluent by gravity at a controlled rate to the reaction tank (6 m^3 capacity bunded polypropylene tank). The speed is controlled using an inline magnetic flowmeter and a pneumatically operated flow control valve, which fluctuates automatically to maintain the flowrate. As the balance tank level decreases the flow rate will reduce, once this reduces past a preset low flow level a centrifugal feed pump will then activate to meet the flowrate. This transfer will then continue until the low level stop preset level is reached.

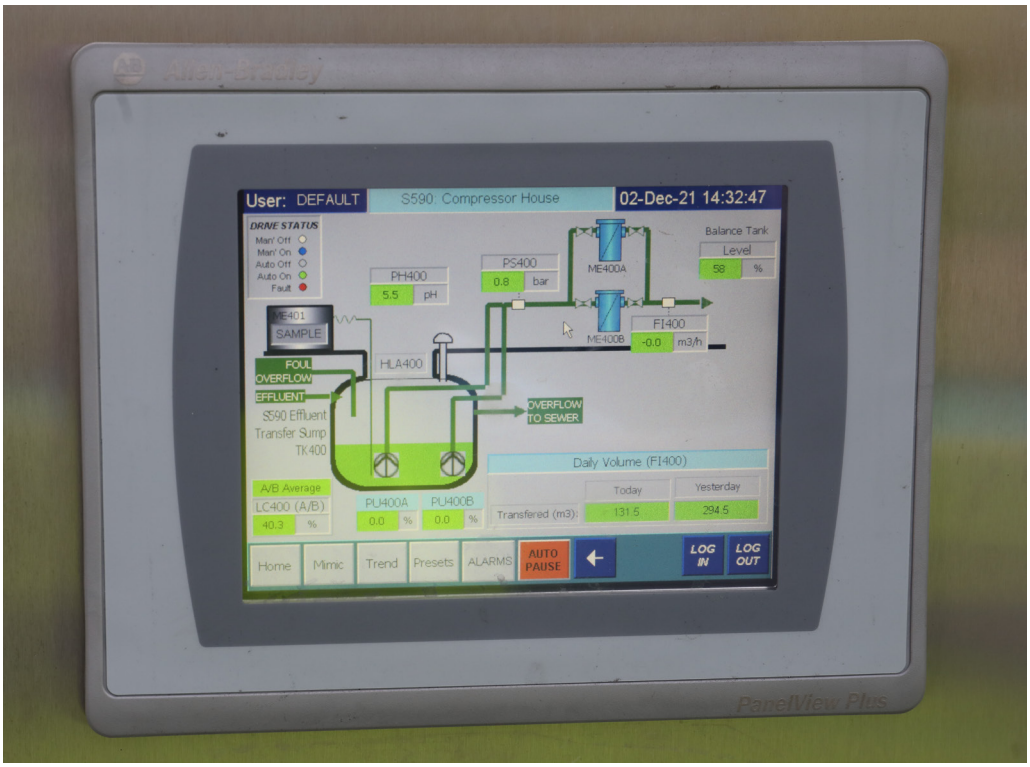
8.47 Within the reaction tank chemicals are added for pH correction and the contents are continually mixed by a marine propeller mixer. The pH is monitored within the tank using dip type pH electrodes and the respective chemical automatically dosed to correct the pH within a preset range.

8.48 Acid and caustic chemicals are stored within bunded chemical storage tanks (10 m^3 and 25 m^3 capacity tanks respectively), each with continuous level monitoring provided by an ultrasonic level sensor. An independent level gauge is also provided outside the bund to provide tank level confirmation for the chemical delivery driver. High level alarms and beacons are provided by the control system. Acid / caustic is dosed into the reaction tank as required using duty/standby diaphragm dosing pumps.

8.49 The pH-controlled effluent flows to the sewer from the treatment tank via an inline magnetic flowmeter. An automatic sampling unit is also installed at this location to provide effluent monitoring capability.

8.50 The complete process is fully automated and controlled by a PLC control system with operator interface via touch screen panel view. This is illustrated in Figure J below.

Figure J PLC process mimic

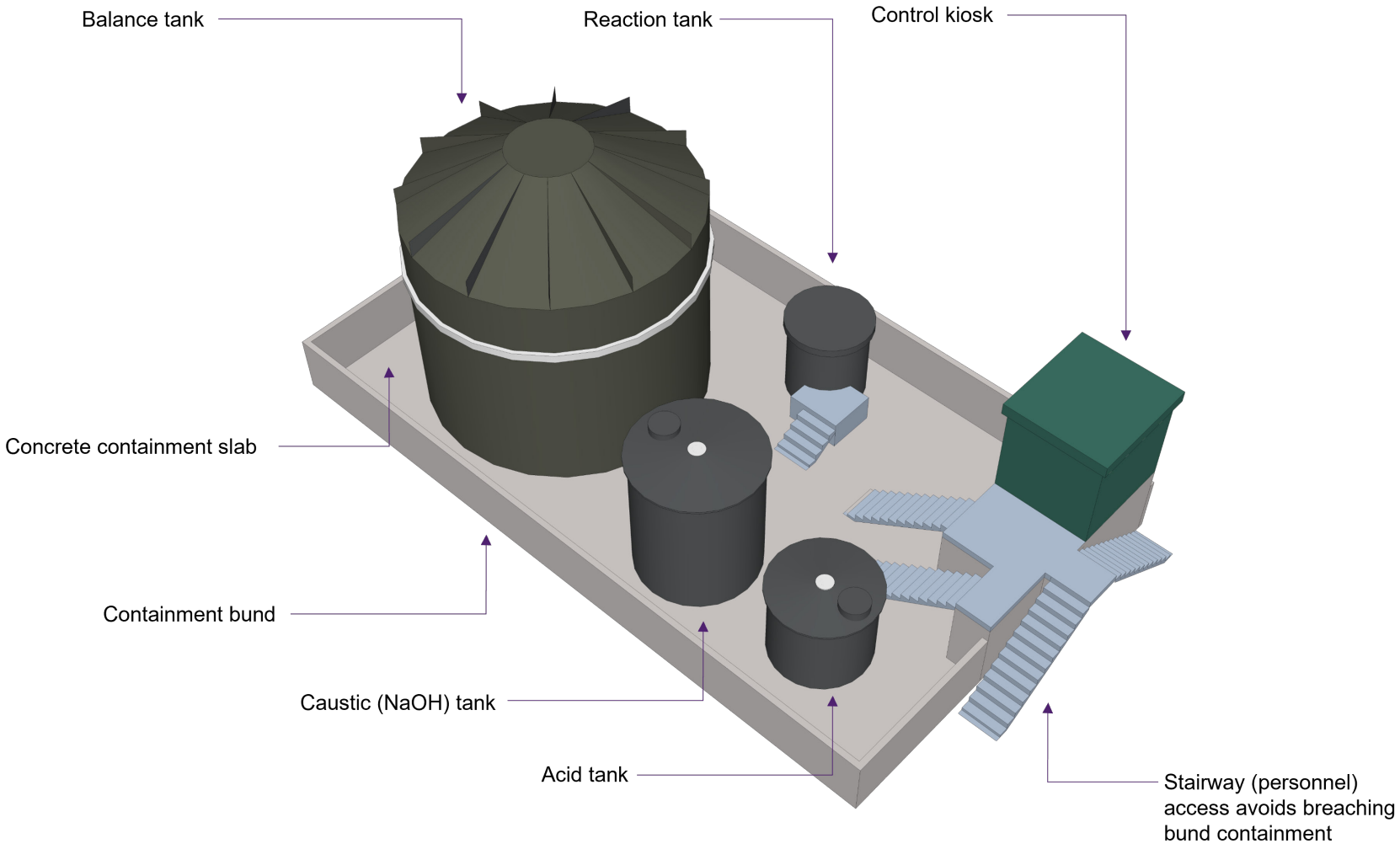


8.51 A dedicated chemical unloading point has been designed to provide containment in the event of a potential spill or loss of integrity of a hose connection. This is illustrated in Figure K .

Figure K ETP process flow

8.52 A schematic 3D illustration of the ETP system is provided in Figure L overleaf.

Figure L Schematic illustration of the ETP system



BAT BOX – Utilities (effluent treatment plant)

The following emissions and containment controls are in place for the ETP system:

- New above ground pipework is used to direct effluent flows associated with the ETP within the installation boundary.
- The ETP is fully bunded, with sufficient capacity to contain at least 110% of the latest single tank and 25% of combined contents.
- Chemicals used for pH adjustment are stored within the bunded area within bulk storage tanks.
- The chemical delivery/unloading area slopes towards the bund allowing any spilt material to be retained within a bunded area.
- Written procedures are in place covering ETP plant management, maintenance and chemical delivery and control.
- Spill kits are available and staff are trained in spill response.
- Whilst treated effluent is now directed to a new discharge point, the original discharge points have been retained in order to retain a back-up disposal route in the event of maintenance of other issues.
- Inspectable stainless steel pipes with flanged joints
- The ETP operates under PLC logic control, with detailed process mimics, data logging and alarms, which sound locally and at the security lodge.
- Common balance tank which provides the facility to buffer flow and composition, reducing demand for chemical addition.

Process gases

8.53 Carbon dioxide is used for aeration of chocolate for manufacturing certain centres. CO_2 is stored in a tank external to the building. The tank is contained within a walled are to protect from vehicle impact. CO_2 is piped to the production area in the adjacent building under pressure. Sensors in the production area detect elevated levels of CO_2, triggering alarms and plant shutdown.

8.54 Refer to section on 'refrigeration' in respect of ammonia gas in use within the installation.

Fire water system

8.55 A firewater tank system and pump house is in place to provide fire water as part of the site's business continuity strategy. The system comprises:

- Two above ground water tanks (capacity 515,000 L each)
- Electrically driven pumps for operation when mains electricity supply is available, with a diesel driven standby pump (375 kW thermal input) for standby use in the event of a failure of the systems electricity supply.

8.56 The fire water system is managed by specialist facilities management contractors under an operations and maintenance contract. This includes servicing and periodic testing of the diesel firewater pumps to ensure they remain available and operational in an emergency situation.

Packing and dispatch

Wrapping and packing is undertaken within the installation prior to despatch from site. The products produced in manufacturing within the installation are individually wrapped bars and units, boxes and plastic pans of single wrapped units, bags of unwrapped units, assorted mixtures of wrapped units packaged into cardboard cartons or tins, all of which may be packaged into cardboard outers.

The processes involved may be separated into two main groups; wrapping and packing.

- **Wrapping** is either encapsulation of single moulded units, bars or eggs in plastic film or foil materials and is the precursor stage to the packaging process.

  Wrapping is performed in predominantly two ways; flow wrap and foiling.

  - **Flow wrap** – where continuous pre-printed film is formed into a tube around the unit which is then crimped and cut to length at either end of the unit by a set of rotating pressure crimp rollers.

  - **Foiling** – where unit or hollow egg are automatically wrapped in a section of foil cut from a continuous reel.

- **Packaging** is the process whereby a pre-determined number or weight of wrapped or unwrapped units are sealed into bags, cardboard cartons or metal tins which in turn are sealed as multiples into cardboard outers and palletised.

BAT Summary – Packing and despatch

The following process and emission controls are in place on packaging and despatch processes:

- Moulded units and bars are the main “raw materials” used in the process. In most cases, these are received directly from the moulding lines via belt conveyors, although some assortment units may be placed onto flat plastic trays and transferred manually to the wrapping machines.
- Packaging lines are designed and operated for maximum efficiency which in turn minimises the amount of waste product and packaging.
- Conveyors are all housed within the separate process buildings and do not represent a source of noise externally.
- Wrapping machines for moulded bars or units are designed to wrap the product with minimum amount of material.
- Wrapped product is either automatically counted or weighed into suitably sized cardboard boxes or plastic pans to provide minimum ullage.
- Weighed and or counted units are sealed into a variety of packaging and involves applying controlled heat and pressure to sealing area of film. Temperature control of heat sealing jaws and plates is achieved via closed loop system.
- Packaging materials such as plastic film, cartons, tins, cardboard boxes are received in palletised loads which are manually transferred to designated storage areas.

