

Lecture 7

Environmental Management System Standards

STRUCTURE

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OVERVIEW

In Unit 5, we discussed how to plan and conduct various types of environmental audits and then in Unit 6, we explained how to use life cycle assessment (LCA) as a tool for minimisation of environmental impacts associated with manufacturing processes and products. However, use of these tools assumes that an environmental manager is someone external to the industry, studying the system with an objective that the industry complies

with the regulations and, on the basis of which, recommends measures for implementation. Establishing an organisational system conforming to environmental management system (EMS) standards, however, represent a paradigm shift away from the traditional approach based on command and control regulations, which set levels for pollutants. EMS standards focus on management practices, which help companies assess the level of their efficiency in meeting their environmental responsibilities. In other words, EMS is more of a foundation or template for environmental performance, allowing companies to put systems in place to address environmental concerns on many levels, and motivating, "to go beyond compliance". It also helps manage pollutants in unison as a whole, rather than in isolation.

Against this backdrop, in Unit 7, we will discuss the concept of EMS. We will also introduce you to EMS standards ISO 14000 and ISO 14001.

LEARNING OBJECTIVES

After completing this Unit, you should be able to:

- explain the benefits of establishing EMS;
- plan the process for establishing EMS;
- discuss ISO 14000 and ISO 14001;
- work as a co-ordinator for getting ISO certification for your organisation.

7.1 ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

The growing public interest in environmental issues and concern for environmental quality has led to the emergence of strict pollution control regimes. This has brought about the development and implementation of various voluntary schemes and standards for environmental management and pollution control. Notable examples are BS 7750, the European Union's Eco-Management and Audit Scheme (EMAS) and the ISO 14000 series. In this context, putting in place systems to meet with these standards assume significance. An environmental management system (EMS) of an organisation is a system designed to:

- meet the regulatory and legislative system requirements;
- improve the control of the environmental impact;
- provide confidence to the customers that the products and services are manufactured with the aim of reducing the negative impact on the environment;
- suitably accommodate changing market trends and gain competitive edge;
- reduce the costs associated with environmental liabilities and insurance;
- gain public and media support.

EMS involves preparing a list of all environmental legislation, making a register of all environmental effects associated with the company's activities, setting targets (such as reducing waste production by a quantifiable amount), keeping appropriate records and undertaking regular reviews of the system. The whole system, in essence, forms the basis for sound environmental performance.

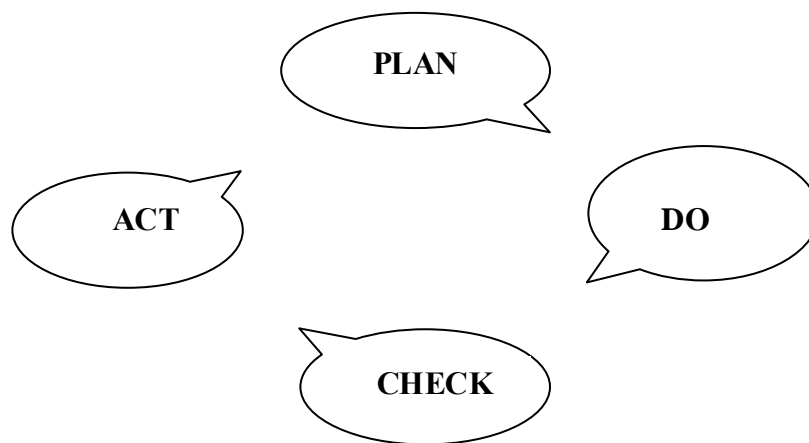
Most EMSs are built on the notational model illustrated in Figure 7.1. This 'plan-do-check-act' model leads to continuous

improvement based upon:

(<http://www.epa.gov/ems/info/index.htm>)

- planning, including identifying environmental aspects and establishing goals (plan);
- implementing, including training and operational controls (do);
- checking, including monitoring and corrective action (check);
- reviewing, including progress reviews and acting to incorporate required changes in the EMS (act).

Figure 7.1
The Plan – Do – Check – Act Model



To reiterate, this model ensures that environmental matters are systematically identified, controlled and monitored. It also helps ensure that performance of the EMS is improved over time.

