Journal of Environmental Protection, Safety, Education and Management

2015, Number 5, Volume 3, date of issue 28th Juni 2015 ISSN 1339-5270

ACCEPTANCE OF ENVIRONMENTAL CRITERIA IN THE DEVELOPMENT, PRODUCTION AND OPERATION OF TECHNOLOGIES

Miroslav RUSKO - Monika MIKULOVA

Abstract

Sustainable continuous management of society means ensuring current needs of the population without the ability of limitations to future generations to meet their own needs. Acceptance of environmental criteria and application of required environmental parameters and elements in the development, manufacturing and operation of technology, processes of design and product manufacturing is usually the only way to make technology cease to produce environmental problems. Environmental technologies are becoming part of the economic activities filling a role to reduce costs, and boost competitiveness by reducing energy and material consumption, thereby decreasing non-desired emissions and waste cumulation. Environmental technologies represent an optimal solution for sustainable growth of public and private trade. Comparison of several technological processes designated for the product production with comparable qualitative parameters in terms of their environmental impact is feasible, provided the supply of an appropriate specification of environmental requirements. Technology assessment is a scientific, interactive, and communicative process that aims to contribute to the formation of public and social opinion on societal aspects of science and technology. The selection of technology should take into account several requirements, in particular, technological, economic, environmental and social aspects. Environmentally safe technologies are not just individual technologies, but entire systems that include know-how, procedures, goods, services, and equipment as well as organizational and managerial processes.

Key words:

environment, technology, assessment

Introduction

In terms of sustainable continuity of company management in the long run is inevitable its gradual transition from the use of non-renewable to renewable use of sources. The operation of each technology has an impact on the environment. The point is to what extent are the negative impact on the environment, respectively what is the socially and environmentally acceptable level of negative impact on the environment. [25]

Sustainable development is of an upmost priority of global society. We are talking of synchronized platform for

- integration, activity leaning towards sustainable development, monitoring and assessment,
- support of domestic technological development, research in innovations including the need of suitable political environment for the development and besides other also industrial diversification,
- modernization of infrastructure and renovation of industry in order to make them sustainable,
- higher effectivity use of resources and better acceptance of clean and environmentally sound technologies and industrial processes,
- achieving sustainable management and effective use of natural resources.

Continuity of Sustainable management means satisfying the current needs of the population without limitation, to the ability of future generations to meet their own needs. To achieve such a management of society it should therefore be necessary to make partial changes in technology, practices and habits not only on the production side but also from the consumers side view. The interplay between people and their environment is very versatile. Rapid development of science and technology is making increasingly difficult the task of prediction result of human impact and activities on the environment. While the most comprehensive assessment of the environment on Earth was the result Project Millennium Ecosystem Assessment ("ecosystem assessment at the turn of the millennium"), which involved about 1400 experts from around the world. [23] This resulted in the publication of numerous studies on biodiversity, desertification, industry and other areas and summary report "Ecosystems and Human Well-being". It notes that people have changed in 50 years the ecosystems on Earth more than ever in human history, and that the increase in the standard of living of people took place at the cost of damaging 60% of global ecosystems. The report further states that the degradation of ecosystems is an obstacle to poverty reduction and achieving food security. [22] Environmental factors are degraded significantly by industry

that is a producer of a wide range of pollutants from toxic substances to inert waste. Especially prevalent are point sources of pollution of all sizes and types [15].

Influence of new technologies are visible on new products, tools, machines, materials and services. Among new benefits of developing technologies belongs foremost higher productivity, better lifestyle, more free time and wider variety of available products. Benefits arising from technologies are confronted with problems of technology development, such as traffic jams, air and water pollution, insufficient energy sources. It is often pointed to the need to promote such an approach that seeks benefits arising from technologies and suppresses the undesirable side effects [21]. New technologies encounter problems – such as lack of reliable information on the performance of innovative technologies that leads to a lack of market penetration of potentially excellent technology as well as the incorrect assessment of the risks, benefits and limitations, which not only discourages investors but also customers. This aspect is reflected in the further technology development. The result is a low level of innovation, which has a negative impact on increase of competitiveness of eco - innovative organizations and effectiveness of measures to protect the environment.

Technical development is only a small part of the overall development, which influences a number of other factors. Perceptive managers must not only respond to social pressures, but it is required to further anticipate political forces and legal rulings that may be adopted and to follow up on them. [34] In fact, this is not an easy task to handle. It is also necessary to remember that a company, which is in a long term environmentally oriented, should not be by the adoption of new legislative rules competitively disadvantaged. It would mean a hard legislative approach to the problems of environmental pollution.

Technological breakthrough can result in much more desirable alternatives. It is therefore vital that the recipients and users of technologies are able to choose an option that meets their specific needs and capabilities so that environmentally sound operation remains on the site during its entire life cycle. It is necessary that the technology is economically viable and socially acceptable and thus sustainable.

