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ISO 14001

— Implementing an Environmental Management System

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Purpose of this Handbook

The purpose of this guide is to provide basic knowledge and tools to assess whether implementing an environmental management system (EMS) is applicable to your company and whether it adds value to your operations and your business. The guide has a clear business focus and is intended for managers without a background in environmental management systems.

This guide focuses on the implementation of an EMS which complies with ISO 14001. It provides a method of self assessing the status of an environmental management system, explains the basic steps in implementing an environmental management system, proposes techniques and tools for every step, compares the different EMS standards (ISO 14001, EMAS and BS 7750) and provides help with new EMS terminology.

I will try to keep this guide up-to-date with the latest developments in EMS. If you have any suggestions or questions feel free to contact me.



Dr. Andreas Sturm

Keywords

ISO 14000
BS 7750
EMAS

Related Keywords

Business Environmental Management, Eco-Efficiency, Eco-Management and Audit Scheme, Environmental Audit, Environmental Communication, Environmental Impact Added, Environmental Management, Environmental Management Standards, Environmental Management System, Environmental Performance, Environmental Policy, Environmental Report, Environmental Review, Shareholder Value, Stakeholder, Sustainable Development

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1 Background of Environmental Management Systems

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1.1 The Development of EMS Standards

The world's first standard for environmental management systems (EMS) - BS 7750 - was developed and published by the British Standards Institution (BSI) in 1992. This standard was the model for the ISO 14000 Series developed by the International Organization for Standardization (ISO). ISO 14001, which establishes the requirements for an EMS, was finalized in 1996. BS 7750 was also the basis for the European Union's Eco-Management and Audit scheme, known as EMAS.

ISO is an international standard and therefore must incorporate the different interests of many countries. This standard clearly has the weakest requirements. By contrast, EMAS is the most stringent and detailed standard reflecting the high environmental standards of German interests and companies which played a key role developing it.

Because ISO 14001 and EMAS are both based on BS 7750, all three standards are quite similar in their approach. If your organization complies with BS 7750 today, little effort will be needed to fulfill the requirements of ISO 14001 or EMAS. Be aware however, that EMAS emphasizes public environmental reporting. A more detailed analysis of similarities and differences as well as a table that lists the corresponding parts of each standard can be found in the appendix (page 68).

1.2 EMS Standards and Other Environmental Management Tools

Today there are two major areas in the evaluation of environmental management practice. One area focuses on organizational issues, and the other on products, services and processes. The ISO 14000 series covers the following topics (an overview of the ISO 14000 Series is given in chapter 5.1 on page 66):

- ▶ Organization Evaluation
 - ▶ Environmental Management Systems (ISO 14001, 14004)
 - ▶ Environmental Performance Evaluation (ISO 14014, 14015, 14031)
 - ▶ Environmental Auditing (ISO 14010, 14011, 14012, 14013, 14014)

- ▶ Products, Services and Processes
 - ▶ Life Cycle Assessment (ISO 14040, 14041, 14042, 14043)
 - ▶ Environmental Labeling (ISO 14020, 14021, 14022, 14023, 1402X)
 - ▶ Environmental Aspects in Product Standards (ISO 14060)

An overview of environmental management is given in Figure 1.

NOTE: This publication mainly deals with environmental management systems standards [ISO 14001, 14004] and to some extent with performance evaluation and auditing.

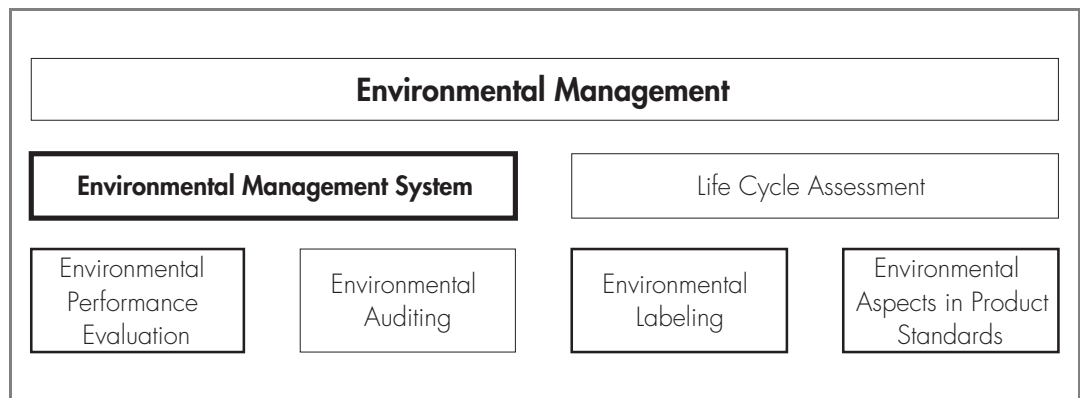


Figure 1: Environmental Management

1.3 System Assessment and Environmental Performance

For a better understanding of EMS standards you should consider the following point:

EMS standards are **process** - **NOT performance** - standards!

In other words these standards do NOT tell organizations what environmental performance they must achieve (besides compliance with environmental regulations). Instead, the standards describe a system that will help an organization to achieve its own objectives and targets. The assumption is that better environmental management will lead indirectly to a better environmental performance [TIBOR/FELDMAN 1996].

1.4 Reasons to Seek EMS Registration

You can implement an EMS that is in line with one of the EMS standards without external certification. Once there is a clear reason to demonstrate conformance to third parties, external certification and registration becomes a factor. Some situations where certification could become important are [TIBOR/FELDMAN 1996]:

- ▶ A customer requires an EMS certificate as a condition to sign a contract.
- ▶ Your organization supplies to a customer who strongly suggests you get registration.
- ▶ A government provides benefits to registered organizations.
- ▶ You have a site in the European Union, where market pressure or the regulatory environment forces you to get registration or certification.
- ▶ You export to markets where EMS registration is a de facto requirement for entering the market.
- ▶ You expect to gain a competitive advantage through EMS registration
- ▶ Your major stakeholders (local community, shareholders, unions, etc.) expect environmental excellence and an EMS registration is the way to demonstrate it.

If one of the reasons above applies in your case, then you should decide whether to get registration for the organization as a whole or just for parts of it. If you are already ISO 9000-certified, it makes sense to define its scope in a similar manner [TIBOR/FELDMAN 1996]. If you go for a site by site registration, you have the advantage of not losing the registration for your whole organization if one of the sites does not comply with the requirements of the standard. Also, this way the process of implementing, certifying and registering the EMS is broken down into smaller projects that are easier to handle.

1.5 Costs and Benefits of an EMS: Creating Shareholder Value and Reducing Environmental Impact by Implementing an EMS

The implementation of an EMS has a wide variety of impacts on different levels of a company. There are no general answers to the question of costs and benefits of an EMS. These differ for every company. Nevertheless, research conducted in England and Thailand by the School of Management strongly indicates that organizations in industrialized countries spend more on software (e.g. training, environmental handbooks etc.), while organizations in newly industrializing countries spend more on hardware (e.g. investment in pollution abatement equipment to meet environmental regulations or investments in recycling, waste management etc.).

The main reason for implementing an EMS standard is the need of companies to provide assurance to stakeholders regarding compliance to environmental regulations. Beyond legal compliance, an EMS certification gives a company a competitive advantage in international trade and is a potential source of productivity improvement. Nevertheless, before implementing an EMS, you should analyse the potential costs and benefits to make sure that the system provides a positive economic return. If environmental management does not increase the value of a company, financial markets will not finance the strategy and the company will be pushed out of the market. Convincing financial markets of the profitability of environmental management is crucial for its success.

A useful approach for analysing the costs and benefits of an EMS is the shareholder value concept [RAPPAPORT 1986, COPELAND 1990]. This concept takes a long-term perspective and clearly shows the sensitivities of different factors - so-called value drivers - on corporate or shareholder value (if you are not familiar with the concept see the remark on page 88).

By analysing the economic effect of management decisions regarding environmental issues on value drivers, the costs and benefits of an EMS, in terms of decreasing or increasing shareholder value, can be quantified. Value creation along with reduced environmental impact added can be regarded as sustainable growth from a company perspective.

A closer look at the factors which increase or decrease shareholder value and discounted free cash flows, shows that the following management decisions and value drivers are linked with value creation [for more information about value driver analysis see RAPPAPORT 1986, COPELAND 1990]:

<i>Management Decisions</i>	<i>Operating</i>	<i>Investment</i>	<i>Financing</i>
<i>Value Driver</i>	Sales Growth Rate	Investment in Working Capital	Cost of Capital (Debt and Equity)
	Profit Margin	Investment in	
	Tax Rate	Fixed Capital	
<i>Value Creation (Corporate Value)</i>	Free Cash Flow (FCF)		Discount Rate
	Σ Discounted Free Cash Flow (DFCF)		
<i>Sharholder Value (SV)</i>	Corporate Value - Debt		

Table 1: Management Decisions and Corporate Value

POSITIVE Impact on Shareholder Value	
Potentially Affected Value Driver (c.p.)	Examples of Potential Effects of Implementing an EMS
Profit Margin	<ul style="list-style-type: none"> • optimized products and production processes lead to less material input and lower costs • cost savings due to reuse and recycling result in less excess material input and lower material costs • cost savings due to waste reduction, reuse and recycling result in lower waste disposal costs • lower transportation and storage costs due to less material and energy input • easier compliance with environmental standards, lower compliance costs • lower risk of redesigning costs due to changing regulations or customer perception • lower environmental impact leads to reduced charges, pollution penalties • lower environmental risk leads to lower insurance costs and compensation payments
Sales Growth Rate	<ul style="list-style-type: none"> • better knowledge about products and production processes leads to innovation and better quality • renovation of product portfolio leads to higher competitiveness • improved public image leads to higher acceptance and higher sales • new markets due to product innovation (e.g. combined with eco-labels) • ensured access to markets due to product innovation (e.g. combined with eco-labels) • environmental information/consulting improves client relations
Investment in Working Capital	<ul style="list-style-type: none"> • less excess material and energy due to waste prevention and energy savings program leads to less working capital
Investment in Fixed Capital	<ul style="list-style-type: none"> • focus on preventing environmental impact leads to less end-of-the-pipe investments • lower warehousing investments due to low-risk material usage • easier to obtain permits and authorization
Tax Rate	<ul style="list-style-type: none"> • obtaining tax relief due to lower environmental risk
Cost of Capital	<ul style="list-style-type: none"> • increased awareness of environmental problems and reduced environmental risk attracts shareholders and investors which leads to lower cost of debts and equity • subsidies due to overfulfillment of environmental regulations • weak loans due to overfulfillment of environmental regulations

Table 2: Environmental Measures and the Potential Positive Impact on Shareholder Value

Analysing the costs and benefits of implementing an EMS (or any environmental measure) is based on quantitative estimates of the effect of these value drivers. The

following tables provide some examples of potentially positive and negative impacts of an EMS implementation on shareholder value.

If the EMS is expected to increase shareholder value you should start the process by providing top management with basic EMS knowledge. The decision of whether or not to implement an EMS has a wide range of implications that will change the way an organization does business. Therefore, top management needs to know exactly what they are committing themselves to, before going for one of the EMS standards. A presentation and discussion of the basic modules of an EMS at the top level of a company is absolutely necessary for successful implementation. An overview of the modules can be found in chapter 2 on page 12.

<i>NEGATIVE Impact on Shareholder Value</i>	
<i>Potentially Affected Value Driver (c.p.)</i>	<i>Examples of Potential Effects of Implementing an EMS</i>
Profit Margin	<ul style="list-style-type: none"> • additional costs of implementing an EMS reduce profit margin • investment in pollution abatement technology to comply with environmental regulations leads to higher production costs
Sales Growth Rate	<ul style="list-style-type: none"> • investment in EMS and pollution abatement technology to comply with environmental regulations leads to higher cost and market prices
Investment in Working Capital	<ul style="list-style-type: none"> • environmentally friendlier, but more expensive materials and energy
Investment in Fixed Capital	<ul style="list-style-type: none"> • investment in pollution abatement technology to comply with environmental regulations
Cost of Capital	<ul style="list-style-type: none"> • because of the public environmental report, financial markets suddenly realize the environmental risk of an organization, its products and services and ask for a premium

Table 3: Environmental Measures and the Potential *Negative* Impact on Shareholder Value

2 Overview: Modules of an Environmental Management System

An Environmental Management System that is in line with current EMS Standards like ISO 14001, BS 7750 or EMAS consists of the following seven modules:

- ▶ Module 1: Commitment and Environmental Policypage 14
- ▶ Module 2: Initial Environmental Review 14
- ▶ Module 3: Planning the Environmental Policy..... 14
- ▶ Module 4: Implementing the Environmental Policy 15
- ▶ Module 5: Measurement and Evaluation 16
- ▶ Module 6: Audits and Review 16
- ▶ Module 7: External Environmental Communication 17

The following figure gives an overview of the modules and their interactions.

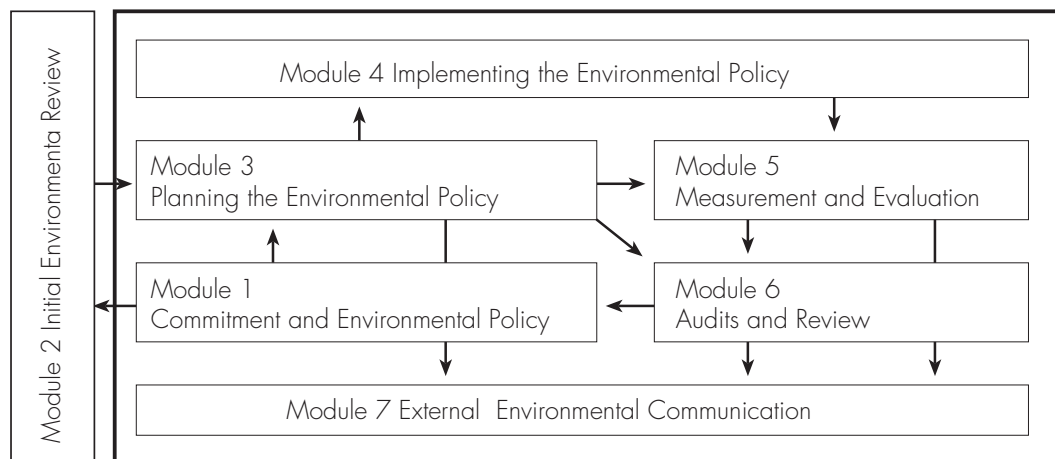


Figure 2: Modules of an Environmental Management System

Below is a short description of each module. For organizations that have already implemented one of the EMS standards and want to switch from one standard to another, more information about the corresponding modules for different EMS standards is also provided (see appendix on page 68).

2.1 Module 1: Commitment and Environmental Policy

The starting point of an EMS is top management commitment and an environmental policy. The policy is a written document, with two components: a) the rationale for the company to become „green“ and b) the overall intentions of the organization regarding environmental issues. The policy contains a commitment to comply with all environmental regulations, to prevent pollution and to initiate a process of continuous improvement. An environmental policy is unique to an organization. It must be communicated to all members of the organization and made available to the public. The environmental policy is the basis for developing a consistent structure of environmental objectives and targets for an organization.

Modul 1: page 19

2.2 Module 2: Initial Environmental Review

Before an organization can plan and implement an environmental policy, an initial environmental review should be made. This review will provide an overview of the environmental issues a company is facing. In this initial environmental review every aspect of the future EMS is checked. The organization then knows the strengths and weaknesses of its present operations and its management systems. This review and the policy statement are the basis for planning the implementation of the environmental policy.

Modul 2: page 25

2.3 Module 3: Planning the Environmental Policy

In the planning stage, all of an organization's interactions with the environment are identified. Legal and other requirements that an organization must meet are determined. Environmental objectives and targets are defined and environmental management programs are developed to achieve these targets. The environmental management programs then assign responsibilities and name the means and time frame by which the targets will be achieved.

Modul 3: page 34

2.4 Module 4: Implementing the Environmental Policy

The implementation and operational components of an EMS take the most time and effort within an EMS project. The following aspects are covered in this stage:

- ▶ The roles, responsibilities and authority of personnel whose activities have an impact on the environment are defined, documented and communicated to all members of the organization. In addition, resources for the implementation and maintenance of the EMS are provided. A special management representative with the responsibility and authority to enforce the EMS requirements is appointed. This management representative reports the environmental performance of the organization directly to top management.
- ▶ Management must ensure that personnel throughout the organization are aware of the environmental policy, the environmental management programs and the actual or potential impact of their activities on the environment. All personnel with a significant contribution to environmental performance need to be adequately trained to handle the environmental aspects of their activities. The organization must ensure that these people have the competence to deal with their responsibilities either through education, training and/or experience.
- ▶ To integrate relevant environmental aspects into daily business information.
- ▶ To ensure that external auditors can certify the management system according to one of the current EMS standards, the EMS must be well-documented. This documentation includes a description of the basic elements of the system and their interaction. It also points to related documents. There is no need to develop an EMS handbook, but it is common practice to do so. The documents related to the EMS must be reviewed, revised and approved on a regular basis so that up-to-date information is available on the task or work activity being performed.
- ▶ To make sure that the environmental policy is implemented and the objectives and targets met, an organization must identify processes and activities that have a significant impact on the environment. The organization must ensure that these activities or processes are conducted as intended (operational control). The organization must also identify environmental aspects of the goods and services it uses, and communicate its environmental requirements to its suppliers and contractors.
- ▶ The organization must identify the potential for accidents and emergency situations (emergency preparedness) and develop appropriate procedures to

respond to these. This includes the prevention and mitigation of the environmental impact added. These procedures need to be communicated internally and tested to make sure that the response is effective and efficient.

