

METHODOLOGY FOR IDENTIFICATION OF ASPECTS AND RISK ASSESSMENT IN SYSTEMS FOR ENVIRONMENTAL MANAGEMENT

Milka VICHEVA

Technical University of Sofia, Bulgaria

Abstract. An analysis of the process of risk management according to ISO 31000 standard "*Risk Management. Principles and guidelines*" is done. The requirements of ISO 14001 "*Management systems in relation to the environment. Requirements and guidelines for implementation*" for the identification of environmental aspects are analyzed and the guidelines for implementation according to ISO 14004 "*Management systems in relation to the environment. General guidance on principles, systems and methods for deployment*" are systematized. A review of the types of methods for risk analysis according to EN 31010: 2010 "*Risk Management. Methods of risk assessment*" is carried out. Taking into account the requirements of the new structure of the management systems a methodology for identification of aspects and risk assessment in environmental management system is developed; a sample of risk assessment is composed.

Keywords: risk, environment management system, risk assessment, aspects of environment

1. Introduction

The risk is one of the new elements in the structure of the standards of management systems (MS) [1]. Measures in order to determine the risk and actions to deal with it appropriately integrated into the management of the organization are introduced in the new framework of MS. According to [1] the elements of the MS structure devoted to risk are:

pt. 6 Planning

6.1 Actions to address risks and opportunities

When planning the management system, the organization shall determine the risks and opportunities that need to be addressed to:

- Ensure that the management system can achieve its expected results;
- Prevent or reduce adverse effects;
- Achieve continual improvement.

The organization shall plan:

a) actions to address these risks and opportunities, and

b) How to:

- Integrate and implement the actions in process of management system;
- Assess the effectiveness of these actions.

6.2 Objectives and planning to achieve them

Risk management in the MS requires appropriate organization, policy, evaluation and impact. ISO 31000 standard "*Risk Management. Principles and guidelines*" [2] lays down the general principles and approaches to risk management.

The purpose of this article is based on the requirements of the new structure of MS [1], the principles, the organizational framework and the process of risk management according to ISO

31000 standard [2], the requirements of EN ISO 14001 [3] and the instructions of EN ISO 14004 [4] for introducing a system of environmental management (EMS) to establish a methodology for identification of aspects and risk assessment.

2. Basics of ISO 31000 standard "*Risk Management. Principles and guidelines*"

Each organization in its activity is under the influence of external and internal factors that create risk to achieve its goals.

Risk is the impact of uncertainty on the achievement of the objectives [2]. This impact is most obvious deviation from a given expectation. It is characterized by potential events and their consequences. For effective risk management it needs to be identified and analyzed to assess the need for impact on it. The ISO 31000 sets out a strategy for risk management and defines a total system approach for its implementation.

The structure of the standard includes basic principles, organizational framework and process of risk management. It is represented in Figure 1 [2].

2.1. Components of the organizational framework of risk management

The organizational framework of risk management includes policies, objectives, powers and arrangements for risk management, responsibilities, resources, processes and activities for the development, implementation, monitoring, review and continuous improvement of risk management throughout the organization. It is an integral part of the policy and practices throughout the organization [2].

