7 – Background Material

7 Textbook

7.1 Purpose of the textbook "Indicators and environmental controlling"

Planning and controlling instruments

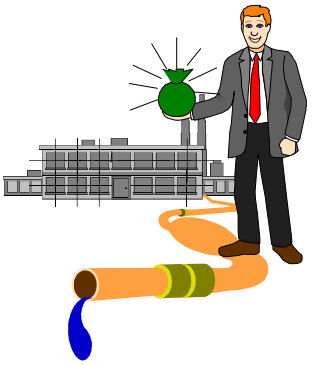
The business controller of a company provides data about the systematic planning, analysis and control of its entire activity. He creates transparency in a company. Environmental controlling is the systematic planning and control of a company's environmental aspects. As such it is an important part of company management. This textbook presents an approach to environmental controlling and environmental management as an opportunity to achieve:

What are the benefits of environmental controlling?

- Legal compliance, even if new environmental laws and regulations become effective;
- Transparency concerning the material and energy consumption and its development;
- A systematic analysis of potentials for material and energy optimization to increase the efficiency of a company; and
- Systematic continuous improvement of environmental impacts caused by the company.

This textbook is intended to help you make the step forward from a one-time project towards the integration of continuous reduction of environmental aspects into corporate management.

In this textbook, methods and tools for systematic, continuous optimization of the environmental aspects of a company are introduced.



7.2 What does "environmental controlling" mean?

"Controlling" means not only the monitoring of the production process, but also includes its planning and control in the sense of a controlled process which contributes to continuous improvement.

Example: Controlling as a feedback control loop

The room heater thermostat is an example of a feedback control system. There needs to be a thermometer recording the room temperature. When the temperature in the room drops below a certain value, which is determined by a so-called controller, a valve is opened, feeding more hot water to the heater and thus increasing room temperature.

Environmental controlling provides information and tools that help management to improve the environmentally relevant processes of the company. Controlling is therefore a management tool. In order to introduce a successful controlling system, an information system needs to be implemented providing management continuously with information about the relationship of planned and actual development, thereby enabling logical and goal-focused corrective action (in the case of internal or external disturbances).

Controlling should be as future-oriented as possible so that deviations can be detected and corrected at an early stage.

Example: Driving a car

When a driver approaches a slope on a road, he does not wait until the speed of his car drops and accelerates only then. He knows from experience that he has to collect speed before so that he does not slow down.

It is the aim of environmental controlling to identify environmentally motivated optimization potentials, benefit from them and actively improve unsatisfactory processes, in order to detect, avoid and reduce future risk potentials.

In order to ensure all this, environmental controlling has to fulfil the following functions:

Functions

- **Definition of targets** and **pre-warning function** with regard to the identification of environmental risks and resulting **weak points** of the company's production of goods and services;
- Collection and preparation of **information;**
- **Analysis** and **evaluation** of this information from the point of view of decision making;
- Monitoring and **control** within the framework of the (environmental) corporate policy: planning of measures;
- **Identification and implementation** of optimization measures;
- Monitoring of success;
- Creation of documentation and **corporate communication of the improvements.**

Figure 1 shows the most important elements of environmental controlling in the form of a controlling loop: it starts with the definition of the environmental policy of a company. The control system is based on the environmental information system which provides information about the status of the environmental impact of the company (e.g. by means of input/output analysis, material flow analysis, emission audits, risk assessments, organizational audits). In addition, it includes an up-to-date register of laws and regulations relevant to the company as well as information about best available technology.

