Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara,
Department of Exact Sciences,
Contact: web: http://dse.usab-tm.ro, e-mail: secretariat_dse@usab-tm.ro

THE POLLUTION OF THE SOILS, THE UNDERGROUND AND SURFACE WATERS, FROM HUNGARIAN–ROMANIAN CROSS–BORDER AREA

János Nemcsók[1], Hermesz Editare[1], Jancso Zsanett[1], Adrian Băneş [2], Marinel Horablaga[2], Cristian Bostan [2]

[1]University of Szeged, Department of Biochemistry, Faculty of Sciences, P.O. Box 533, H–6701, Szeged, Hungary,
[2]Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara, Exact Sciences Department, Calea Aradului no.119, 300645 Timisoara, Romania, banes@usab-tm.ro, hnm75@yahoo.com, bostancristian2000@yahoo.com

Abstract. The aim of the pollution reduction project is to facilitate exchange and evaluation of interventions on environment and health exposure reduction measures on a regional level, and promote implementation of successful initiatives in Hungarian–Romanian cross–border area. One of the problems addressed by the present project is the pollution caused by the improper management of domestic and agricultural waste in the neighbouring communities of the border area. The area is evaluated by the parteners as being of community importance and will be proposed to be included the exchange of useful practices in two key areas in environmental health policy: (1) the reduction of transport–related health hazards (air pollution and noise) and (2) the improvement of the indoor environment by reducing indoor exposure to environmental health hazards.

Keywords**:** environmental factors, health policy, good practice; pollution reduction.

Introduction

Protection and improvement of the environmental conditions is a matter of great importance that affects the life of the people and economical development of the countries around the world. Environment protection complies with the needs and interests of peoples, and simultaneously represents a duty for every government [JEEVAN, 1994]. The normal state of charge the environmental factors with different elements and the way of they are influencing the quality of the environment was created from practical needs, through experiences and repeated tests for the appreciation of different levels of loading of the environment with pollutants, comparing all the three elements of the environment water, air and soil, the last is most difficult to be assessed from the point of view of the appreciation of its quality. [JEEVAN, 1994, KESTER, 2005]

The pollution of the underground and surface waters. The sources of pollution of the underground and surface waters were:

– main sources, of supply of the underground water body they being represented by: storage reservoirs, transport ways of the chemicals or of the chemically impure waters, technological installations *etc.* (initial pollutant chemical compounds reach on the soil are representing source of initiation of the risk for the pollution of the underground waters);
– indirect pollution sources that proven usually from the main sources (chemical compounds that can migrate in subsoil – these indirect sources of pollution are represented by chemical compounds that have remained in area at a residual saturation are supplying slowly and continuously the underground water layer). [O'CONNOR, 2005]

Their particularisation is difficult, but is important for the evaluation of the performances of the remediation solutions for the water quality that implies a laborious and costly study. The pollution of the underground and surface waters it was and it is possible through:

– prolonged storage of some products residues;
– storage of the products (row materials, intermediary products, finished products *etc.*);
– accidental loses of substances in time from the technological installations that

have functioned;
- the manipulation of products in deposits that can generate leakages of products;
- intervention, reparations, revisions, technical and mechanical damages;
- loses through sewerage systems and their connections and the local purification installations: tanks washing *etc.* [IUPAC 1997 JEEVAN 1994, SHENDELL, 2007, VAN DEN HAZEl, 2006]

The limit values for the pollutants from the underground waters will respect the values allowed by the law 458/2002 regarding the quality of the drinking water, modified and completed by the low 311/2004. [HECK, COWLING and SIMS, 1998] Measures to address environmental health problems increasingly rely on scientific information, and a growing number of international bodies give guidance to the direction in which both science and policy are moving.

The majority of the World Health Organisation [WHO, 2008] member states in the European region have set up National Environment and Health Action Programmes during the last decade, confirming the great importance of environmental health protection.

The importance of scaling down this approach to regional and local level is evident in order to improve the conditions of life [VAN den HAZEL et al., 2006]. There is a general consensus that a reduction of exposure to environmental hazards is beneficiary to human health [SHENDELL, 2007].

Material and methods

The analysed samples were prepared and analysed after the rules of the Romanian Standardisation Association (A.S.R.O.). Te determining method uses the dosing at spectrophotometer with atomic absorption in conformity with ISO 11466. Heavy metal determination determined from extract with an atomic absorption apparatus, produced by Analytikjena. [A.S.R.O.]

In table 1 are presented the quality indicators of the natural waters.

Table 1.

