

## ENVIRONMENTAL DISASTERS' MANAGEMENT AND DETECTION OF PRIORITY PROBLEMS FOR FUTURE RESEARCH

Dana PROCHÁZKOVÁ - Miroslav RUSKO

### Abstract

*The human system understood as human's live space is open system that is in interaction with its vicinity. The environment is one of the basic assets of human system. On human activities there are reacted both, the planet system and the environment. For the EU safe community concept realisation there is necessary sophisticatedly to manage disasters that disturb security of community and their assets, i.e. to apply measures of prevention, preparedness, response and renovation. The research was concentrated to the following disasters: induced earthquakes caused by certain human activities, such as the construction of large dams, mineral extraction, relocation of materials on the Earth's surface and its vicinity, etc.; disruption of the ozone layer, to which*

*human contributes by CFC emissions; the greenhouse effect, to which human contributes by exhalations of carbon dioxide (CO<sub>2</sub>); maybe even fast variations of climate observed in the present time; contamination of air, water, soil and geological environment; desertification as a result of thoughtless regulation of water flows; decrease in the diversity of animal and plant species; uncontrolled human population explosion, migration of large groups of people; the gradual depletion of non-renewable resources; erosion of soil and rock massifs; and uniformity of the landscape. It identifies deficits at disaster management from the viewpoint of safe community concept that has been promoted by the EU since 2004.*

### Key words

*Human System, Environmental Disasters, Management, Security, Safety, Unknowing the Disasters' Management.*

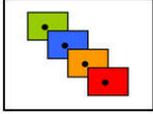
### 1. Introduction

The deepest social fundament of human way life there are general conditions of a historically certain formation. In relation to an individual there are appeared not only material but also intellectual elements of social system. Each human entering to life adopts findings, relations, systems of norms and values. The formation of life form depends on level of human development, on his / her culture understanding as the measure of adopting life conditions and activities, on his / her needs, interests etc. Further, it depends on will, character, capability to go against stress of environs in cases in which the environs forces him / her only one accepted norm of behaviour, way of thinking etc. It is evident that main target of all human exertion is ensuring the human life, i.e. all human needs and wishes. Human needs, interests and wishes are fulfilled by material and immaterial estates that have utility value.

The environment is one of the basic assets of human system, It forms a system (i.e. we distinguish in it elements, links and flows), and therefore, from the view of present knowledge there is necessary system approach to its study and management. Unilateral orientation of view of management on level of states and the EU on environment has even identical recklessness as the oversight of certain aspects of environment without them the human life is not possible. The human as creature talented with intellect must his / her activities by which he / she can disturb environment to rectify so he / she may protect environment against to impacts of natural disasters and realise countermeasures that help to fill demands of sustainable development. For ensuring the security and development it is in the EU performed research, one of which aim is to assess level of management of processes by which environment a Planet react to human activities.

### 2. Human system and environment

Safe human system, for which EU politicians often use the term "Safe space", is defined as a system in which safety is at acceptable level and where care is taken about security of people and public welfare. The human system is a minimal space for human life and human society, and includes elements made up by people, environment necessary for people's lives, parts of Earth necessary for people's lives, property, technology, infrastructure and linkages and flows between these



elements. Protected interests of the human system (assets) are the components, links and flows in the human system necessary for its safety and sustainable development. They are a cherished priority and include life, health and safety of people, property, environment, public welfare, infrastructure and technology [1]. Process model of safety management of the human system [1] shows that the environment is a fundamental asset, a public asset that is protected by governments and international groupings.

People realized the importance of the environment for own life realized only recently [1-7]. Legal protection was established in the seventies of the last century, and only in 1970 environmental protection was codified in the U.S, based on the evaluation of environmental impacts (EIA - Environmental Impact Assessment). It was aimed to ensure permanent sustainable environmental development and to promote the precautionary principle. Protection was roofed by a government agency EPA (Environmental Protection Agency). Similar development took place in the European Union and later in the CR (see the first EIA Act of 1992 and other subsequent legislation). At the beginning the protection in question was conducted completely independently and was considered to be the highest priority of governments. There were many conflicts and, therefore, efforts appeared to find the right governance how to provide people with food and other necessities of life and environmental quality.

Since the beginning of the seventies, an avalanche of works trying to model the evolution of humanity in mutual interaction with the natural environment as a whole began to spread. These works are varied and diverse. They mostly focus on the interaction of certain number of individual elements from social and environmental areas. They usually focus on the abuse of the biosphere and on the demographic issue, without proposing alternative and feasible solutions.