- Waste packaging materials are compacted on site and sent off site. Packaging waste is recycled wherever possible.
- Moulded bars, cartons and bags are automatically counted and packed into cardboard boxes.
- Plastic pans of wrapped units are stored in air conditioned rooms on site. Wrapped units in cardboard boxes are sealed and put in refrigerated storage outside of the installation.
- Cartons are typically sealed at both ends with cold melt glue systems which apply controlled volume of glue.
- All products pass through metal check and check-weigher. Metal check failures go to by-product waste and all check-weigher failures are stripped down and units used as make weights to increase net weight at the initial assortment weighing/counting.
- Packing layout per pallet is optimised to make maximum use of pallet and stack sizes. When stacking is complete the whole pallet is wrapped automatically with stretch wrap.
- Shrink wrap tunnel temperature is controlled by closed circuit control. The shrink wrap machines generate hot air by drawing air over banks of electrically heated elements and distributing it through a series of vents into the heat tunnel. Heated air is recycled within chambers to reduce heating energy requirement, maximising efficiency.

Section III: Supporting Information

This part of the application provides detailed responses to questions in Section I: Application Forms, where further space is required to provide the necessary information.

Responses are provided only where further information is required, and the questions numbers are as stated in the application forms.

The information provided in this section should be viewed in parallel with:

- Section I: Application Forms
- Section II: Technical Description

Form A

5c Details of company directors

Name	Date of birth
Mr. Roberto Gambaccini	12/07/77
Mr. Richard Anthony Hobman	18/12/66
Mr. Rui Pedro Duarte De Ascensao	02/06/87

Form C2

2 About your proposed changes

Proposed changes to current activities within this installation are provided in Table C2: 1 below. A full summary of activities proposed to be included within this installation is provided in response to Form C3 Question 1 later in this section.

Table C2: 1 - Changes to existing activities

Name	Installation schedule 1 references	Description of the installation activity	Description of the waste operation	Description of the mining waste operation	Description of the water discharge activity	Description of the groundwater activity
Bournville Chocolate Works	Section 6.8 A(1)(d)(iii)	**Changes** to existing site activities including transition from Section 6.8 A(1)(d)(i) to Section 6.8 A(1)(d)(iii)	N/A	N/A	N/A	N/A
	Section 5.4 A(1)(a)(ii)	**Addition of activity:** Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving physico-chemical treatment	N/A	N/A	N/A	N/A
	Section 1.1 B(a)	**Removal of activity:** Steam raising boilers will fall below regulatory threshold due to boiler de-rating.	N/A	N/A	N/A	N/A

3 Your ability as an operator

3d Management systems

Mondelez has an established environmental management system (EMS), aligned with the principles of ISO 14001, which comprises a series of corporate-level documented 'standards' (common to all Mondelez sites), supplemented by site-specific documented procedures which describe how the Mondelez standards are implemented at a site level. The EMS forms part of an integrated Health, Safety and Environmental (HSE) Management System. The site also has a certified ISO 50001 Energy Management System.

A summary of the management system is provided below, focusing in more detail on how this is applied to the management of combustion operations.

Table C2: 3d: Management system

Management system features	How Mondelez applies this to environmental permitting
1. Clear management structure and allocated responsibilities	Effective environmental governance is a core element of the Mondelez Global Strategy, underpinned by a commitment to strong leadership and clear communication of accountabilities and responsibilities. The documented Leadership and PDCA standard establishes the key components of the Mondelez International Health, Safety and Environmental Management System (HSEMS) that must be applied by all sites globally, including requirements in relation to leadership at each site. Accountabilities and responsibilities for environmental issues defined in written job descriptions. There are written procedures for control of activities undertaken by contractors.
2. Identification, assessment and management of significant environmental impacts.	The EMS has a written procedure in place for the identification, assessment and management of environmental aspects and impacts. A site-specific aspects and impacts register (environmental risk assessment) has been prepared and is maintained. Documented procedures require that this is reviewed, and where necessary updated, annually or more frequently in the event of changes on site, significant changes to legal requirements or following a significant incident, compliance issue or complaint.
3. Compliance with legal and other requirements applicable to activities having an impact on the environment.	Requirements for compliance with legal and other obligations applicable to the site, including environmental permit conditions, are established within the EMS. This includes a written procedure and a register of environmental legislation, which is managed and maintained via an online system. The site environmental representative is automatically updated in the event of any changes to legislation that may be applicable. Legislative requirements are reviewed at regular intervals and changes are communicated to appropriate management and operational personnel using the internal communication channels defined within the EMS. Evaluation of compliance is undertaken annually via internal audit and is recorded using the online legal register system. A global declaration of compliance is also completed annually.

Management system features	How Mondelez applies this to environmental permitting
4. Establishing an environmental policy and setting objectives and targets.	Mondelez has an established environmental policy and strategy which is cascaded through the organisation. At a site level the Mondelez Environmental Policy is signed and dated by the site manager and communicated to all employees and other individuals working on behalf of Mondelez. There is also an established Mondelez Carbon and Energy Standard. In line with the Global Environmental Strategic Plan, objectives and targets are established which seek to reduce energy use, CO_2 emissions, waste arisings, water consumption and environmental incidents.
5. Environmental improvement programme to implement policy objectives and targets.	A site level environmental improvement programme is defined, which contributes to the Mondelez 2025 Sustainability Goals. The Bournville Plant Roadmap is used to establish the improvement projects for the year which must address the key Mondelez priorities, including sustainability. Progress in achieving these targets is reviewed during monthly governance sessions with the site leadership team.
6. Establish operational controls to prevent and minimise significant environmental impacts.	The Mondelez HSE Management System comprises a series of documented standards, organised into topic areas. Management standards cover issues such as leadership, legislation, contractor management and management of change. Environmental standards cover issues such as carbon and energy management, air emissions and waste management. Sitting below these corporate standards are a series of documented procedures which are adapted at a local level to be site-specific. These procedures establish the processes required to implement the corporate-level documented standards and to meet site specific requirements including the conditions of the site environmental permit. This includes local procedures covering carbon and energy management, air emissions, waste management, spill prevention, control and remediation, wastewater discharge management and refrigerants and halons. Written EMS procedures will be reviewed and, if necessary, updated following changes made on site, including any changes to compliance requirements arising from the issue of the revised environmental permit. Contractor control procedures are also in place as part of the HSE management system.
7. Preventive maintenance programme for relevant plant and equipment.	A planned preventative maintenance system is operated to ensure that equipment and infrastructure is maintained in good condition and that the likelihood of equipment failure, with potential environmental consequences, is minimised. This includes planned maintenance for the new plant and equipment associated with effluent balancing and pH adjustment. The planned maintenance system, including calibration schedule, is controlled and managed at a site level either via the SAP system (for manufacturing equipment) or an alternative computerised maintenance management system (CMMS) for utilities / facilities items. Significant plant performance or maintenance concerns are reviewed on a daily basis during production meetings until the issue is resolved. Any breakdown or failure that could result in a significant environmental effect would be prioritised.

Management system features	How Mondelez applies this to environmental permitting
8. Emergency planning and accident prevention	Emergency planning and accident prevention is addressed by procedures in the EMS. This includes spill prevention, control and remediation. These written procedures ensure that environmental incidents and accidents are minimised and that, if they do occur, action is taken to minimise and mitigate the impacts. Environmental permit requirements, in terms of accident and incident response and follow up investigation, reporting, notification and escalation requirements, are included within these documented site procedures. Written EMS procedures will be reviewed and, if necessary, updated following changes made on site, including any changes to compliance requirements arising from the issue of the revised environmental permit.
9. Monitoring and measuring performance.	The Mondelez environmental governance system establishes monitoring and measurement requirements for environmental key performance indicators (KPIs) such as CO_2 emissions, energy use, waste, water consumption and environmental incidents relating to the site as a whole. Performance data is reported and tracked monthly using a software reporting tool. Planned and reactive maintenance systems ensure that plant and equipment is well maintained and operates efficiently with faults detected and resolved in a timely manner.
10. Monitoring and control systems.	Procedures ensure that monitoring equipment used to verify compliance with environmental legislative requirements is maintained and, where appropriate, calibrated. Environmental procedures include reference to environmental permit requirements, including those relating to air and wastewater emissions monitoring and environmental incident reporting. These procedures will be reviewed and, if necessary, updated following issue of the revised environmental permit. Records will continue to be maintained as required by Environmental Permit conditions.
11. Training.	A site-specific induction training pack is maintained which addresses environmental issues such as awareness of the environmental permit and relevant permit conditions, information regarding spill response, emissions to air and water and resource efficiency. This induction training is provided to all employees and contractors, including temporary staff. A training needs matrix is maintained which lists environmental training requirements including general environmental awareness training and other more specific environmental training needs such as spill awareness and waste handling. This training is delivered to site personnel as required; refresher training is provided as required to ensure knowledge and competencies are effectively maintained. The system of contractor controls in operation ensures that pre-requisites such as evidence of contractor competencies are obtained and reviewed in advance of any work being started and this is supplemented by specific risk assessments and method statements for each individual task, controlled via a permit system.

Management system features	How Mondelez applies this to environmental permitting
12. Communications and reporting incidents of potential or actual non-compliance and complaints	The approach to internal communication of environmental issues, concerns and initiatives includes review of key issues during daily production meetings, monthly governance sessions, monthly HSE committee meetings and on site noticeboards. Period packs are prepared on a monthly basis and are used to brief employees on key issues including KPI performance. Employee near miss cards empower staff to identify and report any issues of concern as well as opportunities for improvement, which may include environmental issues on occasions. Procedures are in place covering requirements for reporting and responding to environmental incidents and permit non-compliances.
13. Auditing	An internal audit programme is maintained by Mondelez covering the HSE management system. A proprietary EHS software system is used to schedule internal audits and record progress. Internal audit processes are designed to ensure that all aspects of site activities, which may have an environmental relevance, are audited on a regular basis. Internal audits are undertaken using a two-stage approach: establishing whether site activities comply with site procedures and reviewing whether site procedures meet the requirements of the established Mondelez standards. Internal audits are completed by designated auditors using a series of specific checklists. For checklist criteria a score is allocated, depending on level of compliance observed; where performance against any of these criteria does not meet the minimum standard required, a non-conformance is raised, which is recorded using the EHS software system. In addition to the local site-based internal audit system, a programme of inter-site auditing is carried out whereby one site is audited by trained personnel from another. This audit programme, which is undertaken by HSE managers from other Mondelez sites, ensures that all Mondelez sites are audited against Mondelez standards at least once every three years.
14. Corrective action to analyse faults and prevent recurrence	The EMS contains procedures for the identification and reporting of environmental related incidents and non-conformities. These may arise from numerous sources including internal and external audits, site walkovers and inspections and employee near miss cards. When non-conformities arise, corrective actions are identified to ensure the immediate symptoms are remedied and as well as analysis to identify corrective actions for the root causes of an issue. Audit non-conformities are recorded in audit reports held within the internal audit system and managed with other corrective actions using the EHS software system.

Management system features	How Mondelez applies this to environmental permitting
15. Planning	There is a Mondelez standard and site-level procedure in place to address management of change requirements. Site personnel follow a three-stage process, applied in succession, which ensures that environmental considerations are taken into account when planning new or amended activities. This includes: • Authority to modify; • Authority to commission; and • Authority to operate. At each stage there is a requirement to review and challenge the proposed change to ensure that HSE impacts are avoided, minimised, controlled or appropriately managed. This includes reference to environmental permit and Best Available Techniques (BAT) requirements, where applicable. In addition, mandatory Mondelez engineering standards also incorporate BAT requirements.
16. Reviewing and reporting environmental performance	The Mondelez HSE Management System incorporates review processes to ensure the continuing suitability, adequacy and effectiveness of the system and to ensure that continual improvement in environmental performance is maintained across the business. Monthly governance meetings are held with the site leadership team which includes review of environmental KPI performance. In addition, an annual management review is held at a site level which considers overall performance of the management system.
17. Managing documentation and records	The HSE management system documentation is maintained on the Mondelez business intranet and document control procedures are in place for all system documents and records. All controlled documentation within the HSE management system is identified by a unique document reference, date and revision number. All documentation is subject to periodic review to ensure its continued relevance; an electronic record of revisions and approvals is held via the document control system. Environmental records are managed on site in accordance with document control procedures.

6 Environmental risk assessment

The table overleaf sets out the screening assessment for environmental risks within scope of the EPR. The risks identified and discussed relate only to the activities proposed as part of this variation application.

