

Attachment D

**INFRASTRUCTURE & OPERATION**

**Glanbia Food Ingredients (Ballyragget) Ltd.  
Revised IPPCL Application**

Project Ref: OES1044\_01

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## Attachment No. D

### D1 Operational Information Requirements

Glanbia is an international dairy processor and food ingredients Group with an evolving nutritional focus.

Glanbia has core operations in Ireland, the UK, United States and Africa serving local and global markets. Glanbia Food Ingredients Ireland is one of the leading global suppliers of dairy-based ingredients to the food and beverage industry, with around 600 employees at three manufacturing sites located in Kilkenny, Waterford, and Cavan.

Glanbia Ingredients is Ireland's largest milk processor utilising over 40% of the total Irish milk and whey pool to make over 275,000 tonnes of ingredient products.

Glanbia Ingredients manufacture, milk proteins, whey proteins and derivatives, butter and AMF products, fat-filled milk powders, cheese products, and dairy-based solutions. Integrated quality systems, from milk supply right through manufacturing and supply chain, give best-practice quality and food safety levels. About 95% of all products are exported to key markets across Europe, North America and Africa.

Glanbia Ingredients Ireland (GII) operates 3 plants in Ireland in Ballyragget, Waterford, and Cavan. The Ballyragget facility is the largest of these and is the largest dairy in Ireland with a production capacity of over 3 million m<sup>3</sup> of dairy liquids (milk, whey, creams) per annum.

The range of products manufactured at the site includes solid and liquid products derived from whole milk. The plant in summary comprises of a milk processing plant, wastewater treatment plant and utility plants such as Combined Heat and Power (CHP) Plant, boilers, cooling water, refrigeration, compressed air and chemical storage.

Because of seasonal fluctuations in the availability of the whole milk substrate, some of the unit operations observe an off peak outage.

However, historical peak to trough ratios in terms of processing activity have decreased over the past number of years, and are continuing to decrease, owing to the drive to improve processing plant efficiency through extending production around the so called "shoulder periods" (i.e. November to February). A number of processes, particularly butter manufacture, operate all year round.

Control of the processes undertaken in each of the plant areas and the transfer of liquid substrates between unit operations is highly automated. In addition to the sophisticated programmable logic controller (PLC) systems, product quality is ensured through a regime of frequent, routine sampling and analysis and is regulated under a strict Quality and HACCP Food Safety System.

Although the majority of unit operations are highly automated, Glanbia retain approximately 350 permanent employees and 50 contract staff at Ballyragget.

In addition to down time associated with substrate availability, each plant area has a scheduled regime of plant outages to enable cleaning in order to observe strict hygiene requirements.

Cleaning typically employs dilute acid and caustic solutions. The frequency and cleaning solution specification is governed by the requirement of each unit operation.

In situ cleaning of pipelines, vessels and other plant items is termed here 'clean in place (CIP)'. Process control of the CIP sequence of cleaning and flushing is highly automated.

## **D2 List of Processes**

The following processes are carried out at the Ballyragget installation:

**D2.1 Dairy Liquid Process**

**D2.2 Yellow Fats**

**D2.3 Casein and Whey**

**D2.4 Cheese Production**

**D2.5 Storage**

**D2.6 Services**

**D2.7 Roads and Paving**

**D2.8 Laboratory**

**D2.9 Process Waste Water Treatment**

**D2.10 Emission Abatement Equipment**

### **D2.1 Dairy Liquid Process**

The primary raw material for production activities at the plant is fresh milk, with a projected annual intake of approximately 1.2 million m<sup>3</sup> per annum.

In addition to milk, whey is imported from other dairies for direct incorporation in the process. Of the 1.2 million m<sup>3</sup> of whey projected for production, the bulk of this will be derived from on-site sources (cheese and casein manufacturing operations), with an approximate 420,000m<sup>3</sup> being imported from off-site locations.

Milk is collected throughout the Munster and Leinster areas in 9,000 litre and 22,000 litre road tankers from individual farms and depots, with collections commencing at 4.00 am during peak production.

Fresh milk is delivered directly from the farm or depot to the Ballyragget plant, with deliveries commencing at approximately 6.00am. Milk intake at Ballyragget typically operates over 16-20 hours per day.

Whole milk is received by road tanker at the intake area at a rate of approximately 3,200m<sup>3</sup> per day. Approximately 75% of the whole milk receives heat and centrifugal

treatment for pasteurisation and separation of the cream and skimmed milk fractions. The cheese plant consumes the balance of the whole milk.

The milk intake operates to off-load fresh milk for storage and distribution throughout the plant as quickly and efficiently as is practicable in order to maintain high quality standards of freshness and quality. Delays in the intake of milk can lead to reductions in quality and as a result, restrictions in the processes within which the milk can be utilised.

As a raw material, milk must be refrigerated to maintain freshness and prevent degradation in quality.

Fresh whole milk is comprised of a mixture of protein, carbohydrate, fat, vitamins, minerals and water in the following proportions:

#### Typical Composition of Milk

| Parameter          | Proportion (as %) |
|--------------------|-------------------|
| Fat                | 3.5%              |
| Carbohydrate       | 4.5%              |
| Protein            | 3.2%              |
| Minerals, Vitamins | Trace             |
| Water              | 88%               |

On reception, milk is transferred to storage silos prior to incorporation in manufacturing activities. From storage, milk is distributed on rotation, with oldest milk being used first.

Milk distribution within the plant is through a combination of above ground and underground pipelines. Underground pipelines are located within a central services duct, which serves the entire plant.

There are three main production areas on the site which are referred to as follows:

- Plant 1 - Dairy Plant (Manufacture of butter, butteroil and powders).
- Cheese Plant (cheese manufacture).
- Whey Plant (whey and lactose powders).

The range of products currently manufactured at the Ballyragget site comprise the following:

**Table D.1 Ballyragget Product Range**

| Product           | Market / Uses  |
|-------------------|--|
| Butter            | Catering and consumer packs.                         |
| Butteroil         | Bakery, confectionery, food preparations.            |
| Cream             | Processed offsite (Cream Liqueur).                   |
| Cheese            | Consumer packs.                                      |
| Whole Milk Powder | Confectionery, baking, food preparations, ice cream. |

| Product                        | Market / Uses   |
|--------------------------------|---|
| Skimmed Milk Powder (SMP)      | Manufacture of ice cream, confectionery, soups, sauces, baby food, bakery.                                  |
| Casein (Rennet & Acid)         | Bakery, confectionery.  |
| Milk Protein Concentrate (MPC) | Meat products, whiteners, desserts, medical products, cream liqueurs.                                       |
| Lactose Powder                 | Bakery, baby food, confectionery, meat products.  |
| Whey Powders (WPC & A600)      | Dry mixes, ice cream, bakery, confectionery, Infant nutrition, meat products, soups, sauces, and dressings. |
| Whey Concentrate               | Dry mixes, bakery, confectionery, dressings, mayonnaise, soups, yoghurts, and ingredient in animal feed.    |

The range of products produced within each of the plants is tabulated below:

**Table D.2 Manufacturing Operations**

| Product                        | Plant                    |
|--------------------------------|--------------------------|
| Butter                         | Plant 1- Butter Room     |
| Butteroil                      | Plant 1- Butter Room     |
| Whole milk powder              | Plant 1                  |
| Skimmed milk powder            | Plant 1                  |
| Buttermilk powder              | Plant 1                  |
| Cream                          | Plant 1                  |
| Casein                         | Plant 1 - Casein Factory |
| Milk Protein Concentrate (MPC) | Plant 1                  |
| Cheese                         | Cheese Plant             |
| Lactose powder                 | Whey Plant               |
| Whey Powders                   | Whey Plant               |
| Whey Concentrate               | Whey Plant               |

The plant produces approximately 250,000 tonnes of product annually.

#### Raw Material Intake

There are a series of liquid intake areas associated with the main processing plant, including primary milk intake, cream intake (Plant 1- Separation area) and whey and whey concentrate intake (Whey Plant). The milk intake area comprises the following:

1. A weighbridge
2. 9 reception bays (REC)(oflone& CHP)
3. CIP station for washing.
4. A milk sampling facility.

Milk reception operations are on going on a continuous basis. There are nine milk reception bays (REC) at the milk intake area.

On arrival of a milk tanker, the driver enters the registration number of the truck and necessary details on product into the computer system. The driver then drives to a loading bay and hooks up the appropriate hose for suction and CIP. Milk off-loading is automatically controlled.

As off-loading is taking place, a sample of milk is collected for analysis. Off specification or reject milk is transferred to a dedicated silo.

Truck number, bay number, time of arrival and which product it brings, skim, whole milk, etc. are noted on a log sheet to allow traceability of each batch of milk which is offloaded at the reception area.

When trucks are empty they are flushed with water for approximately four minutes and the first 1 minute of actual flush goes to milk tank and the remainder 3 minutes goes to drain.

In addition to fresh whole milk, skim milk and cream can be handled at the milk reception area.

Milk suitable for cheese processing is directed to storage silos 5 & 6 for subsequent incorporation within the cheese manufacturing process.

Depending on the milk utilisation schedule, whole milk is pumped from storage to one of the main production plants for incorporation into powder, cheese or concentrate manufacture. Whole milk is thermised automatically using one of the two pasteuriser units to meet requirements for cheese, despatch or whey plant.

Milk destined for use within Plant 1 Dairy undergoes a separation and pasteurisation process.

Whole milk is fed from one of the whole milk silos to a pasteuriser where it is pasteurised at 72.5°C for 15 seconds before being cooled to 6°C.

Following pasteurisation the milk is separated through the removal of fat into skim milk and cream.

Skim milk produced during separation can be dispatched without further processing, dried to form skim milk powder or is used in the manufacture of casein.

Cream is used in butter and buttermilk manufacture.

### **Throughput**

The milk intake has a capacity of 454m<sup>3</sup>/hr.