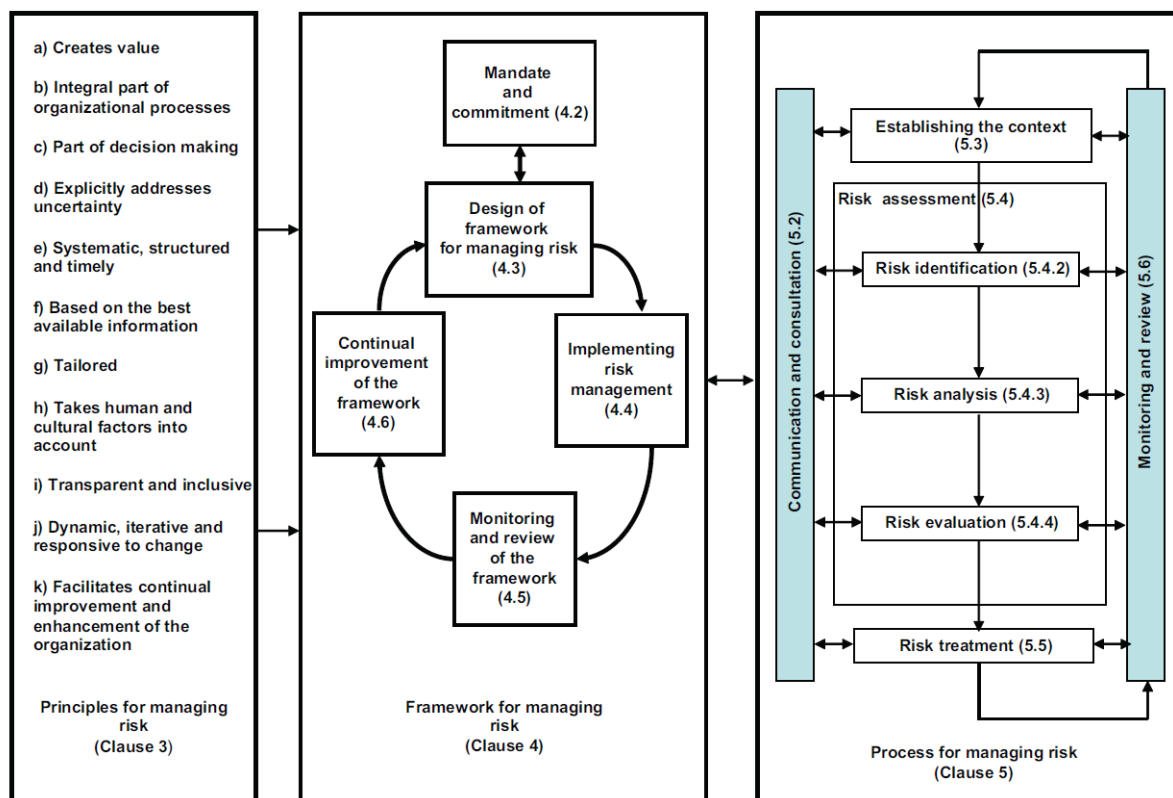


Figure 1. Relationships between the risk management principles, framework and process of risk management

The purpose of the organizational framework is to integrate risk management into the overall management system of the organization. Its development includes:

- 1) Understand the organization and its circumstances;
- 2) Create a policy for risk management;
- 3) Responsibility;
- 4) Integration in organizational processes;
- 5) Resources;
- 6) Creating mechanisms for internal communication and reporting;
- 7) Creating mechanisms for external exchange of information and reporting.

Implementation of risk management is carried out by:

- 1) Implementation of the organizational framework of risk management;
- 2) Implementation of the process of risk management.

2.2. Process of risk management

The process of risk management is a systematic implementation of the activities for the exchange of information, consultation, establishing the circumstances and activities for the identification, analysis, evaluation, impact, monitoring and review of risk. It is an integral part of the overall management of the organization and adequately

integrated into the process. The process of risk management includes [2]:

- 1) Exchange of information and consultation;
- 2) Establishment of internal and external circumstances and those associated with the process of risk management, as well as setting criteria for risk;
- 3) Risk assessment;
- 4) Impact on risk;
- 5) Monitoring and review;
- 6) Maintain records of the process of risk management.

Central to the management process is *risk assessment*. It covers the processes of identification, analysis and evaluation of the risk.

Risk identification is the process of detection, identification and description of risks. Identification covers both the sources of risk and their causes and their potential consequences. Factual data, theoretical analyzes, recommendations of experts and other competent persons, taking into account the needs of stakeholders, can be used for identification.

Risk analysis is the process of understanding the nature of a risk. Based on the analysis the risk is assessed and decisions to influence it are made.

Assessing risk is the process of comparing the results of the risk analysis with risk criteria to determine the acceptability or admissibility of the

risk. This process supports the decision making on the impact of the risk.

Risk criteria determine the conditions to which the significance of the risk is accessed.

Impact on the risk is a process designed to change a risk.

3. Methods for identification of aspects and risk assessment in EMS

In order to plan actions [3] concerning the risks and opportunities, the organization must:

- Identify the environmental aspects of its activities, products and services that can manage and those which may be affected, taking into account planned or new developments, or new or modified activities, products and services;
- Identify aspects that have or can have significant impact on the environment.

Standard EN 31010: 2010 "*Risk Management. Methods of risk assessment*" [5] provides guidance on selection and application of systematic methods for risk assessment.

Methods of risk analysis are qualitative, semi-quantitative or quantitative. Particular application depends on the availability of reliable data and the needs of the organization.

Qualitative methods determine the consequences, probability and risk level by terms such as "high", "medium" and "low" and can be combined and subsequently likely to evaluate the obtained level of risk.

The *semi-quantitative methods* use digital scales for assessing the consequences and the probability in order to combine them to get the level of risk, using a formula.

Quantitative analysis provides estimates of the actual values of the consequences and their probabilities and gives values for the level of risk in specific units. Comprehensive quantitative analysis is not always possible or desirable due to insufficient information about the system or activity that has been analyzed, the absence of data, the influence of human factors, etc. or when efforts to quantitative analysis are not justified or necessary. In such cases the application of qualitative or semi-quantitative methods of risk analysis can be effective.

Guidelines for planning the actions of the organization relating to the risks and opportunities are given in standard EN ISO 14004 [4].

The methodology for the identification of environmental aspects and risk assessment is compiled based on standards ISO 14001, ISO 14004, ISO 31000, EN 31010.

