11 – Background Material

11 Textbook: From Cleaner Production to Environmental Management Systems

11.1 Introduction

11.1.1 From cleaner production to environmental management systems

Cleaner production programmes and environmental management systems according to ISO 14001:2004 have common objectives:

Cleaner production aims at preventing pollution by reducing the use of energy, water and material resources. Through this approach waste and emissions are minimized without reducing profitability or production capacity. Cleaner production involves rethinking conventional methods to design "smarter" products and more efficient production processes.

Traditional environmental protection focuses on the treatment of waste and emissions once they have been generated. Treatment and disposal generally only address the symptoms of an inefficient process. Waste is often an indicator that money is being lost unnecessarily.

The goal of cleaner production is to avoid pollution in the first place, which often results in lower costs, reduced risks and the identification of new opportunities. Cleaner production aims at reducing waste and inefficiencies at the source and can help to optimize processes, products and services.

Cleaner production provides an integrated approach aiming at both economic development and environmental protection, while at the same time improving workers' health and safety. An additional benefit is more transparent communication with employees and customers, and as a consequence, new business opportunities.

ISO 14001:2004 requires the introduction of an effective management system by creating a Plan-Do-Check-Act cycle for continuous improvement of the environmental performance of a business. The elements of the Plan-Do-Check-Act cycle are defined in Figure 1 on the next page.

Plan-Do-Check-Act management cycle

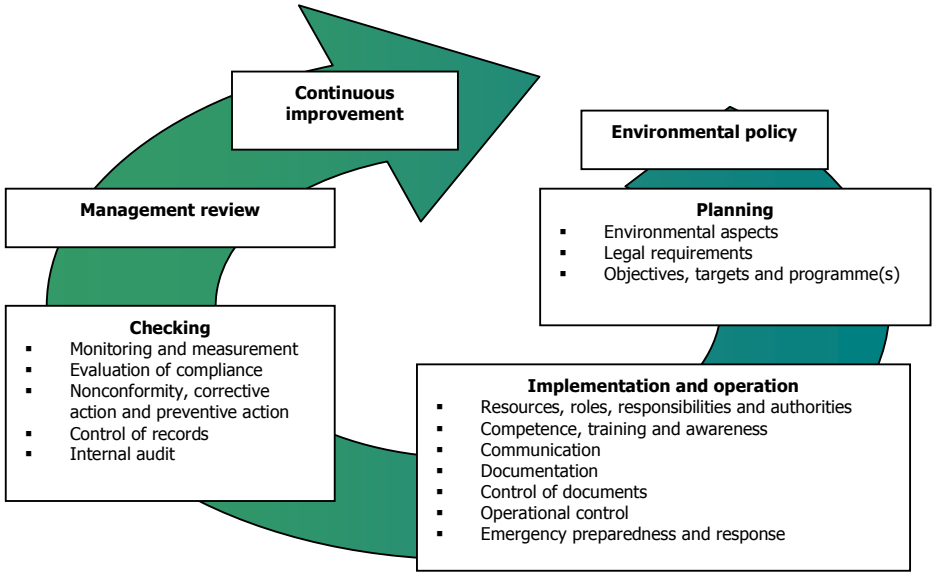

Figure 1: Plan-Do-Check-Act management cycle according to ISO 14001:2004

Plan-Do-Check-Act approach

The Plan-Do-Check-Act approach consists of the following steps:

- **Plan:** The objectives and processes are defined in accordance with the environmental policy of a company.
- **Do:** The processes are implemented.
- **Check**: The processes are monitored and measured against the environmental policy, objectives, goals, legal requirements and requirements from stakeholders. The results are reported.
- **Act:** Measures to continually improve the performance of the environmental management system are implemented.

Typically this process is carried out by an environmental team (see Volume 2 of the UNIDO Toolkit), lead by the environmental manager of the company (ISO 14001:2004 uses the term "environmental management representative" in this context).

The management system which can be certified according to ISO 14001:2004 can build on measures implemented in previous cleaner production programmes. Some new elements have to be introduced in addition to the work carried out during a cleaner production project.

Table 1 provides an overview of the measures implemented during a cleaner production project and the additional measures required for setting up an environmental management system according to ISO 14001:2004.

System comparison ISO 14001:2004/ cleaner production

Table 1: Overview – system comparison between ISO 14001:2004 and a cleaner production project

Environmental management system	CP
▪ Clear statement of support of the system by management	▪ Commitment of management to the CP project
▪ Comprehensive analysis of environmental aspects of the company (materials, technology and organization) including accidents	▪ Input-output analysis, material flow and energy analysis, treatment of hazardous materials
▪ Preparation of the environmental policy; approval and official declaration by the company	▪ Definition of the environmental policy
▪ Legal compliance audit (including register of relevant legislation and requirements from permits, etc.)	▪ Not covered in UNIDO CP Toolkit
▪ Environmental programme	▪ Environmental programme as in IPA assessment report (Volume 9)
▪ Implementation of concrete measures (technical, organizational)	▪ Implementation of concrete measures (technical, organizational)
▪ Involving the whole company	▪ Environmental team
▪ Preparation of an environmental management manual with documented procedures and working instructions	▪ Not covered in UNIDO CP Toolkit
▪ Training of auditors	▪ Not covered in UNIDO CP Toolkit
▪ Training of relevant employees and generation of awareness on environmental issues all over the company	▪ Training provided to environmental team during the CP project
▪ Internal audit (environmental policy, compliance with the programme and standards) and certification audit	▪ Not covered in UNIDO CP Toolkit
▪ Management review	▪ Not covered in UNIDO CP Toolkit

11.1.2 Elements of an environmental management system

EMS elements

The environmental management system controls interaction and documentation of all activities, responsibilities, tasks and procedures at both managerial and operational company level that have significant environmental impact.