### **Process Controls**

The intake process is controlled under the Milk Intake Process Manual. The key process controls are as follows:

| Parameter                 | Control                               | Records    |
|---------------------------|---------------------------------------|------------|
| Raw Milk Quality          | Manual Testing                        | Laboratory |
| Air Pressure              | Manual Inspection<br>- Pressure Gauge | PLC        |
| Quality of Other Products | Manual Testing                        | Laboratory |

|                      |                                      |                |
|----------------------|--------------------------------------|----------------|
| Temperature          | Automatic In-Line Thermometer to PLC | PLC            |
| <b>Parameter</b>     | <b>Control</b>                       | <b>Records</b> |
| Steam Pressure       | Visual Inspection                    | Log Sheet      |
| Mains Water Pressure | Visual Inspection                    | Log Sheet      |

The separation and pasteurisation process is controlled under the milk processing manual and key the process controls are

1. Raw milk quality
2. Temperature
3. Pasteurised milk temperature
4. Cooling temperature
5. Fat content

### **Cleaning in Place (CIP)**

Cleaning is an essential element of milk intake and milk processing. Cleaning takes place each day at appropriate times.

During CIP all milk tanks, milk lines, cream tanks, cream lines, butteroil tank and line, separators and pasteurisers are washed.

Milk trucks are also washed at the end of each days run. The CIP programme is as follows:

#### *Standard Pre-Rinse*

This is carried out to remove deposits, wastes, etc. which have accumulated during production both in line and on open surfaces.

Any debris which has accumulated is removed from the floor/yard for disposal.

#### *Standard Manual Clean*

The purpose of this is to clean, by hand if necessary using brushes, etc., equipment and surfaces.

#### *Caustic Circulation Wash*

The purpose of this is to apply lye (caustic based solution) at a temperature of 60°C to pipework and surfaces so that foam can stay on long enough to soften material so that it may be completely removed on rinsing. The lye is subsequently drained and recovered.

#### *Standard Post Rinse*

The purpose of this is to remove all previously applied lye and leave all surfaces visually clean.

#### *Acid Circulation Wash*

This is carried out when required and its purpose is to further clean and sanitise food contact areas.

#### *Final Rinse*

The purpose of this is to remove all previously applied chemicals and leave all surfaces visually clean.

### Process Controls

The CIP process is controlled under the Milk Intake Process Manual and Milk Processing manual. The key process controls are as follows:

| Parameter   | Control                                    | Records    |
|---|--|------------|
| Pressure  | Manual inspection - pressure gauge.        | Log Sheet  |
| Temperature   | Manual inspection - temperature gauge.     | Log Sheets |
| CIP Times, CIP Temperature, Detergent Strengths, e.g. lactol, acid. | Records start and end of each CIP circuit. | CIP Sheet  |

### D2.2 Yellowfats

The butter plant is located within a process area, which is termed 'Plant 1'. Cream from the whole milk separation process is used as the feedstock of the butter plant, which operates all year round and will produce approximately 2000 tonnes per week of butter from 2005 onward.

Buttermilk and skimmed milk are produced using evaporation and spray drying technologies. Butteroil is exported off site via road tanker.

#### Butter Manufacture

Manufacture of Butter takes place in the Butter plant area of Plant 1 (Appendix D.1). The unit operations in the manufacture of butter are listed below (Appendix D.2).

#### Cream Treatment

Cream to be used in butter manufacture is first pasteurised in order to ensure that it is bacteriologically safe. Pasteurisation extends the shelf life by applying a minimum defined heat treatment.

Cream from all nine separators is pumped to a cream storage tank via a cooler to a second cream storage tank prior to pasteurisation. Pasteurised cream is then pumped to one of 8 ageing tanks or pumped into tanks and despatched as appropriate.

The control temperature for cream in storage is approximately 5-8°C after six hours following pasteurisation, which allows for crystallisation of fat globules.

#### Cream Churning & Working

Cream is drawn from one of eight silos to either of two balance tanks via a pre-heater to the respective butter making machines.

Butter making takes place in two distinct but continuous operations, churning and working.

The objective of churning is to break down the fat globules causing the fat to coagulate into butter grains while the fat content of the remaining buttermilk decreases.

The objectives of working are to unite the granules into a homogenous mass, thereby extruding the remaining buttermilk. During working, water, salt and lactic ingredients are added as per end product specification.

Through working, water droplets are divided into invisible droplets, resulting in butter of good texture and appearance.

### **Microfixing**

Butter in 25kg blocks, which have passed from manufacturing to cold store, is re-worked or softened to render it suitable for re-packaging into consumer pack sizes. This process is referred to as Microfixing.

Butter which has been softened in this way is transferred by pumping to the required packing machines or is passed to the butteroil plant for butteroil manufacture.

### **Butter Packing**

Softened butter is packed into a number of packaging sizes depending upon customer requirements as follows:

1. 25kg cartons fitted with a food grade polythene liner or
2. Foil/parchment wrapped consumer packs of the following sizes: 454 g, 227 g, 250 g, 7g portion packs.

Each carton of product is coded following packing giving the following information:

- (a) Traceability.
- (b) General.
- (c) Extra information specified by the customer.

### **25kg Bulk Butter**

Butter is pumped from one of two trolleys to the packing machine which is fitted with a filling piston. This delivers approximately 25kgs to the carton.

Each carton passes through a metal detector prior to labelling.

Filled cartons are palletised automatically on to wooden pallets (40 or 50 cartons per pallet) and wrapped in plastic before despatch to the cold store.

### **Consumer Packs**

Butter is pumped from one of two trolleys to the packing machines where it is filled into the machine hopper.

Foil or parchment wrapper rolls are placed on the machines and are date stamped and formed continuously as the butter is filled into them from the hopper.

Cartons are stacked on to wooden pallets and wrapped in plastic film before despatch to the cold store.

After packing butter is transferred to the cold store so that it can set giving it a consistent shape and texture.

### **Throughput**

The butter plant throughput is 20 tonnes per hour of finished product.

### Process Controls

The butter manufacture process is primarily under manual control through the Butter Churning Process Manual. The key process controls are as follows:

| Parameter                  | Control                             | Records                     |
|----------------------------|-------------------------------------|-----------------------------|
| Cream Temperature          | Manual Testing                      | Lab & Log Sheet             |
| Cream Churning Temperature | Visual Inspection                   | Log Sheet                   |
| Steam Pressure             | Visual Inspection<br>Pressure Gauge | Log Sheet                   |
| Mains Water Pressure       | Automatic In-line to PLC            |                             |
| Churn Speed                | Visual Inspection/Lab               | Log Sheet & Lab             |
| Chlorinate Dosing          | Visual Inspection/Lab               | Log Sheet & Lab             |
| % Salt                     | Manual Testing                      | Lab Log                     |
| Age (Xtalisation)          | Manual Check                        | Log Sheet                   |
| pH                         | Manual Testing/Lab                  | Lab Log Sheet               |
| Moisture Content           | Manual Testing/Lab                  | Lab Log Sheet               |
| Cream Quality              | Manual<br>Laboratory Analysis       | Laboratory                  |
| Yield                      | Visual Check                        | Log Sheet Production Report |

In addition, the cream treatment process is controlled under the milk processing manual/cream handling process manual. Microfixing and packaging process control primarily manual. Temperature probes, linked to chart recorders provide control over butter cold storage.

### Buttermilk Separation and Despatch

Buttermilk is a co-product of butter manufacture and it is pumped from the butter plant into a raw buttermilk tank in the processing plant. It is then heat treated at a temperature of 72.5°C for 15 seconds, separated, put into tanks as appropriate and despatched.

### Process Controls

The buttermilk process is controlled under the Milk Processing Process Manual. The key controls are as follows:

| Parameter                          | Control                              | Records        |
|------------------------------------|--------------------------------------|----------------|
| Temperature                        | Automatic in line thermometer to PLC | PLC and Record |
| Pasteurised Buttermilk Temperature | Automatic in line thermometer to PLC | PLC            |
| Quality                            | Manual Testing                       | Lab            |
| Air Pressure                       | Manual Inspection                    | Pressure Gauge |

### Butteroil Production

Butter Oil is a 99.9% fat based product manufactured from cream via a multi stage separation process and from reworking butter as follows:

The butter is first melted at 70°C. This melted butter is then heated to 75°C before separation by means of a heat exchanger and cooled to 60°C before storage. It is then ready for pasteurisation at  $92 \pm 2^\circ\text{C}$  followed by cooling and despatch.

Each carton of product is coded following packing giving the following information:

- (a) Traceability
- (b) General
- (c) Extra information specified by the customer.

Butteroil is despatched on receipt of an order. This order is written into a daily butteroil log sheet. Butteroil is pasteurised and then despatched to a lagged milk tanker.

Other product is despatched on receipt of an order advice note. The product is despatched as follows:

- 1. By lorry liner to final customer depot.
- 2. By container (Octabox, Road tankers, barrels) to export customers.

### Throughput

Is dependent upon production schedule and demand. The current plant capacity is 1.5 tons per hour.

It is proposed to rebuild the plant to produce 4 tons per hour. A new building at the east side of the factory facing the Durrow - Ballyragget road is proposed.

### Process Controls

The key process controls are as follows:

| Parameter               | Control                      | Records         |
|-------------------------|------------------------------|-----------------|
| Temperature             | Manual check and automatic   | Chart Recorders |
| Quality                 | Manual - laboratory analysis | Laboratory      |
| Separator Back Pressure | Manual check and automatic   | Log Sheet       |
| Foreign Bodies          | Visual -check screens        | Log Sheet       |

### Cleaning in Place (CIP)

Cleaning is an essential element of the butter production process which is dependent upon high standards of hygiene and cleanliness. Cleaning takes place each day.

During CIP all process lines, heat exchangers, churns, trolleys, and other equipment are cleaned as are all floor areas within the manufacturing plant.

In addition to cleaning, the CIP system functions to recover residual product from process lines. Hot water at 95°C from the CIP centre fills the CIP route. It is circulated for an adequate period of time and is flushed to the product recovery tank. This cycle is repeated again and its purpose is to recover as much product as possible.