The influence of technologies on the environment can be expressed by factors divided to basic groups [2]:

- technological factors – used for the description of technological processes,
- economic factors – involve significant investment and operational costs of main and secondary processes and other economic-organizational aspects,
- environmental factors – include major interactions of assessed processes with the environment,
- social factors – represent the attempt to integrate social aspects of technological processes into decision-making process.

Environmentally sound technology

Current range of primary and secondary causes of contamination contrary to the past, when occurred it was a local issue, environmental contamination now are large and global environmental problems [7]. Their solution is currently demanding approaches compatible with sustainable development of society, which should be aimed at the creation, promotion and transfer of EST (Environmentally Sound Technology – environmentálne vhodné technológie). EST is defined as "technologies which use is less environmentally harmful than relevant use of alternative technologies."

EST protect the environment, are less polluting, use resources in justified manner, recycle more of their wastes and products, and take care of any remaining waste in an environmentally more acceptable manner than the technologies they replace. It would be more acceptable if the recipient of a technology went even further and chose "sustainable technologies", i.e. technology, which has not only environmentally sound properties, but also is economically viable and socially acceptable. These technologies contribute to the three pillars of sustainable development.

Technological changes must be described as an extensive and complex process with aim to avoid the creation and retainment of dependence on the supplier if it is to contribute to sustainable and equitable development. Result for the addressee must be the ability to use, replicate, improve and possibly resell technology. Technological change is more than just the transfer of highly technical equipment from the developed to the developing world or within the developing world. Moreover, it involves much more than just equipment and other so-called "hard" technology, as it also contains the complete system and its partial components, including know-how, goods and services, equipment, organizational and managerial procedures. Only then is technology converted, covering a set of processes involving all dimensions of origin, flow and understanding of know-how, experience.

Performance of implemented technology can vary and it depends on the level of local expertise and staff training, as well as working conditions, infrastructure and other social and cultural differences. Similarly, impacts on natural resources and population may also be different. [10] Technology, which is classified as environmentally sound at s particular time, may not be such in another time and circumstances [3].

Non-compliance with technological discipline, the lack or absence of constant control and maintenance of technological process can even the best EST, during its assessment of impacts on the environment, be degraded as unsuited technology for its operation. [11].

Chapter 34 of Agenda 21 focuses on the transfer of environmentally sound technologies indicates that environmentally friendly technologies as opposed to technologies for which they substituted protect the environment, are less polluting, use all resources in a sustainable manner, allow to recycle more waste and products and treat more acceptably residual waste. EST are handling the remaining waste in a more acceptable manner than the technologies they replace.
In terms of pollution environmentally sound technology are processing and manufacturing technologies "that do not create any waste or only a small amounts of waste. It is therefore a technology to prevent the environmental pollution. They also include so called "end of pipe" technologies that deal with the already existing pollution.
Technology acceptable from an environmental point of view is not just a single technology, but complex systems including expertise, manufacturing procedures, goods and services, equipment as well as organizational and managerial procedures. Discussion on technology transfer must therefore also deal with aspects of human resource development of local capacity including aspects relating to the status of men and women. Technology acceptable from an environmental point of view should be compatible with nationally defined socio-economic, cultural and environmental priorities.

Risk Technologies in the context of Seveso Directive

Major accidents in chemical and petrochemical industry in the 70's and early 80's (Seveso, Bhopal, Mexico City, Cubatao) led the EU to the adoption of Council Directive. 82/501/ EEC on the major-accident hazards of certain industrial activities, known as the "Seveso". The directive was one of the first attempts of the EU to adopt uniform procedures that would enable to identify and categorize enterprises engaged in activities that may be designated by the term "hazardous (risky)". Along with the adoption of the Directive individual EU Member States engaged to build a comprehensive system for assessing the risk of serious accidents in different industries. In 1992, was launched a major commitment in this area and the European Economic Commission of UN (UNECE) in March of the same year adopted the "Convention on the Transboundary Effects of Industrial Accidents (i.e. "Helsinki Convention"). [42]

EU responded in the 1996 to new international activities in this area revising the Seveso Directive with new Directive No. 96/82 / EC on the control of major accident hazards involving dangerous substances (so-called. Seveso II). The Directive entered into force on 3 February 1997. The EU as a whole acceded the Helsinki Convention in 1998, following a decision of the Council. 98/685/EC, but with certain reservations concerning the harmonization of threshold quantities of dangerous substances with the Seveso II Directive. In addition to those Directives and Conventions are in force in the EU still other conventions such as the Convention of the International Labor Organization (ILO) no. 174 on the prevention of major industrial accidents. The Seveso II Directive, as is clear from its title and content is primarily focused on the prevention and preparedness of businesses with the presence of selected hazardous substances to major accidents, namely the establishment of technical, administrative and organizational requirements for early recognition, swift and effective reaction, respectively elimination of consequences of major accidents.