The key elements of an environmental management system can be envisaged by the following questions:

- Environmental policy: Where do we want to go?
- Check of environmental impacts: Where are we?
- Environmental programme and goals: Where are we going?
- Environmental management system: How are we getting there?
- Environmental audit: Are we on the right track?

11.1.3 Benefits of an environmental management system for companies

Benefits of an EMS

Using the systematic approach of an environmental management system, significant benefits can be generated for the company as illustrated in Figure 2.

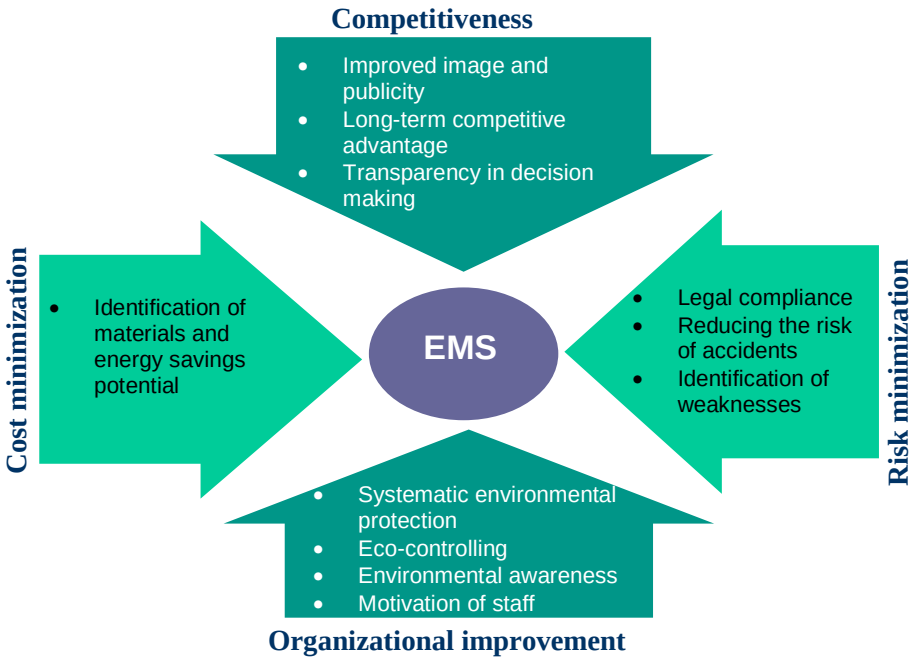

Figure 2: Overview of the benefits of an environmental management system

An outline of the benefits of an environmental management system is given below:

- **Systematic approach to the implementation of environmental measures**: Different environmental measures are integrated in a common framework, minimising inconsistencies and blind spots, and avoiding overlaps. Efficiency is improved as a result.
- **Motivation of employees**: Growing awareness and an increased sense of responsibility helps to foster employee motivation.

- **Risk prevention and reduced liability:** The environmental management system requires documentation of legal aspects, in particular regular monitoring of emissions and dangerous equipment. Documentation of responsibilities and procedures helps to prevent and control emissions by ensuring that regular checks are carried out, and that mitigation measures are in place. In case of an accident the documentation is valuable proof of good management practices which reduces liability.
- **Identification of cost saving potential:** The systematic analysis of environmental aspects helps to identify and realize cost saving potential.
- **Improved public image:** Certified reports on how a company mitigates its environmental impact, can improve its public image.
- **Improved competitiveness**: Companies with environmentally aware customers (multinational companies which have to document their environmental responsibility and corresponding resource allocation) need to have an environmental management system.
- **Improved cooperation with the authorities**: Authorities will exercise minimal intervention if a company can prove that an effective environmental management system is in place. Implementation of an environmental management system that corresponds to the size and nature of a company's activities is the proper way of dealing with environmental aspects. In this way the company shows that it is taking its environmental responsibilities seriously. If the environmental management system is certified, the company demonstrates its environmental performance transparently to its customers, the authorities and the public.
- **Contribution to the sustainable development of the company:** Reduced consumption of resources and increased environmental awareness of staff improves the economic viability of a company, and the quality of life of future generations.

11.2 ISO 14001:2004

The revised standard ISO 14001:2004 was published by the International Standardization Organization (ISO) on 1 January 2005.

Definition of ISO 14001:2004

The standard ISO 14001:2004 defines the requirements for an environmental management system, which provides companies with a framework for the control of the environmental impacts generated by their activities, products and services and helps them to continuously improve their environmental performance. ISO 14001:2004 is conceived as a guideline covering the individual elements of an environmental management system and their implementation.

ISO 14001:2004 defines the necessary outputs of an environmental management system:

- Compliance with all relevant legal requirements;
- Identification, documentation and regular control of objectives and programmes aimed at the continuous improvement of environmental aspects;
- Provision of relevant environmental information for the public.

Environmental aspect in the context of ISO 14001:2004 is defined as *"element of an organization's activities or products or services that can interact with the environment".* Environmental impact, on the other hand, refers to *"any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects".*

The term environmental management system (EMS) is comprehensive and includes the following elements:

- Environmental policy;
- Initial audit;
- Environmental programme;
- Internal audit;
- Certification audit.

A cleaner production project implemented according to the methodology described in the UNIDO Toolkit provides a basis for establishing an environmental management system which contributes effectively to the reduction of the environmental impacts generated by company.

11.2.1 Objectives of ISO 14001:2004

Objectives of ISO 14001:2004

In accordance with ISO 14001:2004, a company shall establish a procedure which describes and analyses environmental impacts resulting from the company's activities in a comprehensive way and take effective action to improve and control them.

ISO 14001:2004 restricts the scope of environmental aspects to those which can be controlled by a company. The definition of environment according to ISO 14001:2004 is extensive: *"Surroundings in which an*

organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation. Surroundings in this context extend from within an organization to the global system".