7.1.1 Core elements of EMS

There is no single best approach to the development and implementation of EMS, since it depends on the nature, size and complexity of the activities, products and services within the organisation. All environmental management systems, however,

have a number of core elements in common and these include the following:

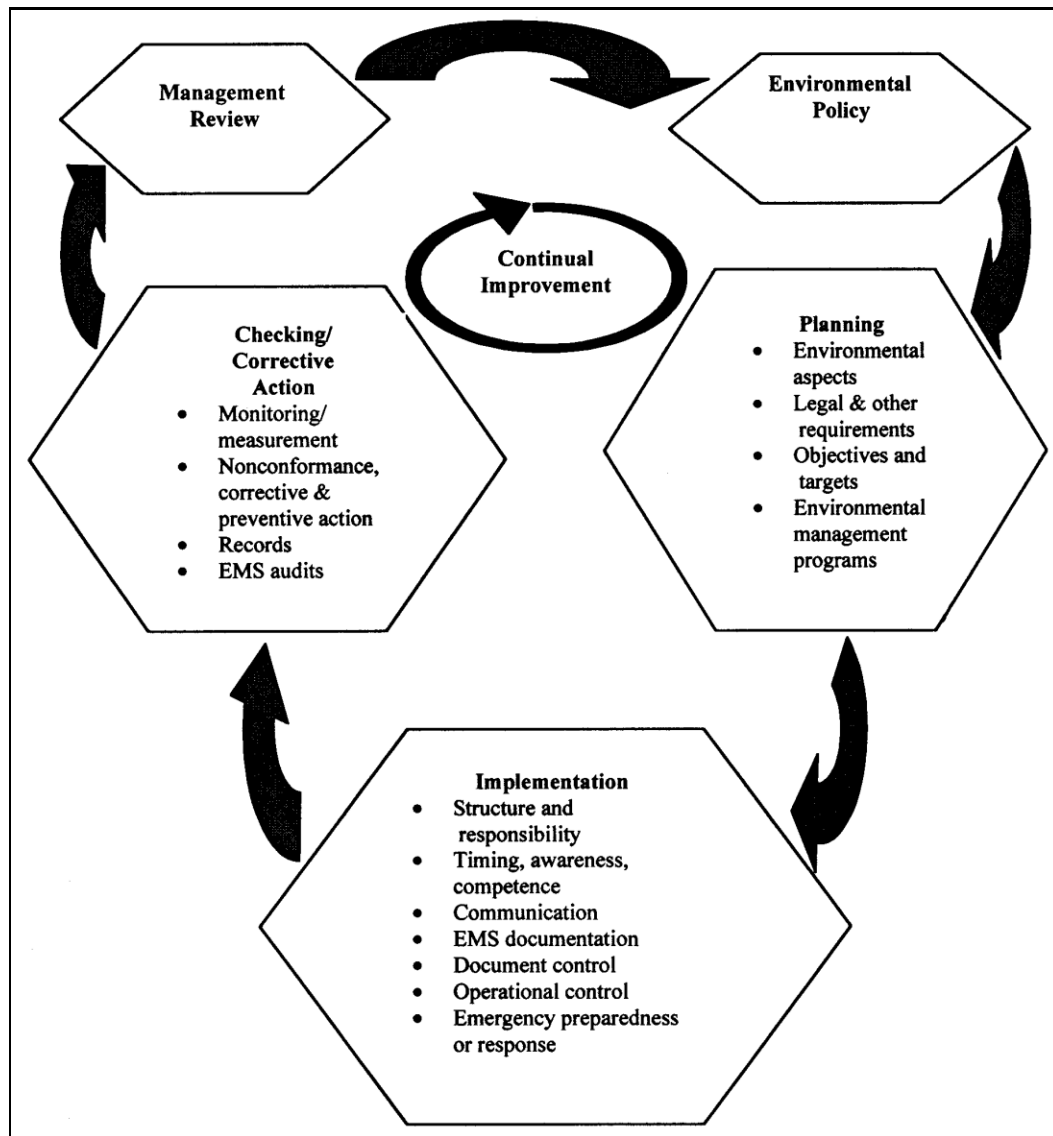
- **Environmental policy:** An environmental policy is usually published as a written statement, expressing the commitment of the senior management to improving appropriate environmental performance. It is most often understood as a public statement of the intentions and principles of action for the organisation regarding the environment. The policy statement should define the broad environmental goals the organisation has decided to achieve. These are most clear if they are quantified, e.g., to reduce emissions of pollutants by 95% within 5 years, to provide sewerage and biological treatment of sludge for 60% of the population within 3 years, etc.
- **Environment action plan:** An environment programme or action plan describes the measures the organisation will take over the coming year(s). The action plan essentially translates the environmental policies of the organisation into objectives and targets and identifies the activities to achieve them, defines responsibilities and commits the necessary human and financial resources for implementation. This includes committing the necessary funds and staff to meet each goal and providing for monitoring and co-ordination of the progress made towards achieving these separate goals and the overall policy goals that have to be fulfilled.
- **Environment related organisational structures:** The structures establish assignments, delegate authority and assign responsibility for actions. In the case of organisations with multiple sites or different activities, structures for the organisation as a whole as well as for the separate operating units are necessary. The senior staff member responsible for the environment, typically, has a direct reporting relationship to

