

## 11 – Examples

### 11-1 Case study: Znovin Znojmo

Znovin is a medium-sized producer of wine and vermouth, supplying approximately 5% of the Czech market. The company has 90 employees in three locations. It is a stock company with a single majority share holder. Znovin's competitive advantage is the high quality of its products. The main market is the Czech Republic. 5,000 to 6,000 tons of grapes are processed annually.

The main environmental problems to address were high water consumption (15,000 m<sup>3</sup> per year) and emissions of wastewater with high organic content. Another important objective of the management in introducing EMS was to increase the awareness of all the employees for environmental protection, the impact of their work on the environment and possible risks and accidents.

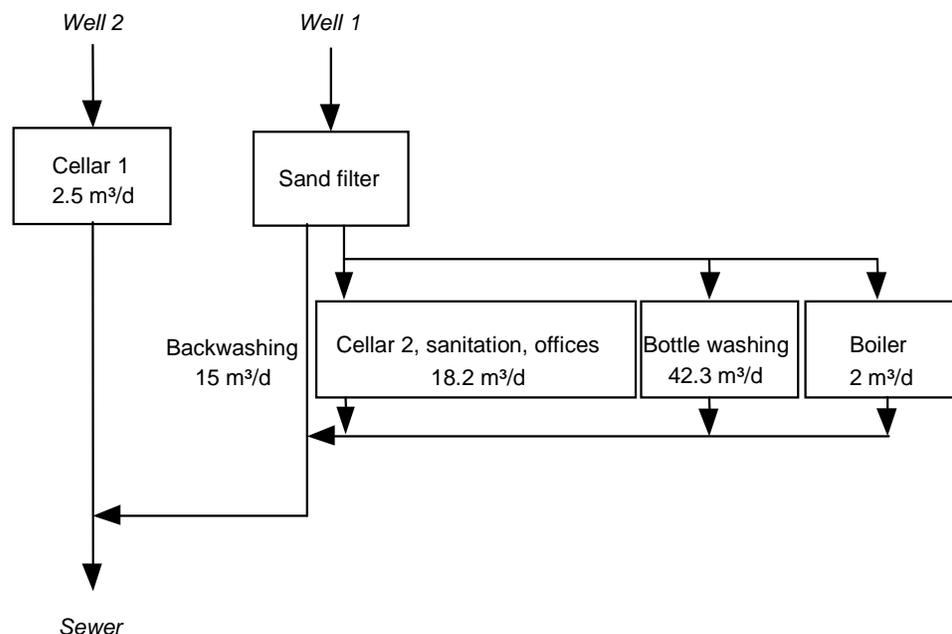


Figure 1: Flow sheet of water in Znovin

The process of producing wine is as follows:

First the grapes are pressed and the juice is stored in tanks. Yeast is added and fermentation starts. The fermentation tanks in this plant are not cooled. After the fermentation, solids settle at the bottom of the tanks. When the wine is clean, the solids are removed and the wine is transferred to storage tanks and after some time to the bottling plant. The bottles are cleaned in a bottle washer. The plant is cleaned as the operators see fit. The same applies to the dosage of chemicals. No data on water consumption was collected.

The company introduced environmental activities, such as monitoring the consumption of raw materials, water and energy on a regular basis. Balances for water and products were drawn up. Consequently, points of loss and inefficient use were identified and measures were proposed.

A new bottle washing line was put into operation in August 1996 and a new bottle filling line in July 1997. The total water consumption could thus be reduced by 25% compared to 1995. If the increase in production is taken into account, this means a 50% reduction of the specific water consumption. Other measures included the installation of new jets in the bottle washing machine and reducing the frequency of backwashing the sand filters in the water treatment plant.



Figure 2: The new bottling line

Organic water pollution was reduced by carefully separating the most heavily polluted water emanating from the production plant from other wastewater. This water is mainly used for irrigation, as the part of the country where the winery is situated is very dry (500 mm of rain per year). The BOD level of the water leaving the company is 25% lower than what it was before these measures were introduced. In total, USD 50,000 could be saved with a payback period of approximately one year. For the next years the construction of a wastewater cleaning plant together with the local authorities and the reconstruction of the heating system are planned.

In addition, selected materials will be substituted with more environmentally friendly alternatives, e.g. by selecting new suppliers or testing new cleaning agents. The employees received training to minimize product losses due to cleaning or leakages. Details of water consumption and losses are recorded to support environmental controlling.