Controlling loop

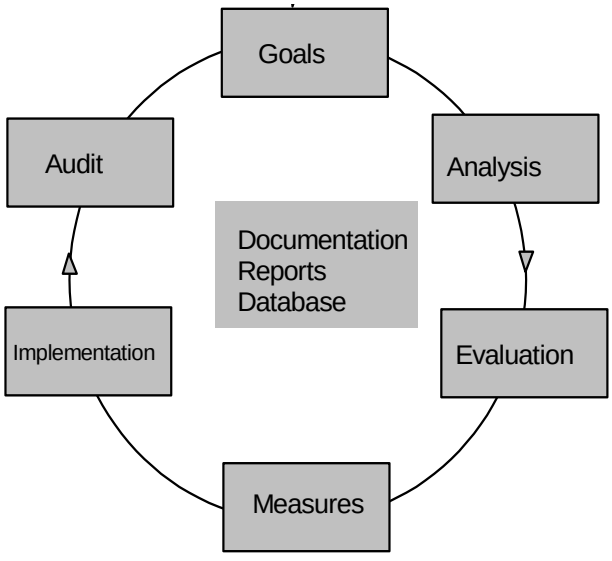


Figure 1: Loop model of corporate environmental controlling

- **Phases of the control cycle**

The following phases have to be repeated on an annual basis:

- Definition of targets: formulation of an environmental policy and definition of environmental objectives and targets;
- Information: documentation of material and energy flows, their analysis and decision-oriented presentation by setting benchmarks, as well as identification of weak points and suggestions for improvement;
- Planning of measures: working out options to utilize potentials and eliminate weak points;
- Priority setting: definition of environmental objectives, targets and an environmental programme;
- Implementation of measures to reduce environmental hazards;
- Monitoring of the success of measures taken;
- Compilation of reports, documentation.

The environmental policy, objectives and environmental targets are regularly (e.g. annually) compared with the corporate policy and the general corporate framework (trends, new legal requirements, changes in company structure) and adjusted if required.

7.3 Organization and implementation of corporate environmental controlling: information, responsibilities, competencies

How is corporate environmental controlling organized? How is environmental protection anchored in the company's organization? Which tools are available?

Organization and implementation

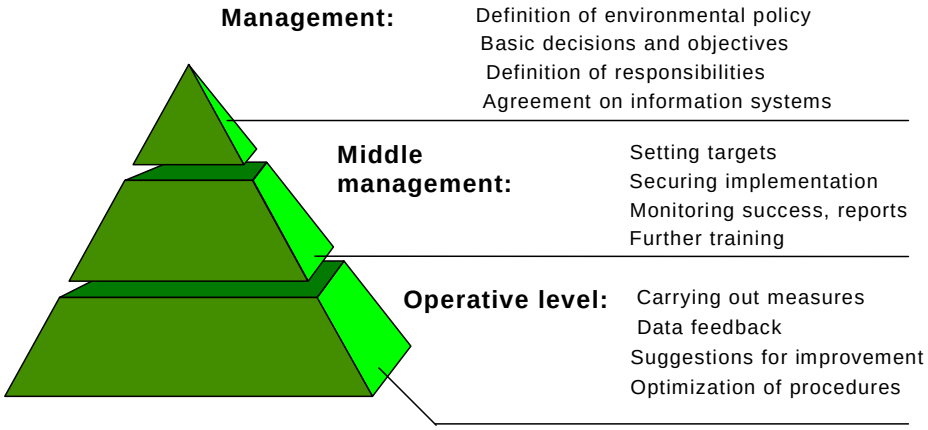


Figure 2: Tasks of the various levels of management (Source: Environmental management in the metal-processing industry, Landesanstalt für Umweltschutz Baden-Württemberg, 1994)

7.3.1 Targets and policy

Targets

The determination of the company's environmental policy, its objectives, targets and strategy is the central element of corporate environmental controlling (for further information see Volume 2 of the Toolkit).

- Does the company have a defined environmental policy?
- Are all staff members familiar with it?
- Can quantifiable targets be derived from it?

7.3.2 Organization: Information and responsibility

Information and motivation of all persons involved

Environmentally responsible thinking and action is required at all levels of hierarchy and in all areas. Management has to integrate environmental protection in strategic corporate planning and clearly define responsibilities at all levels of hierarchy (Figure 2). The most important task of the management is to disseminate information on the company's policy in a convincing manner and to address and motivate all interested parties.