Thereby the standard specifies that the whole life cycle of a product should be considered, if this is feasible for a company. The goal is to meet relevant legal requirements and continuously improve the environmental aspects. The most important aspect of ISO 14001:2004 is continuous improvement.

11.2.2 Structure of ISO 14001:2004

Structure of ISO 14001:2004

ISO 14001:2004 consists of four chapters and two appendixes A and B.

11.2.2.1 Chapter 1: Scope

Scope

Chapter 1 defines the scope of this international standard which is applicable to any type of organization regardless of sector, production site or organizational type. The application of the standard comprises the following measures:

a) Establishment, implementation, maintenance and improvement of an environmental management system;

b) Conformity with the defined environmental policy;

c) Demonstrating conformity with the standard by:

1) making a self-determination and self-declaration, or

2) seeking confirmation of its conformance by parties having an interest in the organization, such as customers, or

3) seeking confirmation of its self-declaration by a party external to the organization, or

4) seeking certification/registration of its environmental management system by an external organization.

11.2.2.2 Chapter 2: Normative references

Normative references

Chapter 2 was only included to maintain the same structure as in the previous editions.

"No normative references are cited. This clause is included in order to retain clause numbering, identical with the previous edition (ISO 14001:1996)".

11.2.2.3 Chapter 3: Terms

Terms

Chapter 3 provides definitions of approximately 20 terms which are relevant to the application of the standard (not included in this manual).

11.2.2.4 Chapter 4: Requirements for an environmental management system

Requirements for an EMS

In chapter 4 the structure of an environmental management system is explained in detail. The following summary provides an overview of the framework whereas further details are explained in chapter 11-3 of this textbook. The structure reflects the Plan-Do-Check-Act cycle represented in Figure 1.

4.1 ***General Requirements***
4.2 ***Environmental policy***
4.3 ***Planning***
4.3.1 Environmental aspects
4.3.2 Legal and other requirements
4.3.3 Objectives, targets and programme(s)
4.4 ***Implementation and operation***
4.4.1 Resources, roles, responsibility and authority
4.4.2 Competence, training and awareness
4.4.3 Communication
4.4.4 Documentation
4.4.5 Control of documents
4.4.6 Operational control
4.4.7 Emergency preparedness and response
4.5 ***Checking***
4.5.1 Monitoring and measurement
4.5.2 Evaluation of compliance
4.5.3 Nonconformity, corrective action and preventive action
4.5.4 Control of records
4.5.5 Internal audit
4.6 ***Management review***

11.2.2.5 Appendix A: Instruction for the application of the standard

Instruction for application

The text in this appendix facilitates the interpretation of the requirements for an environmental management system according to chapter 4.

11.2.2.6 Appendix B: Comparison between ISO 14001:2004 and the quality management system standard ISO 9001:2000

Comparison ISO 14001:2004 and ISO 9001:2000

In appendix B features that the two international standards ISO 14001:2004 and ISO 9001:2000 have in common are explained to prove that both systems can be applied by companies at the same time in a coordinated way.

11.3 Initial environmental review

11.3.1 Procedure of the initial environmental review

Procedure of an EMS

An EMS is based on a detailed evaluation of the environmental aspects of a company. This analysis is called the initial review.

The initial review analyses the environmental aspects and impacts of the company. An inventory of material and energy flows is drawn up to identify options which enable the company to reduce the environmental impact of wastewater and emissions. The technical equipment, processes and activities are analysed to determine possible risks of environmental accidents or incidents. A gap-analysis is carried out to establish whether the EMS meets the requirements of the standard as well as legal requirements. A work programme is drawn up to fill any gaps and reduce the environmental impact where feasible and economically viable.

The initial environmental review has the following objectives:

- Using a register of environmental aspects, collect all relevant data on material and energy flows specifying their volume, cost and risk;
- Evaluate the aspects according to their environmental importance;
- Define company-specific problems which have to be considered in the scope of the environmental policy;
- Set priorities for possible improvement.

11.3.2 Procedure of the initial environmental review

11.3.2.1 Assessment of environmental impacts

Assessment of environmental impacts

The environmental review is an evaluation tool, where the responsible employees analyse the specific aspects and develop ideas for new solutions and measures. It is important to take into account all possible impacts resulting from the activities, products or services of the company in order to ensure that all aspects are covered in the phase of the initial review.

The following table provides an overview of potential significant environmental impacts.

Table 2: List of possible environmental impacts

Impact location	Environmental impact	Substances/influences to be considered
Atmosphere	Global warming Ozone layer Acidification of the environment Ground ozone Hazardous gases Smoke Radioactivity Heavy metals Dust Smog	CO_2, CN_4, N_2O, fossil fuels Freons, halones, other chlorinated substances SO_2, NO_X, NH_3 Volatile organic substances, NO_X Organoleptic gases Energy consumption
Water	Eutrophication Hazardous substances Dangerous organisms Heat pollution Radioactivity Sensory properties Influence on ground water Influence on subsequent water utilization Damage to eco-systems Movement of sediments	Substances containing N and P Crude oil substances, oxygen consumption, organic contamination, acidification, etc. Foam, colour, turbidity Contamination, lowering of the water table, etc. Industrial usage
Soil	Hazardous waste Radioactive waste Other waste Soil contamination Soil usage Soil erosion	 Sealing of land
Resources	Energies Raw materials Non-renewable/ exhaustible resources	
Other	Visual impact Dust Hygiene Odour Noise/vibrations	 Fumes, hazardous properties of materials

Evaluation of environmental aspects

As a company may have to take into account a great number of environmental aspects and associated impacts it is necessary to determine which aspects it considers significant. This evaluation of environmental aspects should be consistent with all the aspects being evaluated using the same criteria. Table 3 lists criteria for evaluating environmental aspects.