This review follows EA guidance on risk assessments for environmental permits[9] and adopts the approach outlined below:

- Identify and consider risks, and the sources of the risks, and assess whether these require further assessment or can be screened out (Table C2: 6-1).
- Where those risks cannot be screened out, undertake the necessary technical assessments (qualitative and quantitative) to determine their level of significance. In undertaking the technical assessments:
    - Identify the receptors at risk (people, animals, property, and anything else that could be affected by the hazard) and the potential pathways through which the risks could be realised.
    - Where risks are potentially significant, measures are identified to control and mitigate these risks, including preparation of a management plan where appropriate.

The methodology and risk assessment is presented in Table C2: 6-3.

9 https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit (accessed February 2021)

Table C2: 6-1: Identification of environmental risks and screening

Identified risk area	Potential Receptors	Consideration of risk	Further Assessment?
Fugitive emissions	**Human receptors (nuisance):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates. **Ecological receptors**: Bourn (Griffins) Brook, which runs through the site.	There are no new potential fugitive release emissions associated with the changes considered by this permit variation application and therefore no further assessment is required. Accidental releases are considered below.	✘ Not required screened out
Emissions to Sewer	**Controlled waters:** River Tame, via Minworth Wastewater Treatment Works. **Ecological receptors**: Bourn (Griffins) Brook, which runs through the site. **Other:** Drainage systems and Minworth Wastewater Treatment Works.	Improvements have been undertaken to effluent management on site in order to improve compliance with the site Trade Effluent Discharge consent. Three separate discharge points have now been re-routed to a single point with provision for effluent buffering and pH correction. The existing three discharge points will also be retained for use in emergency / abnormal circumstances (e.g. maintenance undertaken within the new pH correction facility) and a new emission point to sewer is added to the permit. The quantity and quality of the discharge has not changed (other than in respect of buffering and pH correction). Notwithstanding this further consideration is given in Section 6:1 below. A description of the changes to emissions to sewer is provided in Section II: Technical Description. A summary of point source emissions to sewer is provided in response to Form C3: Q 2 and proposed monitoring of emissions to sewer is provided in response to Form C3: Q3c.	✓

Identified risk area	Potential Receptors	Consideration of risk	Further Assessment?
Emissions to Water	**Controlled waters:** Bourn (Griffins) Brook, which runs through the site. River Tame, via Minworth Wastewater Treatment Works. **Ecological receptors**: Bourn (Griffins) Brook, which runs through the site. **Other:** Drainage systems and Minworth Wastewater Treatment Works.	This permit variation application includes removal of the single remaining process discharge point to Bourn (Griffins) Brook (W21 in the permit). This will reduce potential to impact on the brook. In addition, a review of site drainage has identified nineteen discharge points for uncontaminated surface water runoff (rainwater from roofs and roadways) to Bourn (Griffins) Brook. These discharge points are not new but have not previously been listed in the permit. In line with Environment Agency practice, uncontaminated surface water discharge would not require a permit, however these are listed in this variation application for completeness. No new or updated impact assessments are required. Accidental releases are considered below.	✘ Not required screened out
Emissions to land and/or generation of waste to other processes	**Controlled waters:** Bourn (Griffins) Brook, which runs through the site, River Tame, via Minworth Wastewater Treatment Works. **Ecological receptors**: Bourn (Griffins) Brook, which runs through the site. **Other:** Underlying ground and groundwater on site, or off site e.g. at waste management facilities through incorrect waste segregation.	There are no significant changes in the generation of solid waste from the process arising through these proposed changes and therefore no further assessment is required. There are no direct discharges to ground or groundwater at this installation. Accidental releases are considered below. Further information on waste arisings and waste management is provided in response to Q6e of Form C3.	✘ Not required screened out

Identified risk area	Potential Receptors	Consideration of risk	Further Assessment?
 Odour	**Human receptors (nuisance):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates.	Confectionery manufacturing processes have the potential to generate odours, however these manufacturing odours are generally characterised as having a positive hedonic score (i.e. are considered 'pleasant'). The new effluent treatment facility will not generate any significant odour as liquid effluent is not stored / retained in this facility (the covered balance tank capacity is 250 m^3, the treatment capacity of the plant is 840 m^3/day); treatment consists only of pH correction. ETP is located centrally on site, away from sensitive neighbours. The changes proposed within this permit variation application will not impact the odour generation potential of the installation, thus no further assessment is proposed.	✘ Not required screened out
 Visible plumes	**Human receptors (nuisance):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates.	The nature of the combustion sources is such that plume moisture levels will be low and thus in normal operations, and for the majority of weather conditions, plume visibility is expected to be very low. The changes proposed within this permit variation application will not impact the plume generation potential of the installation and therefore no further assessment is required.	✘ Not required screened out
 Global warming potential	**Global atmosphere:** direct and indirect emissions	None of the changes proposed in this permit variation application have to potential to lead to a significant increase in the global warming potential of the installation. The proposed upgrade of refrigeration plant to modern and more efficient units will contribute to improving the overall energy efficiency of the site; all refrigerant gases used have lower, or no, global warming potential. Further energy information is provided in response to Q6a and 6b of Form C3.	✘ Not required screened out.

Identified risk area	Potential Receptors	Consideration of risk	Further Assessment?
 Noise and vibration	**Human receptors (nuisance):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates.	The new refrigeration plant covered by the scope of this permit variation application have the potential to impact on the noise and vibration environment surrounding the site. A noise and vibration impact assessment has been undertaken (Appendix 3) and is summarised in Section 6.2 below. A noise management plan has been prepared (Appendix 4).	✓
 Emissions to Air (including deposition to land)	**Human receptors (human health):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates. **Ecological receptors:** Bourn (Griffins) Brook, which runs through the site.	Included within this permit variation application is a revised and rationalised list of point source emissions to air – refer to information provided in response to Q2 of Form C3. The proposed changes covered by the scope of this permit do not have the potential to affect point source emissions to air, with the following exceptions: • Maximum boiler emissions (which will reduce due to proposed boiler de-rating project); • The expanded R&D facility in the basement of M1 building includes 3 no. pilot plant scale roasters with 4 no. new air emissions points. Emissions from these sources are insignificant. Further detail is provided in response to Q2 of Form C3. No further assessment is required.	✗ Not required screened out.

Identified risk area	Potential Receptors	Consideration of risk	Further Assessment?
 Accidental Releases	**Controlled waters:** Bourn (Griffins) Brook, which runs through the site. **Ecological receptors:** Bourn (Griffins) Brook, which runs through the site. **Other:** Drainage systems, unmade ground, underlying ground and groundwater. **Human receptors (nuisance):** Surrounding residential receptors. Schools and other community facilities. Footpaths, recreation areas such as playing fields and playgrounds, other businesses, commercial and industrial estates.	An EMS is in operation at the site, which includes measures to identify, manage and mitigate potential environment risks associated with accident scenarios. The changes to site operations and activities covered by this variation application have the potential to affect accident and incident scenarios. Therefore a review of accident scenarios associated with the proposed changes has been undertaken. This is presented in Table C2: 6-2 below.	✓

6:1: Emissions to sewer

Improvements have been made to effluent management on site in order to improve compliance with the site Trade Effluent Discharge consent. Previously, process effluent was discharged via three separate locations (referred to in the permit as emissions points S590, S591 and S630). Each of these separate effluent streams have now been re-routed to a common effluent buffer tank which provides the facility to balance effluent flow and composition. Continuous monitoring of pH and flow is carried out with chemicals dosed as required to adjust pH to comply with the Severn Trent Water Trade Effluent Discharge Consent.

There are no changes proposed as part of this permit variation application which impact the total volume nor the organic loading of the discharge to sewer. The effluent balance tank and pH adjustment aims to ensure a more consistent flow, in terms of loading and pH is passed forward to the sewage treatment works. On this basis, no further assessment is considered necessary.

6:2: Summary of noise and vibration impact assessment

A noise impact assessment has been undertaken and is provided in Appendix 3 to the application document. The assessment uses background noise levels and source noise levels measured off and on site. The data collected from these surveys has been used to construct a detailed 3D noise propagation model of the installation to predict the cumulative levels of operational noise at the nearest noise sensitive receptors in accordance with the method of calculation set out in ISO 9613-2:1996. The predicted operational noise levels have been used to assess the noise impact using BS 4142:2014+A1:2019 and BS 8233:2014 as guidance where appropriate. The noise model includes all new noise sources (i.e. chiller plant) covered by the scope of the permit variation application, as well as pre-existing noise sources.

The assessment shows that noise from the site during the day is expected to be low impact. The assessment shows that noise from the site has the potential to cause adverse impact at night, and therefore mitigation methods using the best available techniques (BAT) have been recommended. These enhanced noise mitigations have already been, or will be, implemented at the Bournville site.

6:3: Accidental Releases

The potential for accidental releases are identified as part of the site Environmental Risk Assessment, as a result of the changes proposed by this variation, are identified and assessed in Table C2: 6-2.

Table C2: 6-2: Potential accidental releases and associated risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs – who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains?
Fire	Local population and ecological receptors including Bourn (Griffins) Brook	Windblown dispersion. Surface water runoff	**Prevention:** Fire/smoke detection and response systems in place including appropriate operational practices, procedures, training and awareness, alarms and sprinkler system. Effluent treatment plant and bulk storage containers are bunded to prevent escape of potentially polluting materials **Response:** Follow site emergency plans and inform relevant authorities.	Very low	High	Low
Failure to contain firewater	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** Fire prevention measures as above. Defined site drainage plan. Instigate drainage protection, smaller quantities of firewater could be retained within drains and ETP tanks. **Response:** Follow site emergency plans and inform relevant authorities. Manage and treat firewater on or off-site as appropriate.	Very low	High	Low

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs – who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains?
Flood (with potential to lead to release of contaminative materials)	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** Parts of the site located are in an area with an indicative high or medium risk of flooding (based on planning land use maps). All contaminative materials in this location are provided with secondary containment. Mondelez is currently working with the Environment Agency on a project to improve flood resilience in the local area. Whilst this project has not yet been completed this is expected to reduce the risk of flooding and associated environmental impacts. **Response:** Inform EA and emergency services. Invoke site emergency and continuity plans.	Medium	Medium	Medium
Failure of containment – ETP (chemicals, process effluent tanks)	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** Entire ETP area is bunded, regular inspection of condition of tanks/containers and bunds. Spill control procedures, training and provision of spill kits. **Response:** Clean up spillage and transfer waste into appropriate containment for recovery or disposal. Provision of containment via double skinned oil tanks.	Low	Medium	Medium
Failure of containment – ETP chemical deliveries	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** ETP tanker unloading area is bunded, regular inspection of condition of tanks/containers and bunds. Spill control and unloading procedures, training and provision of spill kits. **Response:** Clean up spillage and transfer waste into appropriate containment for recovery or disposal. Provision of containment via double skinned tanks.	Low	Medium	Medium

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs – who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains?
Failure of containment – flavour store	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** Flavour store is located within a building and is bunded, regular inspection of containers and housekeeping within this area. Spill control procedures, training and provision of spill kits. **Response:** Clean up spillage and transfer waste into appropriate containment for recovery or disposal. Provision of containment via double skinned tanks.	Very low	Low	Low
Failure of containment – expanded R&D facility	Local water courses (directly or indirectly via WwTW), ground and groundwater.	Site drainage system, overland runoff, infiltration into ground.	**Prevention:** R&D facility is located within a building, regular inspection of containers and housekeeping within this area. No significant quantities of potentially polluting materials are held or used within this facility. Spill control procedures, training and provision of spill kits. **Response:** Clean up spillage and transfer waste into appropriate containment for recovery or disposal. Provision of containment via double skinned tanks.	Very low	Low	Low
Release of refrigerant gases – new refrigeration plant with HFO gas	Local and global atmosphere	Airborne	**Prevention:** Planned preventive maintenance programme in place for new refrigeration plant. New plant utilises R1234ze with lower global warming potential. **Response:** Contracts in place with refrigeration engineering companies to provide prompt response including system isolation to prevent further gas loss (if appropriate), followed by repair.	Medium	Very low	Low