7.3.3 Environmental representative

Environmental representative

There should be one person in the company to coordinate corporate environmental controlling and his position should be at a sufficiently high level. If management fully supports the environmental representative in the implementation of the proposed measures, this form of organization ensures sufficient independence from the technical departments of the company. The position of the environmental representative will, of course, depend on the size of the company.

The environmental representative's main duties include the monitoring of the environmental situation and the information of plant management, heads of departments and divisions. In some exceptional situations (accidents, danger ahead) he should also be entitled to act directly to prevent damage to employees, the company and the environment.

7.3.4 Environmental team

In principle the heads of division and department are responsible for achieving the targets and coordinating the measures and activities with other corporate activities.

Control and supervision are more effective when they are carried out as close to production as possible. This is why the executive level should be integrated in the controlling process. In order to organize the controlling process, document the results, define appropriate action, budgets, training requirements and reporting in the job descriptions for the environmentally relevant positions (purchasing, design, production, waste management). Regular meetings ensure personal contact – which is most often the main information channel. Such meetings facilitate the exchange of information, the identification of weak points and options and the drawing up of suggestions for solutions. All this is best handled by an environmental team consisting of members of the relevant departments.

- Is there an environmental representative in the company?
- Is there a job description for the environmental representative?
- Is there an environmental team to support the environmental representative?

7.3.5 Environmental information system and the use of indicators

The information system is the centre of the controlling process and has to fulfil several functions:

Functions of the environmental information system

Database:

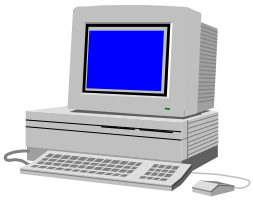
- Documentation of material and energy input;
- Documentation of waste and emissions;
- Documentation of relevant laws and regulations.

Organization:

- Documentation of responsibilities in the company;
- Documentation of problems recognized, measures taken and results achieved.

Information:

- Inform management;
- Inform operators;
- Inform authorities;
- Inform neighbours.



Input/output analysis

First we need "databases" and a defined data evaluation and reporting system. It is very helpful to consider the benefits of computer programs for data storage, evaluation and presentation. "Databases", however, can also be files, log books, notebooks. The use of available information systems would in any case be advised.

A proven basis of the environmental information system is the input/output analysis (see Figure 3) of material and energy flows of a company. In the framework of a company-specific environmental system of accounts, all raw, process and operating materials are recorded and compared with the products and emissions of the company. Water, air and energy carriers used are recorded in the same way. Material is, as far as possible, presented in mass units (kg) and energy in kWh.

If we apply the first theorem of thermodynamics, which basically states that neither mass nor energy can be lost, we can determine how efficient raw materials, process materials and energy are used in a company and create the basis for evaluation. The flow of selected materials is traced in detailed analysis through the company in order to determine the nature and amount of waste and emissions as well as the exact location where they are generated. In addition, the costs associated with these flows and the information sources are documented.

The in-house information system should be clearly structured and up to date. It should show deviations, allow the identification of causes and highlight possibilities for appropriate action. For the sake of quick and economic compilation of information we do not focus on absolute accuracy. In most companies, indicators are already part of economic controlling. Indicators can also be used within an environmental information system to prepare company data in a clearly structured way so that they are easy to interpret.

Input				**Output**			
	kg	USD	Source		kg	USD	Source
Copper	100 000	3 M	Financial accounting	Cables	110 000	120 M	Sales
PE	30 000	300 000	Financial accounting	Cable waste	15 000	120 000	Revenue, accounting
PVC	10 000	100 000	Financial accounting	Plastic waste	15 000	30 000	Accounting
Marking ink	3 000	300 000	Ware-house	Waste oil	500	1 000	Disposal company
Diluting agent	1 000	180 000	Ware-house	Diluting agent	600	1 000	Disposal company
Lubricating oils	500	30 000	Ware-house				
Electricity		1 M	Financial accounting	Waste heat	?		
Heating oil		500 000	Financial accounting				
Cooling water		?	Own well	Wastewater	?		Direct discharge

Figure 3: Example of an input/output analysis for a cable manufacturing company

The following types of indicators can be used for corporate environmental controlling:

➔ **Ratios:**
Creating a relation between two absolute variables of different types based on a factual connection.

