

4 CLEANER PRODUCTION CASE STUDY

This case study originates from a Cleaner Production assessment carried out at a Polish herring filleting plant. It shows what the company did and what the assessment achieved. The description below follows the Cleaner Production assessment methodology described in Chapter 5.

4.1 Phase I: Planning and organisation

Obtain management commitment

The company was under pressure from the local authorities because the organic load in the wastewater was too high; and the neighbours complained about odour and effluent from the plant. For these reasons, the managing director committed the company to a project aimed at reducing the company's emissions to the environment.

Set up a project team

A team was established, consisting of the managing director, the technical engineer and supervisors from the various departments. In addition, consultants were commissioned to assist with the project.

Develop environmental policy

The company decided on the following environmental policy:

Overall aim:

- to upgrade production whilst meeting the demands of the local and central authorities;
- to address the complaints of residents nearby.

Objectives:

- to increase yield;
- to decrease pollution load in effluent;
- to reduce odour; and
- to improve work environment.

Targets:

- to increase yield by 3%;
- to reduce water consumption and wastewater volumes by 50%;
- to receive no complaints from neighbours.

Plan the Cleaner Production assessment

The project team decided to focus the Cleaner Production assessment on the filleting line. The timeframe set for implementing the Cleaner Production initiatives was 2 years. They decided on the following steps:

4.2 Phase II: Pre-assessment

Describe the process

The project team first prepared a short description and flow chart of the production processes.

The company processes both herring and cod. However this project involved the herring processing lines only. The company processes 4000 tonnes of raw herring per year and produces frozen and marinated fillets. The production of herring takes place in two mechanical filleting lines and a hand filleting line. The solid waste is treated in a fish meal plant owned by the same company.

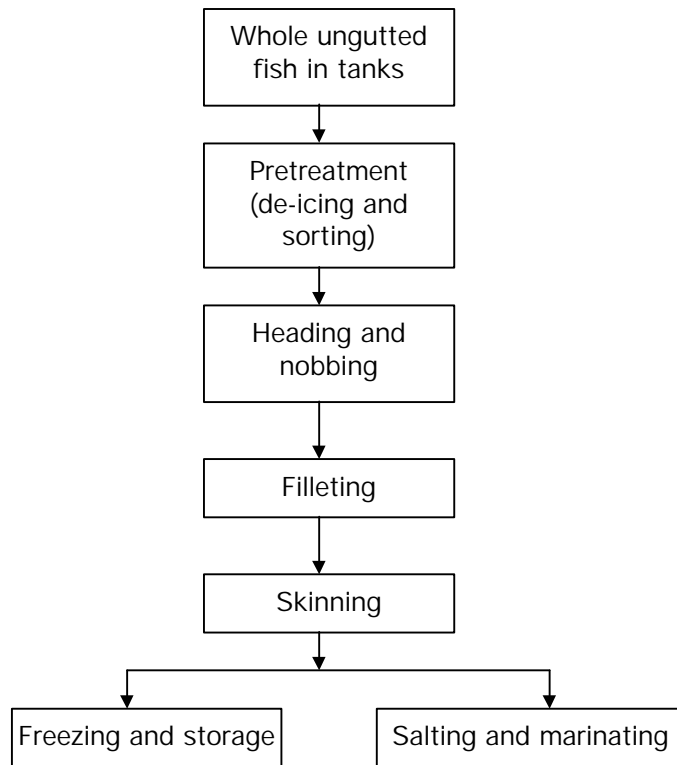


Figure 4–1 Process flow chart of the operation

Undertake walk-through site inspection

A site inspection revealed the following problems:

- poor housekeeping, resulting in excessive waste on floors;
- running hoses;
- poor hygiene;
- insufficient monitoring of yields;
- poor maintenance of equipment;
- a very damp, cold work environment, with waste making the floors wet and slippery;
- an overall impression of untidiness.