Act No. 261/2002 Coll. and its executive decrees implemented Directive 96/82 /ES (SEVESO II) into legislative force of Slovak Republic. Seveso II directs to meet objectives of a specific obligation onto operators of hazardous technologies, which include an obligation for systematic risk assessment of major accident and development of security management, comprising of a risk analysis and management. [26]

Act No.128/2015 Coll. of the prevention of major industrial accidents (ZPH) and the amendment of certain laws has implemented in to legislation of Slovak Republic the EU Directive 2012/18/EU of control of hazards of major accidents involving hazardous substances (Directive SEVESO III).

Slovakia has more than 80 SEVESO businesses in two categories (category A and B). In EU SEVESO III touches almost 10 thousand industrial locations and businesses, that use or store dangerous substances in larger quantities, mostly in areas of standard chemistry, petrochemical and gas industries, but also in area of storage, modification and manipulation with dangerous material. This incomplete 1 % of Slovakian SEVESO businesses today does not differ from others within EU when talking about operating technologies, operator expertise or security, systems safety assessment and evaluation of ZPH risks. Currently all existing SEVESO organizations in category A or B within SR must have risk assessment and evaluation of ZPH with the use of probabilistic engineering analysis and methods allowing quantification of individual and social risk evaluation. In such a cases, when potential impacts of representative ZPH accident scenarios at these entities reached the exceeded borders of business property they already employed a number of responsibilities to competent state and public administration as well as to the public concerned. It can be stated that the existing Seveso companies in Slovakia have fulfilled the relevant obligations, respectively are executing these requirements. However on grounds of inconsistency or lack of criteria determining e.g. acute toxicity values, harmful, or life-threatening levels of heat radiation or shockwave levels of explosion accident scenarios of ZPH, and establishing consistent clearances, obtained results could not be compared and their ability to meet the needs of planners documentation was thus very low. Constant upgrading of inputs to this assessment, creation of generic input databases, increasing operator experiences and the development of software tools for the assessments characterize current situation in the field of risk assessment. The problem is that even the world does not have enough specialists able to assess the needs to implement detailed risk analyses, which are extremely time- and money-consuming and not always lead to the expected benefits.

In addition to the likelihood of initial initiating events (failures, accidents, phenomena) it is mostly the solutions and level of safety and precaution measures of relevant technologies or equipment safety systems that influence the final probability of ZPH. Thus, the analysis is addressing solution of safety barriers, whose role is to prevent the development of potential, fault or emergency event to ZPH, or at least suppress, or locate the potential danger. [41]

Environmental technologies in the context of ETAP

One of the means of supporting the Lisbon Strategy, is an Action Plan for Environmental Technologies (Environmental Technologies Action Plan - ETAP), adopted by the European Commission in January 2004. The main objective of ETAP is economy development by promoting new modern technologies and eco-innovations that are respectful to the environment. Environmental technologies are becoming part of the economic activities where they have a role to reduce costs, and boost competitiveness by reducing energy and materials consumption, thereby decreasing the production of unwanted emissions and waste.

Environmental technologies (ET) in ETAP (The Environmental Technologies Action Plan) are such technologies which use is less harmful to the environment than other relevant alternatives. [17].

Slovak government on 21. December 2005 approved by Resolution no.1046/2005 Document sequence (Roadmap) implementation of the Action Plan for Environmental Technologies (ETAP) in the Slovak Republic. [27] In accordance with this resolution was prepared an executing document and forwarded onto the European Commission by the deadline. Approved material contains a total of 12 points and represents a compromise between the interests of involved sectors. The tasks provide possibilities to support environmental technologies in the Slovak Republic. Each task briefly characterizes and describes the existing situation in the field, the draft of measures, measurable indicator of progress and contact of the responsible department or institution. Draft measures are fundamentally limited by the lack of budgeting funds. Border limits of own funding of concerned departments was one of the conditions of material throughout.

From the requirements of the European Commission, outcomes are regular two-year reviews at the national level of the ETAP implementation as well as updates on the next period. SAŽP/CEM Trnava (Slovak Agency for Environment) in cooperation with the state central administration bodies and the bodies in question, prepared under Government Resolution no. 19/2008 dated on January 9, 2008 Evaluation of the activities related to progress sequences of (Roadmap) implementation of the Action Plan for Environmental Technologies (ETAP) in the Slovak Republic. [30] This document contains the evaluation of the performance of 11 tasks. [28] The overview of the measures updating the implementation of ETAP in Slovakia provides information about a brief characterization of the individual measures, measurable indicator and contact the responsible department or institution [29]. Environmental technologies include:

- end technologies aimed to decrease the levels of pollution (e.g. Lowering the air pollution, technologies of waste management)
- products and services, that have a lower impact on the environment and use less resources (photovoltaic technologies)
- means of effective natural sources use (e.g. Water supply, technologies that save power consumption)

If we are to avoid the transfer of inadequate, unsustainable and dangerous technologies, the recipient of the technology should be able to identify and choose the technologies, which are suitable for its current needs, circumstances and capacities. Therefore, a key element of this broader view of technology transfer is an option. There is no single strategy for successful transfer, which is suitable for all situations. Right situation occurs when the technology recipient chooses technologies, which meet at least the minimum conditions of the definition of "environmental". EST are technologies that have the potential significantly improving the environmental approach.