Examples of ratios:

$$\text{Material input A, 2004} = \frac{\text{Material input, raw material A in kg in 2004}}{\text{kg of product produced in 2004}}$$

$$\text{Waste B produced, 2004} = \frac{\text{Waste B produced in kg in 2004}}{\text{kg of product produced in 2004}}$$

$$\text{Water input, 2004} = \frac{\text{Water input in kg in 2004}}{\text{kg of product produced in 2004}}$$

➔ **Proportional values:**
For presenting a part in relation to the whole.

An example of a proportional value:

$$\text{Drinking water proportion 2004} = \frac{\text{Drinking water input in kg in 2004}}{\text{Water input in kg in 2004}}$$

➔ **Index figures:**
Comparing identical figures over a course of time.

An example of an index figure:

$$\text{Water index 2004} = \frac{\text{Water input in 2004}}{\text{Water input in the base year (2003)}}$$

Comparison of estimates and results

These data make it possible to compare planned and actual results in order to control the material flow, to facilitate inter-company benchmarking by classifying processes and procedures of the company in comparison to similar companies and to analyse variations in performance over a period of time.

Identifying weak points

Indicators are therefore target values, they indicate deviations from the targets and document bottlenecks as well as potential opportunities. They should be company-specific, refer to data which can be influenced, be realistic, and it should be possible to retrieve them automatically. Meaningful indicators can be defined using material (raw, process, operating material, water) and energy input, as well as with various types of waste and emissions. They can be used to describe costs or efficiency of resource input (creation of waste and emissions in relation to the desired product).

The standard *ISO 14031* deals with the definition of environmental indicators and provides detailed information on the selection and formulation of these benchmarks.

The standard describes two general categories of indicators:

1. Indicators for describing the environmental impact of an organization; and
2. Indicators for describing the condition of the environment.

The first are divided into

- **Indicators** related to the **management system;** and
- **Process indicators.**

Indicators help to condense relevant data in order to provide exact and useful information about the efforts of management, the environmental impact of a company's activities or the state of the environment. Benchmarks are chosen as a means to present rough quantity or quality data or information in an understandable and useful way. This information can be provided in the form of absolute or relative, normalized or indicated information.

The appendix to this standard lists some examples of typical indicators.

Examples of **management system indicators:**

- Number of targets achieved;
- Number of organizational units that have achieved their environmental targets;
- Number of improvement options put into practice;
- Number of employees with environmental responsibilities;
- Number of employees participating in environmental programmes;
- Number of employees trained in environmental matters;
- Results of employees who attended trainings;
- Number of environmentally relevant suggestions for improvement identified by employees;
- Results of employee surveys about their knowledge of environmental matters;
- Number of suppliers with environmental management systems;
- Number of products designed in a recycling-oriented way;
- Degree of compliance with laws and regulations;
- Time required to resolve environmentally relevant accidents;
- Amount of corrective action taken;
- Penalties, fines;
- Number of audits carried out;
- Number of non-compliances;
- Number of emergency drills;
- Environmental costs;
- Time needed to recuperate costs of environmental investments;
- Savings from environmental investments;
- Sales increase due to environmentally-oriented design;
- Number of neighbours' complaints;
- Number of relevant newspaper articles;
- Number of programmes for the community;
- Number of production sites with an environmental management system;
- Number of production sites with an environmental programme;
- Number of local initiatives supported by the organization.

