ENVIRONMENTAL MANAGEMENT SYSTEMS

Use of state and international environmental standards is due to the truth that the concern for a clean environment has become part of the national and international competition. The results of the use of standards in developed countries are reflected in increased competitiveness, higher profits, higher process efficiency, reduced costs and greater credibility corporate image. In less developed countries, where it is necessary to update the outdated technology, the enforcement of these standards associated with complex investments.

ISO 14000 – The purpose of environmental standard and its implementation

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International Organization for Standardization was founded with the aim to develop and introduce international trade using harmonized international standards in the field of manufacturing, trade and communications. The organization has its members in more than 120 countries whose representatives can participate in the creation of standards. ISO standards are voluntary and consensual. Countries often include these standards in their regulation and business sector (industry) often define them in the request of the market, and in both cases the use of standard becomes mandatory.

1 ISO 14000 family of standards

ISO 14000 is a series of environmental management standards (Environmental Management), prepared by ISO Technical Committee - TC 207 Standards ISO 14000 families are in conflict with other environmental standards focused on managing the business. Standards, do not put direct requirements for the quality of the environment, do not provide specific levels of protection against pollution, measurable operating parameters, etc. Standards help the company develop its environmental policy, by systematically implemented in the federal process. Since it is in the context of environmental management systems announced the compatibility of the operation with respect to current environmental legislation, these requirements also indirectly involved.

Family of standards has been developed in order to:
- better management of the environment,
- enforcement of general interest to the public and users of the standard,
- cost-effectiveness and flexibility, suitable for organizations regardless of size or location,

- to facilitate the implementation of internal or external verification,
- in order to ensure the scientific validity, practicality, usefulness and usability.

The benefits of implementing ISO 14000 for companies are:
- reduce the negative environmental impacts in terms of environmental regulation,
- competitive advantage at the expense of the certification of the company to an international standard,
- transparency of environmental performance, less interference and evaluating third-party
- integration of the environmental management system with existing enterprise systems management or quality management systems,
- facilitate compliance with the requirements of the environment under the current regulation.

Accepted standards are divided into two groups, consisting of:
- Standards for organizations: Environmental Management Systems, Environmental Auditing and Environmental Evaluation performance;
- Product standards: labelling the environmental suitability of the products (Environmental Labelling), the determination of impacts of products lifetime (Life Cycle Assessment) and environmental aspects in product standards (Environmental Aspects and Product Standards).

Standards of environmental management have three important components:
1) The program,
2) Education and
3) Knowledge of environmental legislation.

The program contains a commitment to companies that produce products or providing services with the highest quality at the lowest possible level of environmental burdens and sets out the procedures which lead to the company's goal. Effectiveness of the program also connects the involvement of employees in the environmental management system and their understanding of it, which provides employee training.

The standards also introduce environmental audits; they are routinely evaluation of the performance of the company. Based on the inventory of inputs and outputs of the system and determining the mass and energy balance point is determined inefficiencies within the system. From the conclusions of the review of the management company shall prescribe the necessary changes that will lead to the reduction of environmental impact. Based on the schedule of implementation is also provided for the following version of the review.

The standards also plan to evaluate the impact of the company's operations on the environment; this is performed by evaluating the impacts of the company's activities in relation to the environment. In the early stages of the inventory process inventory of all environmental impacts, in continuation with the evaluation of the results of the assembler determines the possible indicators of improvement.

Standard determination of the effects of the product in its lifecycle follows the idea that every product life cycle duration, which begins production, will continue to use and ends with the removal. Within each phase appear different effects of the product on the environment.

Environmental labelling standards of appropriateness introduce uniform methods for assessing the products according to their impact on the environment. Eco-labels also allow customers choice when buying products with full knowledge of environmental characteristics.

