

SCIENTIFIC PAPERS  
OF THE UNIVERSITY OF PARDUBICE  
Series A  
Faculty of Chemical Technology  
4 (1998)

**PROJECTS OF INFORMATION SYSTEM  
FOR ENVIRONMENTAL MANAGEMENT  
IN SYNTHESIA PARDUBICE**

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Received July 2, 1998

*The growing importance of environmental management is reflected in a number of important regulations and standards. The aim of these standards and regulations is to harmonize environmental management. All standards emphasize the need of controlling tools for environmental management as well as the need of environmental information system—environmental accounting—as one important part of corporate environmental management.*

*One part of environmental accounting is the identification of environmental costs. Tracking and tracing of environmental costs is a precondition for correct allocation to cost carriers (products) and cost centers. This article deals with the projects of tracking and tracing of environmental costs of the plants incorporated into the chemical company Synthesia Pardubice.*

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## **Introduction**

The expected entry of the Czech Republic into the European Economic Community means a great number of tasks for industrial enterprises with regard to environmental protection. For the top management of these firms it is necessary to know the fundamental principles of environmental management system which belongs to the means enabling the creation of conditions for better position of the firm on the market. The high standard required for environmental protection is not only the aim of environmental policy but also the condition for industrial development.

## **Standards of Environmental Management**

Besides the law standards and other system measures introduced in various countries, nowadays, international standards of environmental management system are exercised step by step. Among key documents of this kind belong the EU directive on the environmental management and audit scheme Council Regulation (EEC) No 1836/1993 which enable the volunteer participation of industrial companies in the plan Eco-Management and Audit Scheme (EMAS), British Standard BS 7750 and ISO 14 001. ISO 14 001 was worked out in succession to the management quality ISO 9 000 and therefore it is of great interest for our producers, mainly exporters.

The structure of the standard 14 000 of the International Standards Organization for environmental management system is presented in Fig. 1.

International Standards covering environmental management are intended to provide organizations with the elements of an effective environmental management system which can be integrated with other management requirements, to assist organizations to achieve environmental and economic goals. The International Standard ISO 14 001 specifies the requirements of environmental management system. It has been written to be applicable to all types and sizes of organizations and to accommodate diverse geographical, cultural and social conditions. The basis of the approach is shown in Fig. 2.

The success of the system depends on commitment from all levels and functions, especially from top management. The overall aim of this International Standard is to support environmental protection and prevention of pollution in balance with social-economic needs.

All standards of environmental management system are very similar as to their content and represent the introduction of aspects of environmental care into the management process of the enterprise on voluntary base. Environmental manage-