Examples of **process indicators:**

- Material consumption per product;
- Input of recycling material;
- Reuse of packaging material per product;
- Process material input;
- Cleaning agent input;
- Water input;
- Water recycling;
- Production of hazardous waste;
- Energy input;
- Energy input according to types of energy;
- In-house energy generation from waste;
- Energy saved through energy-saving programmes;
- Fuel consumption;
- Freight kilometres according to means of transport;
- Land use;
- Business trips;
- Number of recyclable products;
- Rejects;
- Complementary products generated;
- Product life cycle;
- Energy consumption through product life cycle;
- Waste generated;
- Amount of hazardous waste produced;
- Amount of recyclable waste produced;
- Emission amounts (per year, per product);
- Ozone destruction potential of gaseous emissions;
- Greenhouse effect caused by gaseous emissions;
- Emissions in wastewater;
- Noise;
- Radiation.

Examples of **environmental indicators**:

- Information about the condition of bodies of water;
- Local air quality;
- Endangered species;
- Resource consumption;
- Water temperatures;
- Climate-relevant figures.

The following environmental benchmarks are recommended for an examination of the company's environmental "state of health":

- **Output indicators** (for waste, hazardous waste, wastewater, gaseous emissions; these benchmarks show the observance of legal framework conditions);
- **Input-oriented corporate indicators** (have an early-warning function, allow quick statements about the corporate material and energy household and can predict trends; they should at the same time be formulated as efficiency indicators);
- **Management indicators** (compliance with laws, achievement of targets, neighbour and staff involvement describe the efficiency of the corporate organization);
- **Process indicators** (structured according to plants or procedures in order to measure the material or energy flows that are required for the achievement of self-defined environmental goals).

Figure 4 shows a flowchart for the identification of relevant indicators. The following questions may help you to define benchmarks:

What figures reflect the targets best?

Which figures are best suited to indicate that these targets are not achieved?

How are critical deviations best measured?

What is the best way of showing who is responsible for a critical deviation?

For which indicators is information easily and inexpensively accessible?