2 Overview of ISO 14000

Environmental management systems introduced by standard ISO 14001 provides a framework for system and provides guidance for the implementation according to the current legal regime and calls for the development of environmental policy in companies. The standard itself does not impose direct criteria for the protection of the environment (emission, imission), but allows self-declaration adequacy, although for most companies it plans to implement control of a third party. It is the only standard of ISO 14000 family, which makes it possible to obtain a certificate of compliance, the rest are support voluntary guidelines. It plans to develop and implement environmental management system and its integration with all activities of the company.

The most important parts of this standard are:

- determination of significant environmental impacts,
- design and discusses the company's environmental policy,
- preparation of plans and procedures to improve the environment,
- review of the environmental management system of the company's management,
- completion of environmental management system.

Environmental review

The purpose of ISO standards of the implementation of environmental reviews has grown into flourishing voluntary implementation of these checks in the 80s and 90s. This concern is reflected in the shift from consensual voluntary programs to practice the application of the new standards.

General principles of environmental reviews summarize the ISO 14010 are the following:

objectivity, independence and competence,

professionalism,

systematic procedure,

uniform criteria for the review findings, the quality and content of the dossier,

the reliability of the findings and conclusions.

Procedures for carrying out environmental reviews are covered in ISO 14011. Eligibility criteria for environmental review are given in ISO 14012, which provides guidance for choosing of internal and external service providers' review. Also includes education, personal qualities and skills required of auditors.

Evaluation of environmental performance

ISO 14031 provides guidelines for setting up a continuous process of evaluation (measurement, analysis, determination) focuses on the effects of the environment, according to its own criteria. This voluntary provision helps to meet the requirements of ISO 14001 at a stage where the company carries out the process of monitoring and measuring environmental impacts relative to its own objectives. The standard is not only useful for implementing the requirements of the environmental management system, but can also be used in all types of companies as a means of measuring the impact, regardless of the size, specificity activities or operations.

The standard provides:

- Determination of the environmental impacts arising from the results of the review of the environmental management, and

- Assessment methods, which are reflected in the possibility of measuring impacts, for example. Waste reduction, efficiency of use of raw materials, tools, whereby an entity measures the environmental impacts and effects of the implementation of the system provisioning environment.

Labelling the environmental suitability

The purpose of ISO 14020 is to provide an international uniform labelling system environmental suitability of the products in which the user will be able to decide to purchase or use.

Labelling standards of environmental suitability can distinctly affect the marketing and sell the company's products. General principles are given in ISO 14020, defines the process of assessment and marking environmental suitability and impact on subsequent processes of advertising and marketing. The principles are designed with the aim to enforce accurate and validated indications and declarations, while ensuring that they are not created unfair restrictive trade conditions.

Terms and definitions are given in ISO 14021. They define requirements for products and services. Expected results include the accuracy and verifiability of statements. Include the impact of the market on reducing the negative impacts of products, processes and services on the environment. Consider options to reduce barriers to international trade.

General principles and processes of species identification can be found in ISO 14024. This standard provides guidelines for government and private organizations in developing programs assessing the environmental suitability of rewarding the designation, for example. German Blue Angel, Japanese Eco Mark, U.S. Green stamps etc.

Determination of the effects of the products in lifetime

ISO 14040 is a tool for assessing the performance of a product, process or service for the lifecycle assessment (LCA - Life Cycle Assessment). It takes into account all impacts of products or services on the environment from cradle to grave, or the lifetime of the product, from the planning to the eliminating products after the use. The process of determining the environmental impact occurs as a conceptual process or as a tool to determine the quality. The process can help in setting up a coherent process of production or the provision of services in three primary components: an inventory of impact, impact analysis and analysis improvements.

The ISO 14040 contains design of the LCA, which provides guidance of four main phases:

definition of the objective and scope
analysis review of the effects
determine the impacts
interpretation

ISO 14041 represents the execution of an inventory of the effects in the lifetime of the product. Contains: references, definitions, detailed introduction, the definition of objectives and scope determination, led to the establishment of an inventory and report on the results.

ISO 14042 comprises principles and procedures for determining the effects of which are at this stage are classified into four groups: classification, characterization and analysis of influence assessment.