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs – who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains?
Release of refrigerant gases – new refrigeration plant with ammonia gas	Local and global atmosphere	Airborne	**Prevention:** Planned preventive maintenance programme in place for new refrigeration plant. This includes use of welded steel pipework construction and an integrated ammonia gas detection system. **Response:** Contracts in place with refrigeration engineering companies to provide prompt response including system isolation to prevent further gas loss (if appropriate), followed by repair.	Low	Medium	Medium
Failure of plant item resulting in increased noise	Local population and ecological receptors	Airborne	Refer to Appendix 3: Noise Impact Assessment.			
Failure of boiler control system, resulting in increased emissions	Local air quality Human and ecological receptors	Airborne	**Prevention:** Digital control system with fault code recording and alarms, higher power operations would be locked out and only recoverable via direct OEM intervention (not available to Mondelez staff directly). Boiler capable of full compliance with MCPD limits even when fully rated. **Response:** Maintenance works undertaken to rectify under specialist contract.	Low	Very low	Low

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs – who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains?
Failure of bag filters	Local air quality Nuisance Human and ecological receptors	Airborne	**Prevention:** Planned maintenance and inspection programme in place. All bag filters incorporate automatic cleaning with compressed air reverse jet to knock off accumulated materials (back into the vessel for reuse) and prevent blinding of filter / blockages (which may otherwise result in emissions to air from operation of an explosion panel or filter burst). **Response:** Identify cause of fault and rectify as soon as practicable. Alter process operations as necessary.	Low	Low	Low

Table C2: 6-3 Risk Assessment methodology

Probability	Probability of exposure is the likelihood of the receptors being exposed to the hazard. Generic risk assessment (GRA) example definitions: • High (4) – exposure is probable: direct exposure likely with no / few barriers between hazard source and receptor. • Medium (3) – exposure is fairly probable: feasible exposure possible - barriers to exposure less controllable. • Low (2) – exposure is unlikely: several barriers exist between hazards source and receptors to mitigate against exposure. • Very Low (1) – exposure is very unlikely: effective, multiple barriers in place to mitigate against exposure.
Consequence	The consequences of a hazard being realised may be actual or potential harm. This utilises a high (4) / medium (3) / low (2) / very low (1) score using attributes and scaling to consider 'harm'.
Magnitude	Magnitude of the risk is determined by combining the probability with the magnitude of the potential consequences: • High risks require additional assessment and active management (12 – 16). • Medium risks require additional assessment and may require active management/monitoring (6 – 9). • Low and very low risks require periodic review (1 – 4).

		Probability			
		Very low (1)	**Low (2)**	**Medium (3)**	**High (4)**
Consequence	**High (4)**	Low (4)	Medium (8)	High (12)	High (16)
	Medium (3)	Low (3)	Medium (6)	Medium (9)	High (12)
	Low (2)	Low (2)	Low (4)	Medium (6)	Medium (8)
	Very low (1)	Low (1)	Low (2)	Low (3)	Low (4)

Source: GRA_SR2018 No.7, supplemented by risk consequence scoring from other GRA documents.

Form C3

1 What activities are you applying to vary?

Activities to be included within this installation are provided in Table C3: 1 below. A summary of the activities to be removed from, and added to, the permit is provided above in Table C2: 2 above in response to Form C2, Question 2.

Table C3: 1 – Types of activities

Installation name	Schedule 1 references	Description of the Activity	Activity Capacity	Annex I (D codes) and Annex II (R codes) and descriptions	Hazardous waste treatment capacity	Non-hazardous waste treatment capacity
Bournville Chocolate Works	Section 6.8 A(1)(d)(iii)	Treatment and processing, other than exclusively packaging, of animal and vegetable raw materials	>75 if animal material (A) is equal to 10 or more, or 300-(22.5 x A) in any other case	N/A	N/A	N/A
	Section 5.4 A(1)(a)(ii)	Disposal of non-hazardous waste involving physico-chemical treatment	>50 tonnes per day	N/A	N/A	N/A

Directly Associated Activities (including description)	
Boilers	Production of steam by 3 boilers (each approximately 6.25 MW thermal input), burning of natural gas, with light fuel oil as backup.
Storage of raw materials	Storage of food raw materials and final product packaging
Water treatment	Filtration of water followed by treatment (e.g. with sodium hypochlorite) prior to process use
Refrigeration	Storage of finished products prior to despatch. Cooling of water for indirect cooling in process.
Chemical storage	Storage of chemicals used in the installation.

2 Point source emissions to air, water and land

A first principles review of all air emissions points has been carried out[10], with a simplified nomenclature adopted. The rationale used to develop this inventory is presented in Table C3:2-1 below. The proposed changes covered by the scope of this permit do not have the potential to impact upon point source emissions to air, with the following exceptions:

- Maximum boiler emissions will decrease due to proposed boiler de-rating project;
- The expanded R&D facility in the basement of M1 building includes pilot plant scale roasters with 4 no. new air emissions points and a further 1 no. new air emission point located on the 1st floor of the M1 building associated with the installation of new pilot plant-scale equipment for electrical and steam-based cooking of cocoa powder.

Table C3:2-1: Point source emissions to air

Included within the inventory	Excluded from the inventory
• Combustion process emissions points.	• Mobile combustion sources.
• External emissions points with the potential to release dust / particulates (either under normal or accident/emergency scenarios) including silo vents and explosion panels.	• Emissions points that discharge to internal areas (i.e. within a building). Where these are fitted with active abatement these have been identified separately within Table C3:2-3. • Non-food contact steam releases e.g. steam from boiler hotwell and flash vessels. • Ambient air extraction fans / blowers / AHUs where simple panel air filters are installed for food safety / product quality purposes.
• External emissions points with emissions abatement plant (e.g. reverse jet (bag) filters).	
• External emissions points releasing product heating, hot washer or other vapours (either under normal or accident/emergency scenarios).	
	• Extraction vents for ambient air within a process building, installed solely to maintain appropriate working conditions from an occupational health or process management perspective (e.g. to maintain the correct room temperature for personnel or plant management purposes).
	• Extraction vents from areas of the site where no manufacturing processes take place e.g. toilets/washrooms and canteen area.

The revised inventory of point source emissions to air is detailed in Table C3:2-2 below. The location of point source emissions to air are shown in Section IV Figure 3.

10 This represents the first major review since the original PPC permit application was submitted in 2004

Refer also to Appendix 5 Medium Combustion Plant Directive requirements for details of Emission Limit Values (ELVs) for emissions to air from boilers following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3:2-2: Point source emissions to air

Emission Point Ref.	Location	Source	Parameter	Expected Emissions		Notes
				Quantity #	Unit	
A1 (previously PPB)	Power plant	Boiler 1 – emissions from steam raising boiler	NOx	<200[11]	mg/m^3	Current permit emission limit
			CO	<150[11]	mg/m^3	Current permit emission limit
A2 (previously PPB)	Power plant	Boiler 2 – emissions from steam raising boiler	NOx	<200[11]	mg/m^3	Current permit emission limit
			CO	<150[11]	mg/m^3	Current permit emission limit
A3 (previously PPB)	Power plant	Boiler 3 – emissions from steam raising boiler	NOx	<200[11]	mg/m^3	Current permit emission limit
			CO	<150[11]	mg/m^3	Current permit emission limit
A4	M2 sugar silo – vent on silo roof (external)	M2 Sugar Silo vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A5	M2 Sugar Silo - panel on silo (external location)	M2 Sugar Silo Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A6	M2 4th floor - hopper located internally and ducted to M2 roof (external)	CE Sugar Hopper vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A7	M2 4th floor - explosion panel for M2 sugar hopper (external location)	CE Sugar Hopper Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A8	U Block Centre Sugar Silo - vent on silo roof (external)	U Block Centre Sugar Silo vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A9	U Block Centre Sugar Silo - panel on silo (external location)	U Block Centre Sugar Silo Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel

11 Emissions limit currently specified in the Environmental Permit

Emission Point Ref.	Location	Source	Parameter	Expected Emissions		Notes
				Quantity #	Unit	
A10	U Block 1st floor west - U1W hopper located internally and ducted to U block wall (external)	U1W Sugar Hopper 1 vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A11	U Block 1st floor west-- explosion panel for U1W sugar hopper (external location)	U1W Sugar Hopper 1 Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A12	U Block 1st floor west - U1W hopper located internally and ducted to U block wall (external)	U1W Sugar Hopper 2 vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A13	U Block 1st floor west - explosion panel for U1W sugar hopper (external location)	U1W Sugar Hopper 2 Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A14	U Block 4th floor west - U1W hopper located internally and ducted to U block wall (external)	U4W Sugar Hopper vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A15	U Block 4th floor west - explosion panel for U1W sugar hopper (external location)	U4W Sugar Hopper Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A16	U Block East Sugar Silo 1 - vented via roof of U Block	U6E Sugar Silo 1 vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A17	U Block East Sugar Silo 1 - explosion panel for U6E silo 1 (external location	U6E Sugar Silo 1 Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A18	U Block East Sugar Silo 2 - vented via roof of U Block	U6E Sugar Silo 2 vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A19	U Block East Sugar Silo 2 - explosion panel for U6E silo 2 (external location)	U6E Sugar Silo 2 Explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel

Emission Point Ref.	Location	Source	Parameter	Expected Emissions		Notes
				Quantity #	Unit	
A20	U Block 6th floor east - hopper located internally and ducted to U Block roof (external)	U6E Sugar hopper vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A21	U Block 6th floor east - explosion panel for U6E sugar hopper (external location)	U6E Sugar hopper explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A22	U Block 6th floor east - Mixer 1 vent	U6E McIntyre Mixer 1 Vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A23	U Block 6th floor east - Mixer 1 explosion panel	U6E McIntyre Mixer 1 explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A24	U Block 6th floor east - Mixer 2 vent	U6E McIntyre Mixer 2 Vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A25	U Block 6th floor east - Mixer 2 explosion panel	U6E McIntyre Mixer 2 explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A26	U Block 6th floor east - Mixer 3 vent	U6E McIntyre Mixer 3 Vent	Dust / particulates	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A27	U Block 6th floor east - Mixer 3 explosion panel	U6E McIntyre Mixer 3 explosion panel	Dust / particulates	N/A – emergency use only		Rated Explosion panel
A28	M1 basement - 3kg rotating fluidised bed roaster	3kg rotating fluidised bed roaster	Dust / particulates / fumes	N/A – pilot scale plant, emissions not significant		New emission point
A29	M1 basement - 200g rotating fluidised bed roaster	200g rotating fluidised bed roaster	Dust / particulates / fumes	N/A – pilot scale plant, emissions not significant		New emission point

Emission Point Ref.	Location	Source	Parameter	Expected Emissions		Notes
				Quantity #	Unit	
A30	M1 basement - drum roaster	Drum roaster	Dust / particulates / fumes	N/A – pilot scale plant, emissions not significant		New emission point
A31	M1 basement -alkalisers	Alkalisers	Cooking fumes / VOCs	N/A – insignificant emissions due to scale of plant and emissions abatement		New emission point Wet scrubber (ammonia removal) with Venturi nozzle
A32	U Block 4th floor west	LEV extraction from addition of inclusions	Dust / particulates / fumes	N/A – insignificant emissions due to abatement plant		Reverse jet (bag) filter
A33	L Block (extraction point through wall of L Block)	Pan wash extraction vent	Steam / fumes	N/A – steam emissions not significant due to scale of plant		
A34	M2 (extraction point through roof of M2)	Mould wash extraction vent	Steam / fumes	N/A – steam emissions not significant due to scale of plant		
A35	ETP balance tank vent	ETP balance tank	Odour / VOCs	N/A – odour / VOCs not significant. Liquid effluent is not stored / retained		ETP is located centrally on site, away from sensitive neighbours
A36	M1 – 1st floor alkaliser	High flavour cocoa alkalisation	Odour / VOCs	N/A – pilot scale plant, emissions not significant		New emission point
A37	Sprinkler pump – diesel fired	Sprinkler pump house	NO_x / CO	N/A – sprinkler pump only operated during testing and emergency use		

A list of air emissions abatement plant is provided in Table C3:2-3 below. Note that some items of plant listed below are associated with emissions points that discharge to internal areas only and therefore have not been included in Table C3:2-2 above.