the head of the organisation. Individuals holding strategic or main environmental responsibilities should be adequately supported with human and financial resources.

- **Integration of environmental concerns:** The integration of environmental management into regular operation means the establishment of procedures for incorporating environmental measures into other operational aspects such as the protection of workers, purchasing, R&D, product development and acquisitions, marketing, finance, etc., in the case of companies and the safety, health and welfare of the community in the case of a local government. This encompasses the development of specific environmental procedures, usually detailed in operating manuals and other operating instructions describing measures and actions to take in the implementation of the environmental programme or action plan.

Figure 7.2 gives a schematic representation of these core elements:

**Figure 7.2
EMS Model**



Because of the cyclic nature of the model, EMS is very dynamic in that a change or revision in any of the core elements of the system will have a chain/cascading effect on other elements.

Note that while there are several EMS models available, the model presented in Figure 7.2 uses the standards set by ISO 14001 as a starting point for describing EMS elements. This is so, mainly, due to the fact that:

- ISO 14001 is a widely accepted international standard for EMS that focuses on continual improvement.
- Companies may be asked to demonstrate conformance with ISO 14001 as a condition of doing business in some markets.

7.1.2 Benefits of EMS

A number of benefits are associated with adoption of EMS. For example, insurance companies are beginning to exclude pollution incidents from their insurance cover, and when they are included, the insurance companies place a surcharge on the policies. In order to improve or reduce any increases in the insurance premiums, companies can carry out an environmental audit and implement a EMS.

From a managerial point of view, a EMS enables a company to develop and maintain a well-organised management structure that ensures compliance with environmental legislation. By keeping the working place cleaner and safer, and the production more efficient, staff interest can be aroused and morale improved. Another incentive is the potential financial gains, which can be achieved. Reducing wastes and emissions and improving their treatment helps many companies to save a considerable sum of money in the long term. Adopting a EMS will also facilitate trade, as major trading blocs are more likely to accept members with a certain level of environmental performance. In other words, the benefits of a EMS include:

- Improved environmental performance.
- Enhanced compliance.

- Prevention of pollution/resource conservation.
- New customers/markets.
- Increased efficiency/reduced costs.
- Enhanced employee morale.
- Enhanced image with public, regulators, lenders, investors.
- Employee awareness of environmental issues and responsibilities.

7.1.3 Certification body assessments of EMS

To be certified, an organisation has to demonstrate that the EMS functions and the various control mechanisms are properly operational. In practice, this means that the EMS has been operational for a minimum of 3 months, the internal audit system is fully operational and that one management review has been conducted (Tech Monitor, Vol. 12. No. 5 Sept-Oct 1995).

Based on the following conditions, certificates are issued:

- Non-conformities identified have been addressed and eliminated.
- The certification body has justified confidence that all provisions in the EMS standard have been met, and, in particular, that provision for compliance with the organisation's policy and objectives is effective.
- The principle of continuous improvement of environmental performance has been stated within an environmental programme and is being adhered to in the EMS.
- All key staff (i.e., those involved in managing significant effects) have undergone a training need analysis and have received training.

Regulatory compliance

An organisation with a certified EMS has a system that should achieve continuing compliance with regulatory requirements applicable to the environmental aspects of its activities, products and services. The certification body confirms that a system designed to achieve the necessary compliance is operating effectively. In situations where authorities issue licenses or permits, it will often be a requirement that the organisation notifies the authority of any breaches. The certification body should ensure that the organisation's EMS records any infringement of regulations and that the appropriate corrective action has been taken.