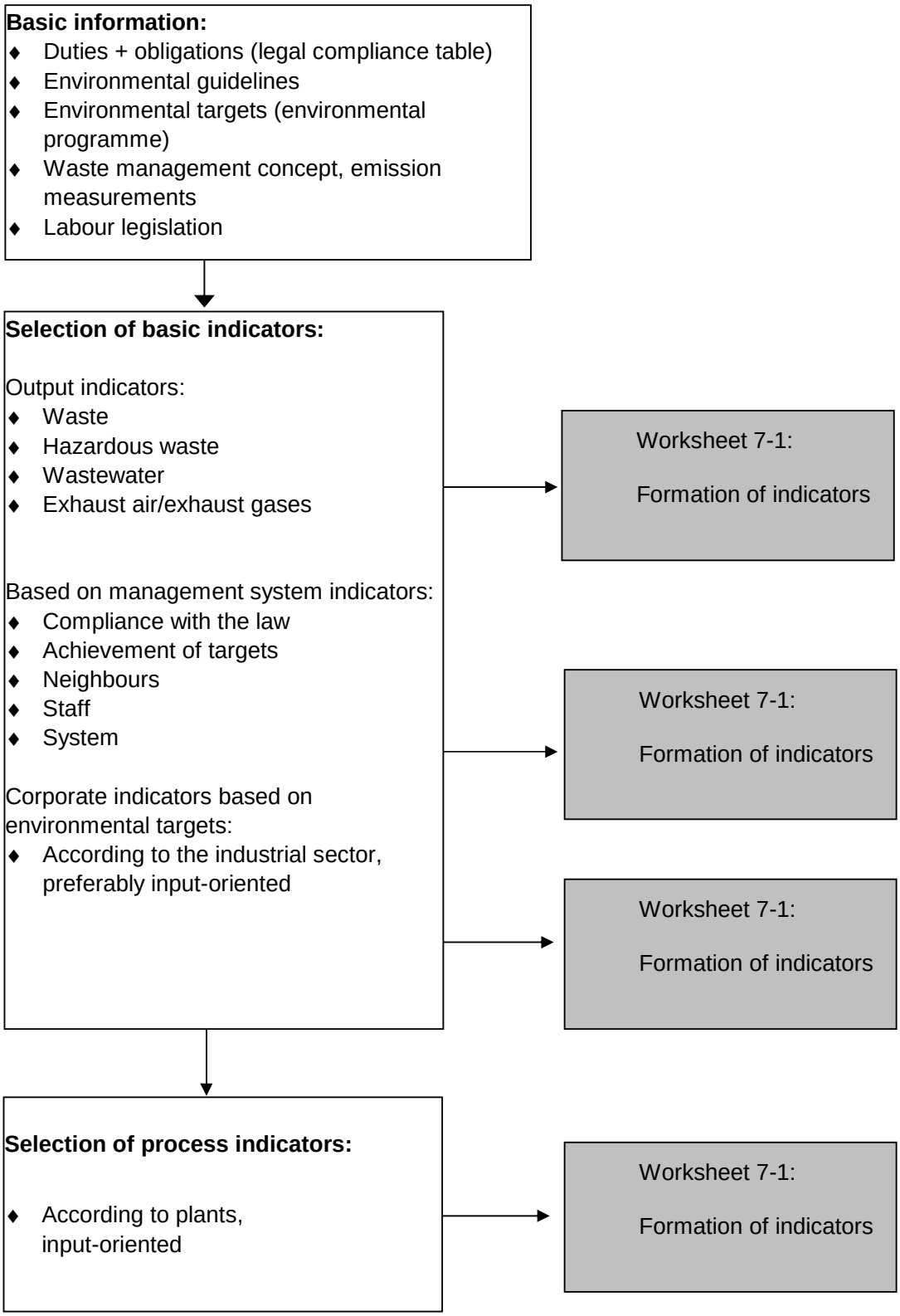


Figure 4: Scheme for environmental indicators selection

- Does the company carry out an input/output analysis?
- Are you familiar with the energy, water and air consumption of the company?
- Do they use environmental indicators?
- Which indicators are relevant?

Evaluation

Learning from benchmarking

We want to learn from our indicators system; and we can do so by comparing our indicators with those of other enterprises. It is, of course, essential that the companies compared are similar; it is also important that the indicators of the reference company have been determined in the same way as in the company you are consulting.

You can also learn from the in-house comparison of indicators by

- Finding out if and how the status quo deviates from plans;
- Analysing variations in time;
- Assessing the frequency of deviations; and
- Examining statistical correlations between benchmarks and corporate influence values.

Spreadsheet analysis programs, such as MS-Excel, can be helpful to create graphical representations which facilitate interpretation.

- Does the company have quantified environmental targets?
- Who is responsible for the comparison of planned values and results?
- Are you familiar with the strengths and weak points of the company concerning environmental matters?
- Do you regularly draw up a list of the most expensive raw materials, the largest waste flows, the most problematic raw materials?

Planning of measures

Finding solutions

As a next step corrective measures have to be identified. The cleaner production solutions included in the textbook of Volume 1 may be helpful. Suitable measures may also include organizational or technical approaches. Feasibility is analysed, investments, costs and savings are determined. The schedule of implementation is planned.

- Who decides about the implementation of suggested measures?
- Who provides the budget?
- Is the environmental performance of the company state of the art?
- Are suggested measures presented on a regular basis?

Implementation

Training

Create an understanding for the measures planned. Explain them in trainings!

- Is the staff regularly trained on environmental matters?

Assessment of success

Determine milestones

Determine milestones together with those involved in order to assess the achievement of agreed targets.

- Are regular meetings with management held where the environmental performance of the company is discussed?
- Do you regularly visit all departments of the company?

7.3.6 Documentation

After the aforementioned steps, it must be examined whether all relevant functions, activities and procedures as well as the corresponding responsibilities are defined in written form, e.g. in the form of work instructions, step-by-step procedures for processes with interfaces between different people involved or job descriptions. The analysis of the organization is a prerequisite for the identification and description of environmental tasks and activities.

