



The ultimate guide

Managing waste in cheese manufacturing



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**Did you know that
food waste in the dairy
manufacturing sector
can cost companies up
to 4% of their
annual turnover?¹**

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¹WRAP (2016) Quantification of food surplus, waste and related materials in the supply chain. Available from:
<https://www.wrap.org.uk/content/quantification-food-surplus-waste-and-related-materials-supply-chain>

We can help you prevent food waste

If you're a food and drink business, we can help you prevent unnecessary food waste.
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www.zerowastescotland.org.uk/FoodDrink

The dairy landscape

The UK is currently the third largest milk producing country in the EU, with Scotland producing 1.37 billion litres of milk in 2018² and has 97 dairy companies³. Milk alone represents 13% of Scotland's total agricultural output⁴.

The dairy sector is currently the manufacturing sub-sector with the most food waste, representing 23% of total manufacturing food waste, estimated to cost companies up to 4% of their turnover on average⁵.

This document is a good practice guide aimed at helping dairies and particularly cheesemakers reduce food and natural waste, resulting in financial cost savings and reduced overheads.

²Scottish Government (2019) Agriculture facts and figures: 2019. Available at: <https://www.gov.scot/publications/agriculture-facts-figures-2019/pages/8/>

³Scottish Government (2018) Dairy contracts in European countries: research. Available from: <https://www.gov.scot/publications/impact-mandatory-written-dairy-contracts-european-countries-potential-application-scotland/pages/4/>

⁴Scottish Government (2019) Agriculture Facts and Figures. Available from: <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/06/agriculture-facts-figures-2019/documents/agriculture-facts-figures-2019/agriculture-facts-figures-2019/govscot%3Adocument/agriculture-facts-figures-2019.pdf>





Sources of food waste

Food and natural waste from the dairy industry can fall into two categories - avoidable and unavoidable waste.

Avoidable waste

There are five key areas where avoidable waste is created. These are:

- Spills
- Leaks
- Wash-down of product
- Spoilage
- Cuttings

A significant proportion of waste from cheese and dairy processing comes from the wash-down of equipment and from product remaining in pipework. Up to 60% of liquid sludge thrown out after cleaning is made up of products that could have been recovered⁶.

In the UK there is 30,000 tonnes of milk waste in the supply chain, through

breakages and leaks during transportation and in retail outlets is lost, with an additional 13,000 tonnes of waste identified during processing⁷. In the home more than 490 million pints of milk are wasted.

Unavoidable waste

The main unavoidable by-product from cheese making is whey. Approximately 9L of whey is generated for each kg of cheddar produced. Typical whey disposal methods currently include land spreading and use as pig feed. If a business doesn't have these disposal options, the whey will usually be uplifted by waste contractors, which can lead to significant costs for the business.

The average whey uplift costs for a small scale cheese producer can range between £3,000 and £6,000 per year.

⁶Tatum, M in. The Grocer (2016) How the Dairy Industry is Tackling Waste. Available at: <https://www.thegrocer.co.uk/buying-and-supplying/the-dairymen-2016/whey-to-go-how-the-dairy-industry-is-tackling-waste/542026.article>

⁷WRAP (2016) Quantification of food surplus, waste and related materials in the supply chain. Available from: <https://www.wrap.org.uk/content/quantification-food-surplus-waste-and-related-materials-supply-chain>

Know your waste

Most dairy manufacturers are aware of the cost of food waste and will actively try to minimise this waste.

Yet it is still common to only measure the most obvious sources of waste i.e. waste disposed of in bins, broken products and spoilage.

Hidden waste such as spillage, leaks or lost curd is often unaccounted for, as there is a tendency to wash these down the drain. For urban businesses in particular, this results in higher effluent discharge costs. So, what can you do?

Monitoring and Measuring (M&M) allows businesses to assign a cost to the hidden waste and implement waste reduction measures. M&M plans can include:

- Regularly taking note of significant spills, regular leaks or spoilage and measuring the amount (estimated litres or kg per batch) in order to assign a cost to the loss.
- Placing filters on any drains within the site to monitor and measure the amount of solid waste being sent to drains.
- Identify the cause of product loss (human or mechanical error) to implement appropriate improvements e.g. training, equipment upgrades or process change.



Waste reduction and re-use options

There are a range of measures that can be taken to reduce the creation of food waste. These measures are described briefly on the following pages and have been divided into low cost, medium cost and high cost investment opportunities.