An organisation with a certified EMS is responsible for continuing compliance with all the regulatory requirements and, therefore, must maintain a record of incidents of non-compliance and the remedial action.

Surveillance audits

At each surveillance, the certification body should pay attention to the following:

- the effectiveness of the EMS with regard to achieving the objectives of the organisation's environmental policy;
- an interview with management responsible for the EMS;
- the functioning of procedures for notifying the authorities of any breaches;
- progress of planned activities aimed at continuous improvement of environmental performance, where applicable;

- follow up conclusions resulting from internal audits;
- action taken on non-conformities identified during the previous audit.

The certification body should be able to adapt its surveillance programme to the environmental issues related to the activities of the organisation and justify this arrangement. The surveillance audit of the certification body should be agreed with the organisation, taking into account the internal audit programme and the reliability that can be attributed to this work.

7.1.4 Documentation for EMS

While data relates to fact, information refers to a series of data analysed to provide a decision. Information is an answer to a question. All information comes from data, but not all data come from information (Tech Monitor, Vol. 12. No. 5 Sept-Oct 1995). In other words, executives making decisions often receive excessive amounts of data, but they do not always get the information they need, presented clearly and adequately for use in decision-making.

Decisions are usually related to solving problems. In order to solve a problem, one needs information to decide. A EMS, therefore, requires a proper documentation system in order to collect, analyse, register and retrieve information.

The documentation should describe the EMS and make clear the relationship to any other management system in operation within the organisation, or as having an influence on the operations of the entity, subject to certification. It is acceptable to combine the documentation for environmental and other management systems (such as for quality of health and safety), as long as the EMS can be clearly identified, together with the appropriate interfaces

between different EMS documentations and the order of precedence.

Environmental effects may have been considered within safety reviews, hazard and operability studies and risk/consequence analysis, etc. In such cases, the EMS documentation should refer to the critical areas where significant effects are covered by other management systems. The EMS documentation should be available to all appropriate staff and should be kept up-to-date.

Environmental management manual

A key EMS document is a company's environment manual. This is a document that establishes the general policy of a company on this issue. It usually contains an environmental policy and a clear statement on the person who is in charge of verification of activities in the organisational structure pertaining to the maintenance of the environmental system. It lays down how each requirement of the policy will be handled in the organisation and includes a list of all procedures.

The manual also contains a description of the system, which was or is being implemented. There are considerable benefits in preparing a manual:

- clarifies responsibilities;
- is useful for audit purposes;
- can be highly effective for training of new employees;
- makes easier the process of obtaining approval of licenses from protection agencies;
- is useful for marketing purposes.

The highest executive in the company must sign the document. It should contain the vision of the organisation about environment and its commitment to continuous improvement. The document should detail targets to be reached and explain how they will be reached, with what resources and under whose responsibility. The company must also realise that it is necessary to measure results in order to evaluate how correctly the policy is being applied. The company should, therefore, have a programme for achieving its objectives and targets.

To prepare the manual, it is necessary first to identify all mandatory regulations, standards and codes to be complied with. In addition, the company needs to identify other requirements, such as headquarters' policies, top management's strategic vision, market demands, etc.

The discussions that we have had so far provide you with a basic knowledge of EMS. Now, we will next discuss the importance of ISO 14000 and its supporting systems. Before we do so, let us first do Learning Activity 7.1.

being developed and implemented. In Subsections 7.2.1 to 7.2.3, we will discuss the various aspects of ISO 14000 series.

7.2.1 Evolution

The International Organisation for Standardisation (ISO) was formed in 1947 and has since become the premier international standards organisation. Since its inception, ISO's mission has been to promote worldwide standardisation in order to facilitate international commerce. The organisation began by developing international agreements and in 1951 published its first standard, Standard Reference Temperature for Industrial Length Measurement. Since that time, ISO has developed more than 9,000 standards for a variety of subjects ranging from screw threads and fasteners to high-tech clean rooms. ISO also developed the widely used quality management system (QMS) standards, i.e., the ISO 9000 series. The ISO standards are published for voluntary acceptance, but they are often incorporated into national standards of individual countries.

The membership of ISO includes over 100 countries. Each Member Country is represented by one standards organisation. For example, the American National Standards Institute (ANSI) represent the U.S and Great Britain by the British Standards Institute (BSI).