ISO 14043 is interpreted and applied in determining the stage of the impact on the management, evaluation, and research in the fields of determining the environmental impact of lifetime: a synthesis of inventory and determination of the effects of the comparison areas and improvements, conclusions and recommendations.

Environmental aspects in product standards

ISO Guide 64 is a guideline intended for those preparing standards for products. Guideline sets out the relationship between product standards and the environment. Specifies the aspects that make the product standards may lead to a negative impact on the environment. Promote the principle of environmentally pleasant design and production, reduce the use of raw materials and energy sources, taking into account impacts of products lifecycle environmental, balanced competitiveness of the products at about the same impact on the environment and other scientific methods for reducing the negative impacts of products on the environment.

3 The aim of Environmental Performance Evaluation

The basis of Environmental Performance Evaluation is to define the role of business organizations toward the construction of a sustainable society. In order to determine environmental efforts, it is necessary to precisely measure and evaluate the impacts of organization's activities on the environment and the outcomes of environmental actions (environmental performance). For measuring and evaluate environmental performance the environmental performance indicators are required (EPI) (Pochyluk, Szymański 1999a, 1999b).

Objectives and Benefits of an EPE Program:

• **determine the effect of an organization on the environment;**

• **comparison possibility as a basis for benchmarking management, operational and environmental performance;**

• **identification of improvement opportunities for energy and resource efficiency usage,**

• **determining that environmental objectives and targets are being met,**

• **demonstrating compliance with regulations,**

• **determining proper allocation of resources,**

• **the awareness of employees increasing, and relationships with customers' improvement.**

Environmental Performance Indicators (EPI)

Environmental performance indicators support the efforts of environmental organizations, and give the ability to evaluation and preparation of decisions. It consists of selecting environmental indicators, collecting and analyzing data, assessing information in the light of environmental performance indicators, reporting and communication, and periodical review of the process and improvement (Jasch 2000; A Guide to Corporate Environmental Indicators Federal Environment Ministry 1997).

The Environment Performance Indicators (Table 7) (Jasch 2000):

- allow to define the organization's environmental impact;
- allow to create common information, which is equally important for the suppliers, customers, residents, communities, employees, shareholders, governmental and financial institutions;
- allow the understanding and knowing the efforts of inserted in the care of the environment;
- allow to integrate the environmental policies of the national and local governments, such as basic environment plans, and environmental activities of organizations.

Table 7: Environmental Performance Evaluation Indicators type

EPE Indicators	
Environmental performance indicators (EPIs)	Environmental Condition Indicators (ECIs)

- **Management performance indicators (MPIs):** policy, people, planning activities, practice, procedures, decisions and actions in the organization	Provide information about the local, regional, national or global condition of the environment
- **Operational performance indicators (OPIs):** inputs, the supply of inputs, the design, installation, operation and maintenance of the physical facilities and equipment, outputs and their delivery	

The most important indicators needed to assess the environmental impact of company are: Management Performance Indicators and Operational Performance Indicators.

Management Performance Indicators measure methods and organizations that manage and operate resources for business activities and their environmental activities as contributions to the society. These indicators provide information about the efforts of management to influence the environmental performance of the organization. They refer to actions taken by the management company, aimed at improving the efficiency of environmental action. Illustrate the effectiveness of executives.

They concern, among others, costs associated with the implementation and maintenance of the EMS, training, staff, achievement of environmental goals. MPI indicators may be used to track:
- implementation and effectiveness of environmental management programs,
- management actions that affect the environmental effects of the organization and possibly on the environment,
- efforts of particular importance for the success of organizations environmental management,
- the organization's environmental management, including flexibility to respond to changing conditions, the achievement of specific objectives, effective coordination and problem-solving skills
- compliance with legal requirements and compliance with other requirements that
- organization has adopted,
- costs or financial benefits.