## D2.3 Casein and Whey

### D2.3.1 Casein Manufacture

The Casein plant is located within Plant 1. Rennet and Acid casein are manufactured on site from skimmed milk. The casein production process entails cooking, decanting, clarifying and drying unit operations to produce approximately 20,000 t (10,000t each) per year of dried products. The dried products are subsequently bagged as predominantly 25kg and 1t IBC's for export offsite. Skimmed Milk Powder (SMP) and Milk Protein Concentrate (MPC) are also manufactured through evaporation and drying.

The unit operations in the manufacture of Casein are described below and are illustrated diagrammatically on Appendix D.1. Manufacture of Casein takes place in Plant 1 - Casein Factory. Both acid and rennet casein are manufactured at the plant. The manufacturing process for both acid and rennet casein is described below.

- Pasteurised Skim Milk Treatment
- Acid Casein Manufacture
  - Heating Skim Milk
  - Acidification
  - Cooking
- Rennet Casein Manufacture
  - Heating Skim Milk
  - Renneting
  - Cooking
- Curd Handling
  - De-wheyng (Whey Treatment)
  - Washing of Curd
  - De-watering
  - Drying
  - Blending
  - Milling and Sieving
  - Storage
  - Screening
- Bag Off, Palletising, Shrink Wrapping
- Storage, Grading and Despatch
- Cleaning in Place (CIP)

#### Skim Milk Treatment

Pasteurised skim milk is pumped from milk intake as required to one of three silos, where casein manufacture takes place.

#### Acid Casein Manufacture

##### *Heating Skim Milk*

Skim milk is pumped to skim silos at  $\approx 7^{\circ}\text{C}$  and stored until required for manufacturing.

##### *Acid Addition*

The skim milk is pumped through syneresis tube and hydrochloric acid (HCL) is added (metered) in sufficient quantity to bring the pH down to 4.6. This is the isoelectric point, the point at which precipitation of casein takes place.

### *Cooking*

The gel is cooked in the syneresis tube using the method of steam injection and cooled as appropriate based on experience to bring about the formation of curd and whey. The curd and whey are then pumped through a dewheying decanter.

### **Rennet Casein Manufacture**

Skim milk is heated to a temperature of 25-30°C. When the quantity and temperature of the skim milk in the silo is adequate, rennet is added. The mixture is agitated and subsequently allowed to clot to a gel.

The gel is cooked by pumping it through a syneresis tube and using the method of steam injection.

The curd and whey are next pumped through a dewheying decanter.

### **Curd Handling**

#### *De-Wheying, Washing and De-Watering*

Separation of curd and washing is carried out next.

Curd is first separated from whey using a de-wheying decanter and the whey goes for whey treatment.

Curd is next transferred and washed in vats. Separation of wash water and curd takes place using a de-watering decanter.

The wash water is subsequently clarified with the fines being returned to the de-watering decanter. Supernatant is passed through a reverse osmosis process and re-used.

#### *Drying, Blending, Milling and Sieving*

The dewatered curd is dried in a fluidised bed drier (FBD) where the milled curd is passed over several trays of perforated stainless steel. The heated air flows through the beds of curd from the bottom to the top

The dried curd or casein is blended prior to milling.

Milled casein is classified according to 30, 60 and 80 mesh sieves sized through which it will pass. After sieving, the classified casein is transferred for storage in one of two silos as appropriate.

No. 2 = Casein  
No. 3 = Casein Fines

### **Bag Off, Palletising, Shrink-Wrapping**

Product is screened and fed from one of two silos to a hopper (capacity = 5t). This hopper is emptied by an auger to a weigher. Approx. 25kg of powder is fed into a weigher which is then fed into a bag.

The open bag then travels to the closing line which consists of four stations:

1. Stretcher Station
2. Cleaning Station
3. Sealing Station
4. Folding/Taping

The sealed bag then travels past a metal detector and an inkjet coder.

The bags are then palletised on to wooden pallets (1.5 tonnes per pallet).

The pallet of product is then stretch wrapped with plastic and placed in the powder stores prior to despatch.

**Storage, Grading and Despatch**

Composition and grading of casein is carried out by laboratory staff and casein is stored and sold to customers as appropriate per in-house specifications.

**Throughput**

The casein plant throughput is 4.5 tonnes per hour of finished product. The process yield is one tonne powder per 32 m<sup>3</sup> of skim milk (yearly average).

**Process Controls**

Casein production is controlled under a Casein Production Manual. The key process controls are as follows:

| Parameter  | Control  | Records           |
|--|--|-------------------|
| Foreign matter                                   | Filter   | Log Sheets        |
| Yield and % recovery for de-wheyling decanter.   | Manual check on control panel and decanter gauge respectively. | Log Sheets        |
| Quality of wash water (fines)                    | Manual check   | Log Sheets        |
| Quality of whey, e.g. lactose content (fines)    | Manual check   | Log Sheets        |
| Quantity of acid/rennet                          | Manual Check - Meter   | Log Sheets        |
| Quality of curd                                  | Manual check/lab analysis                                      | Log Sheets/Lab    |
| Temperature of curd                              | Manual check/PLC   | Log Sheet/PLC     |
| Temperature and air drier                        | Manual check   | Log Sheets        |
| Quality of Casein, e.g. moisture, mesh, sediment | Manual check/lab analysis                                      | Log Sheets<br>Lab |
| Steam pressure                                   | Automatic in line to PLC                                       | PLC               |
| Mains water pressure                             | Automatic inline to PLC  | PLC               |
| Air pressure                                     | Manual inspection<br>Pressure Gauge                            | Log Sheet         |

**Cleaning in Place (CIP)**

Cleaning is an essential element of the production process which is dependent upon high standards of hygiene and cleanliness.

A main wash is carried out once per week. Milk silo, whey silo lines, etc. are washed daily.

During CIP all process lines, silos, decanters, wash towers, pasteurisers, tanks, heat exchangers and clarifiers are cleaned as well as all floor areas within the casein manufacturing plant.

The casein CIP systems are controlled by computer and include both an acid/lye programme and acid program only. A caustic based solution called lactol is used as well as nitric acid.

### **Powder Manufacture**

The unit operations in the manufacture of skim milk and buttermilk powders are set out below.

The production process involves the concentration of the material to be dried in an evaporator prior to final moisture reduction and powder formation in a drier.

Concentration of Skim Milk takes place in the Wiegand Evaporator in Plant I. Spray Drying of Skim Milk Powder and Buttermilk Powder takes place in the Niro 1 dryer which is located in Plant 1.

### **Evaporation**

The Wiegand I Evaporator is used to concentrate skim milk from its normal solids of about 9% up to 48%.

The product feed passes from storage silos through a balance tank prior to feed to the evaporator. This balancing ensures a steady feed to the evaporator and reduces the potential for air entrapment within the feed lines.

### **Pre-heating of Skim & Product Flow Control**

Skim is introduced via the balance tank, through the feed pump and then through coils in the various effects before entering the pasteurising section which is part of stage 1.

The product flow is controlled via a flow controller and control valve located directly after the feed pump.

### **Pasteurisation**

The pasteuriser is located internally in Stage I and features a Thermo compressor and a holding tube. Normally a 3" tube is used but an 8" tube is available for higher heat treatments. Temperature is controlled via a steam control valve and controller.

### **Thermo Compressors**

A thermo compressor on each part of Stage I pulls the vapours off the separators. Control of steam pressure to these determines the amount of evaporation done. This controller is called the Steam Density Controller and is used for final solids control.

### **Condensate**

Condensate is divided in two stages. 1<sup>st</sup> Stage condensate comes mainly from the thermo compressor steam being returned for boiler feed during production. 2<sup>nd</sup> Stage condensate is used for pre-heating the drying air in Niro 1. Both streams have conductivity monitors, which divert the condensate to drain if quality is poor.

### **Cooling Tower**

Vacuum is produced primarily by the action of the cooling tower which pumps water through the condenser, which cools the vapours from the process and they are condensed on the surface. The rate of condensation and therefore the vacuum is controlled by a flow control valve and its associated flow controller located on the circulating line. Because the circulating water is being heated in the condenser it is re-cooled in the cooling tower.

## **Spray Drying**

### ***Product Feed to Balance Tank***

The Niro 1 Spray Drier converts liquid concentrate from the evaporation stage to powder form. The various products which can be dried are:

1. Skim Milk Powder
2. Buttermilk Powder

The product feed material passes through the balance tank which is used to ensure a steady stream of air free product to the drying process.

### ***Product Atomisation in the Drier***

The product is atomised with a rotary wheel atomiser.

### ***Drying of Atomised Product in the Drying Chamber (Spray Drying)***

The atomised product next enters the drying chamber, meets hot air and is dried as the product falls through the tower. The product falls to the bottom of the tower and exits via a rotary valve while the hot air together with product fines is removed by the exhaust duct.

Air for the drying of product is drawn from the drying room through air filters. The air is then heated by:

- A. Secondary condensate from the evaporator.
- B. Circulating hot oil.
- C. Steam

The hot oil is generated by a burner, which runs on natural gas, and heats oil which in turn heats the air as it flows over the heating coils.

### ***Separation of Fines from Exhaust Air***

On exiting the Niro 1 spray drier, the exhaust air passes through a manifold which feeds six cyclones. The fines are separated from the air within the vortex chamber of the cyclones and fall through a rotary valve into the main powder stream.

### ***Powder Transport***

The transport fan lifts the powder from the drier together with the fines from the cyclones. This passes through a final cyclone where the powder falls through a rotary valve and the air is returned to the other cyclones.

The powder is sieved through a 1.5mm screen and is then blown to one of two storage silos.

### ***Throughput***

The output for milk powders is 2.5 tonnes per hour.