Modul 4: page 39

2.5 Module 5: Measurement and Evaluation

After implementing the environmental policy, management needs to measure environmental interventions and their impact on the environment. This is done by building up an environmental effects register (environmental inventory). All equipment used for monitoring and measuring must be accurate and calibrated on a regular basis. To check the compliance status of an organization, additional information about regulations and other requirements is needed. A so-called „environmental regulations register“ is often installed and maintained for this purpose. Evaluation assesses environmental performance against the environmental targets and objectives.

Responsibilities and authority need to be defined to deal with non-compliance within the EMS. This includes specifying the actions to be taken to correct an undesirable situation and to prevent future non-compliance.

Modul 5: page 42

2.6 Module 6: Audits and Review

Audits determine the capability of the EMS to achieve the organization's environmental objectives and targets. The EMS must be audited on a regular basis to ensure that the system is working as intended. The audit provides the information which top management needs to review the EMS. This review is a check to ensure that the system is operating effectively. This top management review also addresses changes needed in the environmental policy, objectives and targets or in the EMS itself.

The review helps to ensure that the following functions are accomplished:

- ▶ meet third party expectations (stakeholders)
- ▶ take into account new businesses or operations
- ▶ consider changes in technology
- ▶ implement audit findings or
- ▶ improve environmental performance

To make sure that the EMS can be audited by external authorities, the system must be documented and the organization must keep records related to the EMS. These records must be identified, collected, stored and maintained to provide objective evidence of compliance with the EMS standard, including legal and other requirements.

Basic records include:

- ▶ training records,
- ▶ measurement and evaluation results,
- ▶ management review records and
- ▶ audit results.

Modul 6: page 58

2.7 **Module 7: External Environmental Communication**

One of the key success factors of an EMS is effective communication of an organization's activities regarding environmental issues. There are two main communication directions:

- ▶ communicating environmental aspects of activities, products and services to stakeholders on a continuous basis
- ▶ providing periodic information with an environmental report

Continuous communication should target customers, employees, suppliers, authorities, neighbours, the media and the general public. This is not one-way communication. A frank relationship with these stakeholders can only be achieved with dialogue. Here, the organization should focus on the values and interests of each specific group. To open up this dialogue, an organization should consider the following measures:

- ▶ Identify a contact person to handle inquiries on environmental issues.
- ▶ Determine the procedure for dealing with external inquiries.
- ▶ Involve the PR department in compiling information about the organization's environmental protection scheme.
- ▶ Involve the marketing department in compiling information for the customer about environmental aspects of using and disposing of the product.

Periodic information about environmental issues is normally provided with an environmental report. This comprehensive report is compulsory only if an organization chooses to comply with EMAS. Neither ISO 14001 nor BS 7750 requires an

environmental report (for a comparison see the appendix on page 68). Nevertheless, compiling an environmental report is good management practice and is often required by external stakeholders (e.g. shareholders, financial analysts).

An environmental report covers the following topics [EMAS]:

- ▶ Environmental policy
- ▶ Environmental strategy
- ▶ Description of the EMS components
- ▶ Policy regarding environmental aspects related to products and services
- ▶ Listing of all inputs (material and energy) and outputs (air pollution, sewage, waste) over the respective period of time (environmental effects register)
- ▶ Assessment of compliance with environmental regulations (environmental regulation register)
- ▶ Evaluation of environmental performance
- ▶ Description of the environmental management programs, including objectives, targets, measures and schedule
- ▶ Relationships with external stakeholders
- ▶ Audit report findings

Not mentioned in any of the EMS standards, but nevertheless important, is a communication strategy that takes into account the interests of financial stakeholders like shareholders, banks, insurers and financial analysts [for an EMS concept from the financial analyst's perspective see EFFAS 1994]. Management must show that the chosen environmental strategy is efficient and effective and is creating shareholder value. An environmental strategy that does not create future free cash flow is economically unsustainable.

Modul 7: page 60

3 Implementing an Environmental Management System

3.1 Commitment and Environmental Policy

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3.1.1 Introduction

An environmental policy is a statement of the organization's overall aims and principles of action with respect to the environment, including compliance with all relevant regulatory requirements. It is a key tool in communicating the environmental priorities of your organization to employees at all levels, as well as to external stakeholders. As such, it should be written clearly and concisely to enable a layperson to understand it, and should be made publicly available. It is up to the organization to decide on environmental priorities based on an initial environmental review, but these choices should be justified in the policy. To be truly effective the policy should regularly be reviewed and revised and incorporated into the organization's overall corporate policy. The policy statement should set in writing a few achievable quantifiable priorities related to the environmental management system and the significant environmental effects found at the work-site. Furthermore, EMAS requires that the most significant environmental effects be mitigated within three years. Some form of improvement must also be accomplished from year-to-year by the organization and must be shown in the annual reports.

Although the formulation of policies and clear priorities is the most important step of environmental management, this step is often neglected. Many top managers feel pressure to do something for the environment and thus embark on some form of „environmental activism“, often containing many isolated activities but no clear direction. For an organization to be a credible and efficient environmental performer and to reap the benefits of being an environmental leader in its markets, the rationale for investing in environmental management must be very clear.

To ensure an organization's commitment towards a formulated environmental policy, it is essential that top management is involved in the process of formulating the

policy and of setting priorities. Therefore the first step is to get the commitment from the highest level of management. Based on this commitment the organization should then conduct an initial environmental review and draft an environmental policy. This draft should be discussed and approved by the board of directors. Finally, the approved environmental policy statement must be communicated internally and made available to the public.

3.1.2 Getting the Commitment

3.1.2.1 Getting the Commitment from the Highest Level

As the environmental policy establishes an overall sense of direction and sets the principles of action for an organization, it requires commitment from the highest level of management. Top management should be involved in the development and adoption of an environmental policy.

Getting the commitment from the highest level should be argued on the basis of costs and benefits and their impact on shareholder value (see chapter 1.5 on page 9). If the implementation of an EMS increases shareholder value it is easier for top management to commit themselves to approving an environmental policy and to implementing an environmental management system. This commitment includes three basic policy statements:

- ▶ Continuous improvement in environmental performance
- ▶ Compliance with environmental regulations
- ▶ Maintaining public relations regarding environmental issues of the organization, its activities, products and services

3.1.2.2 Commitment to Continuous Improvement

The central focus of the policy should be a commitment to continuous improvement. This means improvement in the EMS itself and a decrease in environmental impacts caused by an organization's activities, products and services. It is important for businesses to show improvement over time, both in environmental performance and in organizational commitment to this path.

3.1.2.3 Compliance with Environmental Regulations

A commitment to comply with at least local environmental regulations is a minimum requirement for all of the environmental standards. However, multinationals operating in various environments and facing different laws in each, should think about which laws to abide by and if it is feasible to adopt the same standard worldwide. Generally, laws in newly industrializing countries are lax as compared to industrialized countries. However, given the increase in interest

in environmental issues in these industrializing countries and the possible impact of the ISO 14000 series, it may be sound practice to adopt the more stringent laws in worldwide operations, where it is feasible to do so. In addition, the adoption of high standards worldwide can yield other benefits, such as an improved public image or easier technology transfer between different sites.

Companies should guard against going overboard in fulfilling environmental policies. Limits are in fact set on how far a company has to go to reduce its environmental impacts. Reductions do not have to exceed levels which can be achieved by economically viable application of the best available technology (BAT).

3.1.2.4 Commitment to Public Relations

Lastly, as a tool to communicate company intentions to the public, a commitment to public relations should also be part of the policy. While EMAS explicitly requires public disclosure, BS 7750 and ISO 14001 do so to a lesser extent, by requiring only that the policy be publicized.

3.1.3 Initial Environmental Review

An environmental review is an initial comprehensive analysis of the environmental management system and the issues, impacts and performance of activities at a site. The purpose of this initial review is to assess the current position of the organization with regard to the environmental management system and the impacts of a site's activities; such as choice of raw materials, types of waste generated etc. For more details about planning, conducting and reporting an initial environmental review, please refer to chapter 3.2 on page 25.

3.1.4 Drafting the Environmental Policy

The environmental policy is a written statement of the organization's overall aims and principles of action with respect to the environment, including compliance to all relevant regulations. It should steer clear of vague, over-ambitious statements, while clearly showing top management commitment to and support of environmental issues. The point of the statement is to provide a set of consistent guidelines to the organization to enable continuous improvement with regard to environmental issues. The issues addressed in the policy can vary from organisation to organisation, depending on its priorities.

Before drafting the environmental policy, the policy must be clearly relevant to the organization's activities, products and services and their environmental effects. In order to determine this, a complete review of operations is required. Based on this initial environmental review, top priorities and the policy direction for the organization is determined, given constraints of time and money. An

environmental policy is unique to an organization and as such should be written to fit a given organization's needs. There are no cut and dried rules to be followed. What is written below are general guidelines which can be followed. The environmental policy must fulfill the following requirements [HILLARY 1994, EMAS, ISO 14001, BS 7750]:

1. State the rationale for having an environmental policy (see chapter 1.5 on page 9)
2. Include a clear commitment aimed at (see chapter 3.1.2 on page 20):
 - 2.1. Continuous improvement
 - 2.2. Compliance with environmental regulations
 - 2.3. Maintaining public relations
3. Cover the main environmental issues a company is facing and set priorities amongst them
4. Define good environmental management practice
5. Define responsibilities and authority
6. Document and publicize the policy.

3.1.4.1 Main Environmental Issues to be Covered

The environmental policy should make a statement on the following environmental issues [EMAS], which can be divided into three main areas [TANEGA 1994, adapted]:

- ▶ Control
 - ▶ outputs
 - ▶ assessment, control and reduction of air pollution
 - ▶ evaluation, control and reduction of noise
 - ▶ assessment, control, reduction and re-useing of waste water
 - ▶ avoidance, recycling, re-use, transportation of waste
 - ▶ inputs
 - ▶ savings, choice and transportation of energy
 - ▶ savings of water
 - ▶ savings, choice and transportation of raw materials
- ▶ Planning
 - ▶ selection of new production technology, changes to existing production processes
 - ▶ design, packaging, transportation, use and disposal of new products
 - ▶ assessment of contractors, subcontractors and suppliers
 - ▶ prevention and limitation of accidents
 - ▶ contingency procedures for incidents

- ▶ Communication
 - ▶ internal education, training and communication
 - ▶ external communication and reporting

With regard these issues, the policy should set priorities according to the organization's specific situation. This can be done by evaluating the environmental exposure of the organization.

3.1.4.2 Good Environmental Management Practice

The draft of the policy statement should be done in a manner that is conducive to establishing good environmental management practices. These principles serve as a guideline for implementing the environmental policy and may include [EMAS, TANEGA 1994] the following:

- ▶ Fostering a sense of responsibility for the environment among employees at all levels.
- ▶ Conducting environmental impact assessment of current and new activities, products and services.
- ▶ Taking measures to reduce resource consumption and to prevent environmental impacts, taking into account clean technologies.
- ▶ Adopting measures to prevent accidents and to limit or remediate damage to the environment resulting from organization activities, products and services.
- ▶ Cooperating with public authorities to ensure that the contingency procedures to minimize the impact of any accidental discharges to the environment are established and updated.
- ▶ Establishing procedures to ensure compliance with environmental policy.
- ▶ Establishing procedures for corrective actions in case of non-compliance with regulations, environmental policy, objectives and targets.
- ▶ Maintaining an open dialogue with the public, providing appropriate information about the environmental impact of the organization's activities.
- ▶ Maintaining an open dialogue with the public, providing appropriate information to customers on the proper handling, use and disposal of products and services made by the organization.
- ▶ Making provisions to ensure that contractors working at the site apply environmental standards equivalent to the organization's own.

3.1.4.3 Responsibilities and Authority

The environmental policy should state the basic responsibilities and authority for enforcing the policy. More information is provided in chapter 3.4.2 on page 40. Questions to be answered in the policy include:

- ▶ Who is responsible for implementing the policy?
- ▶ Who has the authority to enforce the policy?

As a basic rule, the responsibility for implementing and enforcing the environmental policy should be given to a representative from the highest level of management. The responsibility to achieve objectives and targets should be assigned to the line managers.

3.1.5 Environmental Policy Statement

Once the draft is finalized, approval for the environmental policy from top management (board of directors) can be secured. Once this step is completed the final environmental policy statement can be written. The format of the environmental policy takes into account the following elements [TANEGA 1994]:

- ▶ Title of the environmental policy
- ▶ The need for an environmental policy (see chapter 1.5 on page 9)
- ▶ Statement of policy (commitment and environmental issues)
- ▶ Procedure and guidelines for implementing the environmental policy
- ▶ Responsibility and authority
- ▶ Definition of terms

The environmental policy statement should be communicated internally and made available to the public.

After the environmental policy statement is approved by the CEO and publicized, top management should set objectives and targets - at least for the highest priority environmental aspects - which include a time frame within which they must be achieved. To set targets, management must put the environmental priorities in concrete terms. For more information on this step, see chapter 3.3.4 on page 35.

3.2 Initial Environmental Review

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▶	Planning an Initial Environmental Review	25
▶	Conducting an Initial Environmental Review	26
▶	Examination of Existing Environmental Management Practices and Procedures	26
▶	Identification of Significant Environmental Aspects and their Priority	27
▶	Identification of Legal and Regulatory Requirements	32
▶	Environmental Review Report	33
▶	Implementing the Results of the Review	34

3.2.1 Introduction

On the basis of organizational commitment, an assessment of the current position with respect to the requirements of the EMS standards, of the legal environment in which the organization is operating, and of the significant environmental impacts of activities, products and services should be started. ISO 14001 does NOT require an initial review, but it is good practice to do so, as it will help in formulating an effective environmental policy and in planing the implementation as the next step.

NOTE: Do NOT spend too much time with the initial environmental review because this only delays the implementation of the EMS in the future.

3.2.2 Planning an Initial Environmental Review

In planning the environmental review the following issues should be considered [TANEGA 1994]:

- ▶ Authority from the board of directors
- ▶ Environmental review team of qualified people
- ▶ Methodology and concept for conducting the review
- ▶ Approval from operating managers
- ▶ Schedule, including dates and time of planned site visits and interviews
- ▶ Format of the report and presentation

The resolution of the board of directors should delegate formal authority to the review team to conduct the review as required by the EMS standard. This team will report the results directly to the board of directors.

The team can either be exclusively in-house or include external expertise. The experts needed for this step are primarily from two fields: environmental impact assessment and environmental regulation.

Before receiving approval from operating managers and making the schedule, the team should decide on the methodology (checklist, questionnaire) and develop a practical framework for conducting the review.

The first review will involve a considerable number of interviews and visits. Therefore, in order to keep to the schedule, it is advisable to secure the approval of the operating managers involved well ahead of time. To get the operating managers interested in the review process and in the findings and results, the review team should clearly state the economic rationale for investing in an EMS and conducting this initial review. When making appointments, the review team should emphasize that the persons interviewed should take time out from their normal activities. Only by dedicating their time will the persons interviewed learn from this review.

3.2.2.1 Conducting an Initial Environmental Review

An initial environmental review covers all the aspects of an EMS. As a result of this review the organization knows its strengths and weaknesses, risks and opportunities regarding the current status of its EMS. The gap between the requirements of the EMS standard and the actual status of the organization shows which aspects the organization should focus its efforts on to improve the system. This leads directly to the development of an environmental management program that should fill the gaps.

The review should focus on three key areas:

- ▶ Examination of existing environmental management practices and procedures
- ▶ Identification of significant environmental impacts and their priority
- ▶ Identification of legal and regulatory requirements

3.2.2.1.1 Examination of Existing Environmental Management Practices and Procedures

The methodology for assessing existing environmental management practices and procedures is proposed here using a questionnaire (the questionnaire is provided in the appendix on page 71). The review team fills out this questionnaire by interviewing appropriate people, by analyzing existing documents and procedures dealing with environmental issues and by collecting information about environmental aspects of the organization's operations, products and services.