Plan assessment phase

The project team decided to focus the Cleaner Production assessment on the herring filleting department because it generates a large quantity of wastewater with a high content of organic matter and it causes economic losses. The yield had earlier been estimated to be 3–5% lower than optimum levels.

In addition, it was felt that quality, hygiene and waste treatment could be improved significantly.

4.3 Phase III: Assessment

Collect data

The team made a sketch of the plant, showing the water and wastewater reticulation system. On the basis of this sketch, the team decided where to install water meters and where to take samples of the wastewater stream. For each key process area, the following were measured:

- water consumption;
- organic load (COD) and suspended solids content of the wastewater;
- energy consumption; and
- product yields.

Operators read water meters regularly and, when necessary, took manual measurements of flow rates. Effluent samples were sent to a laboratory.

This data was tabulated for each process, resulting in key figures that could then be used as benchmarks against which to track improvement.

Identify Cleaner Production options

Cleaner Production pitons were identified for every process and problem. Team members met with the consultants to discuss solutions to the various problems. Those that were considered feasible are listed in Table 4–1.

4.4 Phase IV: Evaluation and feasibility study

Undertake preliminary evaluation

The project team went through a long list of possible options—far more than those shown in Table 4–1. As most of the possible options had been implemented at other plants in the past, the preliminary evaluation was quickly done.

The option for producing silage from offal had to undergo some testing to determine whether a viable market existed. Farmers were called upon to conduct feeding trials to verify the nutritional value of the silage and to promote a market for the product.

Undertake technical evaluation

The staff member responsible for technical and production issues examined the reduced list of options. This was done to exclude options that had a negative impact on product quality and to ensure that selected options were not restricted by site-specific or technical conditions.

Undertake economic evaluation

The project team estimated the investment required for each option, including equipment costs, the cost of construction and the time needed for making changes. If the estimated yield improvement and increased earnings on the silage were valid, the pay-back time would be approximately 2 years. The technical team made a prioritised action list and presented this to the managing director for final approval.

Undertake environmental evaluation

By implementing the options, the project team expected a 50% reduction in water use and a similar reduction in organic load in effluent.

Table 4–1 List of Cleaner Production options

Problem	Description	Proposed solution	Expected improvement	Time span	Capital cost	Operational cost
Low yield	Yield and quality were estimated to be 3–5% lower than expected. The excessive flesh on the skeleton adds to the pollution due to fluming and pumping of offal in excessive water.	<p>Introduce grading of raw material.</p> <p>Introduce production control system, weighing input and output from important processes, in order to minimise waste and continuously check performance.</p> <p>Introduce a daily production report showing all key figures.</p> <p>Refurbish existing filleting machines, including the purchase of new knives and other spare parts.</p> <p>Undertake machinery tests.</p> <p>Introduce regular maintenance of machinery.</p> <p>Train operators and produce short manuals for checking individual machines to improve operation.</p>	<p>Yield increase of 3–5%</p> <p>Less solid waste</p> <p>Less waste in effluent</p>	6 months	Total US\$65,000	Low
Excessive water use	Water was used unnecessarily, both on machines and by operators. The plant used 32 m ³ water per tonne of raw material.	<p>Stop all running hoses by installing spray guns. Reduce consumption on filleting machines by installing solenoid valves and nozzles using less water.</p> <p>Reduce or stop overflow from bins by installing valves.</p> <p>Avoid unnecessary washing of fillets.</p> <p>Change transport of offal (see next).</p> <p>Monitor consumption on installed water meters.</p>	Reduction of 50% in water use from 32 m ³ /t to 16 m ³ /t raw material	1 month	US\$2500	Low