Elements of activities, products or services of an organization that can interact with the environment are understood under *environmental aspects*.

The organization should identify environmental aspects, which can control and those which can be influenced.

The *environmental impacts* are adverse or favorable changes in the environment, being wholly or partially the result of the environmental aspects of the organization.

3.1. Input elements

The following can serve as sources of information to identify the environmental aspects:

- The nature and organization of activities;
- The characteristics of the activities, products and services;
- Incoming and outgoing materials, energy processes;
- Technology used;
- Details of the purchasing process of dangerous chemicals;
- Information sheets for storage and handling of chemicals;
- Information reports on waste types and their treatment;
- Monitoring data management processes of the environment;
- Reports of past incidents and emergencies;
- Reports on implementation of the program for protection of the environment;
- Audit reports;
- Prescriptions and finding records by competent authorities;
- Applicable legal aspects;
- Applications for permits and licenses relating to the environment;
- Information from other systems management, embedded in the organization;
- Other.

3.2. Analysis and identification of environmental aspects

Environmental analysis is carried out:

- The initial review of the situation in environment conformity assessment of the organization's EMS to ISO 14001, in order to identify the environmental aspects associated with the materials used, existing processes, products and services provided;
- In any change in the organization - processes, products, services;

- After a change or renewal of work technology and equipment to determine their impact on the environment;
- At the annual review of the EMS to update the program on the environment;
- At the commissioning of new capacities;
- At the request of the competent authorities.

Identifying aspects of the environment comprises:

- Past, present and planned activities, products and services;
- All elements of the activities, products and services of the organization and their indicators that affect the environment (air, surface and groundwater, land and soil, subsoil, flora and fauna, health and hygiene aspects of the environment) and are related to the environment and the health and life of people;
- Under normal operation of the organization;
- Conditions of abnormal and emergency situations.

The selected approach for identifying the environmental aspects may consider:

- Air emissions;
- Discharges into waters;
- Contamination of land;
- Consumption of raw materials, natural resources;
- Energy consumption;
- Loss of energy released;
- Waste and by-products;
- Physical characteristics.

For realization of the selected approach is necessary to take into account aspects related to the activities, products and services, such as:

- Design;
- Production processes;
- Packaging and transport;
- Waste management;
- Extraction and distribution of raw materials and natural resources;
- Distribution, consumption and obsolescence;
- Wildlife and biodiversity.

3.3. Assessment of the significance of the environmental aspects

Assessing the relevance involves applying both technical analysis and the assessment of the organization. The use of criteria should help an organization to identify environmental aspects and related impacts can be considered significant. These criteria can be applied to the aspects and environmental impacts. For their implementation the organization can establish levels (or values) of significance associated with each criterion, for

example, based on a combination of the possibility (probability / frequency) of manifestation and its consequences (severity / intensity). Determining the significance can be quantified in numerical or qualitative in terms of levels as high, medium, low or negligible.

Criteria for assessing the impact of aspects of environment and determine their importance:

- Applicable legal requirements;
- Characteristics related to the environment;
- Frequency of occurrence of aspects;
- Duration of impact;
- Scale and severity of the pollution;
- Other requirements adopted by the organization;
- Concerns of internal and external stakeholders.

The applied approach for determining the environmental impacts and the importance of aspects must be distinguished:

- Beneficial and harmful effects on the environment,
- Actual and potential environmental impacts,
- Environmental components that may be affected, such as air, water, soil, flora, fauna, cultural heritage, etc.
- Characteristics of the area, which can influence the effects such as local climatic conditions, altitude, soil type,
- Nature of environmental change.

3.4. Calculation of risk

In calculating the risk a methodology is used for risk assessment [5]. The risk assessment may include: probability of occurrence, severity of environmental impact and regulatory risk. For the calculation of risk an example is given using the following scales:

1. Scale of probability

K1 - frequency of impact

	Very often	Often	Medium	Rarely	Very rarely
Probability (frequency of impact)	5	4	3	2	1

2. Scale of impact

K2 - the weight of environmental impact

	Very high	High	Medium	Low	Very low
Scale (severity of pollution)	5	4	3	2	1

3. Regulatory risk

K3 - regulatory risk

Existence of a regulatory requirement	1
Lack of regulatory requirement	2

The calculation of risk is using the following formula:

$$\text{Risk} = K1 \times K2 + K3$$

The risk assessment is using the following scale:

Risk	Description	Assessment
Unacceptable	The risk causes significant damage. You need to plan adequate preventive measures to prevent or reduce it.	18 - 26
Predictable	The risk is in the range in which it is necessary to take planned actions for its consistent decrease.	10 - 17
Acceptable	The risk is predictable and does not require further action to reduce the level.	3 - 9

Based on the analysis obtained and the estimated risk for each aspect the following "List of environmental aspects" is drawn.