By conducting the initial environmental review, an organization-specific profile of strengths and weaknesses can be drawn up (see Figure 3). Because the score in each EMS area shows the effort needed in terms of financial and human resources,

the organization knows where to focus its efforts when building up an EMS and where the largest effort is needed.

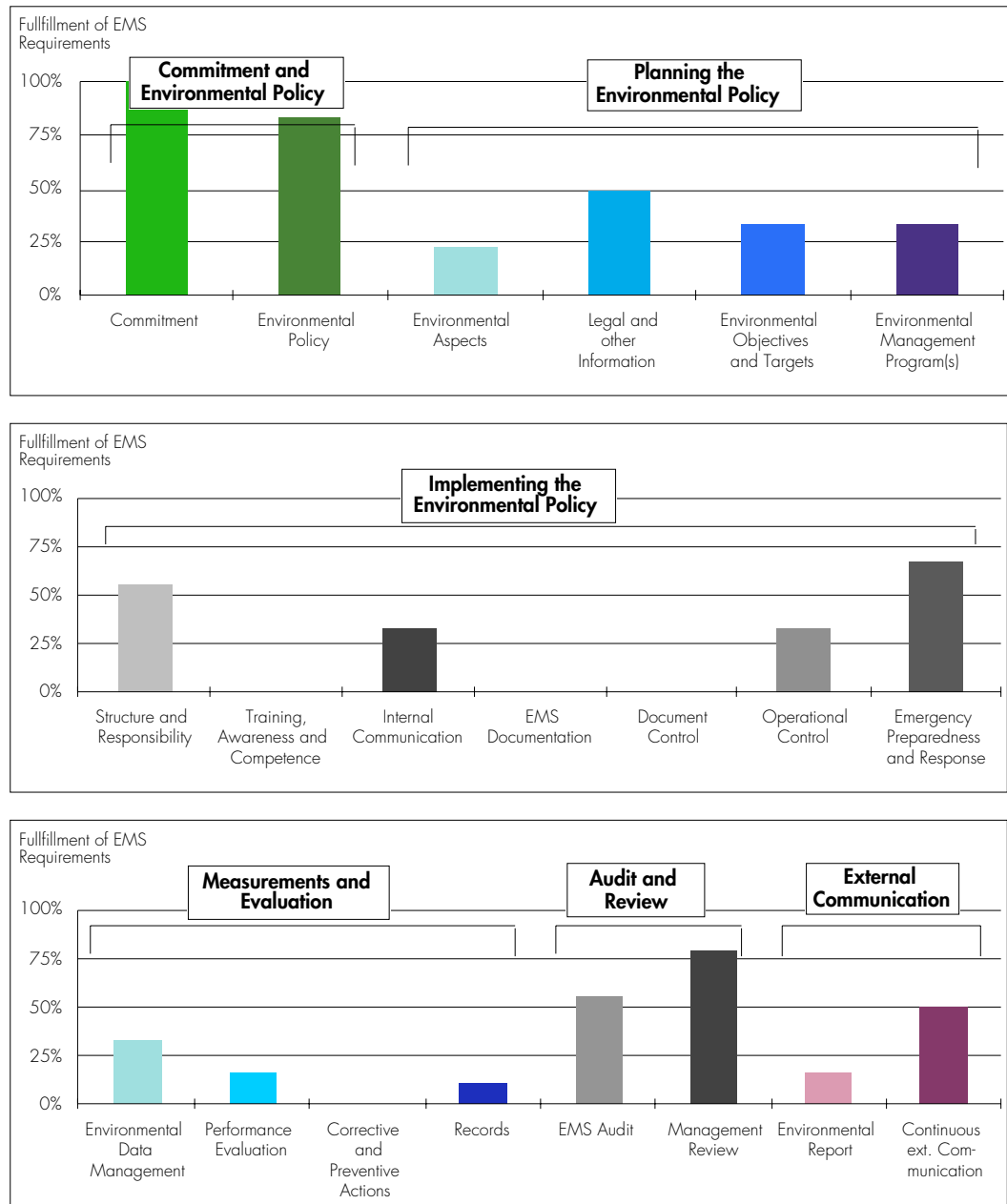


Figure 3: Results of an Initial Environmental Review

3.2.2.1.2 Identification of Significant Environmental Aspects and their Priority

An environmental policy requires top management to set priorities regarding environmental aspects. An initial review clearly shows where to set priorities regarding the EMS itself. But, it does not help to set priorities among different environmental

problems. Many top managers feel pressure to do something for the environment and thus embark on some form of „environmental activism“, often containing many isolated activities, but no clear direction. One way to solve this problem is to develop a so called „environmental exposure portfolio“ [STURM/SCHALTEGGER 1996].

The first step of this portfolio analysis is to assess the exposure and therefore the importance of different environmental aspects for an organization's overall performance. The appropriate perspective and priorities of the environmental policy will differ depending on this preliminary analysis. The analysis should be conducted from the perspective of the stakeholders of the organization, their needs and their importance for the success of the organization. The degree of exposure to different environmental aspects should guide the involvement and perspective of an organization when implementing an EMS. Evaluating exposure to environmental aspects is important, because this exposure is likely to influence the organization's success sooner or later, either through new legislation, public or consumer perception and behavior or otherwise.

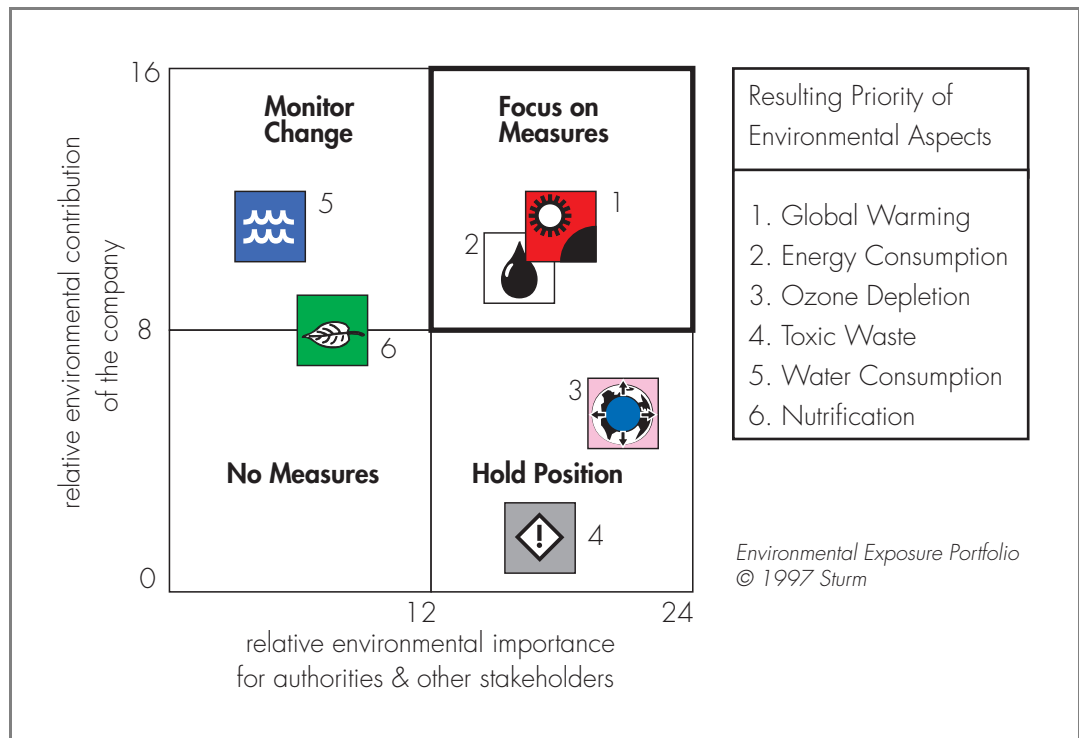


Figure 4: Environmental Exposure Portfolio

The figure above shows an exposure portfolio that focuses on environmental problems and impacts (the country is Switzerland). The same concept could be easily adapted

to evaluate exposure to environmental risks. The environmental contribution of an organization for different environmental problems (e.g. the greenhouse effect, depletion of the ozone layer, etc.) is depicted on the vertical axis. The importance given to these environmental issues by different stakeholders and public environmental policy is measured on the horizontal axis.

NOTE: The selection of environmental problems depends on the socio-political and economic environment. Not every country faces the same problems or perceives them in the same manner. Therefore, the analysis is valid only for the environment it has been conducted in. In other words, a multinational organization needs to perform more than one environmental exposure analysis for each country and/or site in which it operates.

Importance of Environmental Problems	Environmental Problem Area					
	Resource Depletion		Environmental Impact			
Topic	<i>Energy</i>	<i>Water</i>	<i>Global Warming</i>	<i>Ozone Depletion</i>	<i>Nutrification</i>	<i>Toxic Waste</i>
<i>Importance given by scientific evaluation</i>	3	2	3	3	2	0
• <i>social awareness today</i>	2	1	3	4	0	2
• <i>social awareness in the near future</i>	3	2	4	4	1	2
• <i>governmental policy awareness today</i>	2	1	2	4	2	3
• <i>governmental policy awareness in the near future</i>	3	2	3	2	1	3
• <i>regulation density today</i>	1	2	1	4	1	4
• <i>regulation density in the near future</i>	2	1	3	1	1	4
Total	16	11	19	22	8	18
Ranking by Importance	4	5	2	1	6	3

Score	(4 = high; 3 = middle; 2 = low; 1 = very low; 0 = none)
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Table 4: Importance of Environmental Problems

The method for measuring environmental exposure is based on data from a questionnaire given in the Table 4 and Table 5. The greater the organization's contribution to an environmental problem (high score in Table 5) and the higher the importance of the environmental problem (high score in Table 4), the higher the exposure and therefore the priority of the problem from the organization's point of view.

Importance of Environmental Problems	Environmental Problem Area					
	Resource Depletion		Environmental Impact			
Topic	<i>Energy</i>	<i>Water</i>	<i>Global Warming</i>	<i>Ozone Depletion</i>	<i>Nutritification</i>	<i>Toxic Waste</i>
• <i>in-house production processes</i>	3	2	3	3	3	1
• <i>upstream production processes</i>	3	3	4	1	4	1
• <i>consumption of products</i>	2	1	1	4	1	0
• <i>downstream processes</i>	1	1	3	0	1	0
Total	9	7	10	5	9	2
Ranking by Importance	3	4	1	2	5	6

Score	(4 = high; 3 = middle; 2 = low; 1 = very low; 0 = none)
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Table 5: Contribution of the Organization

This step is mainly a task for top management. Lower down the organization, line and staff managers can be involved in the formulation of targets and strategies to meet these targets. This can be done by contributing to working groups, which investigate and formulate an opinion on topics of special importance in their respective fields of competence.

The analysis of the expected exposure of an organization to different environmental problems and the weight given to these aspects by various stakeholders enables management to focus on environmental issues that are a high priority to the organization. This is represented in the quadrant in the upper right corner of the environmental exposure portfolio. However, the two quadrants on the left must also be observed, although less vigorously. Issues with low public priority, to which the firm contributes heavily become a problem as soon as the

perception of the stakeholders and the public environmental policy changes (the quadrant in the upper left corner of the portfolio). That this can happen very rapidly is obvious, for example from Shell's „Brent Spar“ dumping case (detailed information about this case is available from Shell or Greenpeace at their respective WWW-sites). Investments in new production technology, products and services can increase the environmental impact of the organization when not anticipated early enough. In this case, a problem ranked in the lower right corner of the portfolio would shift to the field with the highest priority. Problems ranked in the lower left corner are of no priority. No measures should be taken here. An overview is given in Table 6.

Focusing Environmental Activities/Programs	Priority			
	1 <i>Focus on Measures</i>	2 <i>Hold Position</i>	3 <i>Monitor Change</i>	4 <i>No Measures</i>
<i>Environmental Problem</i>				
1. <i>Global Warming</i>	•			
2. <i>Energy Consumption</i>	•			
3. <i>Ozone Depletion</i>		•		
4. <i>Toxic Waste</i>		•		
5. <i>Water Consumption</i>			•	
6. <i>Nutrication</i>				•

Table 6: Focusing Environmental Activities/Programs

Based on this example of an environmental exposure analysis, top management should develop an environmental policy and set priorities derived from the environmental exposure analysis. High priorities then lead to environmental objectives.

3.2.2.1.3 Identification of Legal and Regulatory Requirements

The identification of legal and regulatory requirements assesses two levels of an organization:

- ▶ production-related environmental regulations
- ▶ product- and service-related environmental regulations

The former addresses the production department while the latter addresses the marketing and R&D departments. Basically, three questions must be answered:

- ▶ Which are the relevant environmental regulations? (= target)
- ▶ Is the current situation in the organization known? (= actual)
- ▶ Does the organization comply with relevant regulations? (=gap)

The methodology used here is a questionnaire. To obtain information about environmental regulations the following information sources can be used:

- ▶ governmental authorities
- ▶ industry associations
- ▶ daily newspaper
- ▶ university publications (law departments)

The table below can be used to conduct the review. It is important to collect not only information about current regulations but also to look ahead. With a pro-active approach, activities, products and services can be planned and adapted earlier, with the added benefit of having more time to develop and assess alternative ways to ensure compliance with future environmental regulations. This should lead to lower costs and/or higher economic benefits.

Review of Environmental Regulations			Compliance Status within the Organization	Applicable to	Responsibility
<i>Regulation</i>	<i>Dated</i>	<i>Expected</i>	<ul style="list-style-type: none"> • non-compliance • expected to comply • 100% compliance 	<ul style="list-style-type: none"> • Production • Product(s) 	<i>Name and Function</i>
...
...
...
...

Table 7: Review of Environmental Regulations

As a result of the review the organization knows its current status both regarding its legal compliance, and opportunities and threats arising from changes in its legal environment.

3.2.2.2 Environmental Review Report

Once the review has been conducted all the information should be presented in a report. The following format can be adopted [TANEGA 1994]:

- ▶ **Title Page**
If the information is confidential, it should be specifically addressed to the person who requested it (e.g. board member or senior manager) and marked „confidential“. State the title clearly; naming the organization (organizational unit) and activity. State the name of the author, his or her position, organization, address, telephone, fax and email. Include the date of submission, the name of the addressee of the report and the copyright.
- ▶ **Executive Summary**
As the name suggests, this is a brief summary of the review results. Describe the background and context of the environmental review here and state upon whose request it was carried out. Also draw attention to the most outstanding findings and recommendations, calling for immediate action.
- ▶ **Scope of Review**
In this section, give details of the issues investigated (environmental management system, environmental impacts and environmental regulations). For example, a general questionnaire may have been used initially, with further investigations limited to a specific area. Explain this here and justify your decisions.
- ▶ **Findings of Facts**
Summarize the responses to the questionnaire, the reviewer's impressions of conversations with personnel, observations of the premises and examination of the documents here.
- ▶ **Recommendations**
Prioritize recommendations according to the need for immediate corrective actions and longer term goals. The report should make cost estimations for the recommended courses of action. However, since the cost estimations are not part of the formal requirements of an environmental review, they need not be included.

- ▶ **Conclusions**
Sum up the findings and recommendations into a positive statement of action.
- ▶ **Appendices**
Include the sample questionnaire, summaries of interviews and other important documents.

3.2.3 Implementing the Results of the Review

Based on the results of the initial environmental review, a project can be developed to build up an EMS or to adapt the current EMS to comply with one of the EMS standards. In addition, the methodology for assessing existing environmental management practices and procedures (see the questionnaire provided in the appendix on page 71) and the table for legal assessment (Table 7 on page 32) can be used for the periodic EMS audit required by ISO 14001, BS 7750 and EMAS. The exposure portfolio (Figure 4 on page 28) can also be used to include environmental issues in discussions of business or R&D strategy.

3.3 Planning the Environmental Policy

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▶	Legal and other Requirements	35
▶	Objectives and Targets	35
▶	Environmental Management Program(s)	38

3.3.1 Introduction

An organization should formulate a plan to fulfill its environmental policy. The environmental management system elements related to planning include [ISO 14004]:

- ▶ identification of environmental aspects and
- ▶ evaluation of associated environmental impacts,
- ▶ legal requirements,
- ▶ environmental policy,
- ▶ internal performance criteria,
- ▶ environmental objectives and targets and
- ▶ environmental management program(s).

The initial environmental review is the source of much of the data needed for the planning process. Therefore, it is advisable to conduct a review. The review will help to identify priority environmental aspects and provide information on how far the organization complies with legal and other requirements. This in turn helps in the formulation of objectives and targets, which are then used to develop an environmental management program. The latter is basically a systematic, detailed means of achieving organizational objectives and targets. If the organization does not have an EMS, the first management „program“ should be the implementation of an EMS.

3.3.2 Environmental Aspects

The identification of significant environmental impacts is done by developing an environmental exposure portfolio (see Figure 4 on page 28) for an organization, its activities, products and services. This evaluation of the importance of certain environmental problems to an organization and the analysis of the cause for these problems, as shown later in this chapter, leads to a set of environmental aspects that are significant for an organization.