Environmental technologies represent an optimal solution for the sustainable growth of public and private markets. Comparing several technological processes for the production of products with comparable quality parameters in terms of their environmental impact is feasible by providing an appropriate specification of environmental requirements. Based on this set of criteria in the context of other technological, economic, security and social criteria, it is possible to identify potential risks in the operation of the technology. The result should be making such a decision, when choosing a technology to produce products with comparable quality parameters (substituents) which would prefer due to its technological, economic, environmental and social characteristics of such technology from alternative processes that not only represents the maximum economic benefits, but also the least risk in terms of safety and environmental impact.

European system of environmental technology verification

The European Commission has prepared informal proposal (European Environmental Technologies Verification System - EETVS), aimed at promoting environmental technologies (eco-technologies) in small and medium-sized businesses with the possibility of implementing it. One of the priority measures of the Action Plan for Environmental Technologies (ETAP), adopted by the European Union in 2004 is to improve the development of environmental technologies and implement them in practice is system of Environmental Technologies Verification. Verification is for this purpose defined as

"an independent quantitative assessment of the characteristics of environmental technology based on technology properties claims or pre-set protocols". [37]

Best available techniques

There is an integrated prevention and control (IPPC - Integrated Pollution Prevention and Control) implemented at the international level adopted by Directive EPaR no. 2010/75 / EU on industrial emissions (integrated pollution prevention and control of environment) [32]. This replaces Directive 2008/1/EC on IPPC and EPaR Regulation (EC) No. 166/2006 establishing a European Release and Transfer Register of pollutants [33] amending Council Directives 91/689/EEC and 96/61/EC (E-PRTR). Integrated permitting is proceedings of coordinated authorizations and permits that sets out conditions of operation activities in existing plants and in new operations in order to guarantee an effective integrated protection of environmental aspects and to maintain the level of pollution within the environmental quality standards.

IPPC according to Act no. 39/2013 Coll. on integrated prevention and pollution control and on amendments to certain laws, is a set of measures to prevent pollution, to reduce emissions into air, water and soil, the reduction of waste and the recycling, recovery and disposal of waste in order to achieve overall high level of environmental perseverance. Act no.39/2013 Coll. on integrated prevention and control of environment pollution and amendment of certain laws, among other things regulate the rights and obligations of persons in the field of integrated prevention and control of pollution, processes to integrated permitting, the competence of state administration in the field of integrated prevention and control of pollution protection, sanctions for infringements.

Act No. 39/2013 Col. Among other set out basic terminology such as:

- new technology is a technique for an industrial activity that, in the further commercial development, could provide a higher general level of environmental protection, or at least the same level of environmental protection and higher cost savings than existing best available techniques;
- Best Available Techniques (BAT) is the most effective and advanced stage of development activities, technology and method of operation which indicate the practical suitability of particular techniques, in particular in terms of determining the emission limits in pursuit of prevention of emissions in operation in order to prevent and, where this is not possible, at least reduce emissions and environmental impact, and
    - the technology is used in the operation, the way the operation is designed, built, maintained, operated and which the activities are terminated in thereafter;
    - the available technique is developed on a scale, which allows its use in the relevant industrial sector, under economically, and technically viable conditions, taking into consideration the costs and benefits, regardless of where this technique is used or produced, as far as appropriate conditions make it available to the operator.
    - the best technique is the most effective techniques to achieve a high level of environmental protection as a whole.

The outcome of formal information exchange is presented in the form of BAT reference documents (BAT Reference Documents - BREFs) and is gradually released for all monitored activities pertaining to the IPPC. Some activities aren´t characterized only for one industry (e.g. cooling systems) – in this case, we talk about cross-sectoral BAT, which are collected in the so-called. Horizontal / cross cutting BREFs. The system must have a feedback on the implementation and impacts of the IPPC Directive, progress of environmental performance of businesses and the impact of their activities on the environment. Industrial enterprises that are subject to the scope of the IPPC Directive are out coming a series of relatively extensive obligations to inform the public about the impact of their activities on the environment. The information must be made publicly available and in addition to basic data of the plant, they must include information on emissions and other impacts of activities on the environment. Executing documents on this Act is a Ministry of Environment of the SR Decree No. 183/2013 Coll., implementing the requirements of the Act. No.39/2013 Coll. on integrated prevention and control of environment pollution and on amendment of certain laws. [31]