ISO considers the following three key principles in developing international standards:

- (i) **Consensus:** The views of all interested parties are taken into account, including manufacturers, vendors, consumer groups, testing laboratories, governments, engineering professionals and research organisations.

- (ii) **Industry-wide applicability:** The goal is to draft standards that satisfy industries and customers worldwide (ISO has no authority to impose its standards on any government or organisation).
- (iii) **Voluntary nature:** All of the international standards developed are voluntary. Thus, their acceptance by industry is market-driven and based on voluntary involvement of all interests in the marketplace.

A review of historical developments reveals that standardisation on a worldwide basis was accelerated with quality and occurred generally independent of environmental management. Attempts to standardise quality requirements were made by many organisations. However, it wasn't until the 1990s that a significant level of agreement was reached.

In 1990, Business Charter for Sustainable Development (BCSD), an organisation of fifty business leaders with interest in environment and development issues, was created for environment protection with the premise that economic development can take place only in a healthy environment. Partly in response to the proliferation of differing environmental standards, such as EMAS worldwide, the ISO formed a Strategic Action Group on the Environment (SAGE) in 1991. The purpose of SAGE was to investigate the usefulness of drafting international standards for environmental management. SAGE focused its attention on the following three areas:

- (i) Promoting a common worldwide approach to environmental management in business and industry.

- (ii) Increasing the ability of incentives for organisations to measure and attain improvements in environmental performance.
- (iii) Facilitating world trade and removing potential environmental trade barriers.

As a result of the findings of SAGE, the ISO formed Technical Committee 207 (TC 207) in 1993. TC 207 became responsible for drafting the ISO 14000 series of standards. At early meetings of TC 207, more than thirty countries and 200 representatives expressed a desire to develop new EMS standards. TC 207 itself had members representing some sixty-nine countries and was divided into six sub-committees. These members included representatives from various industries, standards organisations, governments, environmental organisations, and other interest groups.

For some, the motivation for the development of these standards was due to the fear that the increased number of inconsistent national and regional EMS standards would create trade barriers. There was also the concern that the EMAS programme already in practice in Europe would influence the ISO 14000 standards to make them comparable to EMAS. This concern was in part fueled by the fact that the ISO 14000 standards were being developed in conjunction with CEN, i.e., the European standards-setting body. In fact, the ISO set the standards drafting timetable at 30 months, in part because CEN had agreed to accept ISO 14000, if they were finalised quickly enough. There were also fears that the standards were a reflection of European not American technology. Nevertheless, the standards were developed with each participating member having equal say in the process.

A sub-committee of TC 207 prepared the draft EMS Standard, based on BS 7750. It was presented at the Earth Summit in Rio de Janeiro, and the draft of the standard was agreed in Oslo (June 1995).

7.2.2 Principles and structure

The aim of the ISO 14000 series of standards is to help organisations implement and improve their EMS.

Some of the principles governing ISO 14000 series are (Tech Monitor, Vol. 12. No. 5 Sept-Oct 1995):

- (i) Understand all activities and processes being undertaken by the organisation.
- (ii) Identify potential aspects associated with the activities of the unit at all stages and determine their impact on the environment.
- (iii) Determine processes/procedures/operation steps that can be controlled to eliminate or minimise the likelihood of an occurrence of the adverse impact.
- (iv) Identify the regulatory requirements relating to them and establish target level and tolerances, which must be met to ensure that operations affecting the environment are under control.
- (v) Establish a monitoring mechanism to ensure control of these aspects.
- (vi) Establish corrective actions to be taken when monitoring indicates that a particular aspect is not under control.

- (vii) Establish a system of emergency preparation and for meeting such exigencies.
- (viii) Establish procedures for verification to confirm that the environmental management system is working effectively in compliance with regulations and recording continuous improvement.
- (ix) Establish documentation concerning all procedures and records appropriate to these principles and their application.

Given the importance of the stakes involved and the generic nature of the international requirements covered, high expectations have been placed on the ISO 14000 series standards (Tech Monitor, Vol. 12. No. 5 Sept-Oct 1995). The standards can be classified into the following two categories based on their focus:

- (i) **Organisation or process standards:** These include environmental management system (EMS), environmental auditing (EA) and environmental performance evaluation (EPE).
- (ii) **Product-oriented standards:** These include life-cycle assessment (LCA), environmental labelling (EL) and environmental aspects in product standards (EAPS).