3.3.3 Legal and other Requirements

The identification of legal and regulatory requirements assesses two levels of an organization:

- ▶ production-related environmental regulations
- ▶ product- and service-related environmental regulations

The former addresses the production department while the latter addresses the marketing and R&D departments. To obtain information about environmental regulations the following information sources can be used:

- ▶ governmental authorities
- ▶ industry associations
- ▶ daily newspapers
- ▶ university publications (law departments)

Assessment of the compliance status of an organization can be done with the methodology used in the initial environmental review (see Table 7 on page 32).

3.3.4 Objectives and Targets

The environmental policy states a commitment to continuous improvement. To control this process, management needs a system of objectives and targets. To be

effective, the objectives should be specific and the targets measurable [ISO 14001].

Setting objectives requires an analysis of the exposure of an organization to different environmental aspects. If an initial environmental review was conducted this step is very straightforward. The identification of significant environmental aspects is done by developing an environmental exposure portfolio, which produces a set of priorities. Environmental objectives should be set for the following environmental aspects as derived from the exposure analysis:

- ▶ Environmental aspects which have high public priority and to which the organization contributes heavily.
Here environmental objectives should be set. They should be given the highest priority, because these environmental problems are very likely to have an impact on the organization's free cash flow.
- ▶ Environmental aspects which have low public priority and to which the organization contributes heavily.
These environmental aspects will have an impact on an organization if public priority changes (e.g. due to new scientific knowledge, accidents etc.). Therefore, the objective should be to keep an eye on possible changes in public perception and hence, priorities, and to prepare alternatives.
- ▶ Environmental aspects which have high public priority and to which the organization has a low contribution.
These objectives should be added to the above if any investments or change in technology (products and production processes) are planned. Because of the high public priority the objective should be to hold the current position by not contributing more to these problems.

Later on, these objectives are used for evaluating environmental performance (because performance can only be evaluated by comparing the current state to a target level or objective).

After the environmental objectives are approved by the CEO, top management should set targets that include a time frame within which they must be achieved. To set targets management must put the environmental objectives in concrete terms. This can be done by evaluating the causes of a specific resource depletion or environmental impact problem. The figure below contains a framework for managing this step. Typically, this step requires the involvement of staff and line managers.

To complete this step, a system of environmental targets has to be approved by top management. An example is given in Figure 5.

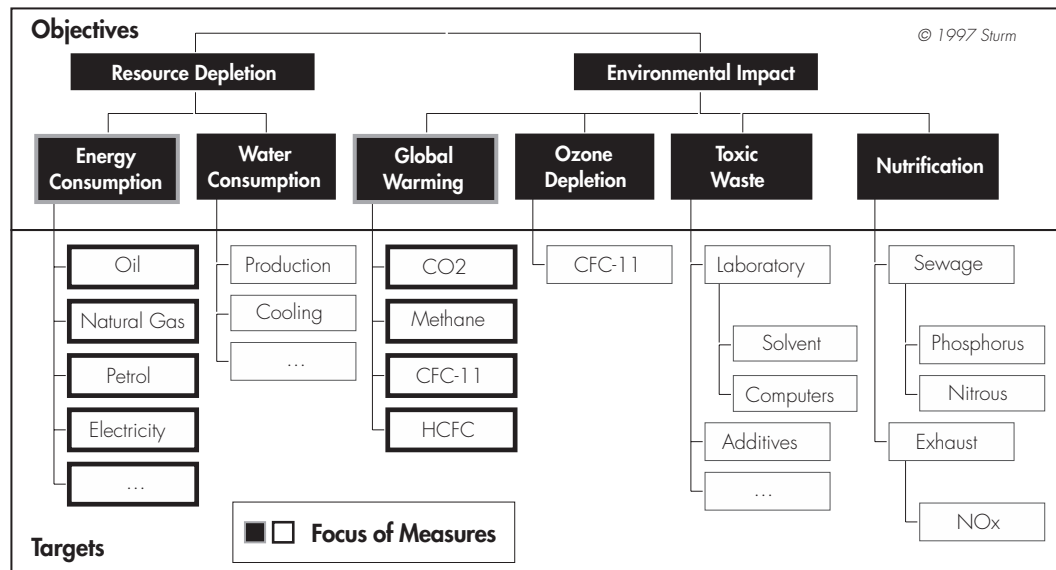


Figure 5: System of Environmental Targets Derived from Environmental Objectives

It is of great importance that the targets are set on an environmental problem level rather than on a causal level. This is illustrated in the following example: Assume that a company wants to reduce its global warming impact by 10% over the next five years. Traditionally, a 10% reduction in fossil fuel consumption would be set as a target. This restricts the organization's options. However, if an approach based on the problem (impact) rather than the cause is followed (Table 8), a company has at least four more options to achieve the target of reducing its impact on global warming:

1. reducing CFC-Emissions
2. changing the mix of energy consumed (for example, substituting natural gas for oil)
3. installing a catalytic end-of-the-pipe methane reduction facility
4. banning the use of HCFCs

All of these measures lead to a decrease in global warming. The question now is which alternative has the least cost or the best return, while achieving the target. In other words, which alternative has the best efficiency, assuming the effectiveness is comparable (10% reduction in the contribution to global warming). To answer this question, management needs a system that enables them to assess the environmental performance of their decisions.

Affected Environmental Objective	Cause = Target (possible examples)	
	Input	Output
1. Global Warming	oil, natural gas, CFCs, R-134a	CO ₂ , methane, ... CFCs, R-134a
2. Energy Consumption	oil, natural gas, electricity, steam, transport	CO ₂ , methane, NO _x , CO, particulate matter
3. Ozone Depletion	airconditioning	CFCs
4. Toxic Waste	additives, solvents	waste, volatile organic compounds
5. Water Consumption	cooling	hot waste water
6. Nutrification	detergents	phosphorus, nitrate

Table 8: From Objectives to Targets

If objectives were anticipated correctly, the expenditure needed to achieve these targets may be a wise investment particularly once competitors are forced by cost drivers (for example, rising energy or waste treatment costs) and/or legislation to improve environmental performance. The sooner a company starts to evaluate alternatives to end-of-the-pipe solutions - for example, by modifying the product and packaging - the higher the return on investment will be. As soon as the competition is forced to improve environmental performance because of costs or consumer pressure and/or environmental law, the initial cost incurred will become a benefit and a competitive advantage.

Besides giving environmental policy a clear focus, this system of targets serves as an input and structure to the environmental effects register.

3.3.5 Environmental Management Program(s)

An environmental management program is a description of the means of achieving environmental objectives and targets [BS 7750]: It details what must be done, by whom, how and when for each of the defined objective and targets of high priority. This entails [TIBOR/FELDMAN 1996]:

- ▶ Designating responsibility for achieving objectives and targets at each relevant function and level.
- ▶ Providing the means (i.e. people, skills, technology, financial resources etc.) for fulfilling the objectives and targets.
- ▶ Designating a time frame within which objectives and targets will be achieved.

To be most effective, the environmental management program should be integrated into the organization's strategic plan. Normally a site will have one environmental program. However, additional programs may have to be established under the following circumstances: new developments or new or modified products, processes and/or services. EMAS requires that the program be in written form, authorized at the highest level and distributed to everyone within the organization. In addition, the program should also be distributed to any contractors or sub-contractors working on the site in question, as the scheme requires that all engaged on the site conform to the site's policy [EMAS].

The environmental management programs should be periodically reviewed and regularly revised to reflect changes in the organization's objectives and targets. There must be a system to clearly demonstrate progress. To do this, a detailed description of all the measures taken so far to meet objectives and targets and their effectiveness is needed. Also, a detailed description of any measures planned for the future, or any measures likely to be taken in any particular circumstances is required.

3.4 Implementing the Environmental Policy

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- ▶ Document Control 41
- ▶ Operational Control 41
- ▶ Emergency Preparedness and Response 42

3.4.1 Introduction

The implementation and operational components of an EMS take the most time and effort within an EMS project. Effective implementation calls for an organization to develop the necessary capabilities and support mechanisms to achieve its environmental policy, objectives and targets. For many organizations, implementation can be approached in stages, depending on the level of awareness of environmental requirements, aspects, expectations and benefits and the availability of resources.

The following aspects are covered in the implementation stage:

- ▶ Structure and Responsibility
- ▶ Training, Awareness and Competence
- ▶ Internal Communication
- ▶ Environmental Management System Documentation
- ▶ Document Control
- ▶ Operational Control
- ▶ Emergency Preparedness and Response

3.4.2 Structure and Responsibility

The roles, responsibilities and authority of personnel whose activities have an impact on the environment are defined, documented and communicated to all members of the organization. In addition resources for the implementation and maintenance of the EMS are provided. A special management representative with the responsibility and authority to enforce the EMS requirements is appointed. This management representative reports the environmental performance of the organization directly to top management.

3.4.3 Training, Awareness and Competence

Management must ensure that personnel throughout the organization are aware of the environmental policy, the environmental management programs and the actual or potential impact of their activities on the environment. All personnel with a significant contribution to environmental performance need to be adequately trained to handle the environmental aspects of their activities. The organization must ensure that these people have the competence to deal with their responsibilities either through education, training and/or experience. Training should be in-depth enough to enable employees to integrate relevant environmental aspects into daily business information.

3.4.4 Internal Communication

Procedures should be established and maintained for internal communication between various levels and functions of the organization. An organization can communicate in a variety of ways including bulletin board postings, internal newspapers, meetings and electronic mail messages, to name a few. Communication should be a two-way process and the information communicated should be understandable and adequately explained.

Communication is also needed to demonstrate management commitment, raise awareness, deal with concerns and questions about the organization's activities, products

or services, and to inform interested parties about the organization's EMS and performance. Results from EMS monitoring, audit and management review should be communicated to those within the organization who are responsible for performance.

3.4.5 Environmental Management System Documentation

To ensure that external auditors can certify the management system according to one of the current EMS standards, the EMS must be well-documented. This documentation includes a description of the basic elements of the system and their interaction. It also points to related documents, which may include a) process information, b) organization charts, c) internal standards and operational procedures and d) site emergency plans. Documentation may be integrated and shared with documentation of other systems implemented by the organization. Although there is no need to develop an EMS handbook, it is common practice to do so.

3.4.6 Document Control

The documents related to the EMS must be reviewed, revised and approved on a regular basis so that up-to-date information is available on the task or work activity being performed. To ensure against unintended use, obsolete documents should be promptly removed from all points of issue and points of use, while any obsolete documents retained for legal and/or knowledge preservation purposes should be identified as such.

3.4.7 Operational Control

To make sure that the environmental policy is implemented and objectives and targets are achieved, an organization must identify processes and activities that have a significant impact on the environment. The organization must ensure that these activities or processes are conducted as intended. This includes procedures to control operations such as documented work instructions to ensure conformance to the EMS, monitoring and control of relevant process characteristics (e.g. effluent waste streams and waste disposal) and so on. Also, the organization should establish procedures for verification of compliance to specified requirements and establish and maintain records of the results. In addition, the responsibility and authority for measures to deal with non-compliance and subsequent corrective actions should be specified. The organization must also identify environmental aspects of the goods and services it uses and communicate its environmental requirements to its suppliers and contractors.

3.4.8 Emergency Preparedness and Response

The organization must identify the potential for accidents and emergency situations and develop appropriate procedures to respond to these. This includes the prevention and mitigation of the impact on the environment. These procedures need to be communicated internally and tested to make sure that the response is effective and efficient.

An emergency plan can include the following elements:

- ▶ Details of possible accidents (e.g. chemical spills, fire)
- ▶ Actions to be taken if accidents occur
- ▶ A list of key personnel and their responsibilities in handling emergency situations
- ▶ Drills to test effectiveness

3.5 Measurement and Evaluation

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3.5.1 Introduction

After implementing the environmental policy, management needs to measure environmental interventions and their impact on the environment. This is done by building up an environmental effects register (environmental inventory). All equipment used for monitoring and measuring must be accurate and calibrated on a regular basis. To check the compliance status of an organization, additional information about regulations and other requirements is needed. A so-called „environmental regulations register“ is often installed and maintained for this purpose. To obtain a better picture about the financial consequences of environmental protection, the accounting system should reflect environmental costs. Therefore, information about environmentally-induced costs and earnings needs to be collected. All this information should be recorded in such a manner that the data can be verified by an internal or external auditor.

Environmental performance evaluation assesses environmental performance against environmental targets and objectives and against applicable environmental regulations. Responsibilities and authority need to be defined to deal with non-compliance within the EMS. This includes specifying the actions to be taken to correct an undesirable situation and to prevent future non-compliance.

The analysis of environmental and economic performance leads to eco-efficiency, the key component in sustainable business management.

3.5.2 Environmental Data Management

The recording of physical environmental data, environmental regulations and environmentally-induced financial information is necessary as a basis for effective decision making. Therefore, financial, legal and ecological data systems must be built up from scratch or adapted to the requirements of the EMS standard.

3.5.2.1 Environmental Effects Register

The collection and preparation of physical environmental information is a relatively new task for managers. Since managers typically have extensive experience with accounting and the management of economic information, it makes sense to apply similar methods to the recording and analysis of ecological information. Therefore, the procedure for building up an environmental effects register follows the methodology of accounting, but all the figures are measured in either kg, t, kWh or MJ.

Four steps are essential in this process:

1. Definition of the systems (periods of time selected, organizational units included)
2. Classification of environmental accounts (structure, names, unit)
3. Selection of an appropriate basis to eliminate the impact of an increase or decrease in production
4. Collection and recording of the data

3.5.2.2 Definition of the System

The first decision to be made in building up an environmental effects register is the period of time over which the data is recorded. It is common practice today to use the same time period as in financial accounting: one year. This means that all environmental data is measured in unit of input per year or unit of output per year.

Next a clear definition of the organizational units to be included is necessary. EMAS and BS 7750 define a system by including all organizational units located in one specific location (in other words one site). This approach to defining system

boundaries is based on legal property rights. By contrast, ISO 14001 is more flexible. Parts of units operating at a specific location can be defined as part of the system while others can be excluded. This choice has to be declared very clearly because it can substantially affect environmental performance (e.g. by excluding the power producing unit from the system to show a better environmental performance).

Classification of Environmental Accounts	
Inputs	Outputs
300 mineral resources	400 main product
301 biomass	401 by-product
302 water	402 waste for further treatment
303 air	403 materials for recycling
304 fossil energy carrier	405 emissions
3041 crude oil	4050 dumped waste
3042 coal	40500 toxic waste
3043 natural gas	40500 municipal waste
3044 ...	4051 ground pollution
305 renewable energy carrier	4052 water emissions
3051 ...	40520 phosphate
3052 ...	40521 ammonium
306 new materials	40522 chemical oxygen demand (COD)
3061 ...	40523
3062 ...	4053 air emissions
3063 ...	40530 carbon dioxide
307 recycled materials	40531 nitrogen oxides
3071 ...	40532 volatile organic compounds (VOC)
3072...	40533 ...

Table 9: Classification of Environmental Accounts

3.5.2.3 Classification of Environmental Accounts

Once the operational units are selected, the data to be collected must be defined. Special attention should be given to the structure of the accounts (see Table 9) and the existing sources of environmentally-relevant data, such as accounting practices for materials and the amount of energy used, site permits for particular pollutants, production statistics, technical specifications of the production machines, etc.

EMAS states that an organization must provide an inventory of all (!) environmental effects. If this requirement is followed, a huge investment must be made to collect data about all inputs and outputs of an organization. Economically, it does not make sense to aim at a full inventory of all mass and energy flows - apart from the

fact that this goal is hardly achievable. For a nearly full inventory, see the example in Table 10 [MOHNDRUCK 1994]. The process of data collection will usually be spread over several years, becoming more in-depth each year.

