TECHNICAL NOTE: DAVIDSTOW EPR ADDENDUM

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SUBJECT:	Addendum to EPR/BN6137IK/V011		
PROJECT:	Davidstow EPR Variation Application	**AUTHOR:**	Karen Phillipson
CHECKED:	Charlotte Daniels	**APPROVED:**	Karen Phillipson

1. INTRODUCTION

Dairy Crest Limited ("Dairy Crest"), submitted an environmental permit variation application to the Environment Agency in May 2022 ("2022 Variation Application"). A summary of the changes applied for is provided in Table 1 below and a detailed description of each, along with an environmental assessment, is provided in the 2022 Variation Application.

In March 2023 the Environment Agency initiated the 'duly made' and determination process. However, since the 2022 Variation Application was submitted, some of the projects have evolved and been developed further as a result of operational experience. Furthermore, additional noise and odour mitigation measures are being implemented at the Water Processing facility ("WPF") as agreed during ongoing discussions with the Environment Agency. This addendum report provides an update to the status of the projects originally described in the 2022 Variation Application and identifies additional changes since its submission in May 2022.

In summary, the changes described in this addendum relate to:

- The installation of a WPC60 processing plant instead of the WPC35 processing plant,
- The installation of an alternative Rapid Chill Store ("RCS"), and
- The installation of additional odour and noise abatement measures.

These changes to the 2022 Variation Application present environmental benefits through further adoption of four key Best Available Techniques ("BAT") themes:

- BAT 22 waste minimisation (FD&M BREF): additional measures to improve the resilience of Creamery operations by providing alternate pathways for processing the whey by-product of cheese production.

  Specifically this provides alternative whey processing capability beyond the current 100% demineralised whey ("D90") production by installing Whey Protein Concentrate ("WPC60") capability. The ability to have some operational flexibility between D90 and WPC60 provides greater resilience and robustness to the interdependent cheese and whey processes of the Creamery and consequently benefits consistency and stability of operation of the Creamery including the WPF.

  Increasing the concentration of whey products from WPC35 (described in the 2022 Variation Application) to WPC60 also provides logistical benefits through export of higher strength WPC products off site.
- BAT 7 reducing water consumption (FD&M BREF): further water recycling for reuse within the whey processing plants supplementing other existing recycled water flows within the Creamery and WPF;
- BAT 18 noise (Waste Treatment BREF): further prevention and reduction measures through noise control and abatement; and

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- BAT 14 odour (Waste Treatment BREF): further containment and abatement measures.

Table 1-1 below summarises the changes included in the 2022 Variation Application, their current status and the updates included in this addendum report.

Table 1-1 – Current Status of Projects in the 2022 Variation Application

Change	Description / Benefit	Current Status	Additional Changes?
Creamery Projects			
Creamery Project No. 1	CIP 4-hour turnaround	Fully implemented	No
Creamery Project No. 2	Milk protein standardisation	Partially implemented: Pilot scale plant implemented, full scale production expected in next couple of years	No 2022 Variation Application covers full scale project description.
Creamery Project No. 3	Milk fat standardisation	Fully implemented	No
Creamery Project No. 4	Whey protein concentrate (WPC35)	Fully implemented	Yes – upgrade to WPC60. See further details in Section 2-1 below.
Creamery Project No. 5	GOS bulk loading	Fully implemented	No
Creamery Project No. 6	Cheese capacity growth phase 3	Partially implemented	Yes – new dedicated Rapid Chill Store (RCS) glycol system proposed. See further details in Section 2-2 below.
WPF Redevelopment Works			
Contingency lagoon & OCU	Provides storage capacity for process effluent during abnormal operations.	Fully implemented	No
2 new DAF units	Provides greater control of total P in the final treated effluent.	Fully implemented	No
Cover BT1/Divert & OCU	Reduces odorous emissions.	Fully implemented	No