Table C3:2-3: Air emissions abatement plant

Location	Source	Emission point ref	Description of abatement plant	Management techniques
M2 sugar silo – vent on silo roof (external)	M2 Sugar Silo vent	A4	Reverse jet (bag) filter	Planned maintenance and inspection programme in place. All bag filters incorporate automatic cleaning with compressed air reverse jet to knock off accumulated materials (back into the vessel for reuse) and prevent blinding of filter / blockages (which may otherwise result in emissions to air from operation of an explosion panel or filter burst).
M2 4th floor - hopper located internally and ducted to M2 roof (external)	CE Sugar Hopper vent	A6	Reverse jet (bag) filter	
U Block Centre Sugar Silo - vent on silo roof (external)	U Block Centre Sugar Silo vent	A8	Reverse jet (bag) filter	
U Block 1st floor west - U1W hopper located internally and ducted to U block wall (external)	U1W Sugar Hopper 1 vent	A10	Reverse jet (bag) filter	
U Block 1st floor west - U1W hopper located internally and ducted to U block wall (external)	U1W Sugar Hopper 2 vent	A12	Reverse jet (bag) filter	
U Block 4th floor west - U1W hopper located internally and ducted to U block wall (external)	U4W Sugar Hopper vent	A14	Reverse jet (bag) filter	
U Block East Sugar Silo 1 - vented via roof of U Block	U6E Sugar Silo 1 vent	A16	Reverse jet (bag) filter	
U Block East Sugar Silo 2 - vented via roof of U Block	U6E Sugar Silo 2 vent	A18	Reverse jet (bag) filter	
U Block 6th floor east - hopper located internally and ducted to U Block roof (external)	U6E Sugar hopper vent	A20	Reverse jet (bag) filter	
U Block 6th floor east - Mixer 1 vent	U6E McIntyre Mixer 1 Vent	A22	Reverse jet (bag) filter	
U Block 6th floor east - Mixer 2 vent	U6E McIntyre Mixer 2 Vent	A24	Reverse jet (bag) filter	
U Block 6th floor east - Mixer 3 vent	U6E McIntyre Mixer 3 Vent	A26	Reverse jet (bag) filter	
M1 basement -alkalisers	Alkalisers	A31	Wet scrubber (ammonia removal)	

Location	Source	Emission point ref	Description of abatement plant	Management techniques
U Block 4th floor west	LEV extraction from addition of inclusions	A32	Reverse jet (bag) filter	
Crumb silo 1	Crumb silo 1 vent	N/A	Reverse jet (bag) filter	Planned maintenance and inspection programme Internal exhaust. Vents discharge internally – no ducting to external areas. All bag filters incorporate automatic cleaning with compressed air reverse jet to knock off accumulated materials and prevent blinding of filter / blockages.
Crumb silo 2	Crumb silo 1 vent	N/A	Reverse jet (bag) filter	
Choc Block 4th floor	L7 crumb hopper vent	N/A	Reverse jet (bag) filter	
Choc Block 4th floor	L8 crumb hopper vent	N/A	Reverse jet (bag) filter	
Choc Block 5th floor	L4 crumb hopper vent	N/A	Reverse jet (bag) filter	
Choc Block 5th floor	L6 crumb hopper vent	N/A	Reverse jet (bag) filter	
M2 5th floor	L3 crumb hopper vent	N/A	Reverse jet (bag) filter	

A full review of point source emissions to water and sewer has been undertaken as part of this permit variation application.

The amended inventory of point source emissions to water is detailed in Table C3:2-4 below. There are no longer any direct emissions of process water as the single remaining discharge, which comprised refrigeration cooling water, is not in use as the equipment generating this discharge is no longer operational on site. However, a review of site drainage has identified nineteen discharge points for uncontaminated surface water runoff (rainwater from roofs and roadways) to Bourn (Griffins) Brook. These discharge points are not new but have not previously been listed in the permit and are included now for completeness only. These are shown on Figure 4.

Table C3:2-4: Installation Key Emission Point to water

Emission Point Ref.	Source	Status
W21	Refrigeration cooling water	**Remove** – discharge no longer takes place. Equipment generating this discharge is no longer operational on site.
W1 – W19	Surface water run-off	**Addition** – A project is ongoing to fully review the site drainage plan. This has identified 19 discharge points for surface water runoff into Bourn (Griffins) Brook. This drainage review is ongoing – refer to Proposed Improvement Programme.

The revised inventory of point source emissions to sewer is detailed in Table C3:2-5 below. A new emission point to sewer S1 is added to the permit. This emission point comprises the

aggregated discharges previously made via existing emissions points S590, S591, S630, but now consolidated and routed via the new effluent treatment plant where pH correction takes place. The three existing emissions points (S590, S591, S630) will no longer receive regular flow but are retained for use in emergency / abnormal circumstances only (e.g. maintenance undertaken within the new pH correction facility). The existing emissions points have also been renamed as S2, S3 and S4 for consistency. The location of point source emissions to water and sewer are shown in Figure 4.

Table C3:2-5: Point source emissions to sewer

New emission point ref.	Previous emission point ref.	Source	Parameter	Expected Emissions		Techniques to minimise emissions
				Quantity	Unit	
S1	N/A – new emission point (existing effluent stream, now pretreated)	Site-wide effluent generation including cleaning washwaters, boiler blow down, softening plant and bundwater.	COD	<10,000 [12]	mg/l	Water use is minimised and only used where necessary. Interceptors and basket filters are in place where needed to reduce discharges of fats and solids. Effluent treatment plant installed to adjust pH to maintain discharge consent compliance
			Suspended solids	<1,000[12]	mg/l	
			pH	6 – 10[12]	pH units	
			Mercury	0.005[13]	mg/l	
			Cadmium	0.0113[13]	mg/l	
			Flow	<1,200[12]	m^3/day	
S2	S590	North west processing blocks (moulding and cocoa blocks) and central power plant	Effluent, if discharged, would be similar to S1 above (although daily volume of effluent would be a proportion of the expected emissions indicated above)			As per S1 above
S3	S591	North east processing blocks (U, V, L and O)	Effluent, if discharged, would be similar to S1 above (although daily volume of effluent would be a proportion of the expected emissions indicated above)			As per S1 above
S4	S630	Moulding blocks and ancillary buildings	Effluent, if discharged, would be similar to S1 above (although daily volume of effluent would be a proportion of the expected emissions indicated above)			As per S1 above

[12] Emissions limit specified in Severn Trent Water Trade Effluent Discharge Consent (ref. 009123V). No limit is proposed for these substances is proposed in this permit variation application
[13] Emissions limit specified currently specified in the Environmental Permit

3c Types and amounts of raw materials

The changes covered by the scope of this permit variation application do not have a significant impact on the types and quantities of raw materials used on site. However, a review of raw materials use has been undertaken and an updated summary of raw materials use is provided in Table C3 3c-1 below.

Table C3: 3c-1: Raw Materials

Material	Composition / nature of material	Max amount stored	Approx. annual usage	Potential environmental impact	Is there a suitable alternative with a less significant
Product ingredients					
Milk chocolate crumb	Granular, solid	<900 tonnes	81,000 tonnes	No known impact.	No viable alternative.
Food flavours and oils	Food grade flavours and oils	<100 tonnes approx.	100 tonnes	No known impact at quantities used. Potential impact on water quality in the event of a spillage.	No viable alternative.
Fruit, nut and other inclusions	Raisins, various nuts, candy etc	<3,000 tonnes approx.	3,330 tonnes	No known impact at quantities used.	No viable alternative.
Granulated sugar	Granular, solid	<200 tonnes	8,050 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Milk powder (skimmed)	Powder	<50 tonnes approx	75 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Glucose syrup	Aqueous solution	<200 tonnes	8,000 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Palm oil	Oil	<100 tonnes	1,450 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Vanillin	Crystalline solid and solution	<10 tonnes approx.	11 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.

Material	Composition / nature of material	Max amount stored	Approx. annual usage	Potential environmental impact	Is there a suitable alternative with a less significant
Glycerine	Vegetable oil based mono and triglycerides	<20 tonnes	38 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Egg powder	Powder	<5 tonnes approx.	7 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Emulsifier	Fat and soya lecithin	<80 tonnes	3,300 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Invert sugar syrup	Syrup	<60 tonnes	400 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Cocoa butter	Fat	<150 tonnes	15,250 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Citric acid	Liquid	<20 kg	1.5 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Cocoa liquor	Liquid	<80 tonnes	925 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Whey powder	Powder	<50 tonnes	1,610 tonnes	No known impact. Potential impact on water quality in the event of a spillage.	No viable alternative.
Cleaning and sanitation					
Caustic soda	Sodium hydroxide solution	<10 tonnes	60 tonnes	Contribute to trade effluent loading. Potential impact on water quality in the event of a spillage.	No viable alternative, low mercury caustic in use.
Cleaning (CIP) chemicals	Includes non-ionic surfactants in phosphoric acid solutions; non-ionic surfactants in hydrogen peroxide	<10 tonnes	100 tonnes	Potential impact on local water quality in the event of a spillage.	No viable alternative.

Material	Composition / nature of material	Max amount stored	Approx. annual usage	Potential environmental impact	Is there a suitable alternative with a less significant
Various cleaning liquids / creams / soaps / wipes / cloths	Various including ionic and non-ionic surfactants, fabrics, plastics etc	<250 kgs approx.	<250 kgs	No known impact at quantities used.	No viable alternative.
Various sanitiser and biocides	Sanitiser	<300 kgs	10 tonnes	Contribute to trade effluent loading.	No viable alternative.
Oils and greases / other Maintenance materials					
Lubrication oils - various	Mineral, synthetic oils with additives, glycol oil. Food grade oils and grease	<6,300 litres approx.	6,000 litres	Potential impact on water quality in the event of a spillage.	No viable alternative.
Greases	Synthetic and aluminium complex greases	<200 kgs approx.	200 kgs	Potential impact on water quality in the event of a spillage.	No viable alternative.
Hydraulic oils	Synthetic oils with additives	<3,000 litres approx.	3,000 litres	Potential impact on water quality in the event of a spillage.	No viable alternative.
Various engineering lubricants, pastes and sprays, metalworking fluids, industrial cleaning agents etc	Predominantly mineral oil / hydrocarbons in solvent bases	<2,650 litres approx.	2,650 litres	Potential impact on water quality in the event of a spillage.	No viable alternative.
Salt - gritting	Sodium chloride	<20 tonnes	18 tonnes approx. depending on the weather	Potential impact on water quality in the event of a spillage.	No viable alternative.
Light fuel oil (boiler standby fuel)	Petroleum hydrocarbon	140,000 litres	30270 litres	Potential impact on water quality in the event of a spillage.	No viable alternative.
Carbon dioxide	Gas	<8 tonnes	100 tonnes	Potential impact on local air quality.	No viable alternative.

Material	Composition / nature of material	Max amount stored	Approx. annual usage	Potential environmental impact	Is there a suitable alternative with a less significant
Acetylene	Gas	<500 kgs approx.	500 kgs	Potential impact on local air quality.	No viable alternative.
Argon	Gas	<500 kgs approx.	500 kgs	No known impact.	No viable alternative.
Oxygen	Gas	<500 kgs approx.	500 kgs	No known impact.	No viable alternative.
Nitrogen	Gas	<500 kgs approx.	500 kgs	No known impact.	No viable alternative.
Water treatment / refrigeration chemicals					
Anti-freeze	Propylene Glycol	<8 tonnes	14 tonnes	Potential impact on water quality in the event of a spillage.	No viable alternative.
Biocides	Biodegradable and non-biodegradable	<5 tonnes	4,000 kgs	Potential impact on trade effluent.	No viable alternative.
Corrosion inhibitors	Including propylene glycol, catalysed liquid sulphite, polyphosphate and synthetic polymers, sodium hydroxide and polymers, inorganic salts, borate and heterocyclics. Sodium phosphate, oreanic dispersant.	<5 tonnes	17,000 kgs	Potential impact on trade effluent.	No viable alternative.
Packaging materials					
Flow wrap	Laminated metallised plastic primary product wrapping	2,900 tonnes	300 tonnes	No known impact.	No viable alternative.
Date mark printing inks and solvents	Organic solvent and oil based inks	<100 kgs approx.	<100 kgs	No known impact.	No viable alternative.

Material	Composition / nature of material	Max amount stored	Approx. annual usage	Potential environmental impact	Is there a suitable alternative with a less significant
Hot melt packaging glue	Polymer base	<100 kgs approx.	<100 kgs	No known impact.	No viable alternative.
General cardboard packaging	Cardboard	<5,000 tonnes approx.	5,000 tonnes	No known impact.	No viable alternative.
Shrink wrap	Polyethylene based	<100 tonnes approx.	100 tonnes	No known impact.	No viable alternative.
Pallets	Wood and plastic	Not stored on site	1,000,000 units	No known impact.	No viable alternative.