The examples of performance indicators management MPI:
- implementation of environmental objectives;
- environmental costs;
- participation fees and penalties in the total cost of environmental activities;
- staff training;
- participation of suppliers assessed in terms of impact on the environment;

- the degree of compliance with the environmental management system requirements;
- time to respond to environmental incidents, or time to repair their consequences;
- percent of the exercises carried out in checking the preparedness and response failures in relation to the planned showing the planned readiness;
- return on investment on projects to improve the environment;
- savings achieved by reducing the consumption of resources, pollution prevention or recycling of waste;
- income from sales associated with new product or product side designed to achieve environmental performance or the proposed objectives;
- number of press publications about the environmental performance of the organization;
- funds used to support local environmental programs.

Operational Performance Indicators measure environmental burden caused by organization's activities, flow of materials and energy, only controlling environmental burdens.

The Operational Performance Indicators are divided into two, general groups (Table 8) and the examples of operational performance indicators OPI for manufacturing company are presented in Table 9 (Jasch 2000; Thorensen 1999).
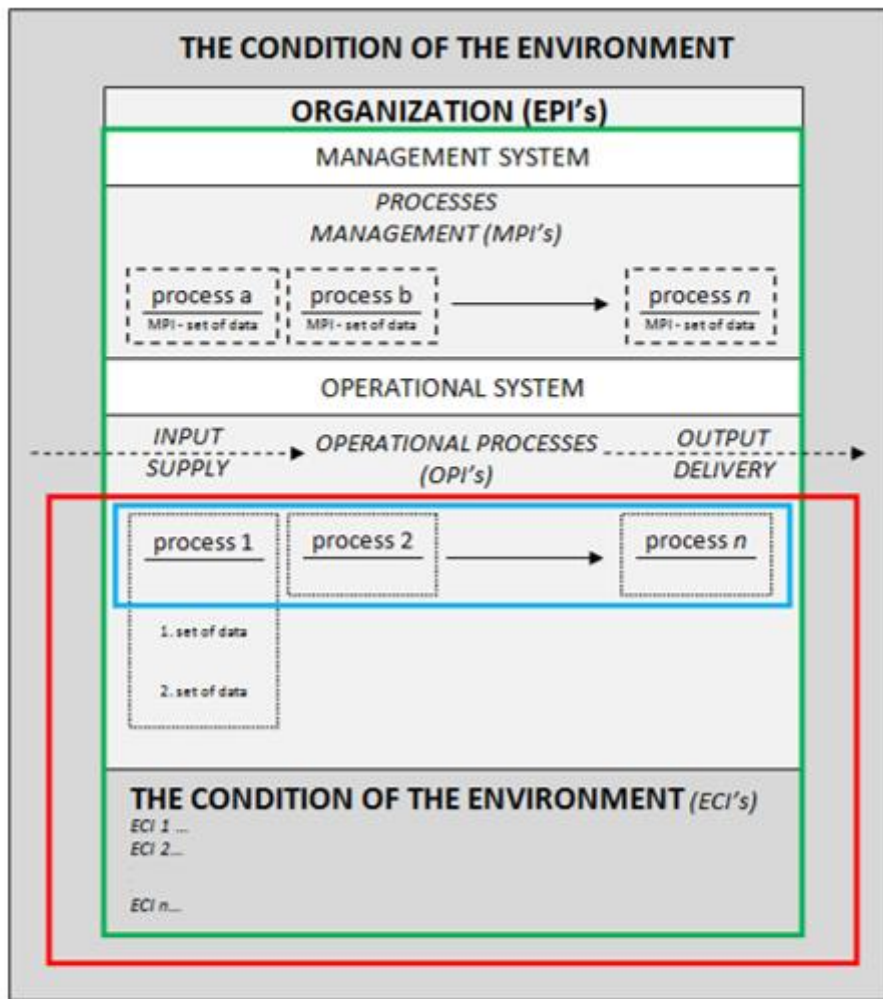
Table 8: The Operational Performance Indicators type

Operational Performance Indicators	
Input Indicators:	**Output Indicators:**
- total amount of energy input, - total amount of material input, - total amount of water input.	- amount of greenhouse gasses emissions, - chemical substances release and transfer, - amount of production or sales, - amount of waste generation, - amount of final disposal of waste, - amount of water drainage.