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Upgraded AFM tanks	Reduces raw water consumption (treats final effluent for reuse at the factory).	Fully implemented	No
3rd RO plant	Improves resilience of the Water Recovery Plant (WRP); recovers water for reuse at the factory.	Fully implemented	No
UF / RO flow attenuation tank	Modulates the flow of final treated water discharged.	Fully implemented	No
Downstream tertiary filters	Reduces the concentration of suspended solids in the final treated water	Fully implemented	No
4th MBR loop	Provides increased MBR capacity to deliver clean water to the WRP process.	Fully implemented	No
New raw material store	Chemical storage area.	Fully implemented	No
Upgraded outfall pipework from WPF	Replacement pipework.	Fully implemented	No
BT1 / Divert new aeration pumps	Replacement plant and equipment.	Fully implemented	No
Acoustic fencing	Improved noise mitigation.	Fully implemented	No
Noise monitoring equipment	Improved noise monitoring.	Fully implemented	No
Floating discs on BT2	Improved odour mitigation.	Trialled	Yes – it is now proposed to cover and extract BT2 to a scrubber. See further details in Section 2-3 below.
Perimeter containment wall	Provides containment for tanks at WPF.	Fully implemented	No
Replacement of W2 sampling point	Improved effluent monitoring.	Fully implemented	No
Enclosure of sludge centrifuges & trailer	Improved odour mitigation.	Fully implemented	No

Automated forward/divert (cheese/whey & Demin/GOS)	Improved process control.	Nearing completion: Currently in final stages of commissioning	No
Additional Odour & Noise Mitigation			
BT2 and anoxic tanks – cover & extract to OCU	Improved odour mitigation.	Proposed December 2023	N/a
Acoustic fencing and enclosure of blowers	Improved noise mitigation.	Proposed December 2023	N/a

2. CHANGES TO 2022 VARIATION APPLICATION

2.1 Creamery Project No.4 Whey Protein Concentrate (WPC35 → WPC60)

The existing WPC35 plant, as detailed in Section 4.4 of the 2022 Variation Application, has been operational since October 2019 and has been successful in supporting the control of protein levels within infant formula powder. The WPC35 plant will be replaced with a WPC60 plant to provide an alternate opportunity for whey processing when needed. Flexibility beyond the current production of 100% demineralised whey ("D90") by installing supplementary Whey Protein Concentrate ("WPC60") capability provides greater resilience and robustness to the interdependent cheese and whey processes of the Creamery and consequently benefits consistency and stability of operation of the WPF

The modified WPC35 plant will concentrate the whey stream and produce WPC60 either for protein management of infant formula powder or for export as a separate value stream which can be used by 3rd party food manufacturers in high protein products. Permeate from the WPC60 membranes will be treated further to create whey concentrate and water. The whey concentrate will be exported to food manufacturers or anaerobic digestion plants.

Water generated from the concentration of whey in the WPC60 process will be polished and re-used to clean the WPC60 equipment. An updated version of Figure 4-1 (Creamery Production Processes) included in the 2022 Variation Application is provided in Figure 2-1 below to reflect these changes, i.e. the additional WPC60 export stream.