A red tractor is shown in a green field under a blue sky with white clouds. The tractor is positioned on a slight rise in the field, and the background shows a line of trees and a fence.

Low investment <£5,000

These low investment recommendations will not necessarily create additional revenue, but they can often lead to indirect savings.

Pig feed

This option, if available, allows for year-round disposal of small to medium amounts of liquid whey. A finishing pig or a sow can consume on average around 10 litres of liquid whey per day⁸. However, this is dependent on having pigs on site or close to the dairy, as the whey should be given fresh. For more information on local pig producers visit www.scottishpigs.coop

Land spreading

This is the most common disposal method for whey as it can act as a fertiliser, but it cannot be spread on waterlogged or frozen land due to pollution risks. As a result, this option can require significant storage space during the winter. For more information refer to SEPA guidance documents.

Improved drainage systems

Good practice for filtering out whey from cheese vats includes double filtration systems or micro-sieves. This practice allows maximum curd recovery. In addition, increasing the efficiency of the effluent drain filters can reduce the amount of solid waste (such as curd) sent to effluent, therefore reducing discharge costs and allowing more product to be recovered.

Dry-cleaning

Dry-cleaning ensures all product is removed from equipment before cleaning with water and can reduce overall water costs. For example, using squeegee mops can be useful to recover as much curd as possible from the cheese vat. Squeegee mops can also be used during the wash-downs to minimise water use.

Filter trays

Filter trays are effective in capturing lost product. When drained in moulds, curd can often fall out. Filter trays placed under the moulds can prevent curd from falling to the floor, allowing it to be reused.

Whey recovery

Whey is lost during the curd-draining and moulding operations and is often sent to effluent instead of storage tanks. Draining the curd moulds over a vat or a recovery tray allows for as much whey as possible to be recovered and diverted from effluent, therefore reducing discharge costs.

⁸Newcastle University School of Agriculture Food & Rural Development (2002) Feeding Organic Pigs: A handbook of raw materials and recommendations for feeding practices. Available at: http://www.britishpigs.org.uk/Newcastle_handbook_of_raw_materials.pdf



Low investment <£5,000

Bioeconomy opportunities

Several industries are exploring the potential of processing whey within different bioeconomy sectors, including food & drink, chemical engineering and infrastructure. It may be possible for dairies to donate and potentially sell liquid whey to interested businesses. More information on research projects can be found at: www.ibioic.com and www.interface-online.org.uk

Additionally, larger manufacturing companies such as Arla, First Milk and Volac may purchase liquid whey from nearby sites to process it into whey powder.

Whey for human consumption

Once filtered, fresh liquid whey can be consumed in drinks such as smoothies or fruit juices, or in food such as bread, pastries or soup. Whey can also be used as a base ingredient for alcohol and butter. For example, Dorset-based dairy

Seaborough Manor is reusing the whey resulting from cheese production to create Black Cow Vodka.

The nutritional benefits of whey can be used to market the whey-based products. This option will utilise small amounts of whey but may add significant value, especially if the dairy has a café and restaurant on-site or close-by.

Whey from pasteurised milk can be used for fresh drinks, cooked or uncooked food if kept refrigerated and used within 48 hours.

Whey from unpasteurised milk can be used in fermented or distilled drinks, and cooked food such as soups or baked goods if kept refrigerated and used within 48 hours.

Visit or contact Food Standards Scotland to ensure adherence to relevant food safety guidelines.



Good practice in action

Michelin-starred chef James Lowe buys in liquid whey each week from Blackwoods Dairy in Kent to be used in savoury sauces, salad dressings, bread and cocktails⁹. He has found unpasteurised whey particularly preferable as it translates many of the milk's natural flavours into the dishes.

Bellevue Cheese Company supply one of the Arran bakeries with small amounts of fresh whey to use as a base for baking special lines of bread, biscuits and pastries. The whey acts as a substitute for butter which has generated financial savings for the bakery.

⁹Foodism (2017) The Whey Forward. Available at: <https://www.foodism.co.uk/the-chefs-and-restaurants-getting-creative-with-curds-and-whey/>

Medium investment £5,000 - £20,000



Process redesign

Most dairies are restricted by a lack of space and have expanded their operations based on a production focus rather than on the efficiency of the manufacturing process.