Table 9: The examples of Operational Performance Indicators

The example of operational performance indicators OPI for manufacturing company
- annual electricity consumption;
- energy consumption per unit of production;
- thermal energy for m^3 volume of buildings heating
- share of groundwater in the total consumption of water;
- share of returnable packaging in the total weight of the packages;
- material consumption per unit of product;
- water consumption per unit of product;
- the amount of water re-used;
- number of emergency or non-routine operations (e.g. exclusions) during the year;
- the total area of land used for production purposes;
- area of land used to produce a unit of energy;
- number of hours of preventive maintenance of equipment in the year;
- average fuel consumption of vehicles of the organization;
- quantity of by-products of manufactured product unit;
- the amount of waste per unit of product;
- the amount of waste per year;
- the amount produced per year of hazardous waste treated recycled or intended for re-use;
- total waste for disposal;
- the amount of collected waste;
- the amount of waste controlled by the license;
- emissions of CO_2, SO_2, NO_X and other compounds into the air in a year;
- emissions of CO_2, SO_2, NO_X and other compounds into the air per unit of product;
- emissions into the air affecting the depletion of the ozone layer;
- amount of waste per year;
- amount of waste per unit of product;
- amount of material headed to the landfill per unit of product;
- noise level during the day;
- noise during the night;
- noise levels in certain areas;
- the amount of released radiation.

Evaluation of Operational Performance Indicators is necessary to control materials input and released, and give the information for strategies to reduce these environmental burdens from the time of input. In the other hands these environmental indicators are designed to control the material balance, e.g. considering input and output of energy and materials into/from an entire business activity. Also those indicators evaluate the efficient and effective use of resources and energy, and the prevention of greenhouse effect.

Figure 19: The organization area of Environmental Performance Indicators evaluation

THE CONDITION OF THE ENVIRONMENT

ORGANIZATION (EPI's)

MANAGEMENT SYSTEM

PROCESSES
MANAGEMENT (MPI's)

| process a | process b | → | process n |
| MPI - set of data | MPI - set of data | | MPI - set of data |

OPERATIONAL SYSTEM

INPUT SUPPLY → OPERATIONAL PROCESSES (OPI's) → OUTPUT DELIVERY

| process 1 | process 2 | → | process n |

1. set of data

2. set of data

THE CONDITION OF THE ENVIRONMENT (ECI's)
ECI 1 ...
ECI 2 ...

ECI n ...

EPE for management process (ISO 14031)

EPE for process n (ISO 14031)

Life Cycle Assesment LCA (ISO 14040)

Environment Management System (ISO 14001)

Environment declaration (ISO 14025) with performance level (ISO 14024)

EPI - Environment al Performance Indicator
MPI - Management Process Indicator
OPI - Operational Process Indicator
ECI - Environmental Conditions Indicator

The Environment Condition Indicators ECI provide information about the state of the environment in the vicinity of the plant. They are most often used by government agencies in order to determine the emission limit.

ECI indicators are not measures of the impact on the environment, but the can provide helpful information about the correlation between the state of the environment and the activities,

products and services of the organization. ECI indicators, in the context of environmental organizations can help with:
- identification and management of significant environmental aspects of the organization,
- assessment of the relevance of environmental performance criteria,
- selection of indicators MPI and OPI,
- setting the benchmark for determining changes,
- determining the environmental changes in time with respect to the environmental program,
- study the possible relationship between the state of the environment, and the organization's activity.

The examples of environmental indicators (ECI):
- the concentration of certain contaminants in the ambient air in selected monitoring points;
- the temperature in region at a predetermined distance from the devices of the organization;
- The weighted average noise level on the border between devices of the organization;
- the degree of transparency of air from the windward and leeward of organization's device;
- temperature of the water.