The measures introduced provided indicators for the environmental performance of the company and feedback for actual improvement. A team consisting of the managing director, the environmental consultant, the financial director, the technical director, the foremen in charge of the cellars at each site, the foreman responsible for transportation and maintenance, the foreman of the bottling plant, the main dispatcher, the laboratory manager and the accounting officer was formed to implement and maintain an environmental management system according to ISO 14001.

The activities focused on raising awareness within the company and on defining responsibilities for key activities, such as purchasing, production and maintenance. At the beginning, a team of employees was trained in the cleaner production methodology. During the second training phase, all the employees were trained in the management of environmental aspects. In a third phase, selected employees were trained in auditing.



Figure 3: The foreman with the manual

Znovin's environmental policy and objectives were communicated to the workforce by the managing director and the environmental consultant in a joint meeting of all employees from all production sites. Znovin is a small company where all the employees are known to each other, which fosters the collection of employees' ideas and inputs. The company does not have a strict management hierarchy and each worker is used to discussing new ideas with his supervisor or even the managing director.

Rapid implementation of good ideas has become the rule. Znovin's employees became increasingly aware of environmental protection and the impact of their work on the environment. Since the measures introduced clearly improved their working conditions, the employees were increasingly motivated to participate in the project.

The company's environmental policy was published in a brochure, which provided detailed information on the company's environmental impacts, the methods and procedures for solving problems and the results that were achieved by implementing cleaner production strategies. Information about the certification was published in the regional and national press. In future, Znovin will also try to influence its suppliers and customers and encourage them to improve their attitude towards the environment.

Table 1 compares the aqueous emissions of the company to the sewer before and after the project:

Table 1: Aqueous emissions of Znovin before and after the project compared to production

<b>Parameter</b>	<b>Units</b>	<b>1995</b>	<b>1997</b>
Production	m <sup>3</sup>	2 344	3 000
Water consumption	m <sup>3</sup>	21 377	15 000
Wastewater load (BOD)	kg/a	22 800	4 950
BOD concentration	mg/l	1 067	330

In November 1997 the company was the first winery in the world to be ISO 14001 certified, to our knowledge.

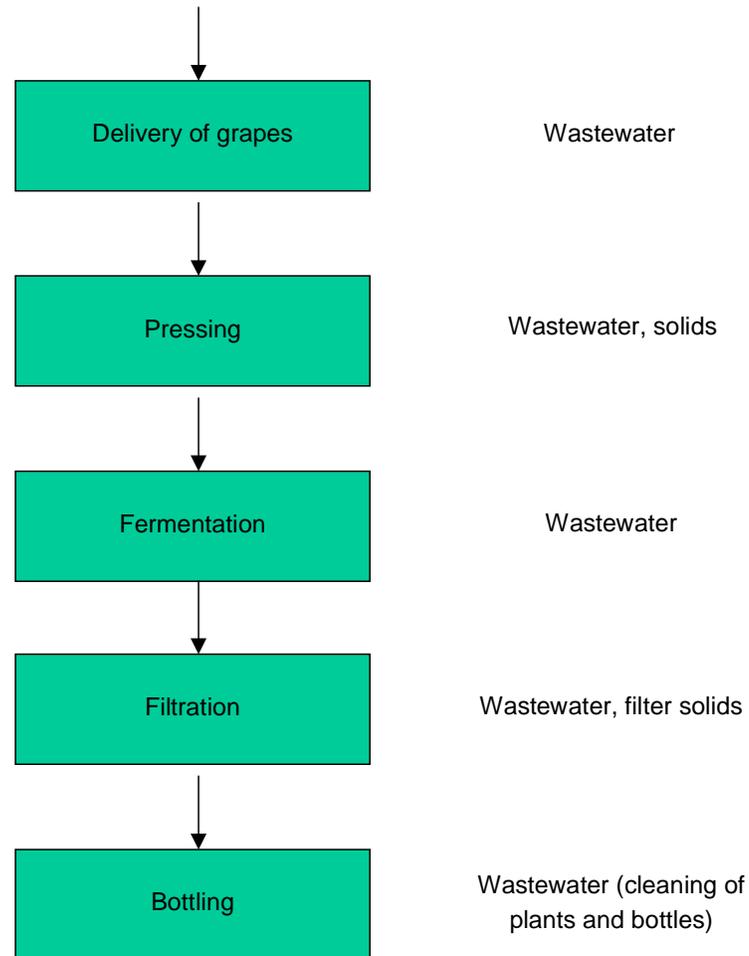
**11-2 Sample solution for the case study Znovin**

Figure 4: Flow sheet with waste and emissions

## Input-output analysis:

- Raw materials: grapes, filters, precipitation agents;
- Electrical energy;
- Fossil fuels;
- Bottles;
- Cleaning agents;
- Products: wine;
- Emissions: wastewater with organic load and chemicals;
- Solids.