Quality indicators of the natural waters

Quality indicators	Measurement units	Quality categories		
		I	II	III
Daily measurements				
Dissolved oxygen (DO)	mg/l	6.0	5.0	4.0
Total suspended solids	mg/l	750	1000	1200
Chlorides	mg/l	250	300	300
Oxygen consumption – Winkler test	mg/l	10.0	15.0	25.0
Ammonium	mg/l	1.0	3.0	10.0
Nitrates	mg/l	10.0	30.0	–
Nitrites	mg/l	1.0	3.0	–
Phenols	mg/l	0.001	0.02	0.05
Weekly measurements				
Cadmium	mg/l	0.003	0.003	0.003
Chrome	mg/l	0.05	0.05	0.05
Copper	mg/l	0.05	0.05	0.05
Iron	mg/l	0.3	1.0	1.0
Manganese	mg/l	0.1	0.3	0.8
Nickel	mg/l	0.1	0.1	0.1
Lead	mg/l	0.05	0.05	0.05
Zinc	mg/l	0.03	0.03	0.03

The water samples were analysed in conformity with the standardised analysis methods presented in table 2.

Table 2

Standardised water analysis methods

Nr.	**Quality indicator**	**Measurement unit**	**Analysis method**
1	pH	unit, pH	STAS 8619/3 – 90
2	Conductivity	μS/cm	SR ISO 27888 – 97
3	Alkalinity	mval/dm^3	SR ISO9963 – 97
4	Calcium (Ca^{2+})	mg/dm^3	STAS 3662 – 90
5	Magnesium (Mg^{2+})	mg/dm^3	STAS 6674 – 77
6	Sulphates (SO_4^{2-})	mg/dm^3	STAS 8601 – 70
7	Chlorides (Cl^-)	mg/dm^3	STAS 8663 – 70
8	Nitrites (NO_2^-)	mg/dm^3	SR EN 26777:2002
9	Nitrates (NO_3^-)	mg/dm^3	SR ISO 7890 – 2:2000; SR ISO 7890 – 3:2000 SR ISO 7890/1 – 98
10	Ammonia nitrogen (NH_4^+)	mg/dm^3	SR ISO 5664:200; SR ISO7150 – 1/2001
11	O_2 dissolved	mg/dm^3	STAS 6536 – 87
12	Oxygen consum. – Winkler test	mg O_2/dm^3	STAS 6954 – 82
13	COD	mg O_2/dm^3	SR ISO 6060 – 96
4	BOD_5	mg O_2/dm^3	SR EN 1899 – 2/2002

In table 3 are presented the measurement units, analysis methods and the limit values for pollutants. [WHO 2002, WHO 2008, ISO-190.11.46.6, 1999, ISO-190.11.04.7, 1999; Monitorul Oficial al Romaniei, 1997].

Table 3

Measurement units, analysis methods and the limit values for pollutants of water
[WHO 2002, WHO 2008, ISO-190.11.46.6, 1999, ISO-190.11.04.7, 1999; Monitorul Oficial al Romaniei, 1997, HG: 100 / 2002, STAS 1342 – 1991].

No	Pollutant		Measurement unit	Testing method	Allowed values, L: 458 / 2002, HG: 100 / 2002, STAS 1342 – 1991
1.	Total metals	Arsenic (As)	µg / dm^3	SR ISO 17294 – 2 / 2003	10
2.		Bismuth (Bi)	mg / dm^3		–
3.		Cadmium (Cd)	µg / dm^3		5
4.		Total chrome (Cr_T)	µg / dm^3		50
5.		Cobalt (Co)	mg / dm^3		–
6.		Copper (Cu)	mg / dm^3		0.1
7.		Total manganese (Mn_T)	µg / dm^3		50
8.		Molybdenum (Mo)	mg / dm^3		–
9.		Nickel (Ni)	µg / dm^3		20
10.		Lead (Pb)	µg / dm^3		10
11.		Selenium (Se)	µg / dm^3		10
12.		Tin (Sn)	mg / dm^3		–
13.		Zinc (Zn)	µg / dm^3		5.000
14.		Mercury (Hg)	µg / dm^3	STAS 10267 – 1989	1
15.	Concentration of the hydrogen ions		pH unit	SR ISO 10523 – 97	6.5 – 9.5
16.	Residue filtered and dried at 105^{0}C		mg / dm^3	STAS 9187 – 84	100 – 800
17.	Ammonium (NH_4^+)		mg / dm^3	SR ISO 7150/1 – 2001	0.5
18.	Chlorides (Cl^-)		mg / dm^3	SR EN ISO 10304 – 2/2003	250
19.	Nitrites (NO_2^-)		mg / dm^3	SR ISO 6777 – 1996	0.5
20.	Nitrates (NO_3^-)		mg / dm^3	SR ISO 7890/3 – 2000	50
21.	Oxygen consum.–Winkler test		mg O_2 /dm^3	SR EN ISO 8467 / 2001	2.5

Management practices for soil pollution prevention are:

- develop and implement a methodology to improve prevention and reduce impacts of spills and other accidental release from operations;
- periodically review and identify pollution prevention options; and
- develop approaches for reducing release. [WHO 2002, WHO 2008, ISO-190.11.46.6, 1999, ISO-190.11.04.7, 1999; Monitorul Oficial al Romaniei, 1997].