4a Monitoring

A summary of monitoring proposed for point source emissions to air, water and sewer is provided in Tables C3:4-1 and C3:4-2 below.

No changes are proposed in respect of point source emissions to air. The existing air emissions monitoring programme is summarised in Table C3:4-1 for completeness.

Refer also to Appendix 5 Medium Combustion Plant Directive requirements for details of monitoring proposals for emissions to air from boilers following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3:4-1: Emissions monitoring – point source emissions to air

Emission Point Ref.	Location	Emission	Frequency	Limit	Technique
A1, A2, A3	Boiler stack	Oxides of Nitrogen	Annual	200 mg/m^3 2 hourly average	Instrumental technique in accordance with ISO 10849
		Carbon monoxide	Annual	150 mg/m^3 2 hourly average	Instrumental technique in accordance with ISO 12039

The current permit requires annual monitoring of Cadmium and Mercury at the three existing emissions points to sewer (previously referred to as S590, S591 and S630), with compliance based on mass balance calculation. For each emission point, the discharge limit for Cadmium is 0.01 mg/l and for Mercury is 0.005 mg/l. It is proposed that this monitoring requirement is removed from these monitoring points and transferred to the new monitoring point S1

No monitoring is proposed in respect of point source emissions to Bourn (Griffins) Brook. Point source emissions to the Brook comprise only clean surface water runoff (all emissions of process effluent to the Brook, previously included within the permit, have since been removed / ceased).

Table C3:4-2: Emissions monitoring – point source emissions to sewer and water

Emission Point Ref.	Location	Emission	Limit	Frequency	Technique
S1	Effluent treatment plant	Suspended solids	None	Monthly[14]	SCA blue book 105 ISBN 0117519154
		COD	None	Monthly[14]	SCA blue book 97 ISBN 0117519154
		pH	None	Continuous[15]	pH probe

[14] Monitoring undertaken in accordance with existing permit conditions.
[15] Monitoring undertaken in order to assess compliance with Severn Trent Water trade effluent consent. The permit does not require monitoring of these parameters and no such monitoring is proposed as part of this variation application.

Emission Point Ref.	Location	Emission	Limit	Frequency	Technique
		Mercury	0.005 mg/l 25 g/yr	Annual spot sample[14]	UKAS accredited laboratory
		Cadmium	0.01 mg/l 10 g/yr	Annual spot sample[14]	UKAS accredited laboratory
		Volume	None	Continuous[15]	Electromagnetic flow meter
S2	North west processing blocks (moulding and cocoa blocks) and central power plant	As for S1	No monitoring proposed. Discharges would be infrequent, and would occur only in the event of temporary diversion from discharge point S1 (e.g. in the event of maintenance).		
S3	North east processing blocks (U, V, L and O)	As for S1	No monitoring proposed. Discharges would be infrequent, and would occur only in the event of temporary diversion from discharge point S1 (e.g. in the event of maintenance).		
S4	Moulding blocks and ancillary buildings	As for S1	No monitoring proposed. Discharges would be infrequent, and would occur only in the event of temporary diversion from discharge point S1 (e.g. in the event of maintenance).		
W1 – W19	Roofs, roadways etc	Clean surface water runoff	No monitoring proposed. Discharges comprise only clean surface water runoff. Controls are in place in respect of potential accidents and incidents.		

4b Point source emissions to air only

The proposed sampling locations and facilities are assessed in Table C3: 4b-1, based on the requirements and recommendations provided in BS EN 15259 and relevant Environment Agency[16] (formerly TGN M1).

Table 4b-1: BS EN 15259 / guidance assessment - Sampling Requirements

EA Guidance	BS EN 15259 relevant clauses	Requirement	Boiler A1	Boiler A2	Boiler A3
Sample plane location	6.2	As far downstream or upstream from any disturbance, which could produce a change in direction of flow (e.g. bends, fans).	Sampling points are located in horizontal gas duct work between the boiler house and flue, as far from downstream and upstream disturbances as practicable. A constant cross-sectional area is present within the flues.	Sampling points are located in horizontal gas duct work between the boiler house and flue, as far from downstream and upstream disturbances as practicable. A constant cross-sectional area is present within the flues.	Sampling points are located in horizontal gas duct work between the boiler house and flue, as far from downstream and upstream disturbances as practicable. A constant cross-sectional area is present within the flues.
	6.2	In a section of duct with constant shape and cross-sectional area.			
	6.2	Recommend five hydraulic diameters* upstream and two hydraulic diameters downstream (or five hydraulic diameters from the top of the stack)			
Sample plane orientation	6.2	Installation of sample plane in vertical stacks is preferred to horizontal ducts			
Exploratory survey	6.2	It is advised that an exploratory velocity traverse is carried out before committing to installation	Existing installation		
Flow criteria	6.2	Angle of gas flow less than 15° to duct axis.	Yes	Yes	Yes
	6.2	No local negative flow.	Yes	Yes	Yes

16 https://www.gov.uk/government/publications/monitoring-stack-emissions-measurement-locations/monitoring-stack-emissions-measurement-locations

EA Guidance	BS EN 15259 relevant clauses	Requirement	Boiler A1	Boiler A2	Boiler A3
	6.2	Minimum velocity (a differential pressure of 5Pa, which equates to 3 ms-1).	37.6 Pa	36.8 Pa	26.9 Pa
	6.2	Ratio of the highest to lowest gas velocity less than 3:1.	1.10:1	1.13:1	1.14:1
Measurement ports	6.2	Planned at detailed design stage because retrofitting can be expensive (for example ducts may have protective linings).	N/A, existing installation		
	6.2	Allows access to sample points.	Yes	Yes	Yes
	Annex A	It is recommended that for small stacks (less than 0.7m diameter) a socket of 75mm is acceptable.	4” BSP (~100mm)	4” BSP (~100mm)	4” BSP (~100mm)
	-	The port socket must not project into the gas stream.	N/A	N/A	N/A
	Annex B	Additional ports may be required to allow access for measurement of other quantities (for example velocity and water vapour)	2 ports provided	2 ports provided	2 ports provided
	6.2	Additional ports for CEMS (if applicable)	N/A	N/A	N/A
	-	The operator must maintain the ports in good condition and free them up prior to work being undertaken	Yes	Yes	
Identification	6.2	Clearly identified and labelled measurement section	Ports are clearly identifiable		

EA Guidance	BS EN 15259 relevant clauses	Requirement	Boiler A1	Boiler A2	Boiler A3
Load bearing capacity	6.2	Permanent and temporary working platforms must have a load bearing capacity sufficient to fulfil the measurement objective	Temporary scaffolding is constructed to relevant codes and provides adequate load bearing capacity		
Position and working space	6.2	Sufficient working area to manipulate probe and operate the measuring instruments, without equipment overhanging guardrails	Temporary scaffolding is constructed to provide adequate working area		
	6.2	A sufficient depth of the working area is given by the internal diameter or depth of the duct and the wall thickness plus 1.5 m			
	6.2	If two opposite measurement ports are installed for one measurement line, a correspondingly smaller working area is required	N/A	N/A	N/A
	6.2	Its recommended that vertical ducts have a working height from the platform to the ports of 1.2 to 1.5m	Temporary scaffolding is constructed to provide suitable working height with safety gate provisions		
	-	Removable chains or self-closing gates at the platform to prevent workers falling through access hatches or ladders.			
Fall prevention	-	Upper handrails at a minimum of 950mm (910mm allowed for old handrails). Gaps in rail no bigger than 470mm. Toe boards required	Yes, provisions incorporated into scaffold design		
	-	Consider installing personal protection systems on vertical ladders	N/A, temporary scaffold		

EA Guidance	BS EN 15259 relevant clauses	Requirement	Boiler A1	Boiler A2	Boiler A3
Access	6.3	Easy and safe access available	Access is reported by the MCERTS contractors as 'safe' and 'easy'		
	-	Consider installing work restraint systems on vertical ladders	N/A, temporary scaffold		
Power supply	6.3	Single phase 110V electrical power of a suitable current provided by a suitable number of sockets at the platform	Adequate power provision is made to meet contractor's requirements		
Lifting equipment	6.3	Lifting systems for raising and lowering of equipment, where access to the sampling platform is by vertical, or steeply inclined, ladders or stairs	N/A, temporary scaffold		
	-	Lifting systems (for example, hoists) and attachments (for example, eyes) must be inspected and maintained by a competent person	N/A, temporary scaffold		
	-	Installation of a support structure for securing portable lifting systems (handrails are not usually suitable for supporting lifting systems)	N/A, temporary scaffold		
Monorails	-	Consider sampling monorails above the sampling ports to enable certain designs of sampling train to be suspended.	N/A		
Exposure to gas	6.3	Avoid areas of sources which emit unexpectedly, for example rupture discs, overpressure valves and steam discharges.	Yes		
Exposure to stack gas	6.3	Avoid areas of significant positive pressure.	External, adequate ventilation reduces risk of exposure to stack gases		

EA Guidance	BS EN 15259 relevant clauses	Requirement	Boiler A1	Boiler A2	Boiler A3
Awareness	6.3	Consider how stack emission monitoring personnel are informed of operating faults that may endanger them?	RAMS and inductions consider safety and evacuation procedures		
Ventilation	-	Well ventilated.	Monitoring takes place externally, adequate ventilation		
Heat and dust	6.3	Protection of the working area from heat and dust.	Monitoring takes place externally, away from hot plant.		
Weather protection	6.3	Protective measures (for example, weather protection and heating to ensure conditions are appropriate for personnel and equipment).	RAMS and dynamic risk assessments will take account of prevailing weather conditions. Work would be postponed if a safety risk existed.		
Lighting	-	Artificial lighting or facilities for temporary lighting.	Task lighting would be provided as necessary		

Notes: Source data taken from Elements Job Ref: EMT02304, 16.12.2021, Boilers 1, 2 and 3.

6 Resource efficiency and climate change

6a Describe the basic measures for improving how energy efficient your activities are

Improving energy efficiency and driving down specific energy usage per tonne of product is a primary management focus at the Bournville Chocolate Works installation. The site operates under an ISO 50001 Energy Management System, and through an environmental governance system has monitoring, measuring, and tracking KPIs including energy use and CO_2 emissions. Within this framework numerous significant investment programmes have been delivered since the original permit application in 2004 and there Mondelez has seen ongoing improvements in the energy efficiency of its production processes.

In relation to this variation application, the replacement of ageing refrigeration equipment with modern, energy efficient alternatives will directly contribute to further improvements in energy efficiency. Overall, the changes covered by the scope of this permit variation application will not lead to an increase in specific energy consumption.

As a result of these incremental improvements in site energy efficiency and other production changes since the steam raising boilers at Bournville were installed, site steam demand and installed steam generation capacity are now substantially mismatched. Therefore, this variation application also includes a proposal to de-rate the existing 3 no. boilers to approximately 6.25 MW each (de-rated from the current thermal input capacity of 12.2 MW).

Some examples of specific projects which have delivered significant improvements in energy efficiency include:

- Ongoing programme to upgrade lighting to LED type.
- Replacement of refrigeration equipment.
- Installation of more efficient manufacturing and packing line.
- On-going leak detection and repair programme undertaken by qualified technicians.
- Upgrade boiler controls.
- Energy material system.