At the end of the seventies after the accident of Three Mile Islands, a new type of safety management was introduced in the area of nuclear technology, which includes the precautionary principle, as it is not limited to risks the occurrence frequency (probability) of which is greater than the normatively determined value (usually 0.05), but also considers risks, the occurrence of which is very small or negligible according to the usual standards, but it's unacceptable impacts have consequences that are catastrophic for at least one of the fundamental interests (assets) protected [7]. European Commission identified specific cases where the use of the precautionary principle is: scientific data are insufficient, inconclusive or uncertain; and from preliminary scientific evaluation it follows that there are reasonable grounds to fear potentially unacceptable impacts on human health, animals and plants.

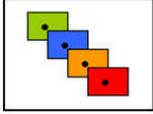
The Commission document also discusses three rules that are necessary when applying the precautionary principle. Their application means that the precautionary principle can only be used when following steps are taken in the monitored problem:

- a comprehensive scientific evaluation performed by an independent accredited professional body with aim to determine the degree of scientific uncertainty,
- assessment of potential risks and impacts that can be realised if the problem is not resolved,
- participation of all interested parties (under the maximum transparency) on the study of possible measures.

According to [7] we have to distinguish the structure, existing energy, material and other (e.g. information) flows and system behaviour in the environmental system. The structure is a set of components and links among them. The system behaviour is very strongly associated with the couplings among components that are interconnected by flows of various kinds (energy, mass, money, people, information, etc.). The most important of all couplings (affinities) of the entire system of environment, there are different kinds of feedback loops that control (manage) the balance (and stability) of the system. When examining and solving the specific tasks, we divide environmental system according to our needs to a greater or lesser number of components that we examine separately. From the perspective of the whole it must always be taken into account that any more or less detailed division is artificial, since all parts are interrelated by linkages and flows of different nature and different forces, and that some of those are hitherto unknown. Among the components, or more precisely partial (autonomous) from a certain viewpoint) elements of the environment that were divided by a certain perspective, a number of links, many material and energy flows have been identified. In terms of linkages between components, materials and energy flows among the components and mechanisms that keep the entire environment system in balance, it seems that the traditional division into components is highly artificial.

### **3. Data and research method used**

To assess the level of management (control) of processes, by which the environment and the planet respond to human activities, data from specialized areas was used, cited at appropriate places and information on legislation and control mechanisms in the EU [8]. Examples of EU regulatory instruments are listed in Table 1



*Table 1: Regulatory instruments of the state*

Actions of the state		Tools
Active	Direct regulations	Normative
	Indirect regulations	Economical Ethical
Passive	Negotiation	Consensual
	Application of liability rules	Statutory responsibility

In research itself, disasters related to followed domain and selected in [1] have been considered. They are referred to as a result of interactions of planet Earth and the environment on human activities, simply called man-made / induced disasters, to which belong:

- induced earthquakes caused by certain human activities, such as the construction of large dams, mineral extraction, relocation of materials on the Earth's surface and its vicinity, etc.,
- disruption of the ozone layer, to which human contributes by CFC emissions,
- the greenhouse effect, to which human contributes by exhalations of carbon dioxide (CO<sub>2</sub>),
- maybe even fast variations of climate observed in the present time,
- contamination of air, water, soil and geological environment,
- desertification as a result of thoughtless regulation of water flows,
- decrease in the diversity of animal and plant species,
- uncontrolled human population explosion, migration of large groups of people,
- the gradual depletion of non-renewable resources,
- erosion of soil and rock massifs,
- uniformity of the landscape.

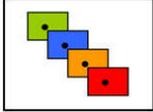
The method of investigation is based on expert evaluation of questionnaire No 1, as described in the Methods chapter. This questionnaire was designed for FOCUS Project [9] and is aimed at finding weaknesses in the EU member states with regard to the management of disasters (Disaster Management), which forms the basis for building EU secure sustainable development.

#### 4. Results of the survey

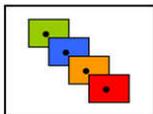
The questionnaire was filled by a University of educated 25 experts having Practical Experiences (first responders, safety managers in plants and utilities, designers, system engineers, operating engineers, safety inspectors, public administration officers, academic workers, lawyers, economists, PhD students - only one political scientist) and was based on professional knowledge in papers dealing with induced disasters and their management [65-81], collected in the CVUT archives. Synthesis was made by five specialists from the Czech Technical University and the Ministry of Interior and it is shown in Table 2.