## Process Controls

The powder manufacturing process is controlled under the Wiegand Evaporator Process Manual and the Niro I Spray Drier Process Manual. The key process controls are as follows:

| Parameter                                       | Control                        | Records              |
|---|--------------------------------|----------------------|
| % Moisture in the Powder                        | Manual Testing                 | Laboratory Log Sheet |
| Vacuum in Chamber                               | Visual Check on Exhaust Flaps. | Log Sheet            |
| Inlet & Outlet Temperature of Drier             | Visual Check - Temperature     | Log Sheet            |
| Air Flow  | Visual Check                   | Log Sheet            |
| Temperature                                     | Thermometer                    | PLC/Log Sheet        |
| Quality of Product                              | Manual Testing                 | Laboratory           |
| Air Pressure                                    | Pressure Gauge                 | Log Sheet            |
| Steam Pressure                                  | Visual Check - Pressure Gauge  | Log Sheet            |
| Water Mains                                     | Visual Check - Pressure Gauge  | Log Sheet            |
| Sieve Screen                                    | Visual Check                   | Log Sheet            |
| Solids in Concentrate coming off the Evaporator | Manual Testing                 | Laboratory           |
| Quality   | Manual Testing                 | Laboratory           |
| Sediment  | Manual Testing                 | Laboratory           |

## Cleaning

Cleaning is an essential element of the evaporation and spray drying process, which is dependent upon high standards of hygiene and cleanliness. Cleaning takes place each day at the end of production.

The Niro 1 Spray Dryer undergoes external cleaning of equipment and surfaces, which are not suitable for foaming or high pressure hosing. Surfaces manually cleaned in the spray drier areas are subsequently spray sanitised.

The Wiegand 1 Evaporator plant is cleaned with a CIP system. During CIP, all process lines, evaporator, feed tank, concentrate coolers, separators and others as necessary are cleaned, as are all floor areas within the Wiegand I Evaporator plant.

The C.I.P. programme comprises Standard Pre Rinse, Standard Manual Clean, Standard Caustic Clean, Standard Post Rinse, and Standard Acid Wash. After a complete clean, hydrochloric acid, is circulated through pipework and surfaces.

All food contact areas are further cleaned and sanitised.

## Whey Manufacturing

The whey plant will process approximately 1.2 million m<sup>3</sup> of whey per annum over the coming year. The plant employs membrane technology, steam heated evaporation, crystallisation and drying (including fluidised bed drying and spray drying) unit operations to produce lactose, whey powders and whey concentrate. Approximately 30% of whey is imported from off-site locations; the remainder is derived from internal cheese and casein manufacture. The Whey plant also produces dried skimmed milk products at a rate equivalent to approximately 1,000m<sup>3</sup> milk per year.

A co-product of lactose crystal manufacture is permeate, the bulk of which is concentrated and used as an animal feed product.

The operations carried out at the whey plant involve the intake and pre-treatment of milk or whey for incorporation within a number of manufacturing processes as follows:

- Whey - Milk Intake
- Whey powder and concentrate manufacture
- Lactose manufacture

### Whey/Milk Intake

Incoming raw material to the whey plant can undergo a number of processes depending upon the milk/whey utilisation schedule. The unit operations are as follows:

- (a) Whey/Milk Intake
- (b) Whey U.O.
- (c) Whey U.F.

### Whey/Milk Intake

The reception area at the whey plant can accommodate whey or whole milk offloading. There are two reception areas with access to three whole milk silos.

Off-loading is automatically controlled with overflow prevention through the operation of a high level alarm.

A low level switch on the tankers activates a tank flushing procedure.

The whey plant intake is controlled under the Whey Intake Process Manual. Whey, milk or skim, which is taken in at the whey intake can be distributed throughout the dairy (Plant 1) and the Whey plant as required in addition to accepting whey from the casein and cheese manufacturing processes.

All raw material intakes at the whey plant are coded with batch number, date and quality information.

In addition to raw material intake, whole milk can be separated/ clarified / pasteurised / thermised as required within the whey intake area.

## Process Controls

The whey intake process is controlled under the Whey Intake Process Manual. The key process controls are as follows:

1. Raw Milk and Whey Quality; Microbiological, Chemical, Compositional (Manual)
2. Temperature (PLC Controlled)
3. Steam Pressure (Manual - Visual Inspection)
4. Mains Water Pressure (Manual)
5. Pasteurised/ Thermised Milk Temperature (PLC)
6. Treated Whey Quality (Manual)
7. Air Pressure (Manual)

## Whey U.O. (Ultra Osmosis)

The ultra osmosis (U.O.) or Nano Filtration (NF) plant is designed to remove water and minerals from liquids such as whey, U.F. permeate and skim milk.

The principle of operation of the U.O. is the use of individual membranes, which act as sieves allowing water minerals and some lactose to pass through while retaining most of the lactose, protein and fat.

Membranes are designed as flat sheets wound spirally around a central permeate tube and each group of membranes is called a module. Modules are linked in series and enclosed in a stainless steel tube to form a loop.

Each loop has an associated circulation pump for pumping whey. Loops are arranged in series to form the plant. Whey increases in solids across the plant as the liquid from the loop passes on to subsequent vessels.

## Throughput

The throughput is dependant upon production schedules and demand with a capacity of between 27,300 and 45,460 litres per hour.

## Process Controls

The key process controls are as follows:

| Parameter                     | Control   | Records    |
|-------------------------------|---|------------|
| Temperature of feed material. | Automatic in line thermometer                         | PLC        |
| Quality of feed material.     | Manual Testing  | Laboratory |
| B.O.D. or Permeate            | Manual Testing  | Laboratory |
|                               | Manual Testing of feed material, product and effluent | Laboratory |
| Temperature of Concentrate    | Automatic in line thermometer                         | PLC        |
| Steam Pressure                | Visual inspection - pressure gauge                    | Log Sheets |
| Mains Water Pressure          | Visual inspection                                     | Log Sheets |

| Parameter  | Control           | Records           |
|--|-------------------|-------------------|
| Air Pressure   | Visual inspection | Log<br>Sheets/PLC |
| Quality of Concentrate and Permeate<br>- pH, protein, etc. | Manual Testing    | Laboratory        |

### Whey U.F. (Ultra Filtration)

The Ultra Filtration Plant is a stand alone plant which takes in a feed of raw whey or a mixture of raw whey and whey concentrate and divides it into a protein rich stream called whey protein concentrate (WPC) also called concentrate or retentate and a de-proteinated stream called permeate. This division occurs at U.F. membrane surfaces and membranes can be regarded as sieves, which retain large particles, i.e. protein while allowing smaller particles, i.e. water and lactose to pass through. Membranes are essentially plastic sheets arranged around a central core in a spiral shape. As whey passes over the surface of the membranes permeate passes through to the central pipe and exits in one direction while the concentrated protein stream exits in a different direction. The spiral sheets of membranes are called modules and are encased in a stainless steel vessel. These vessels are arranged in groups called stages or loops.

Permeate from each stage passes to a balance tank where it is pumped on to evaporation or storage.

The whey protein concentrate stream is pumped through a plate cooler to storage.

### Throughput

Throughput is variable depending upon production schedule and demand.

### Process Controls

The ultra filtration plant process is controlled under the ultra filtration plant process manual. The key process controls are as follows:

1. Temperature of Feed Material
2. Quality of Feed Material
3. Temperature of Concentrate Permeate
4. Quality of Concentrate and Permeate, e.g. Clarity, pH and Protein, etc.
5. Membrane Integrity
6. Steam Pressure
7. Mains Water Pressure
8. Air Pressure

### Cleaning in Place (CIP)

Cleaning is an essential element of the Whey/Milk Intake, Whey U.O. and Whey U.F. production processes, which are dependent upon high standards of hygiene and cleanliness.

The CIP programme is as follows:

#### *Standard Pre-Rinse*

This is carried out to remove deposits, wastes, etc. which have accumulated during production both in line and on open surfaces.

Any debris, which has accumulated, is removed from the floor for disposal.

#### *Standard Manual Clean*

The purpose of this is to clean by hand if necessary using brushes, etc. equipment and surfaces as required.

#### *Caustic Circulation Wash*

Normal caustic is used in the case of whey/milk intake but a special caustic has to be used in the case of U.O. or U.F. membranes. The purpose is to soften material so that it may be completely removed on rinsing.

#### *Standard Post Rinse*

The purpose of this is to remove all previously applied chemicals and leave all surfaces visually clean.

#### *Acid Circulation Wash*

After a complete clean, a solution of sanitizer is applied. All food contact areas are sanitised. Sanitiser is allowed to act for an appropriate period of time. Normal nitric acid is used in the case of whey/milk intake but a special acid has to be used in the case of U.O. or U.F. membranes.

*Note:* The only chemicals permissible for cleaning membranes are:

- Citric Acid or Micro Lax 50
- Ultrasil 53 (with NaOH for pH adjustments)
- Sodium Metabisulphate or Microsan

#### *Final Rinse*

The purpose is to remove all previously applied chemicals and leave all surfaces visually clean.

The CIP process is controlled under the Whey/Milk Intake, U.O. and U.F. process manuals.

### **Whey Concentrate and Powder Manufacture**

Whey powder manufacturing involves a series of evaporation, concentration, crystallisation and drying stages depending upon the whey product being manufactured.

Whey powder manufacture takes place in the Whey plant in the Niro 2 and Niro 3 manufacturing areas. Lactose crystallisation takes place in the Niro 2 manufacturing area.

#### **Evaporation**

Whey concentrate is produced on one of three high concentration evaporators within the whey plant. Whey concentrate is stored in bulk concentrate storage silos under continuous agitation. The concentrate temperature is cooled to 10-20°C at which time the tank is ready to empty.

If the concentrate is destined for lactose manufacture, the crystallisation tanks are emptied into a large balance tank, which then feeds the lactose decanting system. If concentrate is destined for spray drying the crystallisation tanks empty directly to

appropriate storage silos and from there to the balance tanks. It is also possible to dry directly from a crystallisation tank.