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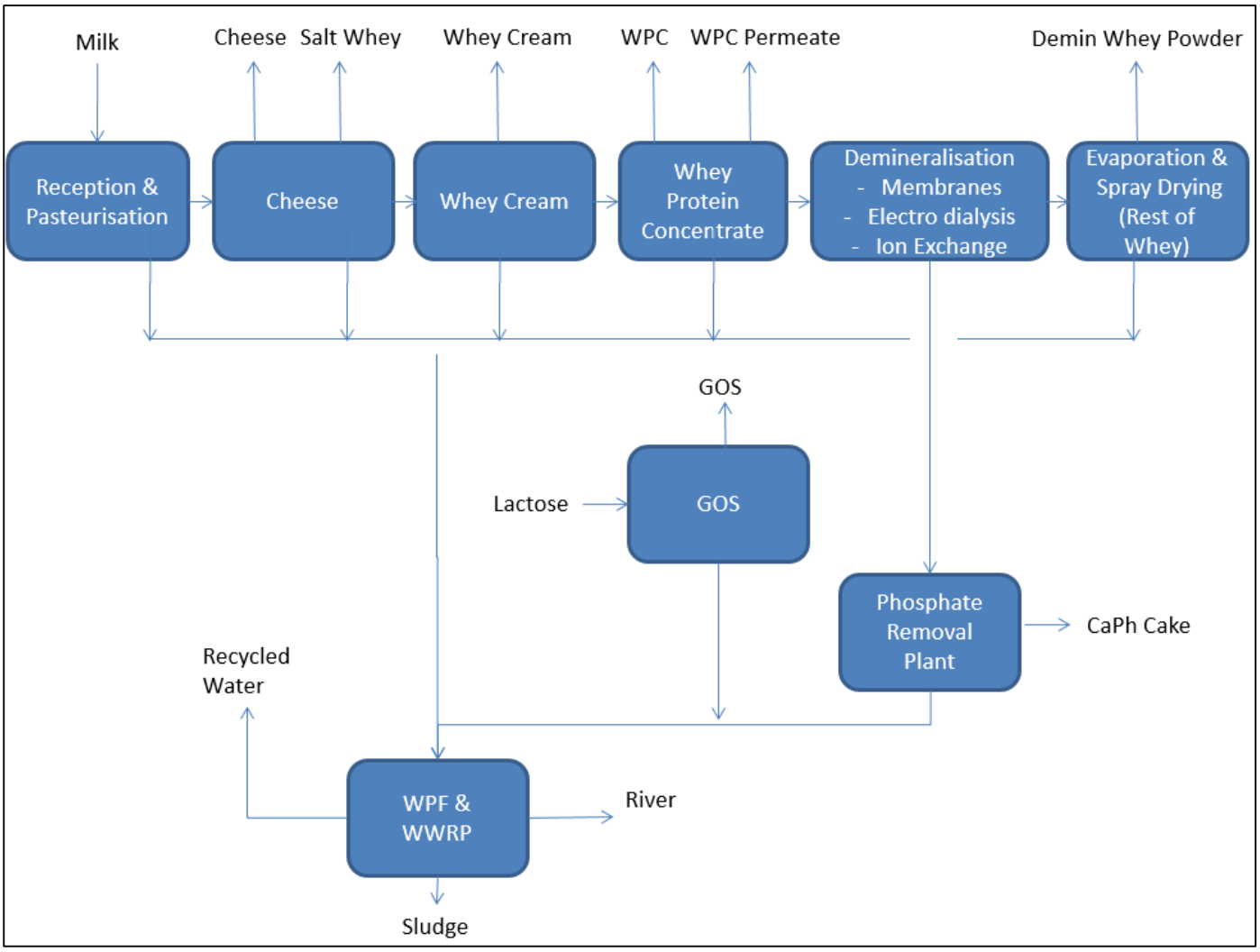
Figure 2-1 – Creamery Production Processes (updated to incorporate WPC60)



The WPC60 plant requires an additional whey storage silo to feed whey into the process. The whey will be heat treated through a whey pasteuriser and held in a buffer silo before going forward into membrane processing. The first membrane processing stage is nano-filtration (NF) where the whey is split into two product streams, retentate (concentrated whey proteins) and permeate (the remaining whey constituents such as water, lactose and minerals).

The retentate (WPC60) will be stored in two re-purposed (ex-WPC35) silos for re-use within the D90 powder process or for export by road tanker to third parties.

The permeate will be processed through a second stage of membrane processing using nano-filtration, reverse osmosis and water polishing (NF/RO/ROP). The NF removes any remaining protein and solids into

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the retentate stream and this is fed back into the first stage membranes for further protein and solids recovery.

The permeate stream is then concentrated using the RO membranes with the removed water cleaned for re-use through the ROP. Concentrated permeate will be stored in two silos for re-use within the D90 powder process or export by road tanker to third parties.

The clean RO water will be stored in two silos and used to CIP and flush the membrane plants at the end of production. Any excess RO water generated during this process will be treated and used on site at the Creamery to reduce demand on imported water supplies.

The new membrane and pasteurising equipment associated with this project will be located adjacent to the D90 process area building in a new process room. The layout of the new equipment and infrastructure is shown in Figure 2-2 below and Figure 2-3 provides a process flow diagram which shows the WPC60 process. The WPC60 processing plant is expected to be installed and operational by Autumn 2024.

Figure 2-2 – WPC60 Equipment Layout (Adjacent to Existing Demineralised Whey Process Area)