*Table 2: Assessment of EU management-level governance from the perspective of strategic management of followed disasters*

Question	Answer (sentence + reasons for)
Does the list of followed disasters given above contain all disasters possible in the EU territory?	Explicitly not included: rapid natural subsidences of surface documented in [10]; artificial surface subsidence's due to undermining documented in [10]; and interaction due to militarization of outer space [11].
Which disasters from the followed one are the most horrible for the EU territory? Give / Put them in order according to your own knowledge and experiences.	- contamination of air, water, soil and rock missive's, - uncontrolled human population explosion; migration of large groups of people, - the militarization of space, - climate variations [12].
For which followed disasters the EU does not systematically perform prevention? Is the prevention level sufficient? What is the situation in the CR? What is necessary to improve?	Insufficient attention is paid to land degradation - lack of European legislation and objectives of soil protection, [11, 13]. The same applies to the CR [14]. It is necessary to transform the EU Solidarity Fund [15].



<p>For which followed disasters the EU does not systematically perform preparedness? Is the preparedness level sufficient? Is the preparedness performed by all important society components (including public) sufficient? What is the situation in the CR? What is necessary to improve?</p>	<p>EU's preparedness for climate change is lagging behind in the sphere of adaptation (in contrast to the absurd emphasis on the causes of the greenhouse effect); little attention is devoted to adaptation in cross-border dimension (e.g. the possibility of international coordination and construction of dams and reservoirs), EIA and SEA processes can be used for adaptation, where there is insufficient attention paid to economic and social criteria [15]. Preparedness for protection against floods in the EU on cross-border scale is not coordinated and is insufficient [16]. CR is not sufficiently prepared for flood protection. The European Commission has threatened the Czech Republic by legal punishment, where CR could face financial penalties. According to Commission, Czech Republic has not proved that timely flood prevention rules have been correctly incorporated into legislation. Specifically, Directive 2007/60/EC on the assessment and management of flood risks is the main issue. 27 EU countries had to incorporate it until November 2009 and subsequently inform Brussels. The Commission has repeatedly warned Prague that it did not do so [17]. Improve flood protection in the CR in legislative, organizational and material terms [16]. Methodological guidance is provided by output of a research project ARCADIS [18].</p>
<p>For which followed disasters the EU does not systematically prepare qualified response? Is this response level sufficient? Is response prepared by all important society components (including public) sufficient? What is the situation in the CR? What is necessary to improve?</p>	<p>The response is not specifically directed to any of the followed phenomena. The current level of response within the EU is often insufficient and toothless. The EU has two main tools that allow first response to disasters in general: humanitarian aid and civil protection [19]. It is necessary to form specific methodologies of response targeted to real nature of individual disasters. In the Czech Republic, state environmental policy is limited to prevention of negative phenomena; it completely ignores the response and recovery scenarios [20]. The safety management philosophy stipulates that public administration, organizations and citizens have their respective tasks during response, - but this is still missing in the CR.</p>
<p>For which followed disasters the EU does not systematically prepare qualified renovation (renewal)? Is this renovation level sufficient? What is the situation in the CR? What is necessary to improve?</p>	<p>EU and CR do not have tools to systematically regulate the recovery process, neither generally nor for occurrence of followed disasters, i.e. a recovery plan. CR has Act No. 12/2002 Sb., which under certain conditions can provide material and financial assistance to citizens and public administration.</p>
<p>Which followed disaster can cause the critical situations in the EU? Which followed disaster can cause the critical situations in the CR?</p>	<p>For the EU and the CR:</p> <ul style="list-style-type: none"> <li>- the gradual depletion of non-renewable resources,</li> <li>- erosion of soil and rock massifs,</li> <li>- uniformity of the landscape,</li> <li>- disruption of large dams.</li> </ul>
<p>Which followed disaster can cause the crisis situations in the EU? Which followed disaster can cause the crisis situations in the CR?</p>	<p>For the EU and the CR:</p> <ul style="list-style-type: none"> <li>- the gradual depletion of non-renewable resources,</li> <li>- erosion of soil and rock massifs,</li> <li>- uniformity of the landscape,</li> <li>- disruption of large dams.</li> </ul>
<p>For which crisis situations caused by followed disasters in the EU the level of crisis management is not sufficient? For which crisis situations caused by followed disasters in the CR is the level of crisis management not sufficient?</p>	<p>Required qualified special attention, either in research or in any type of management process, i.e. even in crisis management, is not paid to followed disasters.</p>