INPUTS	1993/94	92/93	OUTPUTS	1993/94	92/93
raw materials [t]			product [millions]		
endpaper	488.01	562.00	books	48.96	49.50
cut paper	39492.19	26847.00	magazines	335.30	335.30
un-cut paper	120438.91	125548.00	action prints	500.00	495.00
carton	6'497.83	6976.00	brochures	835.00	755.00
additional material	7.63	6.77	calenders	16.32	19.70
laminating material	569.13	636.70	telephone directories	16.00	15.00
shipping material	1'700.97	1962.75	products	12242.52	11665.65
packaging	819.87	942.50		[printed area in 1000000 m2]	
paints/pigments	2666.97	2030.00	recyclable waste [t]		
main operating materials [t]			paper	32339.13	32392.22
fixer	36.69	44.26	wood	1'188.11	1081.28
films	19.95	41.21	printing plates	185.14	174.58
toner	0.29	0.29	var. recyclable waste	-	4.94
photocopy paper	7.40	6.48	non-recyclable waste [t]		
gumming material	3.83	3.66	coated paper	700.70	853.50
membranes	233.09	164.63	various paper	296.32	267.89
cleaner 1	26.56	208.74	construction materials	88.06	91.60
cleaner 2	23.95	0	membranes	22.28	36.29
grease	17.18	22.12	PP-strips	20.57	30.50
spare parts	81.48	0.50	var. non-recyc. waste	65.07	30.64
office supply	57.03	60.22	hazardous waste [t]		
parts f. maintenance	4.05	3.24	paints/pigments	44.04	79.14
printing plates	243.34	156.20	solvents	31.62	51.00
rubber towels	36.98	32.74	filter towels	63.44	98.46
workshop supply	0.51	2.91	developer	17.80	21.75
var. operating mat.	15.18	22.04	clue	5.60	11.40
various operating materials [t]			oily and solid waste	14.07	11.07
clues	734.28	844.90	various waste	0	11.18
labels	3.39	3.60	water emissions [t]		
crepe	16.60	6.77	fresh water	207154.00	197080.00
embossing material	8.92	8.70	water for operation	139240.00	143511.00
metals	45.99	50.22	air emissions [t]		
cartons	375.45	381.50	carbon dioxide	61661.62	59714.55
var. operating materials	13.51	7.00	carbon monoxide	43.35	38.15
hazardous materials [t]			sulfur dioxide	37.04	35.83
chemicals	2.67	23.99	nitrogen oxides	69.31	65.47
fixer	2.75	2.15	particulate matter	4.13	3.14
leaner	573.72	397.68	methane	106.17	113.50
gasoline (cleaning)	958.57	1089.45	non-methane volatile		
grease	0.04	0	organic compounds	10.44	8.99
energy [millions Mj]					
electricity	243.18	241.78			
natural gas	282.83	268.27			
gasoline	20.93	20.94			
propane	1.32	1.29			

Table 10: Inventory of Mohndruck Ltd.

To focus on selected „relevant environmental interventions“ - as required by ISO 14001 and BS 7750 - does not enable the same degree of „fine tuning“ in pollution prevention strategies as a comprehensive data inventory. On the other hand, much fewer resources must be devoted to the completion of a focused environmental effects register and, if the process of focusing and selecting the relevant information is done well (see chapter 3.3.4 on page 35), the data may still offer a sound basis for an efficient and effective EMS.

3.5.2.4 Selecting an Appropriate Basis

The above environmental effects register shows all the figures as input or output per year. This comparison does not take into account the effect of an increase or decrease in production (an increase means more input and/or more output). To demonstrate the success of an effective EMS, production fluctuations have to be eliminated. This can be done by dividing all figures by the amount of output produced. In the above example of a printing company, a reasonable basis would be output in terms of printed sqm of paper. But, how can this basis be chosen? The following rule can serve as a useful guide. The basis should correlate strongly to major:

- ▶ inputs such as energy or raw material or
- ▶ outputs such as waste or sewage.

Having selected an appropriate basis, the effectiveness of environmental management programs, in terms of reduced environmental impact per unit of output can be assessed.

3.5.2.5 Collecting and Recording the Data

Collecting and recording data starts after the system is clearly defined, the specific accounts for the organization have been set up and a choice has been made regarding the basis for a yearly comparison. Collecting data and recording relevant information connected to it is the last and final step in building up an environmental effects register. Here, special attention should be given to documentation. Because there are no rules like those used in accounting it is advisable to ask what information an external auditor needs to verify the data collected. As a starting point, the following data structure (for each entry in an account) can be considered:

Data Structure	
Account number:	3041
Account name:	crude oil
Specification of the input or output:	low sulfur fuel
Year:	1995
Amount:	10000
Unit:	tons
Source of information:	energy statistic
Assumptions and/or calculations:	density = 860.00 kg per cubic meter
Information collection date:	15/1/96
Name of the person in charge:	Mr. Energy

Table 11: Data Structure of Environmental Accounts

Accounting benefits from an environmental effects register, in that environmentally induced costs, such as energy costs or pollution abatement costs, can be allocated to the cost centers and the cost drivers that cause them. As is clear from the discussion above, effective information management requires careful consideration concerning appropriate software.

3.5.2.6 Environmental Regulations Register

The identification of legal and regulatory requirements assesses two levels of an organization:

- ▶ production-related environmental regulations
- ▶ product- and service-related environmental regulations

The former addresses the production department while the latter addresses the marketing and R&D departments. Basically, two questions have to be answered:

- ▶ Which are the relevant environmental regulations? (= target)
- ▶ Is the current situation in the organization known? (= actual)

The table below can be used to built up a register of environmental regulations.

Register of Environmental Regulations			Requirements		Applicable to		Responsibility
<i>Regulation</i>	<i>Dated</i>	<i>Expected</i>	<i>Description</i>	<i>Relevant to Organization</i>	<i>Production Process(es)</i>	<i>Product(s)</i>	<i>Name and Function</i>
...
...
...

Table 12: Register of Environmental Regulations

To obtain the information about environmental regulations, the following information sources can be used:

- ▶ governmental authorities
- ▶ industry associations
- ▶ daily newspaper
- ▶ university publications (law departments)

3.5.2.7 Financial Environmental Data

Corporate (as well as public) environmental protection can only be successful if it is economically sustainable. It is therefore necessary to consider economic information in environmental protection.

From a conceptual point of view, the necessary methods of accounting are known. Economic and financial information has been computed by organizations for hundreds of years. During this period of time, extensive experience with different methods of accounting and information management has been gained and mutually beneficial structures and relationships of reporting have been established.

Nonetheless, in practice, accounting systems are often not differentiated according to environmentally-induced information and other financial information. The process of differentiation can be started by searching for environmental costs and revenues in existing accounting systems. All costs and revenues related to environmental performance must be identified, such as disposal costs, clean-up costs, emission reduction costs, etc. This information gives a preliminary indication of which fraction of total costs is due to environmental issues and how much money can be saved by better environmental performance.

In a next step, the allocation of overhead costs must be analyzed. The main question here is: do the allocation methods reflect the different environmental effects of the materials used or the pollutants emitted? For example, does the allocation of sewage costs take the financial impacts of different qualities of waste water into account, or are these costs allocated by cubic meter of waste water, without

consideration of the incurred treatment costs? In the latter case, environmentally-friendly products would subsidize environmentally-harmful products and distort the calculation of prices.

Calculating Environmentally Induced Costs			
Usual Method		Correct Method	
Costs of Disposal (III)		Costs of Disposal (III)	
Fees	500'000	Fees	500'000
Disposal Costs	300'000	Disposal Costs	300'000
		<i>First Total</i>	800'000
		Costs Incurred in Production (II)	
		Logistics & Transportation	150'000
		Additional Personnel	250'000
		Additional Depreciation	200'000
		Storage	100'000
		<i>Second Total</i>	700'000
		Excess Material Input (I)	
		Purchase	4'500'000
		<i>Third Total</i>	4'500'000
Total	800'000	Total	6'000'000

Table 13: Calculating Environmentally Induced Costs

When referring to environmental costs, the issue of cost allocation deserves the attention of management [WAGNER 1995]. For example, when accounting for waste costs, most accounting systems merely record waste treatment costs, such as payments to the contracted waste management company (costs of disposal: Number III in Table 13). Calculated correctly, internal waste costs usually increase significantly (see Table 13 for an example), making more investment in waste prevention worthwhile. Mostly neglected are the costs that occur in handling excess material (which becomes waste in subsequent steps), the use of machine capacities, etc. (see II in Table 13) as well as costs incurred in purchasing excess material; that is inputs which become waste (see I in Table 13). These costs (I and II) should also be allocated to the product as waste costs. The reallocation of environmentally-induced costs is an important part of making a company more environmentally efficient, because it highlights the potential for shared environmental and economic benefits.

3.5.3 Environmental Performance Evaluation

The goal of this step is to provide decision-makers with a transparent and rational methodology for making environmentally-sound decisions based on environmental objectives and targets and the data collected.

NOTE: This chapter does NOT deal with the evaluation of the performance of the EMS itself. For this kind of system performance assessment refer to the methodology used during the initial environmental review (see the questionnaire provided in appendix on page 71).

Environmental performance needs to be assessed on the following three levels:

- ▶ Assessment of Environmental Effects
- ▶ Assessment of Legal Compliance
- ▶ Assessment of Eco-Efficiency

3.5.3.1 Assessment of Environmental Effects

The data provided by the environmental effects register needs to be analyzed to assess performance against environmental objectives and targets. Environmental objectives are defined according to different environmental problems. To calculate key environmental performance figures which describe the organization's contribution to these problems, management needs a framework which can summarize different releases to the environment (e.g. carbon dioxide and methane emissions) within broader categories (e.g. global warming contribution).

Ideally, all releases to the environment are assessed according to their actual impact. However, most of the existing impact assessment approaches were developed for life cycle impact assessment and provide only information about potential environmental impacts [for an overview, see SCHALTEGGER/STURM 1994].

The most widely used approach to assess environmental impact is the two-step approach of classification and characterization. In this approach, environmental interventions are clustered by their potential link to a specific environmental problem and then assessed according to their contribution to this problem. For example, methane is a gas that can be classified as an emission with an impact on global warming. When its relative impact is characterized it can be seen that the greenhouse potential of 1 kg of methane is about 20 times as high as the potential of the same amount of CO₂ (based on actual scientific knowledge, see Table 14). Therefore, all CO₂ emissions (kg) are multiplied by 1 and all methane emissions (kg) by 20. As a result two figures are derived which add up to a so-called „global warming potential“ (measured in terms of kg CO₂ equivalent).

According to the approach taken by the Center of Environmental Science of the University of Leiden (CML) 16 different classes of environmental problems are currently defined, so that 16 different categories of performance figures can be calculated [the tables are provided in HEIJUNG et al. 1992]. Further developments are expected.

Characterization Factors for Evaluating Contribution to Global Warming	
Objective: Global Warming	
Indicator: Global Warming Potential [kg CO ₂ Equivalent]	
Intervention: 1 kg of	Global Warming Potential (over 20 years)
Carbon Dioxide (CO ₂)	1 kg CO ₂ Equivalent
Methane (CH ₄)	21 kg CO ₂ Equivalent
Dinitrogen Oxide (N ₂ O)	290 kg CO ₂ Equivalent
CFC-11	3500 kg CO ₂ Equivalent
HCFC (R134a)	1200 kg CO ₂ Equivalent
Halons	5800 kg CO ₂ Equivalent
Carbon Monoxide (CO)	3 kg CO ₂ Equivalent
Nitrogen Oxide (NO _x)	8 kg CO ₂ Equivalent
Carbon Monoxide(CO)	11 kg CO ₂ Equivalent

Table 14: Characterization Factors for Evaluating Contribution to Global Warming

For every environmental objective with high priority, an environmental performance figure should be calculated accordingly. As a result, the organization has a set of key figures (see the example in Table 15 and Figure 6), that measure environmental performance based on the environmental effects register. These figures are then compared to the objectives and targets. If the organization does not meet the objectives and targets that have been set by top management, corrective actions should be taken.

From the figures, it is clear that this company focused on waste management from 1992 to 1994. In particular, toxic waste was reduced dramatically.

Environmental Performance Indicators of Mohndruck Ltd.					
Note:		<ul style="list-style-type: none"> • all figures relate to 1000 sqm printed paper, based on the environmental inventory of Mohndruck 1992/93 and 1993/94 • physical data assessed according to the contribution to the respective environmental problem [HEIJUNG et al. 1992], (electricity generation effectiveness = 0.375%) 			
Resource Consumption		1992/93	1993/94	Unit	+/- [%]
<i>input of material</i>	raw material	14'187.441	14'107.263	[g]	
	various operating materials	111.687	97.867	[g]	
	main operating materials	195.663	191.567	[g]	
	total	14'494.791	14'396.697	[g]	-0.68
<i>water</i>	water	16'894.051	16'920.823	[g]	0.16
<i>energy</i>	fuel	1.774	1.689	[MJ]	
	liquid pressure gas	0.178	0.174	[MJ]	
	electricity	7.203	6.953	[MJ]	
	natural gas	23.077	23.226	[MJ]	
	total	32.233	32.042	[MJ]	-0.59
Environmental Impact		1992/93	1993/94	Unit	+/- [%]
<i>global warming potential</i>	carbon dioxide	5'118.848	5'036.623	[g GWP]	
	methane	205.254	182.100	[g GWP]	
	total	5'324.102	5'218.723	[g GWP]	-1.98
<i>photochemical ozone creation potential</i>	nitrogen dioxide	2.116	2.134	[g POCP]	
	methane	3.685	3.269	[g POCP]	
	non-methane volatile organic compounds	0.301	0.355	[g POCP]	
	total	6.101	5.758	[g POCP]	-5.62
<i>acidification potential</i>	sulfure dioxide	3.075	3.026	[g AP]	
	nitrous dioxide	3.929	3.963	[g AP]	
	total	7.003	6.989	[g AP]	-0.21
<i>nutrification potential</i>	nitrous dioxide	0.730	0.736	[g NP]	0.88
<i>waste</i>	non-recycled waste	0.112	0.097	[g]	-13.25
<i>toxic waste</i>	toxic waste	0.024	0.014	[g]	-40.76

Table 15: Environmental Performance Indicators of Mohndruck Ltd.

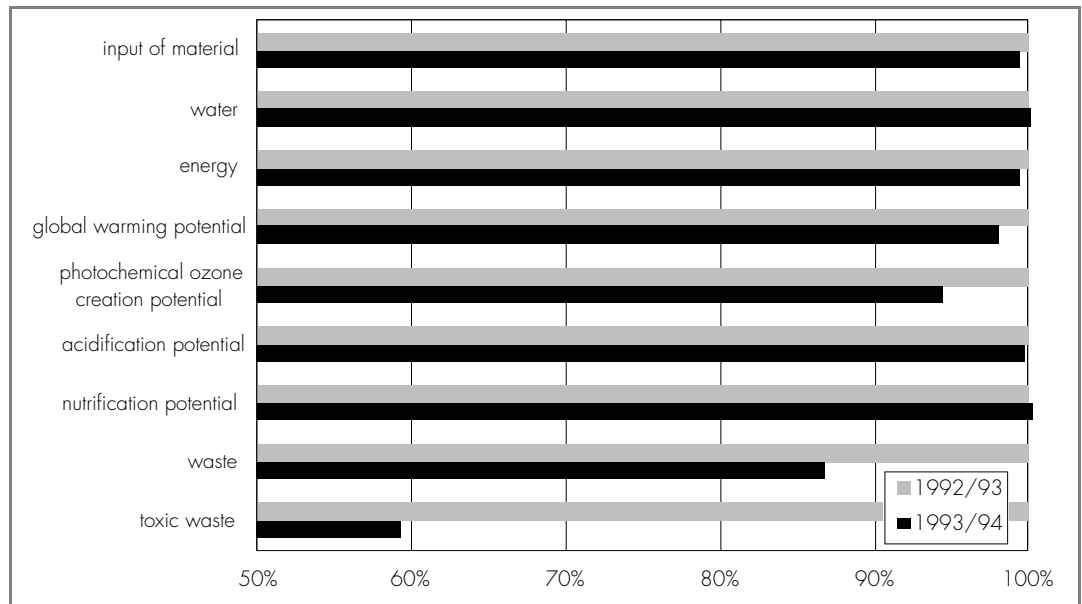


Figure 6: Environmental Performance of Mohndruck Ltd.

3.5.3.2 Assessment of Legal Compliance

To assess legal compliance the organization must analyze the internal implementation of all the regulations applicable to the organization, its activities, products and services. Based on the environmental regulations register two questions must be answered (Table 16):

- ▶ Does the organization comply with regulation „x“?
- ▶ How does the organization comply with the requirements of regulation „x“?

Assessment of Legal Compliance			Compliance Status within the Organization	Applicable to	Responsibility
Regulation	Dated	Expected	<ul style="list-style-type: none"> • non-compliance • expected to comply • 100% compliance 	<ul style="list-style-type: none"> • Production • Product(s) 	Name and Function
...
...
...
...

Table 16: Assessment of Legal Compliance

The status of internal compliance can be classified into the following categories:

1. non-compliance with major environmental regulations
2. non-compliance with minor environmental regulations
3. non-compliance, but expected to comply in the near future
4. 100% compliance with current environmental regulations
5. 100% compliance with current and expected environmental regulations

Statuses 1 to 3 do not meet the requirements of ISO 14001, EMAS or BS 7750. Here, immediate non-conformance and corrective actions should be taken. Status 4 is a minimum requirement.

As a result of this assessment, the organization knows its current status regarding legal compliance as well as opportunities and threats arising from changes in its legal environment.

3.5.3.3 Assessment of Eco-Efficiency

Environmental performance indicators should always be put into the context of economic performance. This can be done by drawing an eco-efficiency portfolio (an example based on a real world case is shown in Figure 7).