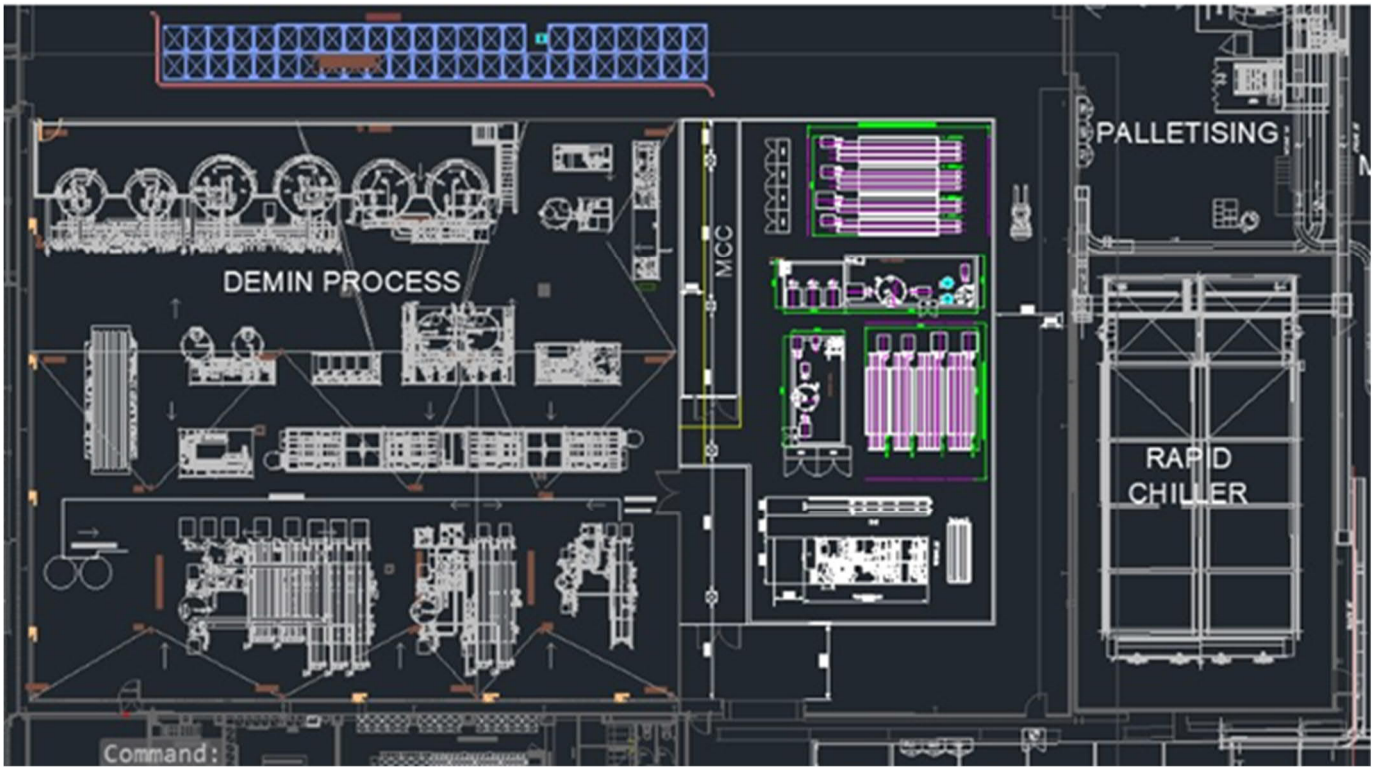

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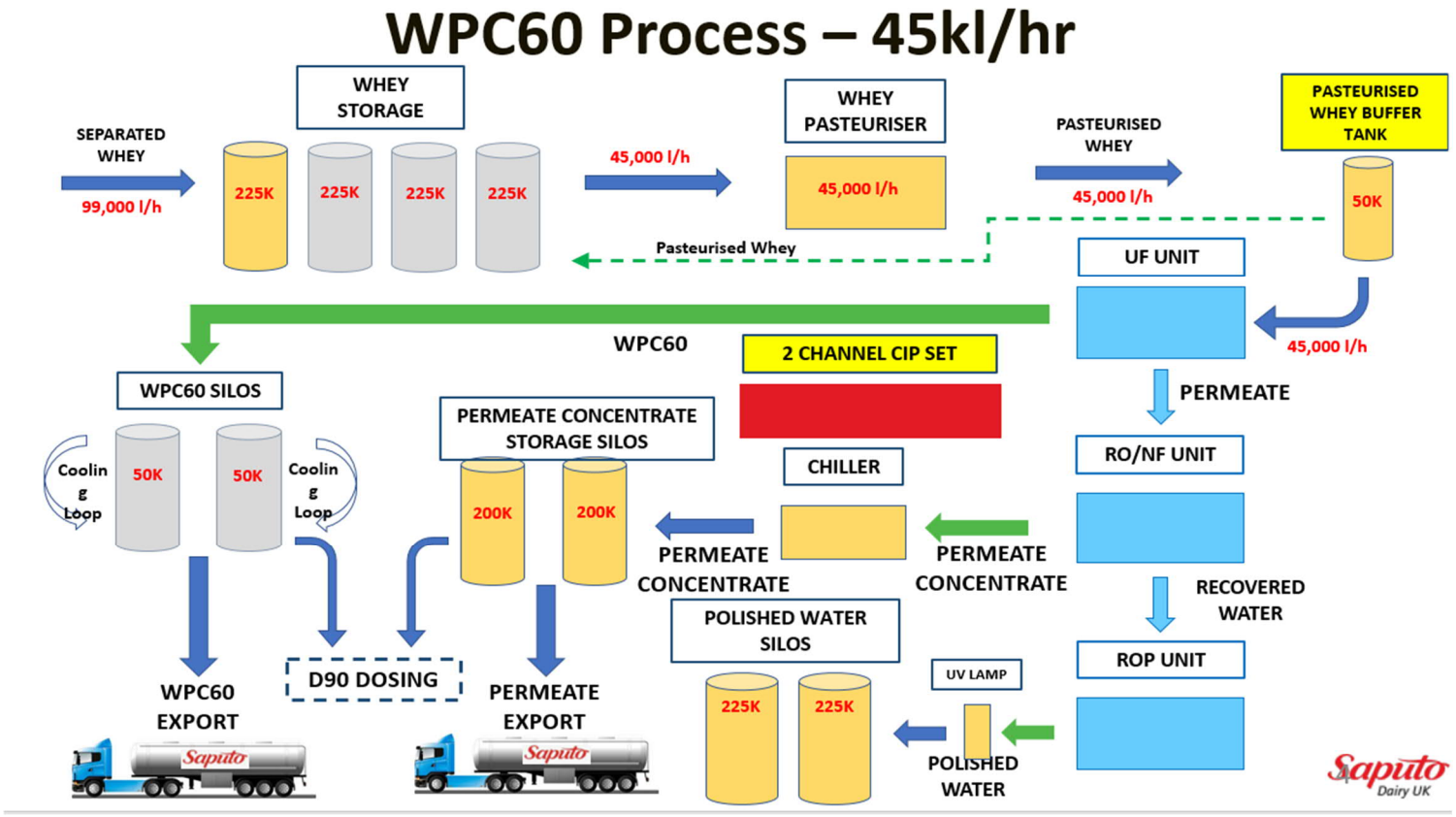
Figure 2-3 – Process Flow Diagram Showing WPC60 Process



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Implementation of the WPC60 project requires the installation of the following additional equipment and infrastructure (as shown in orange in Figure 2-2 above):

- 1 x 225,000 litre raw whey storage silo;
- 1 x 45,000 litre/hr whey pasteuriser;
- 1 x 50,000 litre pasteurised whey buffer tank;
- 1 x 45,000 litre/hr NF membrane plant;
- 1 x 45,000 litre/hr NF/RO/ROP membrane plant;
- 2 x 50,000 litre re-purposed WPC60 storage silos;
- 2 x 200,000 litre concentrated permeate silos; and
- 2 x 200,000 litre polished RO water silos.

All storage silos will be constructed of stainless steel and provided with appropriate containment to ensure that the loss of any liquids stored do not present an unacceptable risk to the environment or human health, as detailed in Table 2-1 below. The table lists all new fixed tanks on site associated with the WPC60 project and should be read as an addendum to Table 5-13 (Containment Measures for New Fixed Tanks) in the 2022 Variation Application. The table also summarises the primary, secondary and tertiary containment measures which are in place for the tanks. All tanks will be impermeable, resistant to the stored materials and regularly inspected for maintenance and integrity purposes.