Table 3: Criteria for evaluation of environmental aspects (in view of their impacts)

Economic	Customer requirements Material costs Energy costs Possible economic savings
Social	Public opinion Public relations Complaints Concerns of employees Interest groups
Legal	Laws and regulations Permits Voluntary agreements
Technological	Customer requirements Substitution of toxic materials New technologies New products New energy sources Best available technologies
Ethical	Voluntary commitments

The following criteria are very often used:

- Impact on the environment under normal production conditions (threshold limit value, emission parameters, dangerous concentrations in water, high losses);
- Impacts due to high volumes;
- Possible impacts during different production conditions;
- Requirements of interested parties (clients, neighbours, environmental groups, society).

The criteria are evaluated using a traffic light scheme:

Red.....stands for the existence of a serious environmental problem and immediate need for action (this part has to be included in the programme);

Orange..stands for a medium-level environmental problem which requires medium-term action;

Green ...stands for low-level or no environmental problems based on current knowledge.

Although ISO 14001 does not specify any particular method of evaluation, the method chosen should be appropriate,

Table 4: Examples of criteria for assessment of environmental aspects

Significance of the environmental aspect – depending on the chemical properties of the substances and their volume.	**Evaluation**
The environmental impact always results in considerable or long-term damage.	Red
The environmental impact can result in damage.	Orange
There is either no considerable negative impact on the environment or no damage.	Green
Possible use of the CP methodology (based on material and energy balances)	**Evaluation**
There is a considerable potential for possible savings with a short payback period – the losses disclosed by the analysis are obvious.	Red
There is some potential for possible savings.	Orange
Our current knowledge does not indicate any potential for possible savings. The balances are part of the operation analysis and material flows are optimized.	Green
Possible breach of legal requirements (based on an evaluation of legal requirements)	**Evaluation**
Standard plant operation regularly results in violation of legal requirements.	Red
Emergency conditions may sometimes result in violation of legal requirements. Violations during standard operation are possible, but not frequent.	Orange
No violation of legal requirements can occur under any conditions.	Green
Waste disposal costs	**Evaluation**
High waste disposal costs	Red
Waste disposal requires simple corrective measures of a technical nature.	Orange
No apparent potential to reduce material losses by waste minimization.	Green

11.3.2.2 Assessment procedure

Procedure for carrying out an assessment

The following steps are followed:

- Site inspection;
- Material and energy analysis (including an assessment of potential measures to reduce resource consumption and minimize hazards by substitution of toxic materials);
- Gap analysis;
- Risk assessment;
- Legal compliance.

Objectives of the site inspection

The objectives of the site inspection (inspecting organizational units) are:

- Identifying sites significant for environmental management, i.e. those sites which have or might have some environmental impact;
- Compiling documents for the initial environmental review.

It is recommended that employees who do not work in that particular plant inspect the site together with the project manager. Alternatively the audit can be carried out by external specialists together with the person in charge of the plant.

During the site inspection, focus should be on the generation of waste, air emissions, noise and vibrations from machinery, the utilization of water and energy or other possible environmental aspects. In addition examine practices related to the operation of the plant should be examined.

The inspectors should determine the most serious environmental problems associated with the plant operation and draft possible solutions.

It is important to make notes of the facts collected during the inspection (use Worksheet 11-6 Map of emissions).

Goal of the site inspection

The goal of the site inspection is to:

- Identify environmental aspects and impacts of all technical equipment, processes and former activities;
- Analyse equipment and compare it to the best available technology (efficiency, losses);
- Analyse possible risks arising from use of equipment which could affect the environment.

The material and energy analysis aims at:

- Identifying material and energy losses due to inefficiencies; and
- Identifying toxic or environmentally harmful substances.

Carry out a material and energy analysis as described in Volumes 3 and 4 of the Toolkit starting with the Top 20 materials (Worksheet 11-3) and draw a scheme as illustrated in Figure 3.

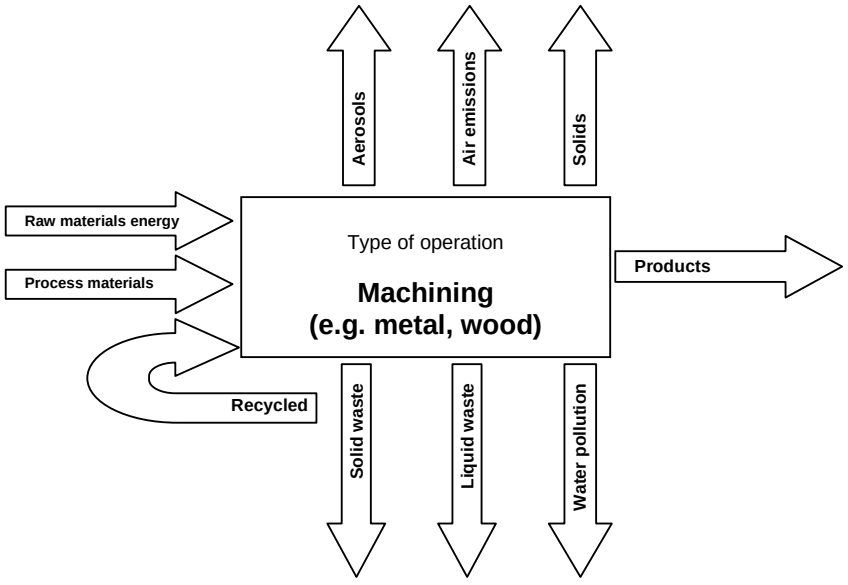

Figure 3: Balance scheme

Employees responsible for the individual operations and technology will compile the table of material consumption (input according to Worksheet 11-3 – Top 20 materials), and the table for products and emissions (output according to Worksheet 11-5 – Top 20 waste and emissions). Examples of assessments are shown in Table 5 and Table 6.