Environmental performance is shown on the vertical axis and economic performance on the horizontal axis. These measures will depend on the topic of analysis. On the horizontal axis, return on net assets (RONA) or shareholder value (SV), are examples of adequate measures of the economic performance of a company. The economic measure taken is affected by the way environmental costs are allocated in management accounting.

Four positions can be distinguished in an eco-efficiency portfolio:

► **Green star position**

A green star company has low environmental impact added and a high economic performance. Low costs are achieved through integrated, clean technologies. The environmental impact is already optimized when the technology is developed. Apart from relatively lower costs, another explanation for such companies is that in some markets where consumers are willing to pay a price premium for environmentally-friendly products. Costs savings, as well as higher prices, result in a higher economic performance. To achieve this position, a strategy of sustainable growth must be implemented. More stringent environmental regulations or the introduction of market-based public environmental policies gives these companies a competitive advantage. This scenario is likely to increase the shareholder value of these companies.

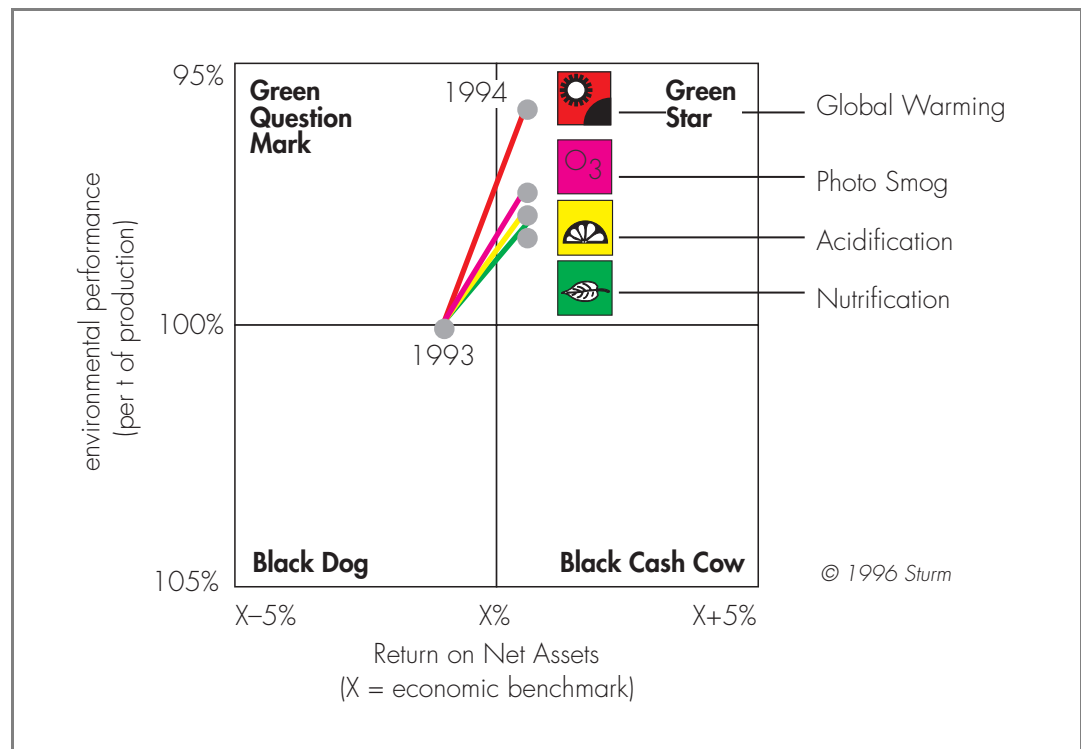


Figure 7: Eco-Efficiency Portfolio of Mohndruck Ltd.

- ▶ **Black cash cow position**
 This position is the result of a strategy which focuses on quantitative growth. It is characterized by relatively high financial revenues and a high environmental impact added. Assuming that governments will introduce a market based environmental policy mix and hence give a price tag to resource consumption and environmental impacts, these companies are likely to move to a „black dog“ position.

- ▶ **Green question mark position**
 These companies have a low environmental impact added, but also achieve a relatively low economic performance. However, in the long run, if the company cannot move to a green star position, it does not contribute to sustainable development, as it cannot prevail because of its economically weak position. The introduction of a market-based environmental policy mix will increase a company's economic performance relative to their „high environmental impact“ competitors.

▶ **Black dog position**

Companies in this position cause a high environmental impact added and have a weak economic performance. This position is economically weak and causes enormous environmental damage. Businesses in this situation should be eliminated or improved economically and ecologically. Changes in public environmental policy, like the implementation of green taxes, will likely force these companies out of business.

The example in the above figure shows a company that has improved both economically and environmentally, to a green star position.

Portfolios which bring environmental and economic data together are a very powerful analytical tool to highlight where different production sites stand relative to each other or how a company heads towards eco-efficiency within different businesses.

3.5.4 Non-Conformance, Corrective and Preventive Actions

When problems occur, the organization must be prepared to correct them and prevent recurrence. It is important to focus on the root cause and not on the symptoms. The whole point is not just to identify the problem, but to understand why it happened and to change the system, so the same mistake is not made twice. In order to do this, the findings, conclusions and recommendations reached from monitoring, audits and other reviews of the EMS should be documented and the necessary corrective and preventive actions identified. It is the task of management to make sure that these corrective and preventive actions have been implemented and that there is a systematic follow-up to ensure their effectiveness.

The basic requirements in ISO 14001 include procedures for [TIBOR/FELDMAN 1996, ISO 14001]:

- ▶ Defining responsibility and authority for handling and investigating non-conformance.
- ▶ Acting to mitigate the resulting impacts on the environment.
- ▶ Initiating and completing corrective and preventive action.
- ▶ Implementing and recording changes to documented procedures that result from corrective and preventive action.

The ISO 14001 standard also states that corrective or preventive actions „taken to eliminate the cause of actual and potential non-conformance shall be appropriate to the magnitude of problems and commensurate with the

environmental impact encountered". Thus, the scope of action depends on the scope of the problem.

3.5.5 Records

The main purpose of records is to demonstrate conformance to the requirements of the standard. As such, procedures for identifying, maintaining and disposing of environmental records should be established. Environmental records include training records and the results of audits and reviews [ISO 14001].

Records are also evidence of the ongoing operation of EMS and in addition to the above, should cover [TIBOR/FELDMAN 1996, ISO 14004]:

- ▶ Legislative requirements, other regulatory requirements and permits (register of environmental regulation).
- ▶ Environmental aspects and their associated impacts (environmental effects register).
- ▶ Inspection, maintenance and calibration records.
- ▶ Incident reports.
- ▶ Product identification; composition and property data.
- ▶ Contractor and supplier information.
- ▶ Emergency response records.

Environmental records must be legible, identifiable and traceable to the activity, product or service involved. The records must be stored and maintained in a manner so as to be readily retrievable and protected against damage, deterioration or loss. The organization must also establish and record retention times for records. Companies should take into account confidential business information in the records management process.

Effective use of information technology can make implementation of the standards easier and more systematic. Therefore, it may be sensible to create electronic environmental management systems to keep track of the vast amounts of environmental data generated.

3.6 Audits and Review

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3.6.1 Introduction

Audits are used to determine if a company is on the right track with regard to its EMS, while a review is used to get it back on track, if it is not. Audits and reviews differ in the sense that audits are not meant to review the EMS itself, even though auditors may provide recommendations if a prior agreement has been made with the client to do so. It is top management's responsibility to determine if corrective actions are needed (management review), using information gleaned from the audit, as well as other sources.

3.6.2 EMS Audit

An audit is defined as „a systematic, documented, periodic and objective evaluation of the performance of the organization, management system and processes designed to protect the environment“ [EMAS]. The information gathered during an audit will be used for verifying the organization's management system and environmental statement (the latter is compulsory for EMAS only). Therefore, it is important to allocate sufficient time and resources for an audit to achieve its objectives.

The purpose of carrying out an audit, according to EMAS, is to help management control all the work practices which have an effect on the environment and to assess how far the company is complying with its own environmental policies [EMAS]. However, ISO 14011 (EMS audit), focuses on determining the existence and proper functioning of the management system elements, not on whether specific performance complies with legal or other requirements. Apart from the main objective of determining conformance to EMS criteria, an EMS audit can meet several other objectives, including [TIBOR/FELDMAN 1996]:

- ▶ Determining whether the EMS is properly implemented and maintained.
- ▶ Identifying areas for potential improvement of the EMS.
- ▶ Assessing the capability of the internal management review process to ensure the continuing suitability and effectiveness of the EMS.
- ▶ Evaluating the EMS as part of a potential contractual relationship.

Audits can be carried out by both internal personnel and/or by external parties selected by the organization. In either case, the auditor(s) should be independent, impartial,

objective and properly trained. As expertise is needed from various fields, audits are generally carried out by teams. The audit team should be independent of the site audited, as any external verifier would require that this condition be met.

The audit should have a clearly defined scope, as determined by the lead auditor and the client (the person for whom the audit is carried out). The auditee should also be consulted. In the scope, describe the extent of the audit and set the boundaries (i.e. which site(s), which activities, how the results are reported). Before embarking on the audit, prepare a list of all the activities and subjects to be covered (see EMAS checklists 16 and 17 for a list of issues and objectives). To avoid confusion, make sure that any subsequent changes are agreed to by the lead auditor and the client (auditee).

Except for EMAS, none of the other standards specify the frequency of audits. EMAS requires that an audit should be carried out at least once every three years. However, it is useful to establish an audit cycle, to ensure that audits of the most significant activities (e.g. treatment of effluents and hazardous waste) are carried out more frequently than activities that have very little environmental effect.

Senior management should be presented with a report of the audit, once it is completed. The report should outline the scope of the audit and provide management with information on the state of compliance with the company's environmental policy and the environmental progress at the site. It should also include information on the effectiveness and reliability of the arrangements for monitoring environmental impacts at the site. While the responsibility for initiating corrective action is up to top management (determined after the review), the need for corrective action, where appropriate, should be demonstrated in the audit report.

3.6.3 Management Review

Based on the audit findings, management should conduct a review to assess the continuing suitability, adequacy and effectiveness of the EMS. The review should be broad enough in scope to address the environmental dimensions of all activities, products or services of the organization, including their impact on financial performance and possibly competitive position. Not all components of the EMS need to be reviewed at once, but can be reviewed collectively over a period of time. Also, reviews of policies, objectives and procedures should be carried out by the level of management who defined them.

The review process should include [ISO 14004]:

- ▶ review of environmental objectives and targets,
- ▶ findings of the EMS audits,

- ▶ an evaluation of its effectiveness and
- ▶ an evaluation of the suitability of the environmental policy and the need for changes in light of:
 - ▶ changing legislation,
 - ▶ changing expectations and requirements of interested parties,
 - ▶ changes in the products or activities of the organization,
 - ▶ advances in science and technology,
 - ▶ lessons learned from environmental accidents,
 - ▶ market preferences,
 - ▶ reporting and communication.

Keeping in mind the commitment to continuous improvement, management should plan corrective and preventive action to improve the EMS. They should also make sure to follow up actions, to ensure that the actions were taken and were effective. In some cases, the management review may dictate changes in the environmental policy and thereby trigger changes in the EMS itself.

3.7 External Environmental Communication

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- ▶ Regular Communication with External Stakeholders..... 60
- ▶ Environmental Reporting 61

3.7.1 Introduction

Environmental reports are rapidly becoming a primary channel for a company's environmental communications. They are a way of providing documented evidence of the environmental challenges a company faces and its efforts to manage them. In environmental reporting, three things should be kept in mind; what needs to be said, to whom and how. Even though environmental reports can be used for both internal and external communication, the focus here is on the latter.

3.7.2 Regular Communication with External Stakeholders

External stakeholders include shareholders, legislators and regulators, employees, local communities, suppliers, customers and consumers, environmental groups, financial analysts, bankers, insurers etc. Regular communication with external stakeholders is vital for attracting capital, maintaining a favorable public image,

gaining market share and attracting and retaining the best employees, among other things.

3.7.3 Environmental Reporting

There are no rules on the frequency of disclosure in environmental reporting. However, both EMAS and financial groups require annual disclosure. Hence, annual reporting may be a good idea. Also, if environmental reports are issued at the same time and with the same regularity as financial reports, they can be tailored to supplement one another.

A comprehensive external environmental report is only compulsory if an organization chooses to comply with EMAS. Neither ISO 14001 nor BS 7750 requires an environmental report (see chapter 5.2 on page 68 for a comparison). Nevertheless, compiling an environmental report is good management practice and is often required by external stakeholders (e.g. shareholders, financial analysts).

3.7.3.1 Content of an Environmental Report

An environmental report covers the following topics [EMAS]:

- ▶ Environmental policy
- ▶ Environmental strategy
- ▶ Description of the EMS components
- ▶ Policy regarding environmental aspects related to products and services
- ▶ Listing of all inputs (material and energy) and outputs (air pollution, sewage, waste) over the respective period of time (environmental effects register)
- ▶ Assessment of compliance with environmental regulations (environmental regulations register)
- ▶ Evaluation of environmental performance
- ▶ Description of the environmental management programs including objectives, targets, measures and schedule
- ▶ Relationships with external stakeholders
- ▶ Audit report findings

3.7.3.2 Linking Environmental with Financial Reporting

Not mentioned in any of the EMS standards, but nevertheless important, is a communication strategy that takes into account the interests of financial stakeholders like shareholders, banks, insurers and financial analysts [for an EMS concept from the financial analyst's perspective see EFFAS 1994]. Management must show that the chosen environmental strategy is efficient and

effective and is creating shareholder value. An environmental strategy that does not create future free cash flow is economically unsustainable.

The disclosure of environmental performance should ideally conform to the main qualitative criteria used in financial reporting. These criteria are [IAS 1991]:

- ▶ **Understandability:**
The language should be simple with technical matters banished to appendices.
- ▶ **Relevance:**
The information should be central to the users' decision-making, including confirming past evaluation or predicting future behavior of the entity.
- ▶ **Reliability:**
Measurement and presentation should be free from material error or bias and should closely represent what it is supposed to represent.
- ▶ **Comparability:**
The information presented should be comparable over time and across companies. This includes informing the user of methods used in measuring and presenting the information.

3.7.3.3 The Structure of an Environmental Report

As a supplementary document to financial reports, environmental reports should follow the format and structure of a financial report as closely as possible. This facilitates reading and will make it easier to combine the two reports, once financial and accounting standards are revised to incorporate environmental costs and benefits. A useful structure for this is given by Holmark [HOLMARK 1995, modified]:

1. **Contextual environmental issues**
 1. Type of industry
 2. Company profile and history
 3. Type of environmental effects of the industry and in the product life cycle
 4. Other contextual environmental information
2. **Environmental management report**
 1. Environmental policy
 2. Environmental objectives and targets
 3. Environmental programs
 4. Environmental management system
 5. Environmental insurance

- 3. Environmental accounting policies**
 1. Definition of terms
 2. Financial environmental performance measurement principles
 3. Physical environmental performance measurement principles
 4. Legal environmental performance measurement principles

- 4. Financial environmental data and performance**
 1. Environmental costs
 2. Environmental benefits
 3. Environmental investments
 4. Environmental liabilities
 5. Cost-benefit and risk assessment

- 5. Physical environmental performance**

(environmental effects register and assessment)

 1. Inputs
 2. Outputs
 3. Risk, incidents, corrective and preventive actions

- 6. Legal environmental performance**

(environmental regulations register and assessment)

 1. Relevant regulations
 2. Changes in regulations and adoption by the organization
 3. Compliance status (legal performance)
 4. Non-Conformance, corrective and preventive actions

- 7. Notes**
- 8. Environmental verification statement**

For some innovative environmental reporting practices see the examples in appendix 6 of the paper about corporate environmental reporting [UNEP 1994].

4 Outlook

A gradual move towards sustainable development is likely to push environmental management to the forefront of company activities by the next century. This has already taken place to a large extent in most developed nations. Furthermore, even newly industrializing countries are showing signs of jumping on the bandwagon, by increasingly incorporating environmental issues into economic activities. In fact, some of the fastest growing environmental markets are in developing and newly industrialized countries [Asia Environmental Business Journal 1995].

Environmental Management standards are indications of the trend towards sustainable growth. The most important standard is ISO 14001. This is the first international environmental management standard of its kind. While the World Trade Organization (WTO) is expected to remove trade barriers, the emergence of environmental standards is likely to form non-tariff trade barriers. For instance, EMAS, possibly the most stringent standard among the three, requires compliance from its suppliers. This could be a difficult task for organizations with no site in the European Union.

Environmental Management Systems provide a systematic way of achieving sustainable growth from a company's perspective. Despite the voluntary nature of these standards, regulatory and competitive pressures continue to play a large role in the drive towards adopting and implementing EMS. Also, the realization that piece-meal solutions can only go so far in appeasing environmentally related concerns, has increased interest in integrated solutions or EMS.