LEARNING ACTIVITY 7.2

List the basic principles of ISO standards.

Note:

- a) Write your answer in the space given below.
- b) Check your answer with the one given at the end of this Unit.

The ISO 14000 series standards are of two types, and these are:

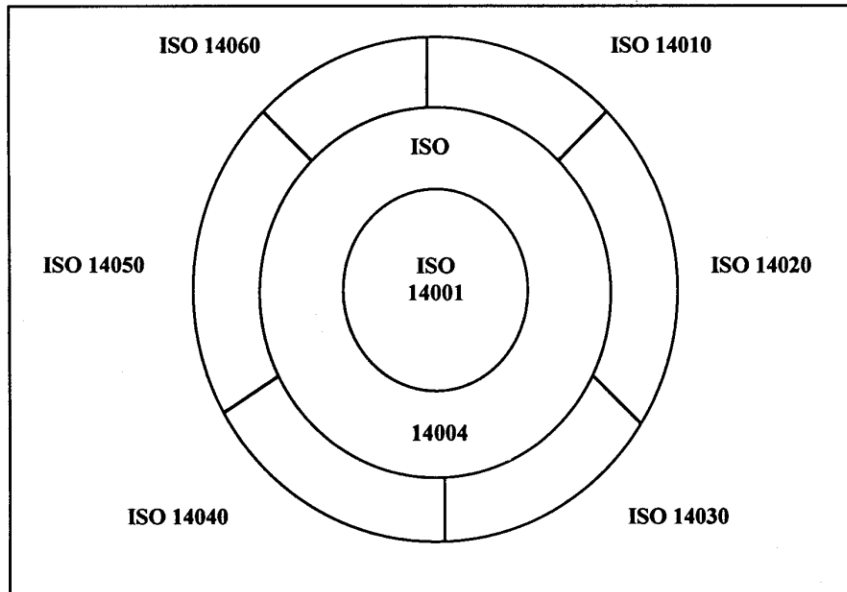
- (i) **Normative standards:** These indicate the requirements that must be met and can be audited for certification.
- (ii) **Informative standards:** These provide guidance and the requirements need not be audited for certification.

In the 14000 series of standards, ISO 14001, (i.e., Environmental Management Systems-specification with guidance for use) is the only normative standard and all other standards are informative standards intended to support the implementation of EMS.

As regards the structure of the Series, ISO 14001, i.e., the requirements for EMS, forms the nucleus, and in the first orbit is ISO 14004, i.e., the guideline standard. (Note that we will discuss ISO 14001 standards in detail in Section 7.3.) The other

standards in the series are supporting systems as shown in Figure 7.3.

Figure 7.3
Structure of ISO Series and Inter-relationships



7.2.3 Supporting systems

The supporting systems of ISO 14000 consist of ISO 14010, ISO 14020, ISO 14030, ISO 14040, ISO 14050 and ISO 14060. (TechMonitor, Vol. 15 No. 5 Sept-Oct 1998). In what follows in this Subsection, we will discuss some of these supporting systems.

Consider Table 7.1, which gives a list of 150 14000 Series standards with their respective publication dates.

Table 7.1
ISO 14000 Series Standards

ISO No.	Title of International Standard/Guideline/Technical Report	Publication Date
ISO 14001	Environmental management	September

ISO No.	Title of International Standard/Guideline/Technical Report	Publication Date
	systems – Specification with guidance for use.	1996
ISO 14004	Environmental management systems – General guidelines on principles, systems and supporting techniques.	September 1996
ISO/AWI 14004	Revision of ISO 14004:1996.	To be determined
ISO 14010	Guidelines for environmental auditing – General principles.	October 1996
ISO 14011	Guidelines for environmental auditing - Audit procedures – Auditing of environmental management systems.	October 1996
ISO 14012	Guidelines for environmental auditing – Qualification criteria for environmental auditors.	October 1996 Corrected and reprinted October 1998
ISO 14015	Environmental management – Environmental assessment of sites and organisations (EASO).	November 2001
ISO/DIS 19011	Guidelines for quality and/or environmental management systems auditing.	July 2001
ISO 14020 2nd Edition	Environmental labels and declarations – General principles.	September 2000
ISO 14020: 1998/DAM1	Draft amendment 1 to ISO 14020:1998.	December 1998
ISO 14021	Environmental labels and declarations - Self-declared environmental claims (Type II environmental labelling).	September 1999
ISO 14024	Environmental labels and declarations - Type I environmental labelling – Principles and procedures.	April 1999
ISO/TR 14025	Environmental labels and declarations – Type III environmental declarations.	March 2000
ISO 14031	Environmental management – Environmental performance evaluation – Guidelines.	November 1999
ISO/TR 14032	Environmental management – Examples of environmental performance evaluation.	1999