Input assessment

Table 5: Input assessment (see Volume 1)

No.	Material	Volume (kg)	Cost ($/kg)	Total cost ($)	Utilization	Percentage in the product
1	Aluminium	603 000	82	49 446	machining	89.6%
2	Steel	780 000	13	10 140	machining	92.9%
3	Cast iron	500 700	17	6 512	machining	81.5%
4	Resin	2 000	332	664	proofing	94%
5	Emulsion oil	7 200	93	670	machining emulsions	0%
6	Loctite 638	15	6 000	91	cementing parts	99%

Output assessment

Table 6: Output assessment (see Volume 1)

No.	Waste or emissions	Volume per year (kg)	Cost of raw materials ($)	Disposal costs ($)	Total expenses on waste ($)
1	Aluminium chips	90 950	7 457 900	- 985 950	6 471 950
2	Steel chips	69 270	900 510	- 77 101	823 409
3	Emulsion oils	59 000	365 050	175 560	540 610
4	Waste cast iron	42 530	510 360	- 58 205	452 155
5	Neutralizing sludge	11 500	155 244	34 500	189 744

The collection of data on relevant materials and emissions involves the following steps:

- Identifying substances whose handling, usage, manufacturing, transporting or disposal may have a negative impact on any environmental aspect;
- Identifying high losses (low percentage in product, high specific consumption in comparison with other companies); and
- Compiling toxic properties of materials used from their material safety data sheets.

Evaluation of material

The material safety data sheets are an important source of information on chemicals used. Chemicals should be evaluated in view of their toxicity and potential for replacement by less toxic materials. The information collected should be kept in an "Initial Environmental Review" file.

11.3.2.3 Gap analysis: Evaluation of responsibilities, existing procedures and documents related to environmental aspects

GAP analysis

The analysis of existing documents aims at:

- Identification of significant (existing) regulations and related responsibilities based on important environmental aspects;
- Verification of appropriate implementation of these documents;
- Determination of required amendments to documents and inclusion of missing responsibilities into the documents;

Execution:

- Check the functionality of the procedures in discussion with employees. Check if the documentation is really used in practice.
- Describe the shortcomings of the current documentation with reference to the standard ISO 14001.

The review of responsibilities and procedures aims at:

- Identifying significant responsibilities according to ISO 14001 (Table 7);
- Evaluating if and how the responsibilities are implemented in practice;
- Identifying the need for procedures and assigning the necessary responsibilities.

Procedures required by ISO 14001:2004

Table 7: Procedures required by ISO 14001:2004

Required procedures and responsibilities	Relevant document	Evaluation		Responsibility for the procedure	Evaluation		Comment
		Exist	Used		Exist	Used	
4.2 POLICY							
Development of an environmental policy							
Providing the policy to interested parties (internal, external)							
4.3 PLANNING							
4.3.1 Environmental aspects							
Identifying environmental aspects of the activity							
Identifying environmental aspects of the services							
Identifying environmental aspects of the products							
Updating the information							
4.3.2 Legal and other requirements							
Identifying legal requirements which are directly applicable to the environmental aspects of the activity							

Required procedures and responsibilities	Relevant document	Evaluation		Responsibility for the procedure	Evaluation		Comment
		Exist	Used		Exist	Used	
Identifying legal requirements which are directly applicable to the environmental aspects of the products							
Identifying legal requirements which are directly applicable to the environmental aspects of the services							
4.3.3 Objectives and targets							
Establishing and maintaining documented environmental objectives and targets							
4.3.4 Environmental programmes							
Establishing and maintaining documented environmental programmes for achieving objectives and targets							
Establishing and maintaining documented environmental programmes related to new activities, products or services							
4.4 IMPLEMENTATION AND OPERATION							
4.4.1 Structure and responsibilities							
Appointing representatives who ensure that EMS requirements are identified, implemented and maintained							
4.4.2 Training, awareness and expertise							
Informing all the employees about the EMS requirements and procedures in accordance with the environmental policy							
Informing all the employees about the significant impacts of the operations							
Informing all the employees about the tasks and responsibilities deriving from the EMS policy including incident plans and emergency instructions							
Informing all the employees about the possible consequences of ignoring the established plant procedures							
4.4.3 Communication							
Communication related to environmental aspects and EMS							
Receiving, documenting and responding to comments from external interested parties							
4.4.5 Control of documents							
All documents should be regularly reviewed, revised and approved by the authorized employees							
Their current version should be available at all sites where they are needed for the effective functioning of the EMS							

Required procedures and responsibilities	Relevant document	Evaluation		Responsibility for the procedure	Evaluation		Comment
		Exist	Used		Exist	Used	
The documents should be legible, dated (revision dates included), easily accessible, maintained and filed (in archives).							
Responsibilities should be assigned for drawing up and amending various types of documents							
4.4.6 Plant management							
Establishing and maintaining procedures concerning situations in which the absence of the procedures might result in a deviation from the environmental policy, objectives and targets							
Establishing criteria for these procedures							
Establishing and maintaining procedures to reduce environmental aspects of products and services.							
4.4.7 Dealing with incidents							
Identifying potential incident situations and incident risks and dealing with them appropriately							
Preventing and moderating the possible impact of incidents on the environment							
Reviewing and revising emergency plans							
4.5 SUPERVISION AND CORRECTIVE MEASURES							
4.5.1 Monitoring and measuring							
Regular monitoring and measuring of key plant characteristics and operations with potential significant environmental impact							
Calibration and maintenance of monitoring equipment							
Periodical evaluation of compliance with relevant laws and regulations on environmental protection							
4.5.2 Nonconformity, corrective and preventive measures							
Defining responsibilities and competencies required							
... For actions aimed at preventing and minimizing damage							
... For initiating and completing all corrective and preventive measures							
Recording the changes in the documented procedures based on corrective and preventive measures							

Required procedures and responsibilities	Relevant document	Evaluation		Responsibility for the procedure	Evaluation		Comment
		Exist	Used		Exist	Used	
4.5.3 Records							
Records should be filed and maintained in such a way as to be easily accessible. They should also be protected against possible damage or loss.							
Keeping the records which prove compliance with standard requirements							
4.5.4 EMS audit							
Carrying out periodical EMS audits							
Establishing the scope, frequency and methodology of the audit							
Responsibilities and requirements deriving from the audit							
Reporting the results							
4.6 MANAGEMENT REVIEW							
Regular review of the EMS by top management							
Management addresses possible need for changes of policy, objectives and other elements of the EMS							

11.3.2.4 Risk analysis

Risk analysis

Risk is determined by relevance and probability. High relevance and high probability generate significant risks (Figure 4). Table 8 provides data for the quantification of relevance, whereas Table 9 illustrates the measurement of occurrence.