Table 2-1 – Containment Measures for New Fixed Tanks (WPC60)

Vessel / Tank	Is the structure bunded? (Y/N)	Description	Tank Capacity (litres)	Primary Containment	Secondary Containment	Tertiary Containment
Raw whey storage silo	Yes	Raw material for WPC60 process	225,000	Stainless steel tank	Concrete bund compliant with CIRIA 736	Trade effluent drains and WPF
Pasteurised whey buffer tank	Yes	Intermediate product storage	50,000	Stainless steel tank	Concrete bund compliant with CIRIA 736	Trade effluent drains and WPF
WPC60 storage silos (repurposed from WPC35) x 2	Yes	Intermediate product storage / export storage tank	50,000	Stainless steel tank	Concrete bund compliant with CIRIA 736	Trade effluent drains and WPF

Concentrated permeate silos x 2	Yes	Intermediate product storage / export storage tank	200,000	Stainless steel tank	Concrete bund compliant with CIRIA 736	Trade effluent drains and WPF
Polished RO water silos x 2	Yes	On-site water supply	200,000	Stainless steel tank	Concrete bund compliant with CIRIA 736	Trade effluent drains and WPF

With regard to the 2022 Variation Application, the installation and operation of the WPC60 project (in place of the WPC35 project) will not change the information previously provided in relation to the regulatory context for Creamery Project No. 4, i.e. the WPC60 plant will be regulated as part of the existing Section 6.8 Part A1(d)(i) activity (treating and processing animal raw material other than milk), as was the case for the WPC35 project. Furthermore, the WPC60 project will not have an impact on emissions or monitoring as it will not introduce any new (or change any existing) point source emissions to air or water. With respect to odour and noise, all of the operations will be carried out inside the Creamery building in a new process room, as shown in Figure 2-1 above, and therefore the previously submitted Odour Impact Assessment and Noise Impact Assessment in the 2022 Variation Application are still considered to be valid.

The WPC60 project will have a small impact on energy consumption, raw material and water consumption, and waste /by-product/ effluent arisings. This information is summarised in Tables 2-2 to 2-4 below.

Table 2-2 – Estimated Energy Consumption (WPC60)

Energy Source	UF Plant (MWh)	RO Plant (MWh)	Pasteuriser (MWh)	Rest of Scope (MWh)	Total per Cycle (MWh)	Cleaning Tanks [1] (MWh)	Total per Year (MWh)	Primary Energy [2] (MWh)
Electricity from public supply	2.71	4.48	0.6	2.5	10.28	0.47	3,703	8,887

Notes: 1. Cleaning tanks = RO + permeate + CIP tanks.

2. Electricity imported from the grid is multiplied by a factor of 2.4 to account for heat losses from thermal generation.

- Data based on sales information and assuming 4 hours of CIP (4 x flush), 360 production/CIP cycles per year.
- Information to be read in conjunction with Table 3-11 in the 2022 Variation Application.

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Table 2-3 – Estimated Raw Material Use – WPC60

Material / Chemical	Use of Material	Risks	Approximate Annual Usage (m^3)	Environmental Impact (where known) e.g. degradability, toxicity	Suitable Alternative for those with Significant Impact Potential / Justification
P3-Ultrasil 69 (enzyme)	Specialist CIP cleaning	H314 Skin corrosion H318 Eye damage	9	This product has no known ecotoxicological effects	No better alternative – most appropriate material for activity. Recommended by specialist equipment supplier.
P3-Ultrasil 67 (enzyme)		H315 Skin irritant H318 Eye damage H334 Respiratory sensitivity H412 Chronic aquatic toxicity	8	Harmful to aquatic life with lasting effects (if allowed to enter a watercourse undiluted)	No better alternative – most appropriate material for activity. Recommended by specialist equipment supplier.
P3-Ultrasil 78 (acid)		H314 Skin corrosion	158	This product has no known ecotoxicological effects	No better alternative – most appropriate material for activity. Recommended by specialist equipment supplier.
P3-Ultrasil 112 (alkaline)		H290 Corrosive to metals H314 Skin corrosion H318 Eye damage	172	This product has no known ecotoxicological effects	No better alternative – most appropriate material for activity. Recommended by specialist equipment supplier.

Notes: Data based on sales information and assuming 4 hours of CIP (4 x flush), 360 production/CIP cycles per year. Information to be read in conjunction with Table 3-11 in the 2022 Variation Application. P3-Ultrasil 112 is the only new chemical to be introduced as a result of the WPC60 project; the other chemicals are already used on site.