ISO No.	Title of International Standard/Guideline/Technical Report	Publication Date
ISO 14040	Environmental management – Life cycle assessment – Principles and framework.	June 1997
ISO 14041	Environmental management – Life cycle assessment – Goal and scope definition and inventory analysis.	October 1998
ISO 14042	Environmental management – Life cycle assessment – Life cycle impact assessment.	March 2000
ISO 14043	Environmental management – Life cycle assessment – Life cycle interpretation.	March 2000
ISO/WD TR 14047	Environmental management – Life cycle assessment – Examples of application of ISO 14042.	1999
ISO/CD TR 14048	Environmental management – Life cycle assessment – Life cycle assessment data documentation format.	1999
ISO/TR 14049	Environmental management – Life cycle assessment – Examples of application of ISO 14041 to goal and scope definition and inventory analysis.	March 2000
ISO 14050	Environmental management – Vocabulary.	May 1998
ISO 14050: 1998/DAM1	Draft amendment 1 to ISO 14050:1998.	December 1999
ISO/TR 14061	Information to assist forestry organisations in the use of Environmental Management System standards ISO 14001 and ISO 14004.	December 1998
ISO/AWI 14062	Guidelines for integrating environmental aspects into product development.	To be determined
ISO Guide 64	Guide for the inclusion of environmental aspects in product standards.	March 1997

Environmental auditing (ISO 14010, ISO 14011 and ISO 14012)

An environmental audit is defined as the systematic documented verification process of objectively obtaining and evaluating audit evidence to determine whether specified environmental activities, processes, conditions, management systems, or information about these matters conform with audit criteria, and communicating the results of this process to the clients. The guiding principles of environmental audits include:

- basing the audit on defined objectives and drawing inferences based on analysis, interpretation and documentation of appropriate information;
- utilising an audit team that is independent of the activities they audit and utilising an auditor who meets the specifics of qualification criteria;
- exercising of due professional care by the auditor to maintain confidentiality and adequate quality assurance;
- using appropriate procedures for an objective audit;
- developing audit criteria, evidence and findings;
- ensuring that the process provides a desired level of confidence in the reliability of the audit findings and conclusions;
- providing an adequate report of findings.

Note that while ISO 14010 provides guidance on general principles for conducting environmental audits, ISO 14011 elaborates on the framework for the conduct of audit in order to ascertain if the organisation is doing what it says it will do and whether the EMS conforms to ISO 14001. ISO 14012 provides guidance on auditor qualification criteria, including education,

training, work experience, personal attributes and skills, maintenance of competence and due diligence.

Environmental labelling standards (ISO 14020)

ISO 14020 is based on a voluntary environmental labelling standard that requires a third party verification and is designed to reduce burdens arising from diverse multiple labelling. Existing eco-labelling schemes, based on government initiatives, aim at influencing customer decisions to select environmentally friendly products, but they lack the application of uniform criteria. These are, therefore, difficult to comply with and are potential trade barriers. The coverage of ISO 14020 is broad and includes goods or services for consumer, commercial and industrial purposes.

The guiding principles and practices for third-party environmental labelling programmes include the following:

- Standard and criteria applicable for environmental labels must be developed through a consensus process, and the programme must be voluntary.
- A product can be considered for environmental regulations of the country in which it is manufactured and marketed.
- Environmental labelling programmers should be selective and should distinguish leading product alternatives.
- The product criteria developed by the certification agency should be periodically reviewed to account for new developments and technologies.
- The process should be transparent with regard to criteria, certification and award procedures. The criteria should be revised periodically and clearly demonstrate that the funding sources for the programme do not create conflicts of interest or undue influence.