Environmental requirements on selection and equipment set up

While selecting technology several requirements should be considered, especially technological, economic, environmental and social ones. These requirements often differ from country to country. These differences often lead to different emphasis on environmental impact regulation. [19]. These include the following examples:

- well defined and documented needs,
- several technological alternatives that are well and reliably characterized in terms of environmental and economic performance and potential social impact [18],
- rational and functional procedures (secondary tools for decision making), that allow selection of optimal technology [20],

- the ability to execute selected technology fully functional to fulfill its potential and is operated without significant harmful implications,
- flexibility of production system, i.e. adaptability of equipment to respond to relatively quick changes,
- active technological control and diagnosis during production process,
- systematic management of processes in real time,
- reduced production of secondary outputs [16], resp. their acceptable chemical compounds in view of environmental protection,
- lower energy requirements [6],
- identification of risk sources for the business [13],
- state of working environment,
- professional preparedness of human resources.

Selection and implementation of technology depends on a number of factors. Identification of environmentally friendly or otherwise acceptable technologies can sometimes be problematic. [4] For example, technology that is rated as being green in the locality, culture, and economic situation or period of its life cycle may not be so in another. Its performance can be significantly affected by the availability of supporting infrastructure and access to the necessary management, maintenance and monitoring expertise [9].

Acceptance of environmental criteria and application of required parameters and elements in the development, manufacture and operation of technologies development process (eco-design) and production process, is probably the only way to ensure technologies stop producing environmental issues, which must then be resolved ex post under pressure of damaging effects they can cause in the environment including subject of public health. In evaluating the life cycle of technological equipment, it is necessary to consider the environmental context in the development phase, construction, operation or its use and to separate stages of normal operation, respectively potential accident or violation of technological discipline, and termination of the technical, moral or economic lifespan [5]:

In 2001, the Göteborg European Council launched the EU strategy for sustainable development. It has set out ambitious objectives and called for more integrated approach to policy, which can achieve economic, social and environmental objectives at once. Therefore it supplemented the Lisbon strategy to achieve this, and EU to be the most competitive and dynamic economy in the world, based on knowledge, enabling sustainable economic growth with more and better jobs and greater social cohesion. It also underlined that sustainable development requires global solutions, thereby supporting the EU's efforts to take internationally a leading role to promote global economic and social development while protecting the environment. In 2002, the Barcelona European Council recognized the strategic importance of investment in R & D (research and development - R & D) for the Lisbon Strategy and sustainable development. It has also been agreed that overall spending on research and development in the EU should increase and reach by 2010 the 3% of gross domestic product (GDP). Investing in research from private and public resources is vital for the EU economy, including eco-industries. In October 2003, the European Council has recognized the potential of technology to create synergies between environmental protection and economic growth [17]. Environmental technologies are the key to it. They include technologies and processes to manage pollution (e.g. Air pollution control, waste management), products and services which are less polluting and less resource-intensive and use more efficient methods of resources management (e.g. Water supply, energy-saving technologies). Thus defined, they cross through all economic activities and sectors, where they often reduce costs and improve competitiveness by reducing energy and resource consumption, and thus generating less emissions and less waste.

Selection and implementation of technologies depends on a number of factors. When introducing technologies into operating conditions are in addition to technical factors, a very important social and economic factors specific to the conditions. From this perspective, environmentally sound technology (EST) is such technology that is not only acceptable from an environmental standpoint, but also economically viable and socially acceptable. The application of such technologies contributes to sustainable development of society.

Technology assessment

Term "technology assessment" - TA) has begun to be used in 1960 in USA with direction to transport in context of environmental pollution. The term was first used under presiding of Emilio Daddario, at Subcommittee on Science, Research, and Development of the House Science and Astronautics Committee of US Congress [41]. In specialized literature, we can come across with several terms in connection to TA, e.g. Parliamentary TA (PTA), Expert TA (often considered as classic TA), Participatory TA (pTA), Constructive TA (CTA), Discursive TA, Argumentative TA, Health TA (HTA) [40]. Health technology assessment (HTA) was developed by U.S. Office of Technology Assessment (OTA) [39].

Technology assessment is a procedure that simplifies understanding of probabilistic impacts of new or modified industrial technologies. [8].

2015, Number 5, Volume 3, date of issue 28th Juni 2015 ISSN 1339-5270

Technology can be assessed from several points, for example from technical, economic, sensoric, produced products (their quality, environmental suitability), environmental influences, energy demand, consumption of resources, availability in the given region, resp. country (added as per [14]).

A significant role in the assessment process of technologies plays an assessment methodology, interdisciplinary discussion, predictable medium and long term processes, scientific approach but also communication in the context of decision-making. [35] In recent years, TA (Technology Assessment) is strongly developing in Europe. This creates space for new methods aimed at testing of scientific and technological innovations and their assessment from a professional point of view. The resulting methodological diversity, debates of the pros and cons of each method has opened space for their assessment is far from finished [36].