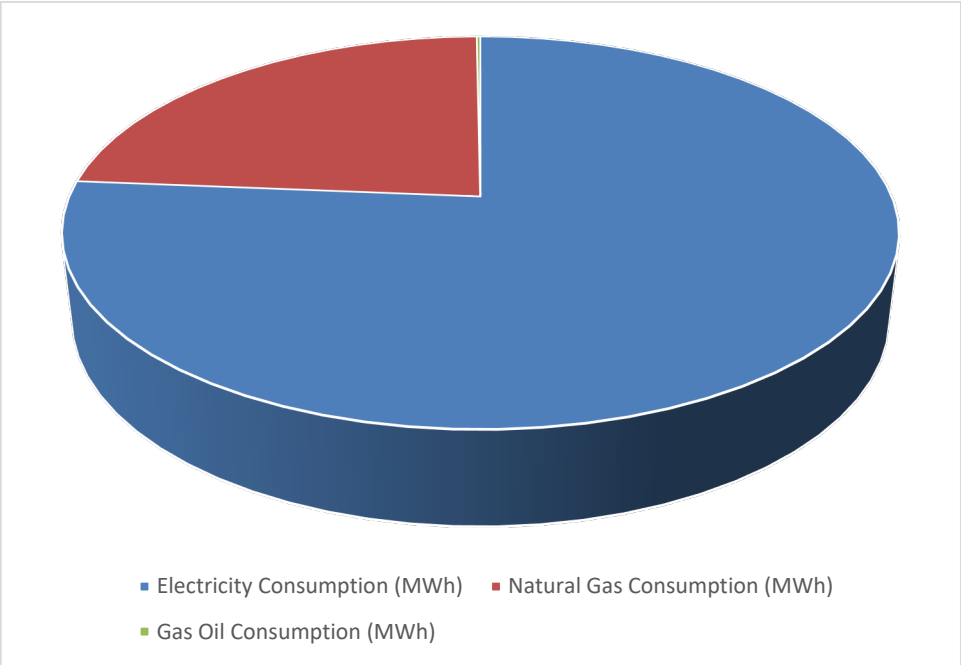
6b Provide a breakdown of any changes to the energy your activities use up and create

Table C3: 6b-1 – Energy consumption by source (2021 data)

Energy source	Energy consumption (MWh)[17]		
	Delivered	Primary	% of total (primary)
Electricity	62,354	149,650	76.3
Natural gas	46,155	46,155	23.5
Gas oil[18]	325	325	0.2

[17] Based on full year data for 2021
[18] Based on 1,171 litres diesel per tonne (Dukes A.4 2019), 45.3 Gross Calorific Value GigaJoule per tonne (Dukes A.1-A.3 2019) and 277.778 GJ to kWh conversion factor

Table C3: 6b-1 – Energy split by source (2021 data)



Global Warming Potential (GWP)

Emissions of CO_2 (a greenhouse gas) arise directly within the installation from the operation of on-site combustion plant and indirectly through use of electricity, although the site has switched to a renewable energy tariff for grid electricity. No other materials identified as having Global Warming Potential (GWP) are released in significant quantities from the activities described in this variation application.

The total GWP has been calculated for the installation based on the 2021 energy use data. Release of carbon dioxide equivalent as tonnes (tCO_2e) has been calculated based on overall gas, electricity and gas oil consumption; the annual mass release has then been multiplied by the GWP value listed in the relevant EA guidance[19]. The results are set out in Table C3: 6b-1.

19 https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-global-warming#identify-greenhouse-gas-emissions

Table C3: 6b-1 Global Warming Potential

Substance	Energy source	Consumption (Primary MWh)	Emission Factor	Mass Released (tCO_2 / year)	GWP Factor	Overall GWP (tCO_2 / year)
Carbon dioxide	Electricity public supply	149,650	0[20]	0	1	0
	Gas	46,155	0.19	8,770		8,770
	Gas oil	325	0.25	81		81
Total GWP						8,851

6d Explain and justify the raw and other materials, other substances and water that you will use

The changes covered by the scope of this permit variation application do not have a significant impact on the types and quantities of raw materials used on site. However, a review of raw materials use has been undertaken and an updated summary of raw materials use is provided in Table C3 3c-1 above.

Mondelez strives to continuously reduce product waste with process optimisation and rework initiatives, to optimise packaging waste and to apply a no landfill policy.

Mondelez has retains two sources of water for site activities: mains water and abstracted water. Mains water use is used preferentially but a licence to abstract water from the Bourn (Griffins) Brook is retained for use as an alternative source of process water, should this be required. A summary of water use during 2021 is provided in Table C3 6d-1 below.

Table C3: 6d-1 Water use (2021 data)

Water source	Annual use (m^3)	% of total use
Mains water	172,564	100
Abstracted water	0	0

6e Describe how you avoid producing waste in line with Council Directive 2006/12/EC on waste

The changes covered by the scope of this permit variation application do not have a significant impact on the types and quantities of waste generated from the site. However, a review of wastes arising from installation activities has been undertaken and an updated summary of waste generated is provided in Table C3 6e-1 below.

20 Green energy tariff

Specific measures to minimise generation of waste are described in Section II: Technical Description. This includes the following:

- Systems in place to prevent spillage and loss of raw materials include automatic level detection of tank/vessel level, pressure detection and PLC control/interlocks/alarms to prevent overfilling and/or over pressurisation.
- Transfer of raw and intermediate ingredients within enclosed systems, to reduce the generation of by-product and unnecessary manual cleaning.
- Materials are recovered for internal rework (i.e. reuse within the process on site) wherever possible. This is held in a vessel with a temperature controlled jacket to keep it at the required temperature and minimise wastage.

Existing waste management and waste handling procedures are applied to all waste streams, ensuring that waste is treated in accordance with the Waste Management Hierarchy. Waste generation is minimised, and where unavoidable waste is sent for re-use and recycling wherever possible.

Documented procedures specify that waste must be segregated appropriately, and waste containers must be in good condition and located on impermeable hardstanding and away from watercourses. Waste storage periods must be minimised in order to prevent unnecessary accumulation of stored wastes and to prevent deterioration of the waste or their containers which may lead to accidents or incidents with environmental consequences.

Procedures are in place to ensure waste 'duty of care' requirements are met including ensuring that waste is only removed from site by contractors properly licenced and approved for use and accompanied by a fully completed waste transfer or hazardous waste consignment note. Waste transfer and consignment note records are retained electronically or as paper copies on site.

Table C3: 6e-1 Waste streams

Waste type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production
General waste	Solid non-recyclable or contaminated waste i.e. from canteen, floor sweepings, contaminated packaging, waste from maintenance and cleaning which is not suitable for recycling	Stored within a designed skip in a bunded area	Incineration with energy recovery	455 tonnes
Metals	Redundant equipment and scrap metal from maintenance activities	Stored within a designed skip in a bunded area	Recycling	510 tonnes
Plastic packaging	Waste packaging materials	Stored within a designed skip in a bunded area	Recycling	114 tonnes
Wood packaging	Broken pallets and redundant packing cases (e.g. new equipment)	Stored within a designed skip located on hardstanding	Recycling	160 tonnes
Cardboard	Transit materials, secondary packaging and waste packaging materials	Stored within a curtain sided trailed following baling	Recycling	800 tonnes
Paper	Office waste paper	Stored in lidded wheelie bins	Recycling	26 tonnes
Oil/water/diesel	Interceptor waste and equipment washing waste	Not stored on site – removed directly by tanker	Recycled	<5 tonnes

Waste type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production
Waste product	Waste product generated due to product quality issues, plant cleans and maintenance etc	Stored within a designed skip in a bunded area	Re-use as animal feed	2,112 tonnes
Used fluorescent tubes	Tube replacement (office and production areas)	Stored within a designed skip in a bunded area	Recycled	1 tonne
Used oil	Lubrication oil from gearboxes and waste vehicle oil e.g. from forklifts	Stored within bunded containers in the hazardous waste storage area	Recycled	30 tonnes
Oily rags	Maintenance activities	Stored within colour coded bags in the bunded hazardous waste storage area	Incineration with energy recovery	1 tonne
Clinical waste	Clinical / sanitary waste including from occupational health facility	Stored within clearly labelled wheelie bins inside buildings	Incineration with energy recovery	1 tonne
Asbestos	Removed from site as part of ongoing asbestos management programme	Stored within clearly labelled, enclosed skip in a bunded area	Landfill	24 tonnes
Batteries	From office and maintenance activities. Forklift truck battery changes	Stored on pallets within the bunded hazardous waste storage area.	Recycling	<0.2 tonnes
Aerosol cans and empty paint tines	From maintenance activities	Stored in a cage within the bunded hazardous waste area.	Incineration	0.2 tonnes

Waste type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production
Chemical drums (empty)	Cleaning and maintenance activities, empty ingredients containers	Stored in a cage within the bunded hazardous waste area	Reuse	<10 tonnes
Used electrical / electronic equipment	Redundant IT and other equipment from office and production areas	Stored inside a dedicated room within a building	Recycling	2 tonnes
Toner and printer cartridges	Office activities	Dedicated containers located within buildings	Recycling	<1 tonnes
Building and construction waste	From site development and maintenance activities	Dedicated skips located on hardstanding. Location depending on the building project.	Recycling / landfill	316 tonnes

Form E2

3 About the parts of the permit you want to surrender and the parts you want to keep

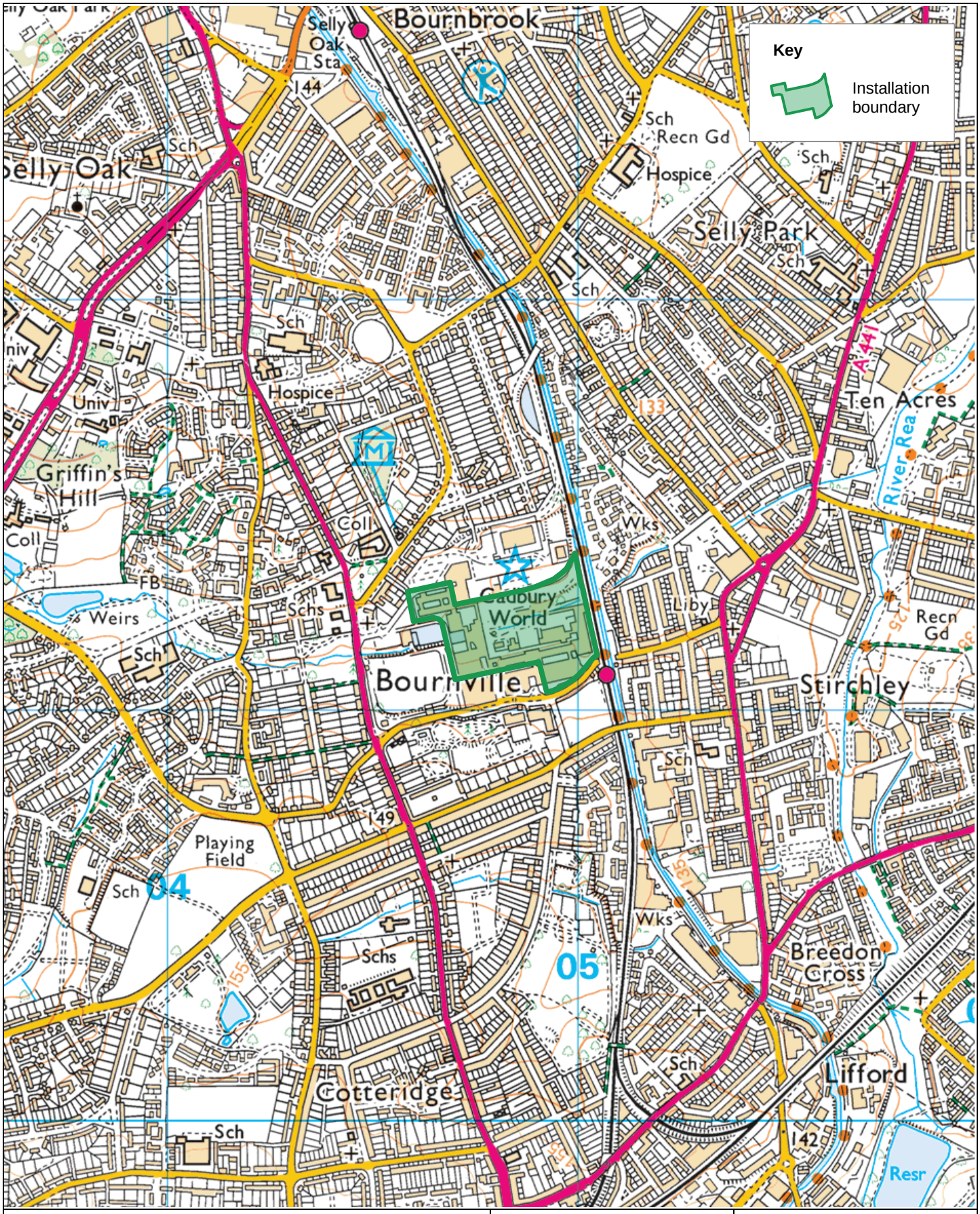
The current installation boundary includes a 7-storey building known as Cocoa Block East. At the time of the original permit application (in 2004) part of this building was used to store finished goods. This building is no longer used for this purpose and is now associated with the Cadbury World visitor attraction. There are no Schedule 1 listed activities, nor directly associated activities, undertaken within this area. Finished goods are stored in other areas of the site and therefore there are no proposals to cease operation of any scheduled activities, or directly associated activities.