Occasionally, the crystallisation tanks are used to cool other concentrates prior to spray drying. These concentrates include:

- Delactosed Whey
- Whey Protein Concentrate
- Partially Demin Delac Whey
- Skim Concentrate

The tank can also be used to cool concentrate prior to despatch as bulk concentrates. These include:

- Whole Milk Concentrate
- Skim Concentrate
- Delactosed Whey Concentrate

There are a number of different evaporator systems, which are used to reduce the solids content of the various whey products prior to drying. These are as follows:

#### *Niro 2 - Line 2 Pre Whey*

Line 2 Pre-Whey takes whey protein concentrate (WPC) and evaporates it to high solids prior to drying.

#### *Niro 2 - Line 5 High*

Line 5 High evaporator takes whey or permeate and evaporates it to a high solids concentration.

#### *Niro 2 - Holvrieka*

The function of the Holvrieka is to evaporate low solids, milks and whey's to a five fold solids concentration.

#### **Niro 2 - Holvrieka**

The Niro 2 Holvrieka is a seven-stage finisher falling film evaporator with vacuum removal of vapours via a surface condenser and cooling tower. The third stage is split into two bodies. The plant boils the liquid under the influence of a vacuum. This enables the liquid to be boiled at a lower temperature 60-65°C. Product is pasteurised prior to evaporation at temperatures ranging from 65-90°C depending on the requirements. The evaporator operates as follows:

##### *Balance Tank*

Product feed passes through this tank.

##### *Pre-Heating*

Raw material liquid is introduced via the balance tank, through the feedpump and then through coils in the various effects before entering the pasteurising section, which is part of stage 1.

##### *Flow Control*

Is by means of a flow controller and control valve.

### *Pasteurisation*

The pasteuriser features a thermo compressor and a holding tube.

### *Thermo Compressors*

A thermo compressor on each part of Stage 1 pulls the vapours off the separators.

### *Condensate*

Condensate is divided in two, 1st stage condensate, which comes mainly from the thermo compressor steam, which is returned to boiler feed during production and 2nd stage condensate is used for preheating the drying air in Niro 3.

### *Cooling Tower*

Vacuum is produced primarily by the action of the cooling tower which pumps water through the condenser. As it passes through the condenser coils the vapours from the process are condensed on the surface.

### **Niro 2 - Line 2 High**

Line 2 High is an evaporator especially designed to process medium solids whey concentrate to a high solids whey concentrate. This water removed is achieved by "boiling" the whey under vacuum at a temperature range of 50-70°C.

The plant consists of a series of tubular structures through which product is pumped and exposed to heat and vacuum. Heat is supplied by steam, vacuum is achieved initially by mechanical vacuum pump and is maintained by the vacuum pump and condensation of any evolved water vapour. Centrifugal pumps transfer the product from stage to stage.

Sensors on the plant show pressure and final product density and flow. The plant is manually operated by adjusting individual controllers to achieve a balanced system.

Product is supplied from whey intake silos to the plant balance tank. Concentrate from the plant is normally pumped to the crystallisation tanks for cooling or directly to the spray drier balance tanks for drying to powder.

### **Drying**

Niro 3 takes high solids Whey Protein Concentrate (WPC) off line 2 pre evaporator and dries it to a powder.

#### *Product Feed to Balance Tank*

The product feed material passes through the balance tank, which is used to ensure a steady stream of air free product to the drying process.

#### *Product Atomisation in the Drier*

The product is atomised with a rotary wheel atomiser.

#### *Drying of Atomised Product in the Drying Chamber (Spray Drying)*

The atomised product next enters the drying chamber, meets hot air and is dried as the product falls through the tower. The product falls to the bottom of the tower and

exits via a rotary valve while the hot air together with product fines is removed by the exhaust duct.

Air for the drying of product is drawn from the drying room through air filters. The air is then heated by:

- A. Secondary condensate from the evaporator.
- B. Circulating hot oil.
- C. Steam

The hot oil is generated by a burner, which runs on natural gas, which heats oil that in turn heats the air as it flows over the heating coils.

#### *Separation of Fines from Exhaust Air*

On exiting the Niro 3 spray drier, the exhaust air passes through a manifold, which feeds six cyclones. The fines are separated from the air within the vortex chamber of the cyclones and fall through a rotary valve into the main powder stream.

#### *Powder Transport*

The transport fan lifts the powder from the drier together with the fines from the cyclones. This passes through a final cyclone where the powder falls through a rotary valve and the air is returned to the other cyclones. The powder is then blown to one of two storage silos.

#### **Throughput**

The normal production output is 7.0 tonnes per hour of whey products.

#### **Process Controls**

The whey concentrate and powder processes are controlled under a series of Process Manuals which cover the operation of the following systems:

Niro 2 Crystallisation Process Manual  
Line 1 Pre Whey Process Manual  
Line 2 High Process Manual  
Line 5 High Whey Process Manual  
Holvrieka Process Manual  
Niro 3 Process Manual  
Line 6 High Process Manual  
Lughillaire – MVR Process Manual

The key process controls are as follows:

| Parameter                                    | Control                             | Records       |
|--|-------------------------------------|---------------|
| % Moisture                                   | Outlet Temperature / Product filled | Lab/Log Sheet |
| Sediment                                     | Condition of powder and cyclones.   | Lab/Log Sheet |
| Cooling                                      | Automatic                           | PLC           |
| Temperature of Feed                          | Automatic                           | PLC           |
| Temperature of Mains Water and Chilled Water | Automatic                           | PLC           |

| Parameter  | Control                             | Records    |
|--|-------------------------------------|------------|
| Quality of Processed Concentrate                             | Manual Testing                      | Laboratory |
| Compressed Air Pressure                                      | Visual Inspection<br>Pressure Gauge | Log Sheet  |
| Product Quantities   | Visual Inspection                   | Log Sheet  |
| % Total Solids   | Control of Flow<br>Steam Valve      | Log Sheet  |
| Quality of Feed  | Manual Testing                      | Laboratory |
| Quality of Evaporated Feed                                   | Manual Testing                      | Laboratory |
| Condensate Conductivity                                      | Automatic                           | PLC        |
| Fines  | Manual Testing                      | Laboratory |
| Temperature of Concentrate                                   | Automatic                           | PLC        |
| Air Free Feed  | Visual                              | Log Sheet  |
| Flow of Feed   | Automatic                           | PLC        |
| Pasteurisation Temperature                                   | Automatic                           | PLC        |
| Product Quantities   | Visual Inspection                   | Log Sheet  |
| Quality of Final Product<br>(concentrate), e.g. pH, sediment | Manual Testing                      | Laboratory |
| Steam Pressure   | Automatic                           | PLC        |
| Vacuum   | Automatic                           | PLC        |
| Final Product Density & Flow                                 | Automatic                           | PLC        |

### Cleaning in Place (CIP)

Cleaning is an essential element of the Niro 2 and Niro 3 production processes, which are dependent upon high standards of hygiene and cleanliness.

Cleaning takes place regularly as appropriate. During CIP all process lines, silos, tanks, etc. are cleaned as are all floor areas within the plants.

The CIP programme comprises Standard Pre-Rinse, Standard Manual Clean, Caustic Circulation Wash, Standard Post Rinse, Acid Circulation Wash, Final Rinse, Standard Manual Clean, Standard Manual Sanitise.

### Lactose Manufacturing

The unit operations in the manufacture of lactose are described below and are illustrated diagrammatically on Appendix D.1.

Manufacture of lactose takes place in the Whey Plant.

### Whey Treatment

The whey is first crystallised in the crystallisation tank. By evaporating raw whey to a high total solids and then cooling it slowly over a period of hours to allow the lactose crystals to form in the concentrate.

This takes place in the crystallisation plant and the crystallisation tanks are emptied into a large balance tank, which feeds the lactose decanting system in the lactose plant.

Lactose crystallisation is the process, which converts a lactose solution into a suspension of lactose crystals.

Lactose is the major component of whey. It is 70% of whey solids. In whey it is totally soluble but in concentrated solutions, lactose forms sugar crystals as the temperature drops.

Lactose crystallisation takes place in 12 tanks, each of which is equipped with a cooling jacket, a cooling circulation system and an agitator.

### **Lactose Decanting**

The crystallised solution is separated from the non-crystallised solids by centrifugal force using a decanter. The non-crystal or delactosed whey is pumped to storage.

The lactose slurry is transported to the dryer by auger.

### **Lactose Drying**

The lactose drying process takes place in two stages:

1. **Dryer**  
The moisture content of the lactose slurry undergoes initial reduction in a dryer.
2. **Plug Flow**  
The plug flow section further reduced the moisture content to a very low level.

The dryer and plug flow are both fluidised bed dryers (FBD)

### **Dried Lactose Handling**

#### *Cooling*

This is carried out on a cooling bed and the aim is to cool the lactose to less than 40°C before milling. The cooling bed is a vibrating fluid bed with ambient air blowing through the lactose at a height of 0.1m.

#### *Milling*

A rotating peg mill is used and this breaks lactose lumps and regular powder particles to give a uniform particle size in the final product.

#### *Conditioning*

Warm air at 25°C and 35°C is blown through this bed. Its purpose is to treat lactose to stop it from caking at a later stage.

#### *Sieving*

The lactose goes through a 2mm x Locker rotex sieve to eliminate any lumps. From there it is blown to the bulk bin (bulk) or to appropriate silo (25 kgs).

### **Throughput**

The plant currently has a capacity of output of 3.5 tonnes per hour of dried lactose.