Table 4–1 List of Cleaner Production options

Problem	Description	Proposed solution	Expected improvement	Time span	Capital cost	Operational cost
Highly polluted effluent	<p>The load in the effluent exceeded the maximum limits set by the municipal wastewater treatment plant.</p> <p>The limits were:</p> <p>BOD: 700 mg/L COD: 1000 mg/L Suspended solids: 330 mg/L Fat/oil: 50 mg/L</p> <p>The measured maximum values were:</p> <p>BOD: 3500 mg/L COD: 10,000 mg/L Suspended matter: 2000 mg/L Fat/oil: 2900 mg/L</p>	<p>Reduce water use as follows:</p> <ul style="list-style-type: none"> • Stop transport of offal in water by installing filtering conveyor (mesh 1 mm) under machines to collect offal. • Stop pumping offal in water by changing the flow of wastewater into a soft flow. • Install a screen (mesh 0.2 mm) for mechanical pre-treatment of wastewater. 	<p>Lower wastewater load able to be treated in the existing plant.</p> <p>Increased amounts of solid waste to be used for secondary products.</p>	6–12 months	US\$35,000 plus construction costs	Relatively low
Solid waste	<p>The offal was processed in the neighbouring fish meal plant. The production:</p> <ul style="list-style-type: none"> • was not profitable; • caused complaints about the odour; • emitted highly polluted wastewater. 	<p>Instead of producing fish meal the waste offal could be used to produce silage in a silage plant.</p>	<p>Odour problems minimised.</p> <p>No wastewater from silage production.</p> <p>Larger amount of secondary products.</p>	6 months	US\$40,000 plus construction costs.	Labour Acid and other additives.

Select options

Of the options listed in Table 4–1, the following were selected for implementation:

- introduction of new process systems to improve product yield;
- dry collection of offal;
- water saving opportunities;
- production of silage from offal.

4.5 Phase V: Implementation and Continuation

Prepare an action plan

Based on the evaluation, an implementation plan was drawn up. The plan took into account the seasonal variation in raw material supplies in order to disturb normal production as little as possible. Those persons responsible for technical design, construction, assessment of training needs and training of staff were appointed.

The following options were implemented:

Yield improvements:

- A system for grading fish was introduced. A belt grader was installed to remove fish that were either too small or too large. This enabled the correct adjustment of the filleting machines for fish of uniform size.
- A production control system was installed and the staff and managers underwent training.
- Equipment monitoring procedures were put in place which included the sharpening and changing of knives at each shift.
- Product yield monitoring procedures were also introduced for each filleting line. Machines are adjusted or overhauled based on the feedback from the monitoring results.

Dry collection of offal:

- Small chutes guide the offal and water to a filtration belt with 1 mm mesh size for rapid separation of the offal from the water. The separated water then flows to floor drains that take it to a microfiltration belt with a narrower mesh size.
- The solid offal separated from the filtration belt is taken to a main belt conveyor for transport to a silage plant.
- Wastewater containing offal that has fallen to the floor is transported by gravity to the main filtration belt for screening. The screened offal is added to the main offal stream and also used for silage.

Water saving activities:

- Water meters were installed to record consumption.
- Trigger nozzles were fitted to all cleaning hoses.
- Solenoids valves were installed on all filleting machines to shut off water during shutdown periods.
- Operators are now made aware of water consumption figures in order to increase awareness.

Production of silage:

- Instead of sending the offal to a fish meal plant, the offal is now used to produce silage. The production of silage is less energy consuming than production of fish meal, and is used as fodder.

Monitor performance

As part of the implementation process, a monitoring programme was established to document improvements. After more than 6 months of production, it was found that:

- product yield improved by 5–7%;
- water consumption fell from 32–20 m³/hour, which is equivalent to a 37% reduction;
- the volume of effluent generated also decreased by a similar amount;
- the organic load of the wastewater reduced by 41–88%.

Silage is being sold and produces an income for the company and no pollution arises from this process. The fish meal plant has been closed and the associated nuisance eliminated.

The Cleaner Production activities are sustained by regular monitoring, and by an annual review of the implementation plan.

4.6 Contacts

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