5 Appendix

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5.1 Standards and Guidelines in the ISO 14000 Series

Note: The ISO 14000 Series is still under development. The technical committee TC 207 is supervising and developing the ISO 14000 Series. The secretariat of TC 207 is held by the Standards Council of Canada (SCC). Each standard undergoes different stages:

- ▶ Preliminary Work Item (PWI)
- ▶ New Work Item (NWI)
- ▶ Working Draft (WD)
- ▶ Committee Draft (CD)
- ▶ Draft International Standard (DIS)

Please contact SCC or ISO to receive an update on the status of each standard (for contact information see page 85). As of this writing (March 1997), ISO 14001, 14004, 14010, 14011 and 14012 are final.

These standards can be classified into four groups according to their focus:

- ▶ Organization and systems standards
- ▶ Evaluation and auditing standards
- ▶ Product-oriented standards
- ▶ Definition standards

5.1.1 Organization and Systems Standards

- ▶ ISO 14001 Environmental Management Systems - Specification and Guidance for Use
- ▶ ISO 14004 Environmental Management Systems - General Guidelines on Principles, Systems and Supporting Techniques

5.1.2 Evaluation and Auditing Standards

- ▶ ISO 14010 Guidelines for Environmental Auditing - General Principles
- ▶ ISO 14011 Guidelines for Environmental Auditing - Audit Procedures - Auditing of Environmental Management Systems
- ▶ ISO 14012 Guidelines for Environmental Auditing - Qualification Criteria for Environmental Auditors
- ▶ ISO 14013 Management of Environmental Audit Programs
- ▶ ISO 14014 Initial Reviews
- ▶ ISO 14015 Environmental Site Assessments
- ▶ ISO 14031 Evaluation of Environmental Performance

5.1.3 Product-Oriented Standards

- ▶ ISO 14020 Goals and Principles of all Environmental Labeling
- ▶ ISO 14021 Environmental Labeling - Self Declaration Environmental Claims - Terms and Definitions
- ▶ ISO 14022 Environmental Labeling - Symbols
- ▶ ISO 14023 Environmental Labeling - Testing and Verification Methodologies
- ▶ ISO 14024 Environmental Labeling - Guiding Principles, Practices and Criteria for Multiple Criteria-based Practitioner Programs (type I)- Guide to Certification Procedures
- ▶ ISO 1402X Type III Labeling
- ▶ ISO 14040 Life Cycle Assessment - Principles and Guidelines
- ▶ ISO 14041 Life Cycle Assessment - Life Cycle Inventory Analysis
- ▶ ISO 14042 Life Cycle Assessment - Impact Assessment
- ▶ ISO 14043 Life Cycle Assessment - Interpretation
- ▶ ISO 14060 Guide for the Inclusion of Environmental Aspects in Product Standards

5.1.4 Definition Standards

- ▶ ISO 14050 Terms and Definitions - Guide to the Principles for ISO/TC 207/SC Terminology Work

5.2 Comparison of EMS Standards: Differences and Similarities between ISO 14001, BS 7750 and EMAS

Both ISO 14001 and EMAS are based on BS 7750. However, there are some fundamental differences among these standards, especially between ISO 14001 and the other two standards [ENDS 1995]. ISO 14001 is an international standard, while EMAS and BS 7750 are regional standards. Generally speaking, ISO is the weakest standard while EMAS has the most stringent requirements. BS 7750 and EMAS are quite similar except for the EMAS requirement for a public environmental statement. A closer look at the details of the standards shows the following differences:

- ▶ **Scope:**
BS 7750 and EMAS apply to a single site, while EMAS generally relates to industrial activities. ISO 14001 may apply to only part of a site; for example, a single operating unit, and it includes non-industrial activities, such as government activities.
- ▶ **Environmental Aspects:**
ISO 14001 requires only the identification of significant environmental aspects associated with on-site activities. By contrast, EMAS and BS 7750 basically require a full inventory of environmental aspects linked to on-site activities. With BS 7750, an additional examination and assessment of environmental effects caused by products and services is also required.
- ▶ **Continuous Improvement:**
BS 7750 and EMAS require an improvement of environmental impacts, whereas ISO 14001 emphasizes the improvement of the EMS as a means of reducing environmental impacts.
- ▶ **Objectives:**
BS 7750 and EMAS require time-scaled environmental objectives. ISO 14001 asks only that the environmental management programs have a timeframe.
- ▶ **Contractors and Suppliers:**
ISO 14001 does not refer to the environmental performance/assessment of contractors or suppliers. It asks only that a company communicate its environmental policy to suppliers and contractors. In contrast, EMAS and BS 7750 direct an organization to ensure that suppliers and contractors comply with the organization's environmental policy.

- ▶ **Documentation:**
ISO 14001 requires documentation of the environmental policy, objectives, staff responsibilities, communication with external interested parties and several other procedures. ISO 14001 requires identification of environmental aspects, but does not specifically require a register of environmental effects and regulations, like EMAS and BS 7750. Both EMAS and BS 7750 require records of the extent to which environmental objectives have been met.
- ▶ **Audits:**
EMAS stipulates that a company must carry out an audit at least every three years. ISO 14001 and BS 7750 do not specify a minimum audit interval. EMAS also requires more extensive auditing than ISO 14001, which requires only EMS auditing.
- ▶ **Initial Review:**
EMAS requires an extensive initial review as part of the EMS. ISO 14001 does not specifically require this, but it is suggested.
- ▶ **Communication:**
EMAS requires a comprehensive public environmental statement that is externally verified by an independent auditor and a simplified annual statement. ISO 14001 and BS 7750 ask only that the environmental policy is publicized. BS 7750 and EMAS require that environmental objectives and targets are made public.

Table 17 lists the corresponding parts of each standard according to the structure of this handbook (which is based mainly on the ISO 14001 standard).

Correspondence between ISO 14001, EMAS and BS 7750				
Step	System Element	ISO 14001	EMAS	BS 7750
—	• Environmental Management System	4.0 General	Article 2.e, 3.a, Annex I.B	4.1
Step 1: Commitment and Env. Policy	• Environmental Policy	4.1	Article 3.a, Annex I.A, I.D	4.2
Step 2: Initial Environmental Review	• Initial Environmental Review	Annex A.4.2.1 (not mandatory but good practice)	Article 2.b, 3.b Annex I.C	Annex A.1.2 (not mandatory but good practice)
Step 3: Planning the Environmental Policy	• Environmental Aspects	4.2.1	Article 3.b, Annex I.B.3, I.C., I.D.2, I.D.3	4.4.2
	• Legal and other Requirements	4.2.2	Article 3.a, Annex I.B.3	4.4.3
	• Objectives and Targets	4.2.3	Article 2.d, 3.e, Annex I.A.4	4.5
	• Env. Management Programmes	4.2.4	Article 3.c, Annex I.A.5	4.6
Step 4: Implementing the Environmental Policy	• Structure and Responsibility	4.3.1	Annex I.A.5.a, I.B.2	4.3
	• Training, Awareness and Competence	4.3.2	Annex I.B.2	4.3.4
	• Internal Communication	4.3.3	Annex I.B.2	4.4.1, 4.9
	• EMS Documentation	4.3.4	Annex I.B.5, I.B. 4.a	4.7.1, 4.7
	• Document Control	4.3.5	Annex I.B	4.7.2
	• Operational Controls	4.3.6	Annex I.B.4, I.D.6-7	4.8
	• Emergency Preparedness and Response	4.3.7	Annex I.C.9	4.4.2
Step 5: Measurement and Evaluation	• Environmental Data Management	4.4.1	Annex I.B.3	4.4.3
	• Performance Evaluation	4.4.1	Annex I.B.3	4.4.3, 4.5
	• Non-Conformance, Corrective and Preventive Actions	4.4.2	Annex I.B.4	4.8.4
	• Records	4.4.3	Annex I.B.5	4.9
Step 6: Audit and Review	• EMS Audit	4.4.4	Article 3.d, 2.f, Annex I.B.6, II	4.10, 4.10.1, 4.10.2, 4.10.3
	• Management Review	4.5	Article 3d, Annex I.B.1	4.11
Step 7: Environmental Reporting	• Environmental Statement/Report	not required	Article 3.f, 3.g, 3.h, 5, Annex V	not required

Table 17: Correspondence Between ISO 14001, EMAS and BS 7750

5.3 Initial Environmental Review Questionnaire

5.3.1 Methodology

The questionnaire follows the ISO 14001 requirements with slight modifications (e.g. it includes external environmental reporting, which is not required by ISO 14001). There are six sections. Within each section a number of questions have to be answered with scores ranging from 0 (worst) to 3 (best). The score indicates the effort needed in terms of human and financial resources to meet the specific statement:

- ▶ 0 points: huge effort needed (= 0% compliance with the EMS requirements)
- ▶ 1 points: high effort needed
- ▶ 2 points: moderate effort needed
- ▶ 3 points: no effort needed (= 100% compliance with the EMS requirements)

Adding up the scores in each section and comparing them to the maximum possible score (= benchmark) gives a company-specific profile of strengths and weaknesses.

5.3.2 Questionnaire

- ▶ Module 1: Commitment and Environmental Policy page 72
- ▶ Module 3: Planning the Environmental Policy.....73
- ▶ Module 4: Implementing the Environmental Policy74
- ▶ Module 5: Measurement and Evaluation75
- ▶ Module 6: Audits and Review76
- ▶ Module 7: External Environmental Communication77

Company name:		Date:
Auditors name:		
EMS Module	Commitment and Environmental Policy	
EMS-Aspect	Issue	Assessment
Commitment	<ul style="list-style-type: none"> • Top management has made a commitment to address environmental issues related to the organization's activities, products and services. 	
Environmental Policy	<ul style="list-style-type: none"> • Top management has defined an environmental policy. • The environmental policy is appropriate to the nature, scale and environmental impacts of its activities, products and services. • The environmental policy includes a commitment to: <ul style="list-style-type: none"> a) prevent pollution. b) continuous improvement. c) comply with environmental regulations and other requirements to which the organization subscribes. • The environmental policy provides a framework for setting and reviewing environmental objectives and targets. • The environmental policy is documented and communicated to all employees. • The environmental policy is available to the public. 	
Total		
score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points	

Table 18: Initial Environmental Review Questionnaire for Modul 1

Company name:		Date:
Auditors name:		
EMS Module	Planning the Environmental Policy	
EMS-Aspect	Issue	Assessment
Environmental Aspects	<ul style="list-style-type: none"> The organization has established and maintained a procedure to identify the environmental aspects of its activities, products and services, in order to determine those which can have significant impacts on the environment. The organization has ensured that the aspects related to these significant impacts are considered in setting environmental objectives. The information about significant impacts and related aspects is up-to-date. 	
Legal and other Information	<ul style="list-style-type: none"> The organization has established and maintained a procedure to identify and have access to legal requirements directly applicable to the environmental aspects of its activities, products and services. The organization has established and maintained a procedure to identify and have access to other requirements to which the organization subscribes, directly applicable to the environmental aspects of its activities, products and services. 	
Environmental Objectives and Targets	<ul style="list-style-type: none"> The organization has established and maintained documented environmental objectives. The organization has established and maintained documented, and whenever possible, quantified environmental targets. The environmental objectives and targets are set for each relevant function and level within the organization. When establishing its objectives, the organization has considered legal and other requirements, its significant environmental aspects, its technological options and its financial, operational and business requirements and the views of interested parties. The environmental objectives and targets are consistent with the environmental policy and the required commitments. 	
Environmental Management Program(s)	<ul style="list-style-type: none"> The organization has established and maintained environmental management program(s) for achieving its environmental objectives and targets. The environmental management program(s) include responsibilities at each relevant function and organizational level. The environmental management program(s) include the means and timeframe by which they are to be achieved The organization has established a procedure to ensure that environmental aspects are included in projects relating to new developments of activities, products and services. 	
Total		
score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points	

Table 19: Initial Environmental Review Questionnaire for Modul 3

Company name:		Date:
Auditors name:		
EMS Module	Implementing the Environmental Policy	
EMS-Aspect	Issue	Assessment
Structure and Responsibility	<ul style="list-style-type: none"> The organization has defined, documented and communicated roles, responsibilities and authority. The organization has provided human and financial resources to implement and control the EMS. The organization has appointed a specific management representative who ensures that the EMS is in line with the EMS requirements and reports the performance to top management. 	
Training, Awareness and Competence	<ul style="list-style-type: none"> The organization has defined training needs for those personnel whose work may create a significant environmental impact. Personnel at each relevant function and level are aware of <ol style="list-style-type: none"> the importance of meeting the requirements of the EMS. the environmental impact of their work activities and the benefits to improve performance. their roles and responsibilities within the EMS. the potential consequences of departure from specific operating procedures. 	
Internal Communication	<ul style="list-style-type: none"> The organization has established and maintained a procedure for communicating between various levels and functions within the organization. 	
EMS Documentation	<ul style="list-style-type: none"> The organization has established and maintained information to describe the core elements of the EMS and their interaction. The organization has established and maintained information to provide direction to related documentation. 	
Document Control	<ul style="list-style-type: none"> The organization has established and maintained a procedure for controlling all EMS documents (properly filed, reviewed, up-to-date). Procedures and responsibility are established and maintained to create and modify documents. 	
Operational Control	<ul style="list-style-type: none"> The organization has identified those operations and activities that are associated with the identified significant environmental aspects. The organization has planned these activities (including maintenance) to ensure that they are carried out under specified conditions. 	
Emergency Preparedness and Response	<ul style="list-style-type: none"> The organization has established and maintained procedures to identify the potential for and response to accidents and emergency situations. The organization has tested these procedures and revised them after accidents. 	
Total		
score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points	

Table 20: Initial Environmental Review Questionnaire for Modul 4

Company name:		Date:
Auditors name:		
EMS Module	Measurements and Evaluation	
EMS-Aspect	Issue	Assessment
Environmental Data Management	<ul style="list-style-type: none"> The organization has established and maintained documented procedures to monitor and measure on a regular basis the key factors that can have a significant environmental impact. Monitoring equipment is calibrated and maintained. The organization has established and maintained information about relevant environmental regulations. 	
Performance Evaluation	<ul style="list-style-type: none"> The organization evaluates and documents performance related to its environmental objectives and targets. The organization evaluates and documents compliance with environmental regulations. 	
Corrective and Preventive Actions	<ul style="list-style-type: none"> The organization has established and maintained procedures for defining responsibility and authority for handling and investigating non-conformance and for initiating and completing corrective and preventive actions. The organization has established a procedure to implement and record any changes in the documented procedures resulting from corrective and preventive actions. 	
Records	<ul style="list-style-type: none"> The organization has established and maintained procedures for the identification, maintenance and disposition of environmental records, including training records and the results of audits and reviews. The environmental records are legible, identifiable and traceable to the activities, products and services involved. The environmental records are stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration or loss. 	
Total		

score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points
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Table 21: Initial Environmental Review Questionnaire for Modul 5

Company name:		Date:
Auditors name:		
EMS Module	Audits and Review	
EMS-Aspect	Issue	Assessment
EMS Audit	<ul style="list-style-type: none"> The organization has established and maintained procedures for periodic EMS audits to be carried out, in order to determine whether or not the EMS: <ul style="list-style-type: none"> a) conforms to planned arrangements for environmental management, including the requirements of the EMS standard. b) is properly implemented and maintained. The organization has established and maintained procedures for periodic EMS audits to be carried out, in order to provide information on the results of audits to management (including top management). The audit procedures cover the audit scope, frequency and methodologies as well as responsibilities and requirements for conducting the audit and reporting the results. 	
Management Review	<ul style="list-style-type: none"> The organization's top management reviews the EMS periodically to evaluate the suitability, adequacy and effectiveness of the EMS. The organization's top management reviews the EMS periodically to determine the necessity to implement changes to the EMS. The review is documented. 	
Total		
score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points	

Table 22: Initial Environmental Review Questionnaire for Modul 6

Company name:		Date:
Auditors name:		
EMS Module	External Environmental Communication	
EMS-Aspect	Issue	Assessment
Environmental Report	<ul style="list-style-type: none"> The organization publishes an external environmental report which covers the company's environmental policy, the objectives and targets, the environmental performance, the environmental management programs and the structure of the EMS. The environmental report is validated by external experts. 	
Continuous External Communication	<ul style="list-style-type: none"> The organization considers processes for external communication about its significant environmental aspects, and records its decision. The organization has established and maintained procedures to identify significant environmental aspects of goods and services used by the organization and has communicated relevant procedures and requirements to suppliers and contractors. The organization has established and maintained procedures to the identifiable significant environmental aspects of goods and services produced by the organization and communicated relevant procedures and requirements to customers. The organization has established and maintained procedures for receiving, documenting and responding to relevant communication from external interested parties. 	
Total		
score	Effort needed in terms of human and financial resources to comply with the EMS standard: huge: 0 points high: 1 point moderate: 2 points no effort: 3 points	

Table 23: Initial Environmental Review Questionnaire for Modul 7

5.4 Terms

Below is an alphabetical list of terms and definitions used in this handbook. The use of these terms and definitions varies largely from one author to another. The list below relies on definitions used by internationally recognized organizations (e.g. ISO, SCC, SETAC), environmental agencies (e.g. Environmental Protection Agency of the USA) or research reports of large groups of scientists and projects [e.g. SCHALTEGGER & KUBART 1995]. As long as „ISO 14050: Terms and Definitions“ is NOT finalized, environmental managers will have to deal with this terminology problem.