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Table 2-4 – Estimated Water Consumption and Generation (WPC60)

Water Source	UF Plant (m^3)	RO Plant (m^3)	Pasteuriser (m^3)	Rest of Scope (m^3)	Total per Cycle (m^3)	Cleaning Tanks [1] (m^3)	Total per Year (m^3)
Water usage [2]	3	4.8	40	43	90	150	32,838
Water generated [3]	0	681	0	0	681	0	245,326
Effluent (drained) [4]	3	686	40	43	772	150	278,164 [5]

Notes: 1. Cleaning tanks = RO + permeate + CIP tanks. Assumes that RO and permeate silos are cleaned 10 times per year and CIP tanks are cleaned every 6 months. To be evaluated later in the project during the HAZOP process.

2. Water usage is minimal for seal flush and CIP push. Flushing is done with ROP water (0.03 m^3/hr/pump).

3. Assumes 20 hours of production @ 45 m^3/hr.

4. Effectively all RO water will be drained at some point + the water usage.

5. Effluent (drained) volume includes RO water generated from the process (removed from whey) and the intention is to use this to clean the plant (150 m^3) and the excess will go to the process water tanks to displace imported water from SWW or the river abstraction. The WPF will therefore only receive an additional 150 m^3/day or 54,000 m^3 per year.

- Data based on sales information and assuming 4 hours of CIP (4 x flush), 360 production/CIP cycles per year.
- Information to be read in conjunction with Table 3-12 in the 2022 Variation Application.

Water imports to the site should therefore reduce further as a result of additional opportunity to recycle water.

As detailed above, installation and operation of the WPC60 plant (upgrading from the current WPC35 plant) will bring further benefits to the Creamery operations as well as logistical benefits through reducing the number of tanker movements required to export the higher strength WPC products off site.

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2.2 Creamery Project No.6 Cheese Capacity Growth Phase 3 (RCS Details)

Creamery Project No. 6 is detailed in Section 4.4 of the 2022 Variation Application and there are no changes to the project description or additional equipment / infrastructure required as provided in Table 4-8. However, with regard to the new Rapid Chill Store ("RCS") as part of Project No. 6, which is yet to be built, it is now proposed to purchase a dedicated glycol refrigeration package chiller rather than modify the existing internal ammonia central plant as detailed in Table 3-16 (BAT 9). This is the only change to the project and it is not expected to have any significant environmental impacts other than a positive impact to the reduction in global warming potential of the refrigerants currently being used.

2.3 Cover and Extract from BT2 and Anoxic Tanks

As detailed in the 2022 Variation Application, periodic olfactory monitoring surveys are undertaken at the site to identify and monitor odorous emission sources and help inform management techniques. This includes quantification of total odorous emissions and the relative contribution of key sources, the results of which are used to assess the effectiveness of prior investments in mitigation measures, abatement equipment and other process controls.

Historically, and as reported in the Odour Impact Assessment submitted as part of the 2022 Variation Application, olfactometry showed Balance Tank 1 (BT1) and the Divert Tank to make the largest contribution to odour emissions. As per Table 4-11 in the 2022 Variation Application, these tanks therefore now benefit from covers, extraction and abatement via an Odour Control Unit (OCU) at designated Release Point A11. Other techniques described in the 2022 Variation Application also reduce the potential for odour creation in BT1, i.e. the auto-divert and pH balancing project.

Ongoing olfactometric assessment, since submission of the 2022 Variation Application, has shown the next greatest contribution to residual odorous emissions to be Balance Tank 2 (BT2) which receives DAF treated effluent from BT1, and the two Anoxic Tanks AN2 and AN3. Although the emissions of odour per m^2 from BT2 are not significant, the surface area of BT2 adds to the magnitude of potential emissions. Therefore, in order to further reduce the potential for offsite odour emissions, as agreed in recent discussions with the Environment Agency, it is planned to install covers, extraction and abatement via a new OCU (designated Release Point A12) from BT2, AN2 and AN3. For completeness, the existing building housing DAF2 will also be extracted to the new OCU to benefit the working environment in that building. The project details are summarised in Table 2-5 below and photographs of the tanks before and after the envisaged covers are installed are shown in Figures 2-4 and 2-5.