Prevention must be the first focus. Only areas required to handle a possible incident are described here.

Risk assessment

Figure 4: Example of a risk assessment

Probability of occurrence

Relevance	1	2	3	4	5
1	1	2	3	4	5
2	**2**	**4**	**6**	**8**	**10**
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Unacceptable risk	A
High risk	B
Average/medium risk	C
Acceptable risk	D

Measurement of relevance

Table 8: Measurement of relevance

	To people	To the environment	Costs*
1. Small	No injuries No time losses	No harmful impact Only local influence	E.g. < 0.1% of turnover
2. Relevant	First aid	< limit, small scale, odour, pollution	< 0.5%
3. Significant	Unable to work for up to 14 days	> limit Confinable danger Unpleasant for whole working area	< 1%
4. Great	Unable to work for more than 14 days	> 10 x limit Non-confinable danger Unpleasant for whole working area	> 3%
5. Catastrophic	Invalidity Death	> 100 x limit External effect Plant shut down	> 5%

* These figures are not valid for all companies. Every company has to define its specific figures.

Measurement of the probability of occurrence

Table 9: Measurement of the probability of occurrence

Probability of risk occurrence	Frequency	Number of people or period of exposition	
1. Small	Less than once a year	< 10% of people	< 10% of work time
2. Low	Annually	< 35% of people	< 35% of work time
3 Possible	Monthly	< 60% of people	< 60% of work time
4. Significant	Weekly	< 80% of people	< 80% of work time
5. High	Daily	> 80% of people	> 80% of work time

For each risk the team must determine the probability of its occurrence and the extent of potential or actual losses. The resulting value determines the risk rating (A, B, C, D).

If the risk is unacceptable (A), the company must take equipment related to this risk out of service and develop measures to reduce the risk.

In case of high (B) or average/medium (C) risk, the aspects must be fully regulated and the responsible employees have to be trained. In the case of high (B) risk it is also crucial to draw up an emergency plan.

Risks of category (D) are considered acceptable.

11.3.2.5 Legal compliance

Legal compliance

The analysis should determine the legal requirements as well as other compliance requirements applicable. It should also outline the procedures to be adopted for the applicable requirements and the related environmental aspects.

The environmental team will draw up a list of requirements according to the following structure:

Table 10: Structure for analysis of requirements

Requirements	
1. Legal requirements • ***Air protection*** • ***Water protection*** • ***Waste management*** • ***Other (general environmental protection, workplace sanitary conditions/hygiene, noise, vibrations, etc.)***	➢ **Laws** ➢ **Regulations, requirements from permits** ➢ **Standards**
2. Customer requirements	
3. Suggestions and complaints from interested parties	

Legal requirements

Table 11: Example of legal compliance

No.	Plant	Obligation	Legal reference	Respon-sible	Checked	Next check
1	Wastewater treatment	Measure COD	Permit – Water – 1506/75	External specialist	Yes	30.12.2007
2	Wastewater treatment	Reporting of measure-ment	Permit – Water – 1506/75	Environ-mental manager	No	30.12.2007

11.3.3 Evaluating the information of the initial environmental review

Evaluation of the initial environmental review

It is very practical to integrate the first three parts of the initial review (material, energy, technical equipment, organization) into one register, especially for small and medium-sized enterprises. This overall register can also be used for prioritization of the evaluated environmental problems.

The register of legal requirements should not be included in this overall environmental register because the evaluated legal non-compliances should not be prioritized, but solved!

Priorities can be set by using the evaluation criteria given in Table 3. In practice economic parameters often determine the order of priorities. Thus the highest priority is often given to problems, where:

- High losses occur but only low investment is required;
- Responsibilities are not defined;
- Limits are exceeded;
- Clear non-compliance with ISO 14001.

11.4 Environmental policy, environmental objectives

11.4.1 Developing an environmental policy

Developing an environmental policy

The process of drafting and issuing an environmental policy is illustrated in Table 12.

Table 12: Steps for drafting and issuing an environmental policy

Step	Description
1. Analysing the requirements for the environmental policy	Evaluate the requirements of the standard EN ISO 14001. Check also other documents which might be relevant in this context (environmental policy of parent group or competitors).
2. Environmental policy proposal	Include the requirements into the environmental policy proposal, which has to be approved by management.
3. Identifying and evaluating aspects	Identify and evaluate environmental aspects.
4. Include significant aspects in the policy	The policy must clearly state the company's activities and their significant impacts.
5. Define environmental objectives	Discuss with heads of department whether the policy can be used as a basis for the definition of environmental objectives
6. Issuing the environmental policy	Management approves the final version of the policy draft; plan the communication with the public and the employees to familiarize them with the policy.

Communicating the environmental policy constitutes an important requirement of ISO 14001. To ensure effective communication, draw up an environmental management programme defining deadlines, responsibilities and channels of communication in accordance with the flowchart of the EMS implementation project. The training of employees is also a means of communicating the environmental policy as, among other things it focuses on raising environmental awareness.