Important role in the TA project plays TAMI (Technology Assessment Methods and Impacts) [36], EUROPTA (European Participatory Technology Assessment - Methods in Technology Assessment and Technology Decision-Making) and PACITA (Parliaments and Civil Society in Technology Assessment). It has its important mission related to the provision of comprehensive knowledge on issues related to innovation and technology. They are involved in the relevant decision-making levels, i.e. citizens, organizations, businesses and policy makers at local, regional, national, transnational and global level. This activity is executed through studies, research, stakeholder involvement, consultation and participation of citizens in political dialogues related to decision-making in this area.[38]

From the environmental point, the technology can be judged by whether it is primarily focused on preventing production of pollutants (secondary outcomes) during the production cycle, or reducing the production of pollutants produced in the environment, i. g. end technology (EOP - "end-of-pipe") and production of environmentally friendly products. Furthermore bio functional respectively biocompatible biomaterials, environmental friendly consumption of raw materials, not only in terms of quantity, but also from the point of the primary view, respectively secondary, renewable, and exhaustible natural resources. [1], [12]

Process of environmental impact assessment of selected buildings, facilities and activities on the environment (Environmental Impact Assessment, hereinafter referred to as "EIA") is applicable in economically developed countries for more than 30 years. In Slovakia, the legislative form of this requirement is provided for in Act no. 24/2006 Coll. Assessment of impacts on the environment and on amendments to certain laws, which came into force on 1 March 2006.

Conclusions

Technologies are becoming a key factor in formation the character and development of economic activities and play a crucial role in reconciliation of economic and environmental objectives. They can provide significant improvements in the impact of manufacturing processes on the environment. However, often absent are the appropriate performance outcomes of such a technologies that would confirm their performance and contribution to the environment. In many countries, we see increased tendency of unproven technology use, and thereby creating environmental problems. Consequently, it is necessary to formulate generally applicable environmental requirements on selection and implementation of technologies and to create a mechanism of technology assessment according to set criteria and meeting these criteria, so technology can be considered as environmentally sound.

Acceptance and application of environmental criteria and application of required parameters and elements into development, production and operation of technology, processes of product development and manufacturing, is most likely the only way to stop technologies produce environmental problems. Environmentally sound technologies are not just individual technologies, but entire systems, which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures.

Availability of scientific and technological information and access to environmentally sound technologies and their transfer, are the core requirements for achieving sustainable development. Provision of adequate information on the environmental aspects of present technologies consist of two interconnected parts: obtaining current information on existing and latest technologies, including their environmental risks, and improving our approach to environmentally sound technologies.

ZOZNAM BIBLIOGRAFICKÝCH ODKAZOV

[1] Analysis reported in Ecotec, 2002

[2] BADIDA, M. – MAJERNÍK M. - ŠEBO, D. - HODOLIČ, J., 2001: *Strojárska výroba a životné prostredie. (Industrial production and the Environment)* - Košice: Vienala, 2.revised and edited issue, 253 pp., ISBN 80-7099-695-1, EAN 9788070996959, p.119

[3] BOTKIN, D.,B. - KELLER, E. A., 2000: *Environmental Science – Earth as a Living Planet*. - New York; Chichester; Weinheim; Brisbane; Singapore; Toronto: John Wiley & Sons, Inc.,3. issue., ISBN 0-471-32173-7, 649pp.

[4] HORSÁK Z., 2006: *Integrated System for Disposal of Biodegradable Waste* – speciál portal, - MZLU Agronomická fakulta : MendelNet 06, 11 2006, ISBN 80-7157-993-X

[5] HRÁDOCKÝ, L. - BADIDA, M. - MAJERNÍK, M., 1994: *Ekologizácia výrobkov a výrob*. (E*kologisation of products and production)* - Košice: KAVS SjF TU, 1.edition, 63pp.

[6] CHOVANCOVÁ, J. - MAJERNÍK, M. - BOSÁK, M., 2005*: Energetická efektívnosť malých a stredných podnikov ako súčasť EMAS.(Energy Effectivness in small and medium size businesses as part of EMAS*) - In: Acta Mechanica Slovaca. year. 9, No. 2-b (2005), p. 177-180. ISSN 1335-2393.