### Process Controls

The key process controls are as follows:

| Parameter   | Control                                | Records                 |
|---|--|-------------------------|
| Lactose Slurry Feed to Dryer<br>- Quantity<br>- Quality   | Visual<br>Manual Testing               | Log Sheet<br>Laboratory |
| Air Inlet Temperature to Dryer - to be 140°C<br>Dryer Temperature to >55°C.<br>Plug Flow Temperature to be >85°C. | Manual Inspection<br>Temperature Gauge | Log Sheet               |
| Height of Lactose or Fluid Bed Dryer.   | Visual Inspection<br>PLC               | R.V. & V.L.T.           |
| Height of Lactose on Plug Flow  | Visual Inspection                      | R.V. & V.L.T.           |
| Steam Pressure  | Manual Inspection<br>Pressure Gauge    | Log Sheet               |
| Mains Water Pressure  | Manual Inspection<br>Pressure Gauge    | Log Sheet               |
| No Cracks on Dryer  | Visual Inspection                      | Log Sheet               |
| Compressed Air Pressure   | Manual Inspection                      | P.L.C./Log Sheet        |
| Filters   | Visual Inspection                      | Log Sheet               |
| Air Flow through the Dryer  | Visual Inspection                      | Log Sheet               |
| Vacuum  | Visual Inspection                      | Log Sheet               |

### Cleaning in Place (CIP)

Cleaning is an essential element of the lactose production process, which is dependent upon high standards of hygiene and cleanliness.

Cleaning and CIP take place three days per week or more often if deemed necessary.

During cleaning/CIP all process lines, slurry tank, decanters, basket centrifuge, balance tanks and driers are cleaned, as are all floor areas and other equipment within the lactose plant.

The CIP programme comprises Standard Pre-Rinse, Standard Manual Clean, Caustic Circulation Wash, Standard Post Rinse, Acid Circulation Wash and Final Rinse.

### D2.4 Cheese Production

The cheese plant, which employs a semi-batch process, has historically manufactured cheddar and mozzarella cheeses, however it now only produces cheddar. The cheese plant consumes approximately of 900 m<sup>3</sup> per day of whole milk to produce a maximum of approximately 90 tonnes per day of cheese.

## **Cheese Manufacture**

Manufacture of cheese takes place in the Cheese plant (Appendix D.1).

The manufacturing processes for cheddar cheese is detailed below.

### **Milk Treatment**

Raw milk is pumped from the primary milk intake as required, through a pre-heater to a pasteuriser unit. Before passing to the pasteuriser, heated raw milk is passed through a clarifier to remove any debris entrained in the incoming milk.

The pasteurisation process used is high temperature short time (HTST) where incoming milk is heated rapidly to 73°C for 15 seconds before being cooled to 31°C.

Following pasteurisation, milk is pumped to one of seven cheddar vats where cheese making takes place.

### **Starter Preparation**

The preparation of starter cultures for cheese manufacture involves four stages as follows:

- Media Pasteurisation
- Starter Incubation
- Starter Cooling/Storage
- Fumigation of the Starter Room

Starter preparation takes place in the starter room, which is located within the main cheese plant building.

#### *Media Pasteurisation*

The starter media functions as a growing medium for the starter bacteria and is stored in a dried form. Prior to starter preparation, this media is reconstituted with water and pasteurised to ensure sterility. Pasteurisation takes place at 92°C over 15 seconds, followed by cooling to prevent deactivation of starter cultures when added.

#### *Starter Incubation*

Frozen starter cultures are added under hygienic conditions to one of three starter media tanks and incubated to reactivate growth. Incubation is carried out for a predetermined time until the desired started acidity is reached.

#### *Starter Cooling/Storage*

The incubated starter is cooled to 4-6°C prior to approval testing. Approved starter is stored in one of two holding tanks for addition to cheese vats.

#### *Fumigation of the Storage Room*

This is carried out at the end of each days preparation.

The steps involved in the manufacture of cheddar and mozzarella cheeses are detailed below in separate sections.

## **Cheese Manufacture**

The steps involved in the manufacture of cheddar cheese are detailed below.

### *Starter Addition*

Depending upon the culture being used, the cheese starter culture is added in line to milk or directly by manual addition to the vats. Ripening takes place on addition of the starter culture.

### *Colour Addition*

If coloured cheese is to be made, colour is added at the beginning of filling the vat.

### *Rennet Addition*

On ripening, rennet is added to the mix and the milk is allowed to clot for up to 45 minutes.

### *Clotting, Cutting, Cooking and Stirring*

The clotted milk or coagulum is cut to the required size and is cooked while being continuously stirred within the cheese vats.

The curds and whey are stirred prior to being pumped onto a cheddar master pre drain screen as part of the curd handling process.

## **Curd Handling**

### *Draining*

Whey is drained off through a perforated belt on an inclined conveyor while the curd passes through a curd blower for transfer to the cheddar tower.

The whey, which is drained off, passes to a storage tank prior to fines being removed in a whey clarifier and returned to the cheddar master. Clarified whey is passed to a whey cream separator. Separated whey is cooled and pumped via pipeline across to the whey plant. Whey cream is cooled, pasteurised and despatched to the butteroil plant.

### *Cheddaring*

The drained curd is blown to a cheddar tower wherein the desired acidity is achieved. On reaching the pre-determined acidity, the curd passes from the base of the cheddar tower to a salting conveyor via a mill, which chops the curd into the chips.

### *Milling /Salting*

The milled curd drops onto a conveyor and salt is added to a final salt content of 1.5 - 2.1%. Salt addition is by mechanical addition with controlled delivery of salt feed.

### *Blockforming*

The salted curd is blown to a curd hopper through where it is sucked into one of eight block formers by vacuum. The block formers operate under the vacuum to compress the curd into 40 lb. blocks.

## Sealing/Packing

On discharging from the block former, the blocks of curd are loaded manually into pre-positioned plastic bags. These bags are conveyed to the packaging area for sealing on a jumbo packaging machine.

The packaged blocks pass through a metal detector prior to being conveyed to a wrap around machine for boxing. At this point each block is individually weighed and labelled on a weigh scales. All batch data is automatically recorded on a computer.

## Storage, Selection and Despatch

After a period of up to eight weeks in cold store at a temperature of  $7 \pm 2^{\circ}\text{C}$ , cheese is inspected by professional graders.

On grading, cheese is selected for despatch to off-site facilities for retail packaging and sale.

## Throughput

The cheese manufacturing operation has an output of approximately 800 tonnes per week.

## Process Controls

The cheese manufacturing process is controlled under a series of Production Manuals, which cover Starter Preparation, Cheese Production and Packaging.

The key process controls in the manufacture of cheese are as follows:

| Parameter  | Control                                | Records          |
|--|--|------------------|
| Raw Milk Quality   | Manual Testing                         | Laboratory       |
| Temperature  | Automatic and manual Thermometers      | PLC/Log sheet    |
| Steam Pressure   | Automatic and manual                   | PLC/Log Sheet    |
| Mains Water Pressure   | Automatic - in-line thermometer to PLC | PLC              |
| Pasteurised Milk Temperature   | Automatic - in-line thermometer to PLC | PLC              |
| Media Quality  | Manual Testing                         | Laboratory       |
| Water Quality  | Manual Testing                         | Laboratory       |
| Acidity of Brine   | Manual Laboratory Analysis             | Log Sheet        |
| Temperature in Vat.<br>Temperature in Cooker<br>Temperature in Flume | In vat thermometer temperature probe   | P.L.C./Log Sheet |
| Product Quality  | Manual - laboratory analysis           | Laboratory       |
| Acidity  | Manual check                           | Log Sheet        |
| Fat  | Manual check                           | Log Sheet        |
| Salt Addition  | Manual check                           | Log Sheet        |
| Bacteriological  | Manual testing                         | Laboratory       |

## Cleaning (CIP)

Cleaning is an essential element of the cheese production process, which is dependent upon high standards of hygiene and cleanliness.

Cleaning takes place each day at the end of the second production shift and continues over an eight-hour period. During CIP, all process lines, tanks and vats and PHE are cleaned, as are all floor areas within the starter and cheese manufacturing plant. The CIP programme is as follows:

### *Standard Pre-Rinse*

This is carried out to remove deposits, packing wastes, etc. which have accumulated during production both in-line and on open surfaces.

The pre-rinse solution goes to drain and is diverted to the effluent treatment plant.

Any debris, which has accumulated, is removed from the floor for disposal.

### *Standard Foam Clean*

The purpose of this is to clean equipment and surfaces as required using brushes.

### *Standard Caustic Wash*

The purpose of this is to circulate caustic (0.8% strength) through pipework and surfaces to soften material so that it may be completely removed on rinsing. The caustic solution is returned to the lactol tank.

### *Standard Post Rinse*

The purpose of this is to remove all previously applied chemicals and leave all surfaces visually clean. The post rinse solution goes to drain and is diverted to the effluent treatment plant.

### *Standard Spray Sanitise*

After a complete clean, a solution of sanitiser is applied. All food contact areas are sanitised. Sanitiser is allowed to act for at least 20 minutes or even overnight.

### *Standard Manual Clean*

The purpose of this is to clean by hand if necessary using brushes, etc. equipment and surfaces which, because of their design or location are not suitable for foaming or high-pressure hosing.

### *Standard Manual Sanitise*

The purpose of this is to ensure maximum kill of bacteria, and microbes on previously cleaned surfaces, which were not suitable for, spray sanitising.

The CIP process is controlled under the relevant Cheese Production Process Manuals.

In addition to bulk liquid materials, there is a range of product stores located within each of the main production buildings.

Palletised storage is provided in the following areas:

| Location     | Store   | Product   |
|--------------|---|---|
| Cheese Plant | Cheese Cold Stores<br>Home Sales Cold Stores (2 Nr.)<br>Salt and Pallet Store | Cheese<br>Cheese<br>Salt (25kg bags)  |
| Plant 1      | Butter Store<br>Packaging Store<br>Powder store No.1<br>Powder store No.2     | Butter<br>Packaging Materials<br>Casein/ Milk Powders<br>Casein/ Milk Powders |
| Whey Plant   | Intermediate storage (silos)<br>Powder store No.3<br>Powder store No.4        |   |
| Engineering  | Engineering stores  | Spares, maintenance materials etc.  |

Materials stored within the above areas comprise predominantly bulk and 25kg bagged powders with some 1 tonne IBC powder storage. In addition, packed cheeses and butter are stored on pallets in refrigerated stores.

## D2.5 Storage

There is approximately 15,000m<sup>3</sup> of storage provided on-site for raw material, intermediate and finished product.