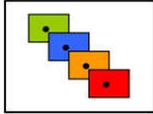


Where the vulnerabilities of human society in the EU can cause a change of a critical situation into the extreme situation? Where vulnerabilities of human society in the CR can cause the change of a critical situation into the extreme situation?	Lack of: drinking water, raw materials, resources, energy, food in case of uncontrolled human population explosion and migration of large groups of people.
Do we have reliable methods for the determination of the scenarios of all disasters expected in the EU? Do we have reliable methods for the determination of the scenarios of all disasters expected in your country?	Degree of reliability of methods for generating, creating and determining of disaster scenarios is given by degree of knowledge in differentiated science disciplines and postulates (characters: theory, methodology, terminology, feedback-application). The answer is NO, e.g. [12]
Do we know for all followed disasters given above successful preventive, mitigation, response and renovation measures and activities? Which weaknesses are in knowledge on preventive, mitigation, response and renovation measures and activities?	NO, because the data sources do not yet exist for followed disasters - there are no catalogues, characteristics and disaster scenarios, etc.
What is necessary to improve?	Create qualified catalogues and qualified characteristics of followed disasters, in order to make search for protective measures possible.
What research is the most effective for the improvement of safety management of the EU? What research is the most effective for the improvement of safety management of the CR?	Both for the EU and the CR: integral safety research focused on all the disasters, open-minded, qualified and free from the influence of lobbyists [1].
What principles, legislation and co-operation rules in the EU are necessary for security and sustainable development of humans?	Create a concept of safe community with sustainable development [1], which takes account followed disasters and propose a long-term plan of its implementation [21].
Can you propose measures for averting the social crises in the EU?	The implementation of professional knowledge for the benefit of the public interest.

With regard to data in table 2 there is assessed the level of control of EU public affairs processes in terms of management of processes by which environment and planet respond to human activities in the EU and Member States. Fundamental deficiencies in managing of monitored disasters are identified to determine areas where measures are needed - Table 3. The result implies that there are many weaknesses, caused by the fact that in the EU lacks the management focused on priority issues. This, however, needs a good background, which should be provided by research.

*Table 3: Proposal for the resolution of identified deficiencies. Priority areas in need for action are in **bold**. The column "Other": M indicates that it is necessary to carry out continuous monitoring in order to achieve effective management of disaster in question, for example, ensuring early warning, rapid mapping of the situation; early start rescue operations, etc.  
C – processing of contingency plan*

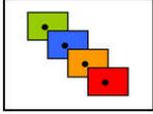
Disaster	List of gaps	Type of measures and activities for remove of gaps				
		legislation	specific management	research	education	Other
Induced earthquakes	The lack of data; factual information is sketchy.	yes	<b>yes</b>	yes	<b>yes</b>	M
Disruption of the ozone layer	Protection of the ozone layer in the EU is dependent only on the implementation of international agreements and not on sanctions. In the CR, separate Act No. 86/2002 Coll. to protect the ozone layer is currently being renewed	<b>yes</b>	<b>yes</b>	yes	yes	M



Greenhouse effect	Protection in the EU is dependent only on the implementation of international agreements, not on sanctions.	yes	yes			M
Rapid climate variations	Lack of data and proposals for protective measures.			yes	yes	M
Contamination of air, water, soil and rock mass	Lack of attention is devoted to land degradation.	yes	yes	yes	yes	Sanction
Desertification as a result of thoughtless regulation of water flows	Lack of monitoring, data and qualified assessment of given phenomenon.	yes	yes	yes	yes	M
Decrease in the diversity of animal and plant species	Lack of monitoring, data and qualified assessment of given phenomenon. The solution is at the level of concepts and policies.		yes			M
Uncontrolled population explosion of people	The problem of population explosion in the EU and the CR is reduced to the demographic shock and to estimates of the time horizon of a certain tipping point, i.e. beginning of decline in absolute population of Europe and the CR	yes	yes		yes	M
Migration of large groups of people	The immigration problem is treated in the EU migration policy and strategic mobility of the Commission. Immigration has its security dimension.	yes	yes		yes	M
The gradual depletion of non-renewable resources	Circulating renewable freshwater resources are threatened by the development of unconventional sources of primary energy in the quantitative sense. The EU has a requirement to reduce demand, minimizing the amount of withdrawn water and increase the efficiency of its use. Pumping speed impacts are not mentioned in any of the key government documents in the CR.	yes	yes	yes	yes	Research necessary
Erosion of soil and rock massifs	Potential threats to soil erosion in the CR is significant, water erosion threatens about 50%, wind erosion about 26 to 45% of arable land nationwide. Erosion of rock massifs is not systematically monitored.	yes	yes	yes	yes	C
Landscape uniformity	Most of the changes are reflected in the devastation of agricultural land. As for land management in the CR, inconsistent compliance with good agricultural practices is clearly remarkable, causing outrage and criticism in the international arena, escalating the threat of financial penalties from the EU.	yes	yes	yes	yes	Finding the safeguard procedures