[7] KOČÍ, V. - KREČMEROVÁ, T., 2008: Mixed municipal waste management technologies in LCA modelling. Poster presentation in SETAC Europe 18th Annual Meeting in Warsaw, 26.-29. 5. 2008

[8] KREČMEROVÁ,T., Metóda hodnotenia environmentálnej technológie (*Environmental technology assessment methods*) – EnTA. In RUSKO,M., BALOG,K. [Eds.] Environmental Managemetn 2003, conference proceedings 11.-12.12.2003 in Trnave, Trnava, 2004, ISBN 80-227-2005-4, p.136-139

[9] KREČMEROVÁ, T. – KOVAŘÍKOVÁ, T., 2006: Metoda posudzování životního cyklu výrobků či procesů v podnikové praxi.(*Methods of life cycle assessment of products and processes in business*) – Verlag Dashofer: Ekologie v podnikové praxi, 9/2006, p. 1-4, ISSN 1801-6324

[10] KREČMEROVÁ, T. - RUSKO, M., 2004: *Posudzovanie technológií z environmentálneho hľadiska.(Technology evaluation from the environmental point)* – In: RUSKO, M., BALOG, K. [Eds.] Environmental management III., conference proceedings 2003. Trnava, ISBN 80-227-2005-4

[11] LIBERKOVÁ, L. - BADIDA, M., 2005: *Vyhodnocovanie environmentálnych nákladov a ich prepojenie s environmentálnym účtovníctvom. (Assessment of environmental costs and their connection to environmental accounting)*.- Acta Mechanica Slovaca 2-B/2005, ISSN 1335-2393, year 9.

[12] MILLER, D., 1997: *Green Technology Trends. The Changing Context of the Environmental Technology Industry.* – In: SAYLER, G., S., SANSEVERINO, J., DAVIS, K., L.[Eds.] Biotechnology in the Sustainable Environment. Environmental Science Research, Volume 54, New York: Plenum Press, 389 s., ISBN 0-306- 45717-2, p.5-12

[13] PROCHÁZKOVÁ, D. – DYTRYCH, P., 2004: *Zdroje rizik pro podnik a řízení bezpečnosti podniku. (Business risk sources and business safety management*) - In: Metodické problémy oceňování podniku, Ed. M. Mařík. Nakladatelství VŠE, Praha, 303p, ISBN 80-245-0738-2, 250-256pp.

[14] RUIZ, J. M. - KOLLÁR, V. - BROKEŠ, P., 2000: *Priemyselné technológie (Kvalita a životné prostredie)*. *(Industrial technologies (Quality and environment))* - Bratislava, 194 pp., ISBN 80-968449-0-3, p.81

[15] ŠAUER,P. et al. *Dobrovolné dohody v politice životního prostředí*. Praha: VŠE-MŽP ČR, 2000, ISBN 80-245- 0116-3, 339 s.

[16] STEJSKAL, B. - VAVERKOVÁ, M. - KOTOVICOVÁ, J., 2007: Srovnání technologie MBU a spalování komunálních odpadů. In: Sborník přednášek konference Odpadové fórum 2007. Praha, p. 3332--3336. ISBN 978- 80-02-01894-0

[17] Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union. - Brussels, Commission of the European Union, 28.1.2004, COM(2004) 38 final

[18] TREBUŇA, P., 2008: *Projektovanie výroby integrované optimálnym systémom hmotných tokov.* (*Production development integrated through optimal system of material flows*)- In: Transfer inovácií. No. 11 (2008). ISBN 80-8075-075-X.

[19] UNEP , Transfer technology. 2003, 49 pp.

[20] VARGOVÁ, J. - HRICOVÁ, B., 2006: *Perspektívy uplatnenia princípov ekodizajnu v strojárskom priemysle*. *(Perspectives of eco-design implementation principles in industry*) - In: Zem v pasci? Analýza zložiek životného prostredia. - 1. Year of international scientific conference, 26.-28.apríl, 2006 Hotel Polianka, Krpáčovo. Zvolen: TU, p. 719-723. ISBN 80-228-1552-7.

[21] WEIHRICH, H.- KOONTZ, H.:*Management*.Praha:Victoria Publishing. 1.české vyd.,ISBN 80-85605-45-7,659 pp.

[22] Miroslav ŠUTA: *Co nám Země dává zadarmo aneb Ekosystémy a lidský blahobyt*.(*What the Earth gives us for free or ecosystems and human well-being*) - [on-line] Available on - URL: http://respekt.ihned.cz/

[23] *Millennium Ecosystem Assessment.* - [on-line] Available on - URL: http://www.millenniumassessment.org/en/index.aspx

[24] WESSELY, E. - KRÁLIKOVÁ, R. - KRUPA, M.: Efficient management in production companies by implementation of PLM. 2008. In: Annals of DAAAM for 2008 , Vienna : DAAAM International, 2008 P. 1527- 1528. - ISBN 9783901509681

[25] KRÁLIKOVÁ, R. - MIHÁLIKOVÁ, R. : Product life cycle management applications. In: RIM 2009: Development and modernization of production, Cairo, University of Bihać, 2009 p. 207-208. - ISBN 978-9958-624-29-2