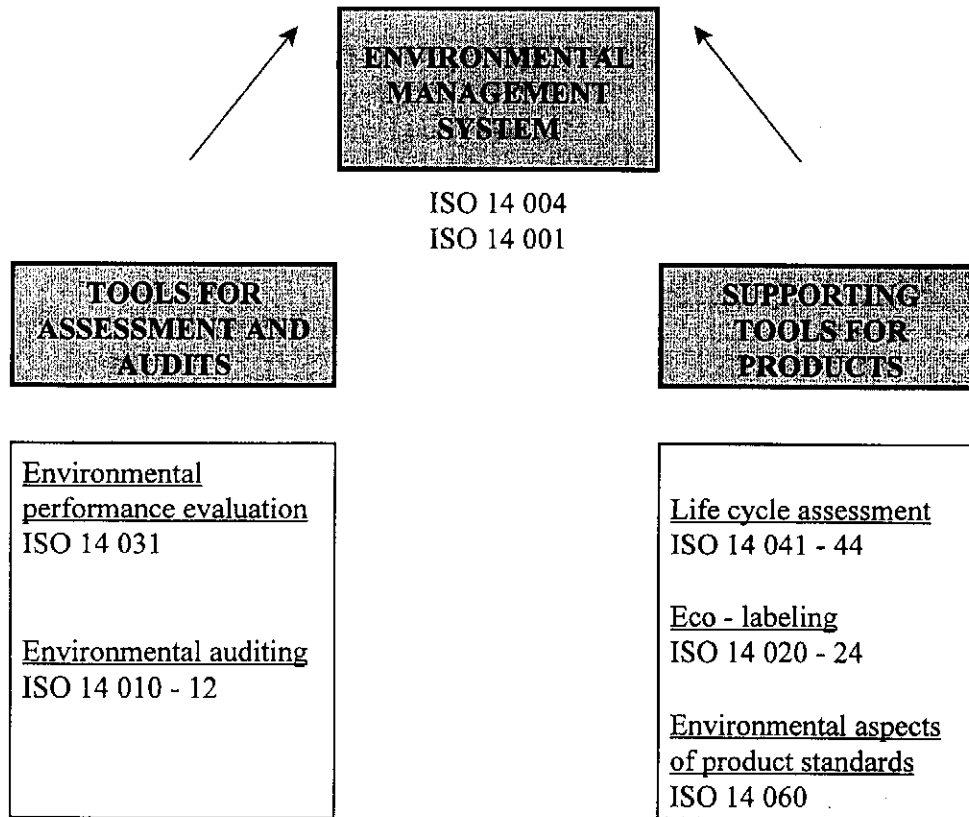


Fig. 1 The structure of the standard 14 000 of the International Standards Organization for environmental management system

ment system becomes an integral part of top management in enterprises which accept its rules. The aim of environmental management system realized according to any of the mentioned standards must be the lasting and systematic decrease of the negative influences on the environment along with simultaneous reducing of consumption of raw materials, materials and energy.

The increase of environmental behaviour of enterprises is not only an increase in costs connected with building of new environmental facilities but, at the same time that it means that better economic results can be reached. Another possible contribution consists in lower environmental pollution fees, lower costs for health care as a result of better health conditions of the employees, easier recruiting and less fluctuation of qualified workers etc.

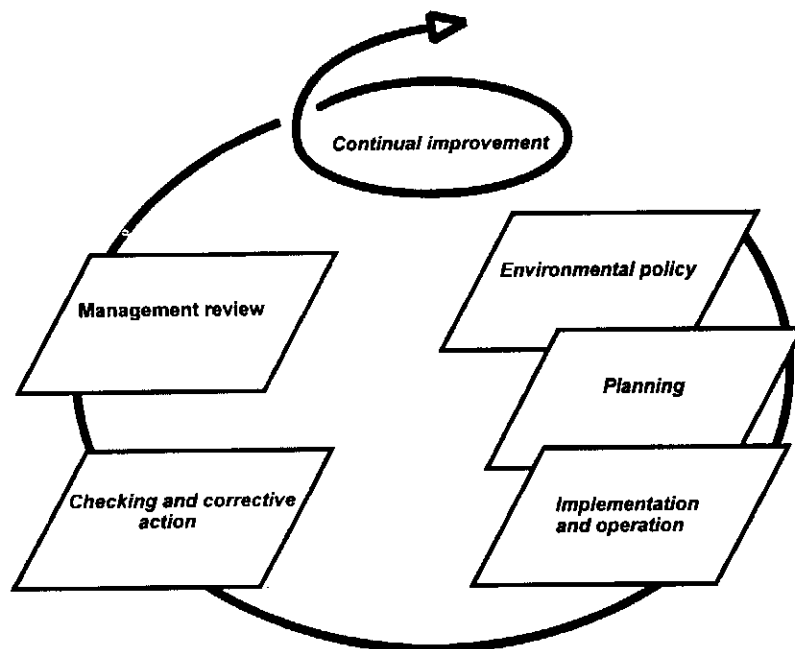


Fig. 2 Environmental management system model for ISO 14 001 [2]

### Information System for Environmental Management

An important condition for successful environmental management system is accessibility of information, e.g. extension of the present information system of the enterprise by the environmental aspects. The information system extended by the environmental aspects—environmental accounting—is becoming the means to solve the problems of environmental protection in agreement with economic interests of the enterprise.

Environmental accounting is a sub-area of accounting that deals with

- activities, methods and systems
- recording, analysis and reporting
- environmentally induced financial impacts and ecological impacts of a defined economic system (e.g. a firm, plant region, nation, etc.) [11].

Accounting is the core information management tool of a firm. Environmental accounting is the application of established tools of accounting (tools of information management, analysis and communications) to environmental management. Environmental accounting must be incorporated in a more comprehensive

environmental management concept. Only then can the respective information be used for goal setting, piloting, implementation and communications. Environmental accounting could use data of financial accounting, managerial accounting and further information. The aim of this system is to find out places and activities that spoil the environment and cause economic losses of the enterprise. Environmental accounting should be aimed first of all at the costs of environmental protection and at the way in which they are situated in the structure of the enterprise. This is the most important thing for the enterprises now. For the concept of enterprise environmental costs it is possible to accept the following definition: Enterprise *environmental costs* are costs connected with enterprise activities (investments, projects, ...) and those activities (waste disposal, prevention of waste emergence, operation of health care equipment, ...) whose aim is to minimize the negative influence of the enterprise on the environment [13].