From the perspective of the diversity of indicators that are possible to identify, the organization, which planning EPE should also take into account:
- the full range of its activities, products and services,
- its own organizational structure,
- the overall strategy of the organization,
- environmental policy,
- information needed to comply with legal requirements and other international environmental arrangements,
- environmental costs and benefits,
- information necessary to analyze the financial effects on the activities of environmental
- the need for consistent information on the environmental performance - per year
- information on local, regional, national and global state of the environment,
- cultural and social factors.

The sequence of steps to follow at all stages of implementation of indicators in ISO 14031 are presented in Table 10 and Figure 15. (Pochyluk, Szymański 1999a, 1999b)

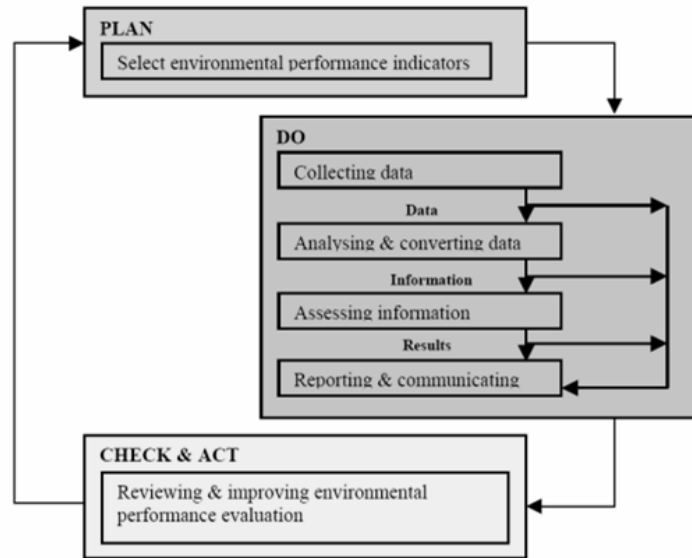*Figure 20: The model of Plan-Do-Check-Act of ISO 14031 implementation*

Table 10: The model of PDCA of ISO 14031 implementation

PLAN	DO
Selection of indicators based on: - significant environmental aspects in present conditions, - internal environmental performance criteria, - opinions of interested parties, based on business plan, production plan and strategy. Indicators: ECI, EPI, MPI and OPI	- indicators evaluation - data updating, collecting the regulations, operating permits, EMS procedures and legal acts (production, processing, monitoring), - data analysis - evaluation of the obtained information - discussion of the results
CHECK & ACT	
Review and performance improvement. Identification of opportunities of environmental performance improvement, based on: - cost and benefit program, - analysis of progress in environmental performance targets meeting, - assessment of correctness of the environmental performance criteria and indicators, - quality data and methods collection .	

Source: Pochyluk, Szymański 1999a; 1999b

4 Comparison of ISO 14001 and the environmental standard EMAS

EMAS was introduced in 1993, ISO 14001 in 1996, but they are not mandatory. ISO 14001 covers a broader range of activities than EMAS. EMAS was intended only for certain specific sites of industrial activity. Methods are not competitive because EMAS has also different accents, which go beyond the depth of ISO 14001 and BS 7750, as it, for example, also requires:
- clear improvement of the environmental impacts,
- formal consent and
- reporting on environmental impacts.

Upon the occurrence of ISO 14001, the European Community in 1997 issued a provision in which this standard is recognized as one of the steps in the implementation of EMAS, thus we eliminate inappropriate duplication of activities.

On a sample of 140 EMAS certification note:
- that 47% of companies made the certification of ISO 14001, which are for the most part large companies,
- half of the 53% that have EMAS do not have the ISO 14001 standard and also have no intention to acquire it,
- 38% received ISO 14001 certification after completion of EMAS.

The adoption of ISO 14001 helped in the implementation of EMAS by raising consciousness in the field of environmental management. Both systems are complemented wherein EMAS is stricter in some areas.