[26] KANDRÁČ J. - SKARBA, D., 2000: Metodický postup na hodnotenie rizík nebezpečných prevádzok a štúdia o podnikoch v Slovenskej republike.*(Methodical procedures for risk evaluation of hazardous operations and studay of business in SR*) - RISK CONSULT Bratislava, 63 s. - [on-line] Available on - URL:

http://www.minzp.sk/files/skody-a-havarie/priemyselne-havarie/metodicke-postupy-a-prirucky/metodick_postup_na_hodnotenie_rizk_nebezpench_prevdzok_november2000.pdf
[27] *Postupnosť (Roadmap) implementácie Akčného plánu pre environmentálne technológie (ETAP) v SR*. [on-line] Available on - URL: http://www.sazp.sk/public/index/open_file.php?file=CEM/ETAP/uznesenie10462005.doc
[28] *Aktualizácie postupnosti (Roadmap) implementácie Akčného plánu pre environmentálne technológie (ETAP) v SR*. [on-line] Available on - URL: http://www.sazp.sk/public/index/open_file.php?file=CEM/ETAP/uznesenie192008.doc
[29] *Prehľad opatrení aktualizácie implementácie ETAP v SR*. [on-line] Available on - URL: http://www.sazp.sk/public/index/open_file.php?file=CEM/ETAP/Prehlad_opatreni_aktualizacie_ETAP.doc
[30] *Vyhodnotenie plnenia aktivít súvisiacich s aktualizáciou postupnosti (Roadmap) implementácie Akčného plánu pre environmentálne technológie (ETAP) v SR*. [on-line] Available on - URL: http://www.sazp.sk/public/index/open_file.php?file=CEM/ETAP/Vyhodnotenie_ETAP_2009.doc
[31] *Vyhláška MŽP SR č. 183/2013 Z. z. (Ministry of Environment SR Decree*) [on-line] Available on - URL: http://www.zbierka.sk/sk/predpisy/183-2013-z-z. p.-35218.pdf
[32] *Smernica EPaR č. 2010/75/EÚ o priemyselných emisiách. (EPaR Directive of industrial emissions)* [on-line] Available on - URL: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2010L0075:20110106:SK:PDF
[33] Nariadenie EPaR (ES) č. 166/2006 o zriadení Európskeho registra uvoľňovania a prenosov znečisťujúcich látok. (EPaR directive) [on-line] Available on - URL: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R0166:20090807:SK:PDF
[34] KORAUŠ, A., 2000: Marketing v bankovníctve a poisťovníctve. (*Insurance and Banking marketing.)*- Bratislava : SPRINT vfra, 297 pp., ISBN 80-88848-52-0
[35] DECKER, Michael - LADIKAS, Miltos, 2004: Bridges between Science, Society and Policy: Technology Assessment - Methods and Impacts. - Springer Science & Business Media, 252 p., ISBN 3540212833, 9783540212836
[36] TAMI: Technology Assessment – Methods and Impacts»(2002-2003). - [on-line] Available on - URL: >https://www.ta-swiss.ch/methodik/tami/<
[37] Verifikácia environmentálnych technológií.*(Verification of environmental technologies*) - [on-line] Available on - URL: >http://www.sazp.sk/public/index/go.php?id=1917 <
[38] Technology Assessment and Policy Areas of Great Transition.-Proceedings from the PACITA 2013 Conference in Prague, ISBN 978-80-7333-106-1, Prague: Technology Centre ASCR, 2014
[39] BANTA, D., 2009: What is technology assessment? - International Journal of Technology Assessment in Health Care, Volume 25, Supplement S1, July 2009, pp. 7-9, Cambridge University Press 2009
[40] Forms and concepts of technology assessment. - [on-line] Available on - URL: https://en.wikipedia.org/wiki/Technology_assessment
[41] US Congress, House of Representatives, Committee on Science and Astronautics. Technology assessment. Statement of Emilio Daddario, Chairman, Subcommittee on Science, Research and Development, to the 90th Congress, 1st Session. Washington, DC; 1967
[41] KANDRÁČ, J. - KANDRÁČ, M, 2015: Metodická príručka pre pomoc a podporu kompetentných orgánov verejnej správy pri územnoplánovacej a povoľovacej činnosti v okolí existujúcich a navrhovaných SEVESO podnikov a rizikových prevádzok. *(Methodical handbook to support agencies with approval activities of SEVESO businesses)* MŽP SR, Bratislava - [on-line] Available on - URL: http://www.minzp.sk/files/oblasti/prevencia-priemyselnych-havarii/metodicka-prirucka.pdf
[42] Industrial Accidents Convention. -[on-line] Available on - URL: http://www.unece.org/env/teia.html

CONTACT ADRESS

Author: Assoc. prof. RNDr. Miroslav RUSKO, PhD.
Workplace: Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava, Institute of Safety, Environment and Quality, Department of Safety Engineering
Address: 49 Botanická Str., Trnava 917 24, Slovak Republic
E-mail: mirorusko@centrum.sk

Author: Monika MIKULOVA, Ing.
Workplace: Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava, Institute of Safety, Environment and Quality, Department of Safety Engineering
E-mail: monika.mmikulova@gmail.com