11.5 Setting environmental targets and establishing an environmental programme

Setting environmental targets and establishing an environmental programme

In the analysis phase (initial environmental review, chapter 11-3) the important environmental aspects of the company were identified. Based on the environmental policy, chapter 11-4 shows the overall direction "where to go". To make this policy manageable for the different departments and responsible actors in the company, the top management sets environmental objectives.

As a next step detailed targets have to be derived from the overall environmental objectives. The way to achieve these targets is described in the environmental management programme. For instance, if the overall objective is to reduce the amount of wastewater by 20% in the next year, the programme will list different activities and related targets.

Environmental targets have to be defined to ensure that:

- All necessary resources are provided;
- Responsibilities are defined at all relevant levels;
- Continuous process improvement is maintained.

Worksheet 11-9 provides a template for the environmental programme.

11.6 Documentation

11.6.1 Remarks on documentation

Remarks on documentation

Documentation is necessary to describe and support the EMS. The EMS manual forms the basis of the company's EMS, and should therefore include all relevant operations and processes. It is a central point of reference for the implementation and maintenance of the overall system and acts as a signpost to other documents within the system. It is usually produced, maintained and controlled by the environmental management representative.

Try to keep the system as simple as possible. The more procedures you introduce, the more you will have to control, maintain and audit. Keep the manual short and use flowcharts where possible to reduce text (see template manual).

A simple way of creating an environmental manual is to follow the headings set out in a recognized standard such as ISO 14001. Under each heading, briefly describe your approach to a given element and indicate the location of supporting documentation.

The EMS manual, which can be either paper-based or in electronic format, describes how the EMS operates. It should include references to the location of:

- The company's environmental policy;
- A chart showing the company's organizational structure;
- A statement of the company's objectives and targets and its environmental improvement programme;
- The responsibilities and authorities of employees involved in the EMS, including the environmental management representative;
- Documented procedures for all processes and activities that have a significant potential impact on the environment.

To monitor and control the impacts that certain processes or materials may have on the environment, procedures should be defined and made available for easy reference at all times. These documented procedures, which should be easy to understand and updated when required, will ensure the smooth functioning of the EMS. The procedures should also be written with a view to increasing efficiency and minimizing waste. An overview of the necessary procedures is provided in Table 7.

Worksheet 11-12 provides a basic template for procedures. Use this worksheet to develop a format for your procedures. Examples for procedures are provided in the Examples section. Once you have written your procedures, examine them for possible measures to minimize waste and improve efficiency.

11.6.2 Documentation of selected elements

11.6.2.1 Operational control and record keeping

Operational control and record-keeping

The company needs to demonstrate conformity with the requirements of its environmental management system. Develop procedures to monitor and control this conformity, making sure that these procedures are available for easy reference at all times, e.g. as part of an existing quality system. These documented procedures, which should be easy to understand and updated when required, will ensure the smooth functioning of the EMS.

Procedures can be changed at any time to improve the integrity or ease of operation of the system. Any changes must be properly documented and controlled (i.e. obsolete documents should be removed and only current version made available). Employees should receive detailed instructions on how to carry out processes and activities which could have a significant environmental impact. The documentation should also indicate who is responsible for investigating and solving problems that occur either suddenly or over a period of time. The records will allow you to determine the performance achieved compared with the objectives and targets. The record-keeping system should be designed to comply with the requirements of any standard that the company may seek to fulfil.

11.6.2.2 Management of the EMS

Management of the EMS

Communication is a key factor in the development and success of an EMS. Extra meetings may be necessary during the early stages of the implementation process to provide sufficient time and to ensure that everyone is aware of their responsibilities. Once the EMS is functioning smoothly, these meetings can be integrated into other regular management meetings. Depending on the company's management system, meetings can be held weekly, monthly or as required. During the meetings minutes should be taken and properly filed along with any records.

Draw up an agenda for management meetings that allows time for discussing:

- Audit reports;
- Proposed schemes that need management approval;
- Issues of non-compliance;
- Other EMS issues.

11.6.2.3 Emergency planning

Emergency planning

Procedures for emergency planning are an important element of the EMS and are essential for external certification/verification. Most companies already have health and safety procedures for emergencies and it may be relatively simple to include environmental emergency requirements in these procedures. Setting up procedures for emergency planning involves the following steps:

- Identify the potential for accidents and emergencies and define appropriate responses.
- Carry out a risk assessment of all environmental aspects to evaluate the potential for pollution arising from an accident or emergency.
- Manage identified risks to prevent or reduce the likelihood of pollution.
- Consult the emergency services and involve them in any plan which is drawn up.

External certification/verification requires evidence of emergency procedures designed to protect watercourses, groundwater, storm water drains and the atmosphere from pollution during an incident. In addition the company needs to demonstrate that it has tested these procedures through a drill, a desk exercise simulating the situation or a full-scale exercise. Companies that operate shifts may find it difficult to get the entire workforce to participate in a drill or simulation exercise. However, an external certifier will need to be convinced that environmental protection measures developed for emergencies will work.

11.6.2.4 Internal audits

Internal audits

Do not confuse an environmental audit with an environmental review. While the initial review 'kick starts' the EMS, internal audits maintain its momentum.

Internal audits involve a systematic inspection and comparison of actual operating methods with the procedures specified in the EMS manual. The aim is to assess whether the EMS is operating correctly. On the one hand the audit should identify and highlight areas where the requirements of the EMS have been fulfilled, on the other hand it should detect non-compliances and suggest possible improvements. An audit may either focus on a procedure (e.g. emergency response) or on an area of operation or production line. The key to a successful EMS is commitment from all the employees. If employees are not committed, the system will be difficult to implement or maintain. Audits provide a valuable tool for gauging commitment within different parts of the company.

Selecting auditors

Two factors have to be considered when selecting employees to carry out an internal environmental audit:

- A particular procedure or area should not be audited by the person who is responsible for it;
- Potential environmental auditors should have experience in carrying out audits and should have received appropriate training.