Bulk storage comprises stainless steel silos, which are located throughout the three main production areas in tank farms. The capacity of storage silos on site varies from approximately 10,000 litres to 265,000 litres.

Storage is provided for the following

| Product             | Tank Type         | Total Capacity (m <sup>3</sup> ) |
|---------------------|-------------------|----------------------------------|
| Milk                | Stainless Steel   | 2,666                            |
| Cream               | Stainless Steel   | 576                              |
| Skim                | Stainless Steel   | 1,054                            |
| Buttermilk          | Stainless Steel   | 114                              |
| Whey                | Stainless Steel   | 285                              |
| Whey concentrates   | Stainless Steel   | 3,800                            |
| Whey concentrates   | Glass Lines Steel | 5,200                            |
| Lactose crystal     | Stainless Steel   | 546                              |
| Nitric acid storage | Stainless Steel   | 75                               |
| Lactol              | Stainless Steel   | 80                               |
| Hydrochloric acid   | Stainless Steel   | 61                               |
| Gas oil             | BMS               | 454                              |
| Diesel              | BMS               | 350                              |
| Calor Gas           | BMS Pressurised   | 1.5 (tonnes)                     |

Arising from the way in which development has taken place at the site over the past 30 years, the degree of bunding on individual tanks and for tank farms is limited.

The tanks themselves are stainless steel and no serious tank failure has occurred at the site in the past 30 years, although minor pinhole leaks have been detected along weld seams on some tanks. The risk of serious tank rupture is considered to be low.

A number of the tank farm areas receive a degree of containment through the routing of adjacent surface water drains to the wastewater treatment plant.

Storage arrangements for fuels and cleaning chemicals differs from dairy storage in that all fuel oil storage tanks and cleaning (CIP) chemical storage tanks are bunded. The storage arrangements for all bulk liquid materials are detailed in Attachment J.

## D2.6 Services

The services provided on-site are as follows:

- Compressed Air
- Water Treatment
- Heat System
- Chilled Water
- Butter Cold Stores Refrigeration
- Cheese Refrigeration

### Compressed Air

The compressed air plant provides an adequate quantity of top quality dry air free of oil and other contamination at a pressure of 7 bar, 100 p.s.i.g. and a dewpoint (Tdp) temperature of less than 4°C for the entire site.

The air compressors in use are two stage water cooled/air cooled machines, which deliver completely oil free air for all requirements. The compressors are connected to the air net, the electricity and the cooling water/air supply.

Compressed air leaving the after cooler and going into the air net is always 100% saturated with water vapour and is next dried.

There are four dryers in use at present, two air cooled refrigeration units, one water cooled refrigeration unit and one adsorption dryer, and these are connected up to the compressors as appropriate.

The operation of the compressed air system is variable on demand.

### Wastes and Emissions

Discharges of cooling water from air compressors goes to drain and is diverted to the effluent treatment plant.

Discharge from dryers consisting of water and oil goes to drain and is diverted from there to the effluent treatment plant.

Air leaks go to the surrounding atmosphere. Water leaks go to drain and are diverted to the effluent treatment plant.

Oil leaks are usually covered with an adsorbent, swept up put into rubbish bags and disposed off to landfill.

### Water Treatment

The water treatment plant provides an adequate quantity of potable water to the quality standards SI No. 81 of 1988 for the entire site.

### Water Supply

1. Well water is supplied from three boreholes located at the back of the factory on the farm. The three boreholes supply the borehole reservoir, which in turn supplies the water treatment plant.
2. River water is supplied from the river Nore that runs alongside the factory.

After pH adjustment of river water using  $H_2SO_4$  or  $HCl$ , incoming process water undergoes the following treatment:

#### *pH Reduction, Coagulation, Flocculation and Settlement*

This applies to river water treatment only and consists of the addition of alum and poly to the water at the entry to the treatment plant to facilitate the removal of particulate matter and suspended solids from the river water in the settlement tank. Well water also enters the treatment plant through the second settlement tank. There are no chemicals added to the well water.

#### *Chlorination*

Chlorine is added to both the river and well water at the open channel leaving the settlement tank. The purpose of this is to provide disinfection of the water leaving it free from disease causing organisms. Chlorine is also added to facilitate the removal of manganese in the filter beds.

#### *Filtration*

Filtration of the well water occurs in two filter beds to remove impurities in the water. Manganese is also removed in the well water filters.

There are three filter beds to remove impurities from the river water. The water flows down through the filter bed and out under drains to the clean water sump.

#### *Storage*

Water is pumped from the clean water sump to the storage reservoir, which has a capacity of  $4,40 m^3$ .

#### *Softening*

The purpose of the softening plant is to remove hardness, i.e. calcium and magnesium ion from the water.

The water treatment system has the following capacity:

| Item                  | IPR                   |
|-----------------------|-----------------------|
| Well Water Treatment  | 200m <sup>3</sup> /hr |
| River Water Treatment | 375m <sup>3</sup> /hr |
| Soft Water Treatment  | 300m <sup>3</sup> /hr |

Note: IPR = Instantaneous Plant Rating

The water treatment process is controlled under the Water Treatment Process Manual. Water recovery takes place when recovered cooling water is softened and reused. This reduces raw water demand and overall volume of discharges.

### **Wastes and Emissions**

Fumes from the hydrochloric acid storage tank are captured in a fume scrubber and diverted to the effluent treatment plant.

Packaging waste is collected, compacted and disposed of to landfill.

Salt bags are returned to the Salt supplier.

Liquid waste from backwashing of filter bed and regeneration of softening plant is discharged to the river.

### **Heat System**

The primary function of the heat system at the plant is steam generation to meet the demand from process areas. In addition, the system provides usable hot water (65°C) for processing areas.

The base steam load at the plant is met by a Combined Heat & Power (CHP) Plant, which is fuelled on natural gas.

The CHP plant was installed in 1999 and has been operational since 2000 in meeting both electrical and steam requirements at the plant. Surplus electrical power is exported to the electrical grid.

The installed capacity of the system is 58 MW (thermal input) comprising 2 No. gas turbines (5 MW electrical output each) and 2 No. heat recovery boilers (HRB)(26,000 kgs/hr steam each).

The heat recover boilers (HRB) will operate to meet steam demand through recovering heat from the turbine exhausts, supplemented where necessary by additional natural gas firing to increase steam output.

The heat system is supplied with feed water from one of two tanks, and returning condensate from process areas throughout the site is stored in these tanks. Excess condensate overflows into a third storage tank, from which it can be returned to feed tanks if in short supply.

Boiler feed water is chemically treated to make it more suitable for boiler use using phosphate (scale inhibitor), sodium sulphate (oxygen scavenger) and caustic soda (pH buffer).

The boiler house plant process is controlled under the Boiler House Plant Process Manual.

### **Wastes and Emissions**

Condensate is diverted to the effluent treatment plant. Stack emissions go to atmosphere.

Debris, dust, etc. accumulates in the boiler house over a period of time. This is swept up, put into rubbish bags and dumped in the normal Avonmore way.

Floors are washed down weekly to drain and wash water is diverted to the effluent treatment plant.

### **Chilled Water Plant**

Cooling load requirements of the plant is met by a single, centralised, chilled water plant

The refrigeration service is supplied throughout the site in the form of chilled water for a central 9,000kw unit.

The standard plant rating (SPR) is 7 days per week, 24 hours per day and depends on the refrigeration cooling load requirements of the plant.

The supply of chilled water is controlled under the Chilled Water Process Manual.

### **Wastes and Emissions**

Evaporator trays are cleaned regularly. Debris is disposed of to landfill.

Waste oil, which has been drained, is put into barrels, identified and sent for recycling by Atlas Oil.

### **Butter Cold Stores**

The butter cold stores refrigeration plant provides adequate capacity to satisfy the cooling load requirements of the three butter cold stores.

The plant is a two stage ammonia (R717) plant, and the stages are low stage and high stage.

There are two evaporators in each cold store and it is intended that the evaporators will maintain the stores at the following temperatures:

Cold Store No. 1 - -10°C  
Cold Store No. 2 - -4°C  
Cold Store No. 3 - 0°C

The system has sufficient capacity to bring temperatures down to -20°C if required.

The HAT 8-125 (V belt driven) compressor capacity (instantaneous plant rating) at the following conditions -40°/+35°C and 1000 rpm is equal to 57,500 kcal/hr or 228,300 BTU/hr

The system operates 7 days per week, 24 hours per day.

The provision of refrigeration is controlled under the butter cold stores refrigeration process manual.

### **Wastes and Emissions**

Accumulation of water on the floor of the cold stores - as a result of the evaporators defrosting. This goes to drain and is diverted to the effluent treatment plant.

Condenser water goes to drain and is diverted to the effluent treatment plant.

Condenser water blow down which may contain water treatment chemicals/other goes to drain and is diverted to the effluent treatment plant.

Oil, which has been drained from the receiver, evaporator and also the separator, is put into barrels, identified and sent off-site for recycling.

Wash water goes to drain and is diverted to the effluent treatment plant.

### **Cheese Refrigeration**

The main cheese refrigeration plant (A) provides adequate capacity to satisfy the cooling load requirements of the:

1. Cheese Cold Store
2. Home Sales Store
3. Rapid Cold Store

The secondary refrigeration system (B) in the loading bay cold store satisfies the cooling load requirements of the loading bay cold stores (cheese).

There are five compressors in total, four in the compressor room and one in the loading bay cold store. There are three Freon condensers and two ammonia compressors.

The system operates 7 days per week 24 hours per day.

The refrigeration process is controlled under the Cheese Cold Stores refrigeration manual.

### **Waste and Emissions**

Accumulation of water on the floor of the cold store as a result of the evaporators defrosting. This goes to drain and is diverted to the effluent treatment plant. Condenser water goes to drain and is diverted to the effluent treatment plant.

Condenser water blowdown which may contain water treatment chemicals/other goes to drain and is diverted to the effluent treatment plant.

Waste oil and oil filters a result of oil change is put into barrels, identified and sent for recycling off- site.