Relevant environmental aspects:

- Organic load of wastewater;
- Chemicals in wastewater;
- Consumption of fossil energy.

Relevant laws:

- Wastewater act: Emission limits;
- Official regulations: Storage of chemicals, storage of fuels, boiler emissions, permit for production plant;
- Health and safety: Safety of workers exposed to chemicals.

Members of the environmental team:

- Environmental manager (general responsibility, budget);
- Maintenance manager (mechanical maintenance);
- Accountant (data of material consumption);
- Plant manager (processes, training);
- Quality manager.

Environmental programme:

- Objectives, measures, responsibilities and budget:
  - Automatic dosage of chemicals in bottle washer by dosage device to reduce consumption of cleaning chemicals by 10%;
  - Separate collection of wastewater streams;
  - Drawing up working instructions for emptying and cleaning pipes and tanks;
  - Etc.

### **Procedures for relevant processes**

Cleaning of tanks:

- Responsible for training and monitoring: foreman;
- Before cleaning collect residues, etc. and distribute them to farmers;
- Cleaning in two stages: First with concentrated alkali with a defined and controlled formulation and then with water. The water is collected and reused for preparing the alkali for the next cleaning operation.

Bottle washing:

- Responsible for training and monitoring: foreman;
- Before cleaning collect residues, etc. and distribute them to farmers;
- Cleaning in two stages: First with concentrated alkali with a defined and controlled formulation and then with water. The water is collected and reused for preparing the alkali for the next cleaning operation;
- Document losses and analyse them monthly.

Documentation:

- Manual with the environmental policy, an organization chart, management procedures, chapters on product design, purchasing, production, training, communication, documentation, audit and management review;
- Procedures for:
  - Definition of policy;
  - Definition of objectives;
  - Identification of environmental aspects;
  - Legal compliance;
  - Environmental programmes;
  - Tasks and responsibilities;
  - Responsibility for environmental protection;
  - Definition of training needs;
  - Definition of training measures;
  - Internal and external communication;
  - Documentation of management system in written form (manual, procedures);
  - Control of documents;
- Correct use of forms.

Internal audit: Key questions:

- Do you know the environmental policy of the company?
- Which objectives do you derive from the policy for your area?
- Which measures did you implement in the last year?
- Which procedures are valid in your area?
- Are they observed?
- Is the relevant documentation up to date?

### 11-3 Case study: Eloxal Heuberger

The company is an anodizing company with 14 employees in Graz, Austria. The company is specialized in processing orders within a very short lead time. Annually, 40,000 m<sup>2</sup> of aluminium sheet metal, profiles and small parts are treated in the plant.



Figure 5: The anodizing plant



Figure 6: Parts ready to be processed

Anodizing is a galvanic process in which the surface of the aluminium is converted to aluminium oxide, which protects the basic material against corrosion and wear. By grinding and polishing, the surface can be prepared in different decorative qualities prior to anodizing. During the process the

parts are immersed in degreasing, pickling, rinsing, anodizing, and final rinsing baths.

Eloxal Heuberger joined the Ecoprofit programme of the City of Graz in 1996. In 1997 the company decided to introduce an environmental management system according to the EMAS scheme of the European Community based on the measures implemented during the cleaner production project.

The project started with an initial review using the information collected during the cleaner production project as a basis. This included:

- Information on material and energy inputs and outputs as well as opportunities for improvement;
- Information on legal compliance;
- Information on the organization of the company.

From this review, a first working programme was drafted, which included:

- Development of a project to guarantee compliance with current Austrian wastewater legislation;
- Evaluation and written documentation of the working conditions at all the workplaces to fulfil these legal requirements;
- Definition of procedures for anodizing, analysis of process baths and maintenance;
- Definition of responsibilities, corrective measures and an auditing procedure;
- Documentation of the management system.