Laws, decrees, guidelines

Keep a list of all applicable laws, regulations and permits for information purposes. This list should always be kept up-to-date; contact the Chamber of Commerce or the environmental authorities for assistance. A register of safety data sheets, relevant standards and manuals, e.g. about ecology and toxicology, complement the company's database.

Report addressed to management

The weak points and suggested measures are summarized in a report that is submitted to management for further planning and/or approval. The means required for implementing the planned measures are taken into consideration in the investment plan.

Documentation is important!

Continuous documentation facilitates communication. Through documentation all those involved are informed in the best possible way, and it also ensures that information can be traced back. The staff will not be able to achieve environmental targets unless they are clearly stated. Management needs exact data and information about the company for determining and reviewing the environmental targets. Every staff member knows the importance of clear, precise and written definitions of tasks and responsibilities. We have all heard of cases where it became clear only after an accident that nobody had felt responsible for a certain task.

A schedule determines who does what in the company and which resources are required.

- Is there a corporate environmental report in the company?
- Are neighbours' complaints documented?
- What data do you pass on to authorities?
- What information do you pass on to colleagues?
- Who keeps the material safety data sheets in the company?
- Who maintains fire and emergency plans?
- Is there a file of applicable laws, regulations, permits, specific requirements?
- Do you have a list of trainings held?
- Who keeps a list of emission values?

7.4 Our example – your example: From theory to practice

7.4.1 Suggestions for environmental controlling of a brewery

Let us take the example of establishing a corporate environmental controlling system for a small brewery, the Cheers Beers Brewery. Make use of the enclosed worksheets to note the activities and check if deadlines are met.

Cheers Beers Brewery (2004)

Staff: 109

Turnover: USD 25 million

Produces lager beer and soft drinks

Known problem areas:

- There is no formal organization of corporate environmental protection;
- High water consumption for cleaning;
- Aluminium labels on the bottles;
- High contents of chlorine in cleaning agents;
- Frequent complaints by neighbours about bad smell.

The company participated in a cleaner production training. After the project, the assistant to the management, Mr. Meier, who is going to be the future plants manager and is already the cleaner production contact person in the brewery, will assume the position of the environmental representative and will be in charge of introducing an environmental controlling programme.

Initial situation

The management agrees that an ongoing review and improvement of the environmental performance of the company should be pursued in addition to the emission reductions and the savings of resources and funds already achieved.

Environmental policy

The environmental policy of the company was defined in the course of the cleaner production project: part of the company's mission statement is an effective reduction of environmental aspects.

Introduction of the environmental controlling system

The management starts by defining an environmental controlling system for the company. The position of the environmental representative (Mr. Meier) is defined. He is responsible for collecting all information required to describe the environmental activities of the company, the material and energy flows in the brewery and for assessing it, for collecting information about the organization, the state of the art and the development of laws and regulations as they apply to the company. He is responsible for preparing this information for the management, suggesting measures and monitoring the implementation of the measures.

Formation of an environmental team

The environmental representative, Mr. Meier (master brewer, quality manager, safety engineer) then suggests the formation of an environmental team consisting of one representative from purchasing (Ms. Müller, also marketing), sales (Mr. Handel), the works council (Mr. Nussbaumer), the area of energy (Ms. Heizer) and the head of division of the malthouse (Mr. Wallner). The team meets once a month for two hours. At these meetings the environmental representative provides information on new legal developments or the development of material and energy input. The team works out, presents and discusses suggestions for optimization and, based on these suggestions, recommendations are formulated which are then submitted to the management. Tasks and results are documented. In department meetings, the heads of department pass the relevant information on to their staff. Further flow of information is ensured via a "green notice board" and the company's in-house newsletter.

The time spent by the environmental team on their environment-related tasks has to be agreed with the management in advance.