Debris resulting from the need to clean condenser pipes is swept up, placed in rubbish bags and disposed of to landfill.

## **2.7 Roads and Paving**

Roads and pavings are generally constructed in reinforced concrete and macadam, laid to falls.

The car park is surfaced with gravel. The area around the wastewater treatment plant is paved with macadam, reinforced concrete and gravel.

## Drainage

Surface water drains collect storm water run-off from the roof and car park areas and discharge to the waste water treatment plant for treatment prior to discharge. The surface water drains via underground pipeline runs into the balance tank at the treatment plant. Surface water from the milk and whey intake areas runs to the treatment plant.

The drainage system was modified after the issue of the current IPC Licence and dedicated surface water drainage was installed to collect clean rain water runoff from parts of the cheese plant roofs, cold stores and engineering building areas. This system discharges directly to the River Nore of emission point SW - 3.

The waste water drainage system collects process waste water, domestic sewage and surface water from the production plant, administration areas and truck wash area for treatment at the waste water treatment plant.

The site drainage arrangements are shown in Appendix E.

## Ancillary Activities

There is a vehicle maintenance workshop located adjacent to the waste water treatment plant. The site is rented by Glanbia Group plc. to an independent company, Surehaul Ltd. Glanbia are not directly involved in the operation of the workshop.

Surehaul carry out maintenance on the fleet of vehicles, which comprise

- HGV's
- Trailers
- Tankers
- Tractors
- Vans

Waste oil from trucks is piped to a storage tank out the back. The waste oil is collected and taken away regularly by Atlas Oil in Portlaoise.

Waste oil filters are stored in barrels and are collected and taken away regularly by Surehaul in Clonmel. Batteries are stored/are collected and taken away regularly by Surehaul in Clonmel.

Other waste such as scrap iron, break drums, springs, etc. are put into a skip, which is collected regularly by a licensed waste contractor.

In addition, Ballyragget Laundry operates a laundry service in the building adjacent to the waste water treatment plant. The laundry operates as a separate commercial activity and is being relocated to a purpose built facility off site.

## 2.8 Laboratory

There is a laboratory on-site, which carries out a range of microbiological, chemical and physio-chemical tests on raw materials, intermediates and end products. The tests undertaken include:

|                         |                             |
|-------------------------|-----------------------------|
| Product quality         | Treated waste water quality |
| Acidity                 | pH                          |
| Fat Content             | Moisture content            |
| Microbiological quality | Particle size               |
| Water quality           | Solids content              |
| Salt content            | Compositional analysis      |
| BOD                     | Protein content             |
| Clarity                 |                             |

In addition to the laboratory, there is a Research and Development (R&D) centre on-site which is involved in new product development, improvement of existing product and new process development.

### Wastes and Emissions

#### Solid Waste

The sources of solid waste at the Ballyragget facility are predominantly debris from clean-up activities together with packaging waste.

Solid waste arises during both normal production activities and as a result of abnormal operating conditions, such as a power failure or equipment malfunction.

#### Normal Operating Conditions

Wastes generated during normal operating conditions include general debris, packaging waste, minor quantities of product as dust, spent consumables (e.g. filters etc) and organic waste (sludges) from the waste water treatment plant.

Where practicable minor losses are collected for use as industrial grade product.

During casein production, milled curd build up on the floor would be bagged for sale as industrial casein. In unusual situations, curd will be bagged for off-site disposal.

Poor quality powder, which cannot be sold for industrial purposes, will be disposed off-site by landfilling.

#### Abnormal Operating Conditions

Wastes generated during abnormal operating conditions include product and spillage's (collected with absorbent material).

During casein production, power failure may lead to coagulation of curd in a silo. In such cases, the curd must be manually removed and, depending upon quality, may be sold or disposed of to landfill.

The solid wastes generated on-site are detailed in Appendix H.

## 2.9 Process Waste Water

The main sources of process waste water arising from production activities at the plant are as follows:

### **Cleaning Operations.**

Cleaning (CIP) is undertaken daily at the end of each production shift with intermittent washing activities ongoing throughout the production shift. Rigorous CIP is undertaken in order to maintain a high standard of hygiene.

### **Waste Product**

During plant start-up and shut-down, small volumes of product (milk, cream, buttermilk, skim, whey) are discharged to the effluent treatment plant.

### **Condensate**

Small volumes of condensate are generated at the cheese vats and casein silos are diverted to the WWTP.

### **Operational/Handling Losses**

In operations involving multiple handling stages, small quantities of product are lost to drain and diverted to the WWTP.

### **Water Treatment**

Effluent from the water treatment plant is diverted to the WWTP. The effluent from water softeners and filter backwashing is discharged directly to the River Nore.

### **Floor Washings**

Floor washings, which are generated in all process and services areas, are diverted to the WWTP.

### **Domestic Sewage**

Waste water arising from the administration areas and canteen along with effluent from Ballyconra House and company houses (supernatant from septic tanks) are collected and diverted to the effluent treatment plant.

### **Condensate**

Condensate from the evaporation processes carried out on-site is diverted to the effluent treatment plant.

In addition to the above process sources of waste water, the following sources discharge to the waste water treatment plant:

### **Dry Goods Stores**

Domestic effluent from the adjacent Dry Goods Stores administration areas is diverted to the WWTP

### **Laundry**

Effluent from the laundry activities of Ballyragget Laundry discharges to the waste water treatment plant. Ballyragget Laundry is located adjacent to the waste water treatment plant (This activity will be relocated off site in the short term).

### **Vehicle Maintenance**

Surehaul Ltd, who provide vehicle maintenance services to Ballyragget discharge foul effluent to the treatment plant.

### Surface Water Runoff

Surface water run-off from 'dirty yard' areas drains to the effluent treatment plant.

### Truck Wash

There is a truck wash located opposite the administration block. Wash water discharges through trapped gullies to the effluent treatment plant. The silt trap is emptied regularly and contents used for landscaping purposes.

### Emissions to Atmosphere

The activity primarily involves the conversion of liquid raw materials (milk and whey) to a range of dry products, the bulk of which are powders.

Accordingly the main sources of process emissions to atmosphere are dryers, which are located in Plant 1 and the Whey Plant.

## 2.10 Emission Abatement Equipment

Abatement equipment employed at the plant is detailed below.

### Emissions to Atmosphere

The primary emissions to atmosphere abatement equipment are as follows:

| Emission Type                            | Abatement System       |
|--|------------------------|
| Particulate matter (powders)             | Cyclones<br>Bagfilters |
| Fume (HCl and Nitric acid storage tanks) | Scrubbers              |

### Discharges to Surface Waters

The waste water treatment plant comprises the following unit operations (Refer to Appendix D1 for process flow diagram).

- Balance Tank 1
- Dissolved Air Flotation Unit 1
- Balance Tank 2
- Inlet Screen
- Balance Tank 3
- PH Correction
- Dissolved Air Flotation 2
- DAF Float Holding Tank
- Biotower
- Inter Stage Settling Tank
- Anoxic Bioreactor Tank
- Oxidation Ditch
- Chemical Dosage for P removal
- Settlement Tank
- Membrane Process
- Final Discharge
- Picket Fence Thickener
- Odour Removal Plant
- Sludge Press
- Sludge Disposal

## Solid Wastes

There are no solid waste abatement systems in place.

## D3 Development & Operational History of the Site

The Ballyragget Food Ingredients installation has been subject to continuing upgrade and modernisation over the past 30 years to reflect changing production practices, new technologies and improved environmental controls.

Developments at the site since construction of the original installation have included:

- Plant Greenfield development (1967)
- Provision of new water supply (1979)
- Installation of UF Plant (1979)
- Construction of Power Plant (1979)
- New R & D Laboratory (1983)
- Extension to Casein Plant (1992)
- Extension to Whey Plant (1996)
- Extension to Whey, Casein & Butter Plant (1998)
- Installation of CHP (1999)
- Extension to evaporator building (2001)

In addition to these capital developments, a number of environmental projects at the site have resulted in improved performance.

- Installation of Kubota membrane bioreactor (1999)
- Separation of portion of surface water runoff for effluent treatment system (2000)
- Reduction in discharges through cooling water line (SW - 2) through minimisation and recovery projects (2000 – 2004)
- Conversion of boilers and thermo heaters to natural gas (2000)
- Installation of bag filter on Lactose Drier (1999)
- Lining of process waste water drains (1999)
- Bunding of intake & discharge bays (1999)
- Installation of new rotary valves on Niro 1 cyclones to reduce particulate (2000)
- Upgrade of water treatment system to include for pH adjustment and improved settlement (2001)
- Achievement of certification to ISO 14001 (2000)
- Construction of additional 5,000 t sludge storage facility (2001) and upgraded in 2005
- Upgrade to bunding (2001 & 2002)
- Recovery of vacuum pump seal water (2003)
- Ongoing Energy Survey projects

### D3.1 Future Developments

The following future developments are proposed for the Ballyragget Food Ingredients installation:

➤ **Evaporator Project**

This will involve the relocation of a 4-stage thermo vapour recompression evaporator from Glanbia Kilmeadan to Ballyragget to facilitate concentration of delactose permeate onsite and avoid transportation of DLP to and from Kilmeadan.

➤ **Butter Oil Project**

It is proposed to rebuild the plant to increase capacity from 1.5 tons per hour to 4 tons per hour. Also a request has been sent to the Agency to dispose of the skim phase produced at the separation stage of the butteroil process, which is normally added to buttermilk, by a licensed Anaerobic Digester at the times it cannot be added to the buttermilk stream.

➤ **Milk Minerals Project**

This project will involve the removal of calcium phosphate from whey and drying it to a dry product. The project will incorporate design to minimise water usage by reusing water removed from whey for washing the calcium phosphate mixture before drying. It is expected that removing calcium phosphate from the whey before evaporation will facilitate longer production runs on the evaporators. It is also expected that there will be a reduction in cleaning of the evaporators, as calcium phosphate is the principal foulant on evaporator hot surfaces.

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