Reducing the distance between the various production points and reorganising the equipment to improve product flow can help reduce solid and liquid waste generated between the different activities (cutting, draining, milling, moulding etc.). Installing catchment trays or spill trays underneath the main process points can allow spilt curd to be captured and reused.

Climate and humidity control upgrades

Storage rooms require a careful control of temperature and humidity to ensure that the cheese ripens properly. Different cheeses require different conditions and inefficient air conditioning units or a lack of adequate

temperature control, can lead to recurring spoilage. Upgrading air conditioning units or installing monitoring controls will reduce the likelihood of spoilage from the maturation process.

Reuse whey as cattle feed

Cheese producers with a dairy herd close by may benefit from feeding their whey to cattle. Several studies, including one undertaken by Scottish Agricultural College, have found that feeding whey to dairy cattle can improve milk quality and in turn cheese yield, while also reducing water and grain feed costs .

- Sweet whey has been shown to improve growth of calves¹⁰, when included up to 20% of total dry matter intake equivalent¹¹. Dairy cows can ingest up to 20 litres per day of fresh whey in partial substitution for drinking water¹².

- Associated investments for this option include stainless steel mobile tanks to store the whey, mix it with water and transport it to the cattle.
- Precautions should be taken to gradually introduce the whey to the cows over a period of several weeks. The whey should not have to travel more than a mile, or it may risk souring, and the whey-feeding process may be slowed in summer to avoid fermentation of the whey.

¹⁰Food and Agriculture Organisation (1977) Use of Whey in Feeding Ruminants. Available at: <http://www.fao.org/docrep/004/x6512e/X6512E09.htm>

¹¹Krishnamoorthy, U, Moran, J (2011) Rearing Young Ruminants on Milk Replacers And Starter Feeds. Available at: <http://www.fao.org/3/i2439e/i2439e00.pdf>

¹²El-Shewy, AA (2016) Whey as a Feed Ingredient for Lactating Cattle. Available at: <https://www.scienceinternational.com/fulltext/?doi=sciintl.2016.80.85>



High investment £20,000+

Product recovery through Clean In Place (CIP) systems

CIP systems allow efficient cleaning of tanks and pipework and can reduce the overall water and energy used to clean tanks and pipework. Automation of the CIP system is a particularly effective way to optimise its use. Turbidity sensors, density measurements and temperature gauges can ensure that the right amount of cleaning solution is fed in or to enable the operators to detect the difference between product, water rinses, and cleaning solutions.

Small dairies with limited pipework may prefer small mobile CIP units which are well suited for periodic cleaning of vats, separate tanks and pipework. These are significantly less expensive than investing in a site-wide CIP system.

Through compressed air or pigging, CIP systems can also provide up to 95% product recovery from the pipes, minimising the chance of remaining product being washed away.

Micro-Scale Anaerobic Digestion

Anaerobic Digestion (AD) is an effective process for farms to handle manure, reduce emissions and produce heat or electricity for their site. While anaerobic digestion traditionally favours large scale sites, new types of AD systems are being developed to effectively digest small amounts of liquid waste such as whey; allowing them to be used by micro-scale dairy sites.

These systems are built from shipping containers, greatly reducing the spatial requirements and can be modified according to the site's specifications. The units can dispose of whey, manure and slurry; while generating heat, electricity, or fertiliser in addition to potential revenue through Feed-In Tariffs and the Renewable Heat Incentive. For more information on anaerobic digestion, visit www.adbioresources.org



Case study - Strathearn Cheese Co.

Strathearn Cheese Company became aware of regular spoilage occurring in the maturation room due to the poor climate control system. Zero Waste Scotland visited the site to perform a food waste opportunities assessment and it was established that the poor equipment was causing the company to lose around 7.4% of annual cheese production, or around £2,900 in lost revenue.

It was proposed that a new temperature and humidity control unit would reduce spoilage by at least 80%, with an identified payback of only 1.4 years. Strathearn Cheese were able to apply to the Zero Waste Scotland's Waste Prevention Implementation Fund to support the equipment's purchasing costs, allowing them to save an estimated 800 portions per year from being sent to waste.

Zero Waste Scotland offers all businesses help not only to prevent food waste but to save money, tackle climate change and to show customers that you care.

We're here to help.

Call us on 01786 433 930

Email food.drink@zerowastescotland.org.uk

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