## 5. Conclusion

Based on the analysis of EU instruments for control of process, by which environment and planet respond to human activities in the EU and Member States, the level of management and control was assessed in an expert manner and according to data in the literature,. Fundamental deficiencies in managing of followed disasters are identified to determine domains where actions are needed. The result implies that there are many weaknesses, caused by the fact that the EU lacks the management focus on priority issues. For this, however, we need quality facilities, which should be prepared by research. Without such quality facilities, only the current critical situations will be addressed, which usually leads to uneven use of forces and resources.



## REFERENCES

- [1] D. Procházková, *Strategic Management of Safety of Territory and Organisation*. Praha: ČVUT, 2011, 483p, ISBN: 978-80-01-04844-3.
- [2] D. Procházková (ed.), *Environmental Monitoring and Adjacent Problems*. ČEÚ and MŽP ČR, Praha 1993, 356p.
- [3] D. Procházková, D. *Environmental Monitoring the Czech Republic*. I. Concept. Praha: Ministry for Environment, 1993, 465p.
- [4] D. Procházková, *Inventory of Observatory and Monitoring Networks of Environment Monitoring for GIS Application*. Praha: Study for Ministry of Environment. ČEÚ, 1993, 66p.
- [5] D. Procházková, *Proposal of Projects for Realisation of Environment Monitoring*. Praha: Study for Ministry of Environment. ČEÚ, 1993, 22p.
- [6] D. Procházková, *Opening Project of Monitoring File on GIS Base*. Praha: Study for Ministry of Environment. ČEÚ, 1993, 20p.
- [7] D. Procházková, *Principles of Sustainable Development*. ISBN 978-80-87472-21-7. VŠERS, České Budějovice 2012, 142p.
- [8] EU: <http://eur-lex.europa.eu>
- [9] D. Procházková, *Questionnaire for special investigation*. 2011. [www.focus.eu](http://www.focus.eu)
- [10] Z. Kukač, K. Pošmourný, Natural Catastrophes and Risks. PLANETA XII (2005), No. 3, 52p., ISSN 1213-3393
- [11] J. Říha, *Expert Judgement 2011*.
- [12] J. Říha, *Safety and Risk Analysis of Environment. Theoretical Outputs*. Praha: CITYPLAN spol. s r.o. , 2009. ISBN 978-80-254-4663-8, 62 p.
- [13] EEA, *Soil*. EEA, Brussels 17. 11. 2011.
- [14] J. Říha, *Protection and Creation of Biophysical Environ*. Praha: ČVUT, 1973, 362p.
- [15] A. Ahtonen, *Adapting to Climate Change: What Role for the EU?* European Policy Centre Brussels, Belgium. November 2010. 4 p.
- [16] J. Říha, *Water and Society*. Praha: SNTL/ALFA, 1987, 340p.
- [17] EU, *European News*. Brussels, 16. 02. 2011.
- [18] ARCADIS, *Upgrade of Risk Analysis and Determination of Active Zones in Water Economy*. "Partners for Water" – Ministry of Agriculture of the Czech Republic 2004. 110302/of4/1o2/000852/le.
- [19] EK, *Scrutiny of Legal Rules in Civil Protection*. Brussels: EU, Dec. 20, 2011.
- [20] MŽP ČR, *State Politics in Environment for Czech Republic 2004 – 2010*. Praha: MŽP ČR 2004. 56p., ISBN 80-7212-283-5.
- [21] J. Říha, *Concept of Sustainable Development Fails*. *Stavební obzor*, 12 (2003), No. 9, pp. 275-281. INDEX 47 755, ISSN 1210-4027.

## CONTACT ADDRESS

Author: Assoc. prof. RNDr. Dana PROCHÁZKOVÁ, PhD., DrSc.,  
Workplace: Czech Technical University in Prague, Faculty of Transportation Sciences  
Address: Konviktská 20, 110 00 Prague 1, Czech Republic  
E-mail: [prochazkova@fd.cvut.cz](mailto:prochazkova@fd.cvut.cz)

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](mailto:mirorusko@centrum.sk)