More than one internal auditor may be required to allow for holidays and sick leave.

Frequency

The frequency of audits depends on the significance of the environmental aspects, but all procedures and areas should be audited at least once a year. The environmental management representative is responsible for establishing the audit programme and communicating the results of EMS audits to top management on a regular basis.

Use the Register of environmental aspects (Worksheet 11-8) to identify:

- Areas of high risk;
- Areas where the company failed to meet legal requirements in the past.

Based on this information an audit timetable is compiled indicating which areas or procedures are to be audited and when.

The audit process

Audit process

Once an audit programme has been established, it is the responsibility of the EMS auditors to conduct the audits in accordance with the audit plan. Conducting an audit is straightforward. Determine which procedure or area you are going to audit according to the audit plan. It is common practice to inform the manager responsible for the area or procedure to be audited prior to the audit to ensure that staff and documentation will be available during the audit, and that no conflict with operational duties or requirements will arise. Read the procedure(s) applicable to that area and then prepare an internal audit form by inserting appropriate questions relating to each section of the procedure(s). This form can also be used as a checklist or memory aid during the audit.

When conducting the audit, keep it simple by asking key questions about the significant areas being audited. Work should be carried out in accordance with the applicable procedure and the supporting evidence should be genuine. Remember, the audit process is designed to provide objective evidence as to the effectiveness of the EMS and not to blame anybody. On the audit form use a simple "yes" or "no" answer to each question, to verify compliance or non-compliance of the area under investigation with the corresponding part of the procedure. If a "no" is

recorded, state the reason for this in the third column. In addition, follow the recommendations below in the process of auditing:

- Try to audit people carrying out the process or working in the areas being audited.
- Ask questions and observe. Record the responses and your observations on the audit sheet accurately and at the time when you are conducting the audit.
- Check that you have filled in and answered all sections before signing and dating the audit form.

In this way, internal audits can be carried out effectively within a short period of time.

Nonconformities

Nonconformities are failures within the system. Usually these relate to differences between the way operations are carried out and requirements set out in the procedures. If a nonconformity, i.e. a "no", is recorded, it is the auditor's responsibility to suggest corrective measures to ensure that it does not happen again. The auditor should prepare a nonconformity report describing:

- The cause of the nonconformity;
- How the nonconformity will be corrected;
- Who is responsible for correcting it;
- When it will be corrected, i.e. the timescale for improvement;
- Measures that can be taken to prevent the nonconformity.

This logical and straightforward process is crucial to the success of the continuous improvement programme.

A nonconformity is sometimes due to a problem with the wording of a procedure rather than incorrect performance. In this case, the written procedure should be modified to improve the description of the operating method. Observations recorded by the auditor may relate to areas in which there are no specific nonconformities, but where the auditor feels that the system could be improved in some way.

11.6.2.5 Information on the management system

Information on the management system

Some parts of the workforce will need more information about environmental issues than others. The amount of information will depend on the level of responsibility assigned to them.

In the course of the certification/verification process it will be checked whether a training needs analysis was carried out to determine if the employees require additional training. In addition it has to be proved that

contractors have received appropriate training before being allowed onto the site.

Basic information

Most employees will benefit from a general awareness raising session that:

- Highlights the company's commitment to environmental management;
- Explains why environmental management is being adopted;
- Describes what the company hopes to achieve from implementing an EMS;
- Introduces the company's environmental policy;
- Explains how it relates to individuals, e.g. taking measurements, recording waste accumulations, segregating waste, sweeping up solid waste and switching off hoses when not in use.

Top management should receive training to make them aware of their own responsibilities for protection of the environment.

Deeper understanding

Employees who are expected to manage particular elements of an EMS and to explain them to others need a higher level of training. This could include:

- More detailed information about specific elements of the EMS and the environmental concerns related to specific environmental issues;
- An introduction to the environmental legislation governing the issues they have to manage;
- An introduction to EMS documentation and procedures.

The persons with direct responsibility for implementing and auditing the EMS should take part in a special training programme, e.g. a recognized external course. Their training should cover:

- Auditing;
- Environmental management system standards;
- Environmental and other relevant legislation;
- The external certification/verification process.

Training records

Keep records of all training received, with an indication of the course content, dates and duration.

11.6.2.6 Contractor awareness

Contractor awareness

Making contractors aware of environmental issues on the site can help to reduce the likelihood of a contractor being responsible for pollution for which the company is held liable. Contractors and suppliers are part of the EMS. Make them aware of their relationship to the EMS and, as a minimum, present them with a copy of the company's environmental policy. Depending on their duties on site, a higher degree of awareness may be achieved through specific contractor training.

Measures to raise contractors' and suppliers' awareness can include:

- Giving them a copy of the company's environmental policy;
- A short introduction to company procedures and requirements given by a company employee;
- A presentation highlighting environmental issues on the site.

To prove that contractors have received appropriate training, ask them to sign a form to acknowledge that they have been given the information (as they do after a health and safety briefing). This will help during the external certification/verification.

11.7 Literature and links

Case studies in environmental management in Central and Eastern Europe, compiled by Claire Buckley, Greenleaf publishing, ISBN 1-874719-20-9

Fresner, J., Setting up effective environmental management systems based on the concept of cleaner production: Cases from small and medium-sized enterprises, in R. Hillary: "ISO 14001 Case Studies and Practical Experiences", October 2000, ISBN 1 874719276

J. Fresner, P. Wolf, M. Galli, "Effective environmental management by cleaner production", Proceedings of the Symposium "Efficiency through management of resources: Green productivity programs in SMEs", EXPO 2000, Hanover, Magdeburg, 1-5 September, 2000

J. Fresner, "Cleaner Production as a means for effective environmental management systems", Journal of cleaner production, 6 (1998), 171 – 179

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