Activity	Aspect	Impact	Frequency of appearance	Weight of impact	Regulatory risk	Assessment	Goals
			K1	K2	K3		

3.5. Determination of priorities in the management of environmental aspects

Identification of significant environmental aspects and associated impacts is necessary to determine the necessary controls and establishing priorities for the actions of management.

In determining priorities in the management of environmental aspects the following factors are observed:

- Degree of non-compliance with regulatory requirements;
- Resource management capabilities aspects;
- Economic and technological possibilities for action to significantly improve aspects;
- Opportunities to take temporary steps to limit the impacts.

3.6. Determination of goals and programs

For significant environmental aspects of the organization general and specific environmental objectives and programs for their achievement are

defined and approved by management. For each identified risk, who's the evaluation falls in the high or middle zone, adequate steps must be implemented for its operational management, including reducing as far as possible. The control steps taken should eliminate the risk or at least reduce its value to an acceptable level (the high zone to fall at least in the middle zone, if it is not possible to fall in the lower zone).

As a result of the evaluation the organization should define its objectives in terms of the environment and the program to achieve them. Any change or development of a new process can lead to a change of the existing aspects or to identify new ones, such as:

- Development of new processes / products / services;
- Modification of technological processes;
- Significantly increase or decrease the capacity of the work;
- Changes in legislation.

The results of the analysis and the proposed method for identifying aspects and risk assessment are shown in Figure 2.

4. Conclusion

An analysis of the process of risk management according to ISO 31000 standard "Risk Management. Principles and guidelines" is done. The requirements of ISO 14001 "Management systems in relation to the environment. Requirements and guidelines for implementation" for the identification of environmental aspects are analyzed and the guidelines for implementation according to ISO 14004 "Management systems in relation to the environment. General guidance on principles, systems and methods for deployment" are systematized. A review of the types of methods for risk analysis according to EN 31010: 2010 "Risk Management. Methods of risk assessment" is carried out. Taking into account the requirements of the new structure of the management systems a methodology for identification of aspects and risk assessment in environmental management system is developed; a sample of risk assessment is composed.

References

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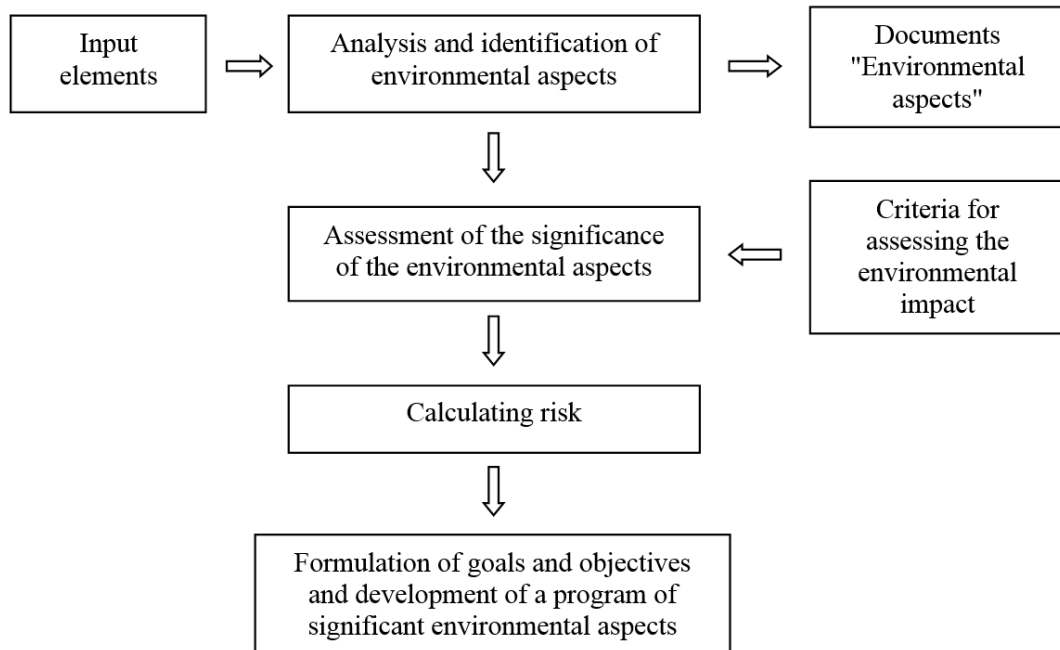


Figure 2. Diagram of the process of identifying aspects and risk assessment

4. ISO 14004:2010 *Management systems in relation to the environment. General guidance on principles, systems and methods for implementation* (ISO 14004:2004)
5. EN 31010:2010 *Risk management. Methods for risk assessment* (IEC/ISO 31010:2009)

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