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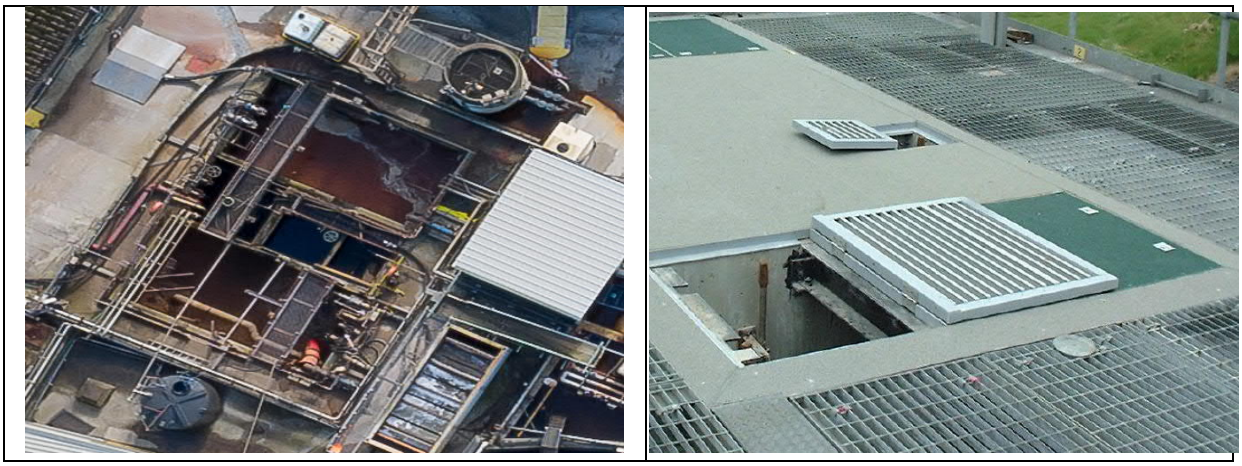
Table 2-5 – WPF Redevelopment: Covering and Extraction of BT2 and Anoxic Tanks

Change / Improvement	Description and Benefits
Covering and extraction of BT2, AN2 and AN3	BT1, AN2 and AN3 will be covered with Glass Reinforced Plastic (GRP) lids (BT2: non-walk-on cover and AN2/AN3: walk-on cover) and the air displaced from the covered headspace of the tanks will be treated via an OCU, in order to minimise odours, before discharge to atmosphere. The new OCU will comprise a single stage, dry chemical scrubber consisting of Diox and Triox media which remove H_2S (the principal odorous compound present) and other odours respectively. The scrubber is designed to achieve 99% removal of H_2S and 90 % of overall odours routed to the OCU. Based on average measured odour emission rates from 2019 to 2022, this represents a reduction of over 40% of the residual odour emissions from the WPF as a whole. An induced draught fan will draw treated air through the OCU at a rate of approximately 1,400 m^3/hour (TBC – subject to detailed design). The fan will be sized sufficiently to accommodate maximum tank fill rate and aeration air added to BT2 whilst maintaining a slight negative pressure in the associated tanks and building. The fan will discharge treated air to atmosphere via a 6 m exhaust stack. The new OCU and exhaust stack (Release Point A12) will be located on top of the new load bearing covers over anoxic tanks AN2 and AN3. The Odour Impact Assessment submitted as part of the 2022 Variation Application included BT2, AN2 and AN3 as area emission sources and, therefore, this assessment is still considered to be valid. However, it provides a conservative assessment as, once these sources are covered, extracted and abated via the new OCU, the emissions and hence the environmental risk will be reduced even further. The new OCU (Release Point A12) associated with this project will be monitored in accordance with the monitoring arrangements specified in Table 5-1 (Monitoring Arrangements) of the 2022 Variation Application. This project is expected to be completed by December 2023 and is being expedited to achieve the associated reduction in odour emissions.

Figure 2-4 – BT 2 Before and After Installation of Cover

Figure 2-5 – Anoxic Tanks AN2 and AN3 Before and After Installation of Cover



2.4 Additional Acoustic Mitigation

Following ongoing discussions with the Environment Agency since submission of the 2022 Variation Application, a number of additional noise mitigation measures are proposed to be implemented on site. These include:

1. Installation of a new, 5m high, acoustic barrier along the north boundary from the entry gate to the east end of the site, closest to the village of Treworra;
2. Enclosure of the blowers for AT3 (note the previous rental blowers have been replaced with a permanent solution);
3. Attenuation for the elevated Triton blowers on AT1a, AT1b and AT2; and

The centrifuge building enclosure, described in Table 1-1 above and included in the 2022 Variation Application, has already contributed to reducing noise emissions.

Subject to obtaining the necessary permissions, this project is expected to be completed by the end of December 2023 and is being expedited to achieve the associated reduction in noise emissions.