IT supported data recording

Together with an external consultant, the environmental representative prepares a computer-based file of material and energy input in the company. Initially, a monthly management report is prepared for the 20 most important types of waste and emissions identified during the cleaner production project. In this report, information about the input of the most important raw, process and operating materials and the most important waste and emissions is summarized in the form of indicators.

Beginning with the legal requirements (wastewater volume, wastewater load) output indicators are defined, as well as input-oriented corporate indicators (for the use of raw, process and operating material and energy), management indicators (number of neighbours' complaints, number of articles in the local media) and process indicators for the most important environmentally relevant processes (use of detergents, cleaning water, cooling water).

Indicators

The following indicators are added to the existing monthly monitoring report which is sent to all department managers and foremen:

- Water input (water input in kg per kg of products);
- Cleaning water consumption (cleaning water input in kg per kg of water used);
- Use of cleaning agents (cleaning agent input in kg per kg of beverage produced);
- Proportion of problematic cleaning agents (input of chlorine and EDTA containing cleaning agents in kg per kg of cleaning agent used);
- Proportion of aluminium (number of bottles with aluminium control label per bottles delivered);
- Number of neighbours' complaints.

Any special event or occurrence leading to deviations from the usual situation is also discussed in these reports.

The defined **target values** are:

- Water input is to be reduced by 20% over the following year;
- The amount of cleaning water is to be reduced;
- The proportion of problematic cleaning agents is to be reduced;
- Aluminium control labels are to be abolished by the end of 2006;
- The number of neighbours' complaints should be limited to three per month.

Defined targets

An **action plan was** set up for all known problems, including responsibilities and deadlines:

- Stop the use of aluminium labels – accompanying marketing concept by the end of 2005, responsible: Mr. Meier; budget: USD 70 000;
- Contacting manufacturers of cleaning agents concerning the development of a cleaning agent that meets the hygienic and environmental requirements by the end of 2006; responsible: Ms. Müller; is allowed to spend two weeks testing cleaning agents in the company;
- Reduction of water input by more careful handling and automation of cleaning procedures; responsible: Mr. Meier; budget: USD 30 000;
- Drawing up a concept by September 2005.

Progress is discussed at the monthly meetings. The measures decided upon are implemented with a similar approach to other projects in the company.

The environmental representative collects and interprets new laws; in doing so he shall be in close contact with the Chamber of Commerce's representatives. In addition, it is his duty to deal with neighbours' complaints immediately. Any such contacts with complaining neighbours are also noted in the monthly reports to the management.

The foremen are responsible for assessing the state of the art of best available technology. For this purpose, they will attend seminars, conferences and trade fairs and study specialized literature (magazines). Their findings are presented at the monthly meetings.

Instructions

At the first meetings of the environmental team, working instructions for the responsible employees in purchasing, design and production are laid down and the persons in charge are informed. Thus it is ensured that the employees concerned are familiar with the environmental relevance of their activities and know how they can contribute to minimizing the environmental impact of their company.

7.4.2 Worksheets

Now try to follow our practical example by using the enclosed worksheets from the Worksheet section:

Worksheet 7-1: Formation of indicators

Worksheet 7-2: Monitoring report

Worksheet 7-1 helps you draw up the corporate indicators that provide you with reference values and figures for relevant target values (material volumes, values, threshold values, etc.).

Worksheet 7-2 is used for summarizing; it also helps you design an environmental report, staff information sheet or a short report to management.

7.5 How to present the environmental controlling system to the management

First an important piece of advice: do not present a complete solution to the management. Submit a short summary of the facts and figures your suggestions are based on, and afterwards formulate your proposals. Start by discussing the corporate goals and define the indicators for measuring deviations from these targets.

Jointly consider all the environmentally relevant activities in the company and then suggest a team. Use the worksheets for data collection and analysis as well as for the definition of measures. Assign responsibilities, define deadlines for each activity as well as procedures for its implementation. Define competencies of the responsible persons. Include sufficient information for staff and management in your planning, they all appreciate clarity!