The next step was introduction of the elements of the cleaner production programme into the daily procedures of the company:

- The baths were analysed daily to optimize the quantity of chemicals. The quantities used were recorded and analysed. Changes of the resulting indicators were discussed in the environmental team's meetings.
- The properties of the chemicals were analysed. Several chemicals were changed since less hazardous alternatives were available. During the evaluation of the operators' workplaces the probability of accidents was analysed and documented. Measures for prevention were defined.
- Hazardous waste was reduced to a minimum. The only remaining hazardous waste is used compressor oil. Non-hazardous waste is separated into paper, metal, plastics, biogenous waste and industrial waste. Packaging materials are almost completely reused for the packaging of products. For the biggest customers returnable packaging systems were arranged. The annual quantity of industrial waste amounts to as little as 1,500 kg.

- Wastewater mainly stems from rinsing parts after pickling and anodizing. Longer dripping times were introduced to minimize drag-out and consequently less water was needed for rinsing. The racks were changed for the same purpose. Spray rinsing was introduced to increase the rinsing effect. The neutralization plant for the treatment of the wastewater will be extended by a unit to separate the solids from the wastewater.
- Electrical energy is used for the anodizing process, driving motors and lightning. A project for the reduction of energy consumption is currently being developed.
- Gas is used for heating of process baths and during winter for heating the workshop. Measures to reduce gas consumption were: introduction of covers for the baths when not in use, and the reduction of heating duration by switching off heating before production stops at night.

The managing director paid particular attention to formulating a convincing environmental policy. The environmental guidelines emphasize the commitment of the company and its staff. They confirm that the protection of the environment is an essential part of management and introduce objectives and procedures for everyone in the company. They were very well accepted by the employees and the feedback was especially positive after they had been amended to include examples showing how they affect daily practice.



Figure 7: The environmental team of Eloxal Heuberger

The sentence "We try to minimize the effects of our activities on the environment", for example, is explained by: "We know that this is a continuous task consisting of many small steps, which have to be

implemented continuously. We try to do so, for example, by improving our racks to optimize the utilization of process solutions and to reduce consumption of water and energy. We try to minimize drag-out by systematically studying dripping and improving our rinsing technology and practice.”

The monthly meetings of the environmental team form the backbone of the management system. This team consists of seven members, representing all areas of the company. In the meetings, the following topics are discussed:

- Progress of the environmental programme;
- Overview of new developments;
- Current problems;
- Compliance with existing regulations;
- Training needs;
- Discussion of current indicators for the consumption of materials and energy;
- Ideas for improvement;

The documentation is kept as brief as possible:

- Minutes of the meetings are documented.
- Current problems and remedies are noted in special forms and printed on red paper.
- Additionally, an audit form and a form to control the consumption of water, energy and chemicals are used to document the environmental effects and the environmental programme.
- Checklists were developed for the key variables of the anodizing process as well as for new orders and purchasing.
- Plans for training and maintenance were drawn up.

Each of the employees was trained in first aid. Training courses were held on the handling of materials and on reducing chemicals.

Although the company doubled its production between 1996 and 1999, water consumption was reduced by 50 %. This represents a cost reduction of USD 20,000. The reduction in the use of chemicals (roughly 10 %) means cost reductions of USD 2,000, the reduction in gas consumption (also 10 %) saved USD 4,000 annually.

The environmental programme for 1999 included measures for a further reduction of water consumption (compressor cooling system, good housekeeping measures), elimination of solids in the wastewater (filtration system), reduction of energy consumption (reduction of peak loads, good housekeeping) and a reduction in use of chemicals (dosage device, improved production planning).

The team formed by the employees and the managing director was highly motivated. They took part in the meetings and contributed many good and practical ideas. However, some practical problems occurred which increased the project duration to almost two years.

The authorities were indecisive regarding the handling of procedural questions due to changes in legislation. The company was therefore very cautious regarding investments in the wastewater treatment plant.

The work had to be done as overtime after the “normal” working hours of the team members. Although overtime was paid, this additional work reduced the team members’ leisure time who had difficulties accepting this.

Originally it was planned that the team should compile the documentation of the management system. Since this proved to be very time-consuming the consultant wrote most of the documentation after discussing the respective topics and procedures with the team members. Consequently, it was difficult for the internal auditors to check the management system critically during the internal audit.