The idea of the entire system is the careful tracking and tracing of the main costs in connection with environmental protection and addition to the products and processes by which they are caused. The analysis of these facts will serve as the starting point for suggestions of solving the problem spots in the enterprise, which could lead to saving and to decrease in economic losses. The result of all these measures should be the reduction of negative influence on the environment. Material and energy flows that pollute the environment do not bring any profit—we have to pay three times for them—at purchase, processing during production and disposing.

### **Environmental Protection in Synthesia Pardubice**

Safety, health and environmental protection rank among the highest priorities of Synthesia. As part of this policy, Synthesia will above all:

- comply with the requirements of laws and regulations related to safety, health and environmental protection in the development, manufacturing, storage, distribution and marketing of its products,
- make efforts to bring its system of environmental management to an international standard and support international activities of chemical industry such as Responsible Care, The Business Charter for Sustainable Development etc.,
- improve environmental and safety awareness of its employees through a company training and education program,
- inform employees and the public about the impacts of its activities on safety, health and the environment and cooperate with the neighboring communities in the implementation of emergency prevention and response systems,
- set quantifiable goals, measure progress towards them and constantly improve its environmental performance.

Tab. I Environmental pollution fees (CZK mil.)

Year	1992	1993	1994	1995	1996	1997
Air pollution	8.1	4.5	8.7	8.7	10.7	9.3
Waste waters	38.5	28.9	24.0	27.3	20.8	40.3
Waste deposition	6.1	5.7	8.6	8.0	6.5	7.4
Imission damage compensation	3.8	1.6	4.0	0.8	4.9	4.5
Total	56.5	40.7	45.3	44.8	42.9	61.5

The Synthesia company was showing an effort to systematically improve and develop its methods of environmental management in the last years. This aspiration was complemented in October 1996, when the Czech Chemical Industry Association conferred the Responsible Care certificate on Synthesia, verifying compliance with the program and the right to use a logo. The implementation of an environmental management system (EMS) according to the international ISO 14 001 standard follows a successful introduction of a quality management system, which was certified by Lloyd's Register Quality Assurance at selected plants of Synthesia's Division 03 according to ČSN ISO 9 002. The Synthesia company regards standard ISO 14 001 as the principal tool when implementing EMS. However, in case the customers and other interested parties wish so, the system can be extended taking into account the requirements of the EEC regulation 1836/93 (EMAS). The establishing of EMS also means that Synthesia meets most of the principles of Responsible Care—an initiative of the Chemical Industry Association. The company did not determine to generally establish the standard in all divisions at the same time. Similarly to the quality system the company elected a progressive implementation in selected plants and departments. In 1996 was created the basic document of the company's EMS—the management systems manual, which combines the quality management and environmental management systems according to the requirements of ISO 9 001 and ISO 14 001 standards. The company started to amend some of about 90 organization guidelines and it is necessary to release further guidelines to satisfy those standard requirements not yet addressed. However, the company has to meet practical objectives and improve environmental performance of the production plants apart from the formal system documentation. The company is therefore trying to develop cleaner production (waste minimization, pollution prevention) programs, which promise not only to reduce the pollution of the environmental media but also to save operating expenses.

## **Environmental Pollution Fees in Synthesia Pardubice**

The structure and quantity of environmental pollution fees in Synthesia are evident from Table I.

The highest item of environmental pollution fees is that of waste waters—in excess of 50% of total fees (in 1992 represented about 68%, in 1993 about 71% of total fees). From this point of view of environmental pollution fees it is evident that for their bold reduction it is necessary to pay heed to reducing of pollution of waste waters and to reducing of quantity of emitted waste waters.

## **The Projects of Tracking and Tracing of Environmental Costs in Synthesia Pardubice**

In 1996 we worked out a partial project of environmental information system in one of the operation plants of the company Synthesia Pardubice. For the process of suggestion of environmental information system we chose the processing plant of organic products production—production of betanaphthol. In 1997 and 1998 we continued on this project in the plant of Monomers. The projects dealt with tracking and tracing of environmental costs. The aim of the projects was to suggest measures for improvement of knowledge of environmental costs. The actual information system in company Synthesia only makes possible to obtain information about some select environmental costs (e.g. environmental pollution fees). Better part of environmental costs is hidden in the summarized items or overheads.