Proposed Improvement Programme

IP Ref.	Related Section	Requirement	Timescale
1	C3:2	Complete review of drainage plan in order to confirm the location and number of uncontaminated surface water discharge points.	3 months from permit issue
2	C2:6	Ammonia (Azane) AHU – sound abatement barrier to be fitted to the front of the AHU.	1/10/22
3	C2:6	Sugar fans (U6 and U1W) – noise abatement to be fitted as per U4 fan.	31/12/22
4	C2:6	Review and select appropriate measure(s) to mitigate noise arising from sugar deliveries at the east and west sugar delivery point (the central sugar delivery location is shielded from receptors by buildings).	31/12/22

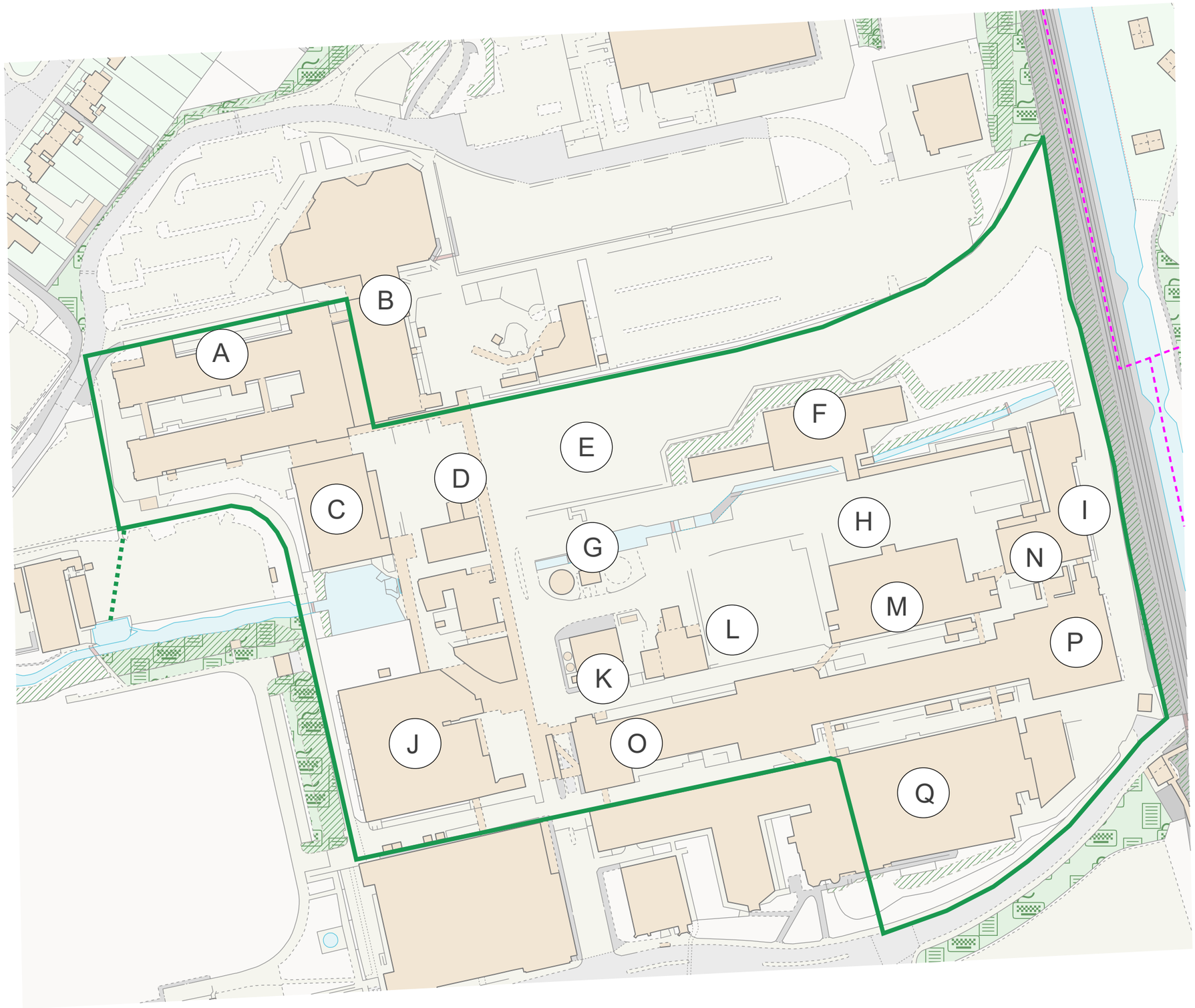
Section IV: Figures

Figure 1: Site Location Plan



Drawing title Figure 1 Site Location Plan	**Scale** 1:25,000 @ A4	**PESL No.** MON.013
Project Mondelez Bournville Permit Variation Application	**Version** ISSUE	**Issue date** 27/06/2022
Mondelēz International SNACKING MADE RIGHT	Project Environmental Solutions	

Figure 2: Installation Layout



- Installation boundary
- A Moulding 1
- B Cadbury World
- C Chocolate Block
- D Crumb silo
- E Yard
- F WIP stores
- G Sprinker system
- H Despatch deck
- I L Block
- J Moulding 2
- K Energy Centre
- L Effluent Treatment Plant
- M O Block
- N Flavours store
- O U Block West
- P U Block East
- Q V Block

N W E S 0 50 m

Document Path:

Date Saved:

Project Environmental Solutions

Drawing title

Figure 2: Installation layout

Scale	1:1,750 @ A3
PESL No.	MON.013

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Mondelez Bournville Permit Variation Application

Figure 3: Key Emission Points

Figure 4: Site Drainage Plan

Section V: Appendices

Appendix 1: Record of enhanced pre-application discussion

Appendix 2: Surrender Site Condition Report

Appendix 3: Noise Impact Assessment

Appendix 4: Noise Management Plan

Appendix 5 Medium Combustion Plant Directive Requirements

Form C2.5 Appendix 1 Specific questions for the MCP / SG
Medium Combustion Plant checklist

MCP Site specific identifier	Bournville Chocolate Works Boiler No. 1	
Grid reference of the location of the MCP	Easting	Northing
	404810	281149
Rated thermal input (MW)	6.25 (approximately)	
Type of MCP	Heat (boiler)	
Type of fuels used	Natural Gas (gas oil back-up fuel)	
Date of first operation	04/2004	
Sector of activity (NACE code)	C10.8.2	
Expected number of annual operating hours of the MCP	8,760 (this figure assumes full annual operation; however, an annual maintenance allowance of 3 days would be expected)	
Average load in use (%)	70% (this can vary depending on site demand)	
Where the option of an exemption…	N/A	
Stack height (m)	46 m	
Distance to nearest human receptor (m)	280 m	
Distance to nearest ecological receptor (m)	1,815 m (Kings Norton LNR)	

MCP Site specific identifier	Bournville Chocolate Works Boiler No. 2	
Grid reference of the location of the MCP	Easting	Northing
	404810	281149
Rated thermal input (MW)	6.25 (approximately)	
Type of MCP	Heat (boiler)	
Type of fuels used	Natural Gas (gas oil back-up fuel)	
Date of first operation	04/2004	
Sector of activity (NACE code)	C10.8.2	
Expected number of annual operating hours of the MCP	8,760 (this figure assumes full annual operation; however, an annual maintenance allowance of 3 days would be expected)	
Average load in use (%)	70% (this can vary depending on site demand)	
Where the option of an exemption…	N/A	
Stack height (m)	46 m	
Distance to nearest human receptor (m)	280 m	
Distance to nearest ecological receptor (m)	1,815 m (Kings Norton LNR)	

MCP Site specific identifier	Bournville Chocolate Works Boiler No. 3	
Grid reference of the location of the MCP	Easting	Northing
	404810	281149
Rated thermal input (MW)	6.25 (approximately)	
Type of MCP	Heat (boiler)	
Type of fuels used	Natural Gas (gas oil back-up fuel)	
Date of first operation	04/2004	
Sector of activity (NACE code)	C10.8.2	
Expected number of annual operating hours of the MCP	8,760 (this figure assumes full annual operation; however, an annual maintenance allowance of 3 days would be expected)	
Average load in use (%)	70% (this can vary depending on site demand)	
Where the option of an exemption…	N/A	
Stack height (m)	46 m	
Distance to nearest human receptor (m)	280 m	
Distance to nearest ecological receptor (m)	1,815 m (Kings Norton LNR)	

Emission Limit Values

MCPD emissions limit values (ELV) for NO_x apply from 1 January 2025. The current permit already specifies the same ELV for NO_x as well as an ELV for CO as shown in the table below (permit ELVs apply when burning gas).

New / Existing	Fuel	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit [21]		Techniques to minimise emissions	ELV status / notes
Existing plant	Natural Gas	A1	Boiler 1	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	Existing ELV which is consistent with MCPD requirement.
					CO	150	mg/Nm^3	Boiler servicing and maintenance Combustion control system	Existing ELV. No relevant ELV in MCPD
Existing plant		A2	Boiler 2	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	Existing ELV which is consistent with MCPD requirement.
					CO	150	mg/Nm^3	Boiler servicing and maintenance Combustion control system	Existing ELV. No relevant ELV in MCPD
Existing plant		A3	Boiler 3	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	Existing ELV which is consistent with MCPD requirement.
					CO	150	mg/Nm^3	Boiler servicing and maintenance Combustion control system	Existing ELV. No relevant ELV in MCPD

[21] Stated at reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 3% O_2

New / Existing	Fuel	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit [22]		Techniques to minimise emissions	ELV status
Existing plant	Gas oil	A1	Boiler 1	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	New ELV proposed in line with MCPD requirements. (No current ELV in place when firing gas oil)
					CO	None		Boiler servicing and maintenance Combustion control system	No ELV proposed on gas oil, no existing limit and no relevant ELV in MCPD
Existing plant		A2	Boiler 2	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	New ELV proposed in line with MCPD requirements. (No current ELV in place when firing gas oil)
					CO	None		Boiler servicing and maintenance Combustion control system	No ELV proposed on gas oil, no existing limit and no relevant ELV in MCPD
Existing plant		A3	Boiler 3	Boiler House	NO_x	200	mg/Nm^3	Low NOx burners. Boiler servicing and maintenance Combustion control system	New ELV proposed in line with MCPD requirements. (No current ELV in place when firing gas oil)
					CO	None		Boiler servicing and maintenance Combustion control system	No ELV proposed on gas oil, no existing limit and no relevant ELV in MCPD

[22] Stated at reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 3% O_2

Monitoring

The current permit specifies annual monitoring of NO_x and CO when burning gas. From 1 January 2025 monitoring of NOx whilst burning gas oil will also be undertaken on a three yearly basis in line with MCPD requirements.

Fuel	Emission Point Ref	Source	Emissions parameter	Monitoring technique [23]	Monitoring Frequency	Notes
Natural Gas	A1	Boiler 1	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Annual	Monitoring frequency as currently specified in the permit.
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Annual	Monitoring frequency as currently specified in the permit.
	A2	Boiler 2	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Annual	Monitoring frequency as currently specified in the permit.
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Annual	Monitoring frequency as currently specified in the permit.
	A3	Boiler 3	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Annual	Monitoring frequency as currently specified in the permit.
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Annual	Monitoring frequency as currently specified in the permit.
Gas oil	A1	Boiler 1	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Every 3 years	Future MCPD monitoring requirement
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Every 3 years	Future MCPD monitoring requirement (although no ELV for CO)
	A2	Boiler 2	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Every 3 years	Future MCPD monitoring requirement
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Every 3 years	Future MCPD monitoring requirement (although no ELV for CO)
	A3	Boiler 3	NO_x	Extractive emissions testing in line with guidance and BS EN 14792	Every 3 years	Future MCPD monitoring requirement
			CO	Extractive emissions testing in line with guidance and BS EN 15058	Every 3 years	Future MCPD monitoring requirement (although no ELV for CO)

23 Aligned to relevant guidance, formerly TGN M2 (https://www.gov.uk/government/publications/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring) and formerly TGN M1 (https://www.gov.uk/government/publications/monitoring-stack-emissions-measurement-locations/monitoring-stack-emissions-measurement-locations)