**11-4 Sample solution for the case study Eloxal Heuberger**

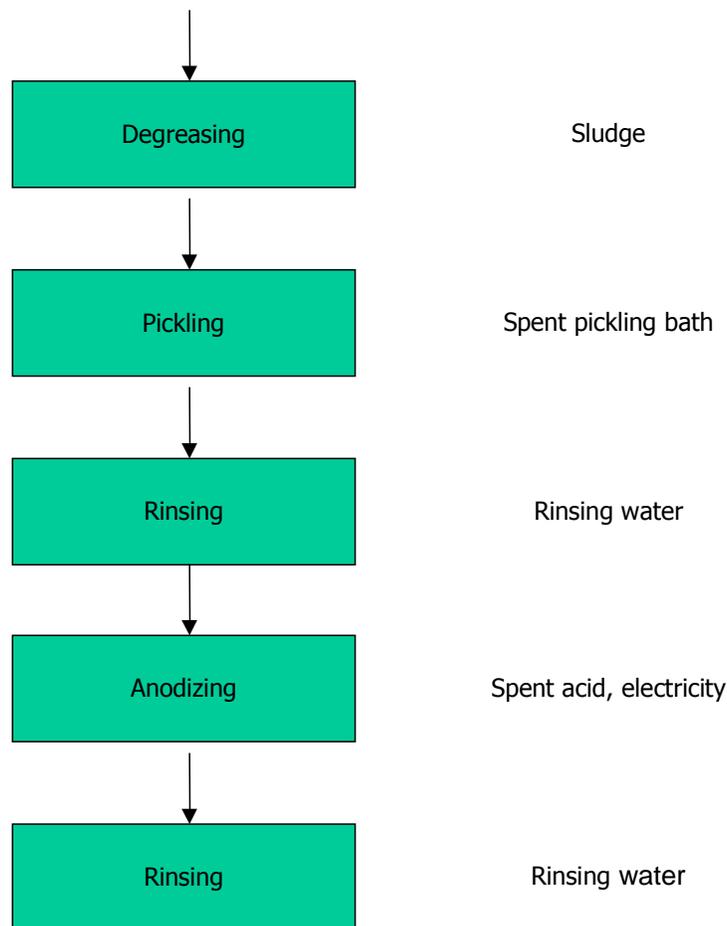


Figure 8: Flow sheet with waste and emissions

**Input/output analysis:**

- Raw materials: aluminium, degreasing agent, caustic soda, sulphuric acid, other chemicals;
- Electrical energy;
- Fossil fuels;
- Product: anodized surfaces;
- Emissions: wastewater with inorganic load and chemicals;
- Solids.

**Relevant environmental aspects:**

- Inorganic load of wastewater;
- Chemicals in wastewater;
- Consumption of fossil energy.

**Relevant laws:**

- Wastewater act: Emission limits;
- Official regulations: Storage of chemicals, storage of fuels, emissions from boiler, permit for the production plant;
- Health and safety: Safety of workers who handle chemicals.

**Members of the environmental team;**

- Environmental manager (general responsibility, budget);
- Maintenance manager (mechanical maintenance);
- Accountant (data of material consumption);
- Plant manager (processes, training);
- Quality manager.

**Environmental programme:****Objectives, measures, responsibilities and budget:**

- Automatic dosage of chemicals in bottle washer by dosage device to reduce consumption of cleaning chemicals by 10 %;
- Daily check of water consumption;
- Formulation of working instructions for anodizing and rinsing;
- Etc.

Procedures for relevant processes:

Draining of parts:

- Responsible for training and monitoring: foreman;
- Parts are removed slowly (< 2 m/min) from the baths;
- Parts are allowed to drain for 20 seconds.

Anodizing:

- Responsible for training and monitoring: foreman;
- Parts remain in process solution for 20 minutes;
- Temperature is maintained at 20 °C, if necessary increase cooling water flow (Do not forget to close the valve at night.);
- Concentration of aluminium is measured every day. If it exceeds 40 g/l, the retardation device is started to reduce the aluminium content of the bath.
- The bath is refilled with water every day.

Documentation:

- Manual with the environmental policy, an organization chart, management procedures, chapters on product design, purchasing, production, training, communication, documentation, audit and management review.
- Procedures for:
  - Definition of policy;
  - Definition of objectives;
  - Identification of environmental aspects;
  - Legal compliance;
  - Environmental programmes;
  - Tasks and responsibilities;
  - Responsibility for environmental protection;
  - Definition of training needs;
  - Definition of training measures;
  - Internal and external communication
  - Documentation of management system in written form (manual, procedures)
  - Control of documents
- Forms.



Internal audit: Key questions:

- Do you know the environmental policy of the company?
- Which objectives do you derive from the policy for your area?
- Which measures did you implement in the last year?
- Which procedures are valid in your area?
- Are they observed?
- Is the relevant documentation up to date?