Abiotic Resources

Resources which are considered abiotic and therefore not renewable. Zinc ore and crude oil are examples of abiotic resources [HEIJUNGS et al. 1992].

Ancillary Material

Material that is not used directly in the formation of a product or service [SETAC 1991].

Auditing

See environmental management system audit.

Biotic Resources

Resources which are considered biotic and therefore renewable. The rainforests and tigers are examples of biotic resources [HEIJUNGS et al. 1992].

By-Product

A useful and marketable product or service that is not the primary product or service being produced [EPA 1993b]. See also co-product.

Certification

The procedure by which third party gives written assurance that a product, process, or service conforms to specific requirements [CASCO]. See also registration.

Characterization

Characterization aggregates classified environmental interventions/aspects within an environmental impact category [DE HAES/HOFSTETTER 1994]. This step results in environmental performance indicators.

Characterization Factor

A factor that describes the relative harmfulness of an environmental intervention within one environmental impact category. A factor is a result of modeling environmental effects/problems [HEIJUNGS et al. 1992].

Classification

Classification attributes are environmental interventions/aspects listed in an

environmental inventory/environmental effects register according to environmental impact categories [DE HAES/HOFSTETTER 1994].

Close-loop Recycling

A recycling system in which a product made from one type of material is recycled into a different type of product (e.g. used newspapers into toilet paper). The product receiving recycled material itself may or may not be recycled [EPA 1993b]. See also open-loop recycling.

Co-Product

A marketable by-product from a process that can technically not be avoided. This includes materials that may be traditionally defined as waste such as industrial scrap that is subsequently used as a raw material in a different manufacturing process [EPA 1993b].

Continuous Improvement

The process of enhancing an environmental management system to achieve improvements in overall environmental performance in line with an organization's environmental policy [ISO 14004].

Damage

A deterioration in the quality of the environment not directly attributable to depletion or pollution [HEIJUNGS et al. 1992].

Depletion

The result of the extraction of abiotic resources (non-renewable) from the environment or the extraction of biotic resources (renewable) faster than they can be renewed [HEIJUNGS et al. 1992].

Downcycling

See recycling.

Eco-Efficiency

The relationship between economic output (product, service, activity) and environmental impact added caused by production, consumption and disposal [SCHALTEGGER/STURM 1992].

Emission

One or more substances released to the water, air or soil in the natural environment [EPA 1993b]. See also environmental release, pollution and environmental intervention.

Environment

Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelations. This definition extends the view from a company focus to the global system [ISO 14004, BS 7750].

Environmental Aspects

Elements of an organization's activities, products or services which can interact

with the environment [ISO 14004]. A significant environmental aspect is an environmental aspect which has or can have a significant environmental impact [ISO 14004]. See also environmental interventions, environmental problem.

Environmental Effect

Any direct or indirect impingement of activities, products and services of an organization upon the environment, whether adverse or beneficial [BS 7750]. An environmental effect is the consequence of an environmental intervention in an environmental system [HEIJUNGS et al. 1992]. See also environmental impact, environmental problem.

Environmental Effects Evaluation

A documented evaluation of the environmental significance of the effect of an organization's activities, products and services (existing and planned) upon the environment [BS 7750].

Environmental Effects Register

A list of significant environmental effects, known or suspected, of an organization's activities, products and services upon the environment [BS 7750]. Also see environmental inventory.

Environmental Impact

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services [ISO 14004]. An environmental impact addresses an environmental problem. Also see environmental effect.

Environmental Impact Added

The total of all environmental interventions of a product or production system evaluated (weighted) according to the harmfulness of each intervention to the environment [SCHALTEGGER/KUBART 1995].

Environmental Intervention

Exchange between the economy and the environment including resource extraction, emissions to the air, water, or soil, and aspects of land use [DE HAES/HOFSTETTER 1994]. If resource extraction is excluded, the term used in this case is environmental release [EPA 1993b]. See also emission and pollution.

Environmental Inventory

An environmental inventory identifies and quantifies - where appropriate - all environmental aspects of an organization's activities, products and services. Also see environmental effects register.

Environmental Issue

A point or matter of discussion, debate, or dispute of an organization's environmental aspects.

Environmental Management

Those aspects of an overall management function (including planning) that determine and lead to implementation of an environmental policy [BS 7750]. See also environmental management system.

Environmental Management Audit

A systematic evaluation to determine whether an environmental management system and environmental performance comply with planned arrangements, and whether a system is implemented effectively, and is suitable to fulfill an organization's environmental policy [BS 7750].

Environmental Management Manual

The documentation describing the procedures for implementing an organization's environmental management program [BS 7750].

Environmental Management Program

A description of the means of achieving environmental objectives and targets [BS 7750].

Environmental Management Review

A formal evaluation by management of the status and adequacy of systems and procedures in relation to environmental issues, policy and regulations as well as new objectives resulting from changing circumstances [BS 7750].

Environmental Management System

The part of an overall management system which includes structure, planning activities, responsibilities, practices, procurements, processes and resources for developing, implementing, achieving, reviewing and maintaining an environmental policy [ISO 14004, BS 7750].

Environmental Management System Audit

A systematic and documented verification process to objectively obtain and evaluate evidence to determine whether an organization's environmental management system conforms to the environmental management system audit criteria set by the organization, and communication of the results of this process to management [ISO 14004].

Environmental Objectives

The overall environmental goal, arising from an environmental policy, that an organization sets itself to achieve, and which is quantified where practical [ISO 14004, BS 7750].

Environmental Performance

Measurable results (see environmental performance indicators/index) of an environmental management system, related to the control of its environmental aspects. Assessment of environmental performance is based on environmental policy, environmental objectives and environmental targets [ISO 14004].

Environmental Performance Index

A parameter describing environmental impact with a single figure. An index is usually calculated by weighting the actual impact level against a target level. Also see valuation.

Environmental Performance Indicators

Different parameters describing the potential impact of activities, products or services on the environment. These parameters are the result of characterizing classified environmental interventions/environmental aspects.

Environmental Policy

A statement by an organization of its intentions and principles in relation to its overall environmental performance. Environmental policy provides a framework for action and for the setting of its environmental objectives and target [ISO 14004]. BS 7750 defines the policy additionally as a public statement.

Environmental Problem

An environmental problem is a description of a known process within the environment or a state of the environment which has adverse effects on the sustainability of the environment including society [ISO 14004]. They include resource consumption and environmental impacts. See also environmental effects, environmental aspects.

Environmental Regulation Register

A list of regulations regarding environmental aspects of an organization. Also see environmental effects register and environmental inventory.

Environmental Release

See environmental interventions.

Environmental Target

A detailed performance requirement, quantified where practical, applicable to the organization or parts or combination thereof, that arises from environmental objectives and that must be set and met in order to achieve those environmental objectives [ISO 14004, BS 7750].

Environmental Strategy

A plan of action intended to accomplish a specific environmental objective.

Interested Party

Individuals or groups concerned with or affected by the environmental performance of an organization [ISO 14004, BS 7750]. Interested groups include those exercising statutory environmental control over an organization, local residents, an organization's investors, insurers, employees, customers and consumers, environmental interest groups and the general public [BS 7750].

Open-loop Recycling

A recycling system in which a particular mass of material (possible after

upgrading) is remanufactured into the same product (e.g. glass bottles into glass bottles) [EPA 1993b]. See also closed-loop recycling.

Organization

A company, corporation, firm, enterprise or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration. For organizations with more than one operating unit, a single operating unit may be defined as an organization [ISO 14004, BS 7750].

Pollution

Residual discharges of emissions to the air or water following application of emission control devices [EPA 1993b]. See also environmental release and environmental intervention.

Primary Product

The product or service which is the strategic focus of an organization. See also by-product and co-product.

Prevention of Pollution

The use of processes, practices, methods or products that avoid, reduce or control pollution. These may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution [ISO 14004].

Recycling

The process of re-using material for the production of new goods or services on the same quality level. If the quality of the goods and services produced with recycled material is lower, then the process is known as downcycling [SCHALTEGGER/KUBART 1995]. See also close-loop recycling and open-loop recycling.

Registration

The procedure by which an organization indicates relevant characteristics of a product, process or service, or particulars of an organization or person, and then includes or registers the product, process, or service in an appropriate publicly available list [CASCO]. See also certification.

Resources

Materials found in the environment that can be extracted from the environment in an economic process. There are abiotic resources (non-renewable) and biotic resources (renewable) [HEIJUNGS et al. 1992].

Reuse

The additional use of a component, part, or product after it has been removed from a clearly defined service cycle. Reuse does not include reformation. However, cleaning, repair, or refurbishing may be done between uses [EPA 1993a].

Solid Waste

Solid products or materials disposed of in landfills, incinerated or composted [EPA 1993b]. See also waste.

System

A collection of operations that perform a desired function [RTI 1993].

Valuation

The process of weighting characterized environmental interventions against each other in a quantitative and/or qualitative way. This process results in an environmental performance index [DE HAES/HOFSTETTER 1994].

Verification Activities

All inspection, test and monitoring work related to environmental management [BS 7750].

Waste

An output with no marketable value that is discharged to the environment [SETAC 1991]. Normally the term „waste“ refers to solid or liquid materials.

Waterborne Waste

Discharge to water of pollutants [EPA 1993b].

5.5 References

5.5.1 World Wide Web Sites and Addresses

World Wide Web sites and addresses of organizations mentioned in this guide:

- ▶ **EPA** (Environmental Protection Agency):
World Wide Web: www.epa.gov

- ▶ **BSI** (British Standards Institution):
British Standards Institution
389 Chiswick High Road
London W4 4AL
Great Britain
Phone: (+ 44 181) 9969000
Fax: (+ 44 181) 9967400
World Wide Web: www.bsi.org.uk
Email: info@bsi.org.uk

- ▶ **ISO** (International Organization for Standardization):
ISO
1, rue de Varembe
Case postale 56
1211 Genève 20
Switzerland
Phone: (+ 41 22) 7490111
Fax: (+ 41 22) 7333430
World Wide Web: www.iso.ch
Email: central@isocs.iso.ch

- ▶ **SCC** (Standards Council of Canada):
Standards Council of Canada
Communications division
1200-45 O'Connor Street
Ottawa, Ontario K1P 6N7
Canada
Phone: (+ 613) 238-3222
Fax: (+ 613) 995-4564
World Wide Web: www.scc.ca
E-mail: info@scc.ca

- ▶ **SETAC** (Society of Environmental Toxicology and Chemistry).
SETAC Foundation Office
1010 North 12th Avenue
Pensacola, FL 32501
USA
Phone: (+01 904) 4691500
Fax: (+01 904) 4699778
World Wide Web: www.setac.org
E-mail: setac@setac.org

- ▶ **TBCSD** (Thai Business Council for Sustainable Development):
TBCSD Secretariat at TEI
World Wide Web: www.tei.or.th/bep/tbcSD/tbcSD.cfm
E-mail: TBCSD@tei.or.th

- ▶ **TEI** (Thailand Environmental Institute)
 Thailand Environment Institute
 210 Sukhumvit Soi 64
 Bangchak Refinery, Building 4
 Prakanong, Bangkok 10260
 Thailand
 Phone: (+66 2) 3310047
 Fax: (+66 2) 3324873
 World Wide Web: www.tei.or.th
 Email: info@tei.org.th

5.5.2 Literature

Literature used in this handbook:

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- ▶ COPELAND 1990: Valuation: Measuring and Managing the Value of Companies. John Wiley & Sons.
- ▶ DE HAES/HOFSTETTER 1994: Definitions of Terms. Paper prepared for the Workshop of the SETAC Working Group on Impact Assessment, Zuerich 8-9 July 1994. EFFAS 1994
- ▶ Environmental Reporting & Disclosures, The European Federation of Financial Analysts' Societies, by Kaspar Müller, Javier de Frutos, Klaus-Ulrich Schuessel, Hugo Haarbosch
- ▶ EMAS: Council Regulation (EEC) No 1836/93 of 29 June 1993 Allowing Voluntary Participation by Companies in the Industrial Sector in a Community Eco-management and Audit Scheme
- ▶ EPA 1993a: Life-Cycle Assessment: Inventory Guidelines and Principles. Cincinnati: Environmental Protection Agency.
- ▶ EPA 1993b: Life-Cycle Design: Guidance Manual. Cincinnati: Environmental Protection Agency.
- ▶ ENDS 1995: Final ISO Draft still weaker than BS 7750 and EMAS, Environmental Data Service (ENDS) Report.
- ▶ HEIJUNGS et al. 1992: Environmental Life-Cycle Assessment of Products. Guide. Leiden (NL): Centrum voor Milieukunde.
- ▶ HILLARY 1994. The Eco-Management and Audit Scheme: A Practical Guide. UK: Stanley Thornes (Publishers) Ltd.
- ▶ HOLMARK et al. 1995: The Annual Environmental Report: Measuring and Reporting Environmental Performance. Copenhagen: Price Waterhouse.
- ▶ IAS 1991: International Accounting Standards. 2nd Edition. Volumes I & II. IAS no. 1-31. Copenhagen: FSRs Forlag.

- ▶ ISO 14001 Environmental Management Systems - Specification and Guidance for Use. 1996.
- ▶ ISO 14004 Environmental Management Systems - General Guidelines on Principles, Systems and Supporting Techniques. 1996.
- ▶ RAPPAPORT 1986: Creating sShareholder Value: The New Standard for Business Performance, New York: Free Press.
- ▶ MOHNDRUCK 1994: Umwelterklaerung und Oekobilanz - Geschaeftsjahr 1993/94. Mohndruck Graphische Betriebe GmbH. More Information about Environmental Management can be found at their Web-Site: www.bertelsmann.com/bag/deutsch/portrait/umwelt/umwelt_mohn.html.
- ▶ RTI 1993: Life-Cycle Assessment: Guidelines for Assessing Data Quality. Unpublished working paper.
- ▶ SCHALTEGGER/KUBART 1995: Das Handwoerterbuch der Oekobilanzierung. Begriffe und Definitionen. 2nd edition, Basel: WWZ 1995 (This handbook includes an english section).
- ▶ SCHALTEGGER/STURM 1992: Oekologieorientierte Entscheidungen in Unternehmen. Bern (CH): Paul Haupt (2nd edition 1994).
- ▶ STURM/SCHALTEGGER 1996: Eco-Controlling for Environmental Management: An Environmental Management Tool to Implement Current Environmental Management Standards (ISO 14001, BS 7750, EMAS), Bangkok: AIT. (www.ait.ac.th/AIT/som/as/ec/index.html)
- ▶ SETAC 1991: A Technical Framework for Life-Cycle Assessment. Washington DC: SETAC.
- ▶ TANEGA 1994: Eco-Management and Auditing: A Practical Guide to the EC Regulations, Bedford (UK): IFS International Ltd.
- ▶ TIBOR/FELDMAN 1996: ISO 14000, Chicago: Irwin Professional Publishing.
- ▶ UNEP 1994: Company Environmental Reporting: A Measure of the Progress of Business and Industry Towards Sustainable Development. Technical Report No. 24. ISBN 92-807-1413-9. UN Publication: UNEP/SustainAbility Ltd.
- ▶ WAGNER 1995: Environmentally-Induced Costs. Working Material. Environmental Management. Augsburg (Germany): University of Augsburg.

5.6 Remarks

The shareholder value of a company is calculated on the basis of future free cash flows.

The free cash flow over a period of time is calculated as follows:

$$\begin{aligned}
 & \text{Earnings before Interest and Taxes (EBIT)} \\
 & - \text{Taxes} \\
 & + \text{Depreciation} \\
 +/- & \text{ Incremental Working Capital Investment} \\
 +/- & \text{ Incremental Fixed Capital Investment} \\
 = & \text{Free Cash Flow (FCF)}
 \end{aligned}$$

Future free cash flows are then discounted by the weighted average cost of capital „WACC“ (interest on debt and equity) to obtain present values. The sum of all discounted free cash flows is equal to corporate value (CV). It can be used to pay either debtors or shareholders. Therefore, subtracting debts from corporate value results in shareholder value (SV) [RAPPAPORT 1986].

- ▶ Negative incremental fixed or working capital investments are not covered by depreciation. If the value is positive, investment is lower than depreciation.
- ▶ Depreciation is an allowance made for a loss in the value of property. It is a non-cash expenditure.

6 About the Authors

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