EMAS is the most credible and robust environmental management instrument on the market. The superior quality of EMAS rests upon (3x3 good reason for EMAS):
- stricter requirements for the measurement and evaluation of environmental performance against objectives and targets, and the continuous improvement of that environmental performance;
- compliance with environmental legislation ensured by government supervision;
- strong employee involvement;
- environmental core indicators creating multiannual comparability within and organizations' validated environmental statements which provide information to the general public; and
- registration by a public authority after verification by an accredited / licensed environmental verifier.

The main differences between EMAS and ISO 14001are presented in Table 11.

Table 11: EMAS and ISO/EN ISO 14001

Element	EMAS	ISO/EN ISO 14001
Status	Under legal bases (EU Member States and EEA countries). Regulation of the European Parliament and the Council under public law	Under no legal bases. (International: worldwide) ISO standard under private law
Organization	The entity to be registered shall not exceed the boundaries of the Member State, and it is intended to go towards entities and sites	Does not go towards entities or sites
Environmental policy	Included commitment to continual improvement of environmental performance of the organisation	Does not include a commitment to the continual improvement of environmental performance but of the performance of the system
Initial environmental review	Obligatory preliminary review, when is the first time that the organisation sets its environmental status	Initial review is recommended, but not required
Environmental aspects	Identification and evaluation of the environmental aspects (direct and indirect). Establishment of criteria for assessing the significance of the environmental aspects	Required only a procedure able to identify environmental aspects
Legal compliance	Obligatory to demonstrate it. Required full legal compliance. There is a compliance-audit	Only commitment to comply with applicable legal requirements. There is no compliance-audit
External communication	Open dialogue with the public. Public Environmental Statement (validated for verifiers)	Not open dialogue with the public. Only is required to respond to relevant communication from external interested parts. Control by public is not possible
Continual improvement	Required annual improvement	Required periodically improvement without a defined frequency
Management review	Is wider and requires an evaluation of the environmental performance of the organization, based in a performance-audit	Required an environmental performance in the management, but not through a performance audit
Contractors and suppliers	Required influence over contractors and suppliers	Relevant procedures are communicated to contractors and suppliers
Employees involvement	Active involvement of employees and their representatives	No

Internal environmental auditing	Includes: system-audit, a performance-audit (= evaluation of environmental performance) and an environmental compliance-audit (=determination of legal compliance)	Included only system audit against the requirements of the standard
Auditor	Required the independence of the auditor	Advised the independence of the auditor
Audits	Check for improvement of environmental performance. Frequency required: 3 year cycle during which all areas are verified at least once	Check environmental system performance. No frequency required
External verification	Accredited environmental verifiers	No
Verification/ Certification Scope	Verifiers accredited according to NACE codes	Certifiers accredited according to EAC code
Authorities are informed	Obligation by Validation of Environmental Statement	No obligation
Logo	Yes	No

Source: EMAS – Factsheet. EMAS benefits, May 2008

5 Conclusion

The purpose of ISO 14000 is to improve the environmental performance of the organization and harmonization of the different national standards on environmental management and, consequently, to facilitate the international trade. 14001 ISO standard focuses on the fundamental principles and procedures associated with environmental management, together to specifying of requirements. It is the most important of the ISO 14000 series of standards, because it determines the system itself. ISO 14031 is the guidelines for setting up a continuous process of evaluation (measurement, analysis, determination) focuses on the effects of the environment. This standard allows for that comply with the requirements of ISO 14001 at the stage where the company conducts the monitoring and measurement of the impact on the environment

The main goal of ISO 14001 implementation is to define the role of business organizations toward the construction of a sustainable society - Environmental Performance Evaluation.

In order to determine environmental efforts, it is necessary to precisely measure and evaluate the impacts of organization's activities on the environment and the outcomes of environmental actions (environmental performance). Tools which will use during company standardization are Environmental Performance Indicators (EPI), which support the efforts of environmental organizations, and give the ability to evaluation and preparation of decisions.