- The labelling programme should use scientific and reproducible methodologies to assess the environmental impacts of products.
- Labelling programmes should be accessible, objective and affordable.

The requirements for awarding a label are divided into general rules that apply to all products and applications, and specific product criteria that set requirements for each product category. The specific product criteria are the only criteria that may be considered as a basis for awarding the label. The certification agency awards the label when satisfied that the applicant has complied with the specific product criteria for the category. It maintains a publicly available list of products currently licensed to carry the label.

After the label has been awarded, it is the responsibility of the certification agency to take all necessary steps to ensure ongoing compliance with the product criteria. The certification agency will require the licensee to take corrective action, if monitoring indicates that compliance is not being maintained.

Environmental performance standards (ISO 14030)

The environmental performance evaluation (EPE) is an important ongoing internal management process. It uses environmental indicators to compare an organisation's past and present environmental performance with its environmental objectives, targets or other intended levels of environmental performance. This process helps management to measure, analyse, assess, report and communicate an organisation's environmental performance over time and to determine necessary actions.

The environmental performance evaluation standard is based on Edward Deming's PDCA cycle, i.e., Plan (P), Do (D), Check (C) and Act (A). Planning a EPE involves considering management priorities and selecting environmental indicators before evaluating environmental performance (D) and reviewing and improving EPE (C). The EPE process involves actions taken (A) to improve the systems, operations, processes and environmental performance. Note that we discussed the PDCA cycle in Section 7.1 (see Figure 7.1).

EPE standards provide guidelines on identification and selection of environmental indicators. There are two types of environmental indicators, and these are:

- (i) **Environmental performance indicators (EPI):** These include the following:
 - the people, practices and producers at all levels of the organisation;
 - the design, operation and maintenance of, supply to, and delivery from, an organisation's facilities and equipment;
 - the materials, energy, products, services, waste and emissions related to the organisation's operations and activities.
- (ii) **Environmental condition indicators (ECI):** These are used to describe the conditions of the environment in relation to the organisation.

Life cycle assessment (ISO 14040)

ISO 14040 provides guidelines for incorporating life cycle assessment (LCA) into environmental management programmes (recall that in Unit 6 we discussed LCA in detail). An LCA is

defined as a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. It is, thus, a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life cycle from the acquisition of raw materials through final disposal. An LCA is done in order to get the whole picture of the environmental impacts throughout the lifetime of products and services. In other words, an LCA provides significantly more information than does evaluating the impact from the manufacturing process alone. It also provides a systematic way to evaluate the costs and benefits associated with products or service changes at various points in the life cycle.

ISO 14040 covers the following three phases of LCA:

- establishing the goals and the scope of the assessment;
- conducting inventory analysis.
- conducting impact and improvement assessment.

The goals of the LCA study should include the reasons for carrying out the study, the intended applications, the intended audience, the initial data, quality objectives and the type of critical review that will be conducted for the LCA. The scope should include background information for the product or service being evaluated, boundaries of the study, method of impact assessment, data requirements, assumptions and limitations of the study.

Environmental terms and definitions (ISO 14050)

The successful operation of the environmental management system requires a correct understanding of the meaning of terms used by all stakeholders in a similar manner. Put differently,

communication is important in implementation and in the operation of the environmental management system. This communication will be most effective, if there is a common understanding of the terms used. Many environmental terms and definitions are the result of a recently developed process. The gradual evolution of these environmental concepts invariably means that environmental terminology will continue to develop.

Environmental aspect in product standard (ISO 14060)

The environmental impacts of products are receiving more attention worldwide. They are, therefore, being addressed in the product standards prepared by the international, regional and national standard bodies. ISO 14060 provides general guidelines that should be taken into account when developing standards to reduce environmental effects associated without sacrificing the intended performance of the product or service. While recognising the complexity of identifying and establishing environmental effects from products and services throughout their life cycles, ISO 14060 provides that environmental effects should be balanced against factors that include product function, performance, safety and health, cost, marketability and quality. The guide also recognises that environmental provisions in product standards must be reviewed and changed to reflect innovation and technology, but not so frequently that innovation, productivity and environmental improvements are jeopardised. The provisions of a product standard should be no more stringent than necessary to avoid excessive or inefficient material or energy use.

The environmental provisions in product standards can incorporate considerations including material and energy inputs; wastes and emissions; impacts from transportation, packaging,