*The following process was chosen:*

- 1 The first step was to get acquainted with the technology of production, to obtain a picture about the flow of material and energy. On the basis of this knowledge it was possible to expose the waste currents of all states—gaseous, liquid and solid states. The limit of the balanced system were the plants of betanaphthol production and of monomers production.
- 2 From the survey obtained the critical spots of influence on environment were named which burden the operation from the environmental point of view most.
- 3 At this stage we tried to make out the environmental costs in 1996 and 1997 in these plants. The starting point for the environmental cost calculation was accounting records and financial statements of these plants and furthermore actual costing for the products. It was necessary for the costing to count not only direct but also indirect costs. It is very important to ascribe the costs to the plants where they emerge and not hide them into any of the overheads.

*The environmental costs contain:*

– *operating costs of environmental equipment*

The term environmental equipment means technology which is integrated into the production for environmental protection. The environmental equipment can be end-of-the-pipe technologies, for example. These are equipments including buildings and pieces of land that recycle or clean gaseous, liquid or solid waste in the original form and quantity as they come out of the main production activity. A part of the costs connected with environmental equipment is represented by the depreciations of the environmental equipment and its operating costs (material and energy consumption, repair and maintenance expenses, other operating costs). End-of-the-pipe technologies are clean-up devices which have been installed mainly for cleaning purposes after the core production process. Scrubbers and waste water treatment plants are typical examples of end-of-the-pipe technologies. They can help to concentrate toxic substances and reduce toxic impacts. However, end-of-the-pipe technologies do not usually solve environmental problems at source, but they rather “catch” emissions before they are released uncontrolled into the natural environment. End-of-the-pipe technologies are, nevertheless, a way of internalizing externalities borne by human society or the environment. The identification and measurement of environmentally related costs is much more difficult with integrated technologies (also called clean technologies). Integrated technologies are more efficient production technologies which reduce pollution at source, or before it occurs. In the case of the betanaphthol plant and the monomers plant the highest item is represented by the costs connected with the operation and use of the biological waste water treatment plant. This plant cleans the polluted water of all the plants of the whole company Synthesia. The costs connected with the activity of the waste water treatment plant are divided according to the balance of polluted streams.

– *environmental pollution fees*—these fees are divided into three categories: fees for air pollution, for water pollution and deposition of waste. Environmental pollution fees are a way of internalizing externalities too.

– *costs for waste*—include costs for recycling, treatment and manipulation of waste, costs of its transport, neutralizing and depositing in landfills.

– *other costs*—these include the service connected with the working out of various studies, expert opinions, analyses, checks and other services.

Our calculations have shown that environmental costs represent about 13% of the total costs in the case of betanaphthol production and about 8,5% of the manufacturing costs in the case of monomers production. The highest share of the environmental costs are the costs connected with the operation and use of the biological waste water treatment plant—about 70% of all environmental costs.



- 4 The environmental costs for each of the betanaphthol and monomers products were numerically expressed. The information about environmental costs were included into the costing of the products.

Subsequent phases should look for solution to help firms to improve their environmental performance and thereby progress on the path of sustainable development.

*The following measures were suggested :*

- Extending the accounting system by further classifying aspect—environmental costs. For the analysis of environmental costs it is necessary to complete the present chart of accounts by more analytical accounts which would serve as evidence of environmental costs. In the existing chart of accounts the environmental costs are hidden in the summarized items. What will be considered an environmental cost is decided by the accounting entity itself. At the same time, a frequency of tracking, tracing and recording single environmental costs was also suggested
- checking the correctness of items dealing with raw material flow, energy and materials at all stages of the production process
- working out or checking the correctness of items dealing with waste flows (of all states: gaseous, liquid and solid) at all stages of the production process
- finding out the information about integrated technologies
- working out or completing documents for the recycling, health care equipment and activities and for other equipment of waste disposal: raw material flows, energy, materials and demand for labour
- including environmental consideration into investment appraisal

The above-listed process and suggested measures can be generalized and applied to further firms.

## **Conclusion**

The introduction of environmental management should bring a number of economic advantages to the enterprise: material savings, decrease of environmental pollution fees, decrease of fines and compensation of environmental damages, increase the ability to compete on foreign markets and increase the production quality. This is connected with the result of activities of the enterprise concerning the environment.

A part of management measures of environmental management system is the complement of the present information system by another aspect—the environmental view. With the aid of this the environmental costs will be allocated to where they belong and the responsibility for environmental protection will be fixed on the

part of the enterprise where these problems arise.

The knowledge of environmental costs and their transparency represent starting data for a lasting evaluation of the efficiency of products, production processes and for responsible planning of products and activities.

Main rules of the recommended process should be the following:

- transparent survey of material and energy flows
- systematic connection of flows with costs for waste flows
- incorporating this knowledge into the economy of the enterprise
- interdisciplinary approach to drawing the necessary conclusions and their exploitation.

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