Results

Topic approached in this paper responds to current priorities for protection of soil quality, an issue of great interest on international standard and in particular to Romania, too. To do analysis due to environmental pollution generated by specific equipment on activity the proposed methodology is divided into modules, interrelated, each with a series of steps and stages of work.

The environmental assessment involves calculating the probability for an ecosystem to receive a dose of pollutant or being in contact with it. Qualitative assessment takes into account the following factors: threat / source, path of action and receptor.

The factor „threat / source" refers to equipment and specific pollutants generated by them which are identified or alleged to be on a site.

The factor „path of action" refers to the manner by which pollutants migrate to the receptor.

The factor „target / receptor" refers to the subjects/objectives which are affected by the harmful effects of certain toxic substances on site that can include plants, people, environmental factors.

The evaluation study regarding the soil pollution with heavy metals has evidenced the presence over the allowed levels of the heavy metals.

For the setting of the pollution sources it was created a programme for the following o the potential sources of contamination and the effectuation of laboratory analyses through the method of atomic absorption.

The protection and preservation of the environment must to be a constant concern of every of us.

The companies are the only ones that contribute to the pollution of the environment, also are the most of us.

Tabelul 4.

Statistical parameters determined from soil samples

No	Statistical Parameter (mg/kg s.u.) / Sampling place	Period / Media	Pb	Cu	Zn	Co	Cr	Cd	Ni
1.	Timisoara	I (03)	31.75	1.143	23.5078	16.4160	8.5945	0.019	1.38
		II(04)	34.29	3.576	19.7378	14.7669	9.9436	0.036	1.89
		Media	33.02	2.359	21.623	15.596	9.2690	0.028	1.63
2.	Dudestii Noi	I (03)	54.03	2.859	17.283	2.1575	0.016	0.044	1.74
		II(04)	55.66	2.584	7.327	5.0177	0.020	0.044	2.16
		Media	54.85	2.722	12.305	3.5876	0.018	0.044	1.95
3.	Becicherecu Mic	I (03)	51.96	2.593	4.013	0.134	0.026	0.006	1.56
		II(04)	52.02	2.675	2.578	0.244	0.028	0.016	1.88
		Media	51.99	2.634	3.296	0.189	0.027	0.011	1.72
4.	Biled	I (03)	21.14	1.771	1.105	0.064	0.032	10.439	0.01
		II(04)	21.40	0.712	6.507	0.109	0.020	10.90	0.18
		Media	21.27	1.242	3.806	0.086	0.026	10.010	0.51
5.	Sandra	I (03)	30.77	0.576	0.752	6.1754	13.4403	4.002	1.15
		II(04)	31.25	0.708	1.044	8.2022	18.8494	4.008	1.45
		Media	31.01	0.642	0.898	7.1890	16.1448	4.005	1.30

6.	Lovrin	I (03)	22.18	1.365	2.815	0.036	0.010	0.015	1.22
		II(04)	23.68	1.723	2.544	0.057	0.014	0.021	1.32
		Media	22.93	1.544	2.679	0.047	0.012	0.018	1.27
7.	Sannicolau Mare	I (03)	32.72	3.805	4.086	0.055	0.016	2.051	2.64
		II(04)	32.94	4.913	5.250	0.102	0.015	2.048	2.81
		Media	32.83	4.359	4.668	0.078	0.015	2.049	2.72
8.	Cenad	I (03)	52.89	4.274	8.2968	11.0525	5.6222	8.021	1.09
		II(04)	53.81	2.642	8.3532	10.6252	4.8868	8.044	1.30
		Media	53.35	3.458	8.325	10.839	5.255	8.032	1.20
9.	Kiszombor	I (03)	42.18	2.2983	4.6151	0.0814	0.0173	4.0199	1.45
		II(04)	43.13	2.4416	4.4013	0.1141	0.0188	4.0294	1.67
		Media	42.65	2.3699	4.5082	0.0978	0.0180	4.0246	1.54
10.	Ferencszállás	I (03)	50.90	4.6191	23.5299	1.5076	12.0700	6.0825	7.46
		II(04)	53.39	8.7444	49.4674	5.8158	15.0568	6.1360	7.62
		Media	52.14	6.682	36.499	3.662	13.565	6.109	7.54
11.	Klárafalva	I (03)	50.74	9.6674	51.8771	1.1765	23.5078	0.0904	7.69
		II(04)	52.96	9.3584	58.2144	4.9128	19.7378	0.1420	13.83
		Media	51.85	9.513	55.046	3.045	21.623	0.116	10.76
12.	Deszk	I (03)	50.98	5.2365	63.1116	11.7229	5.9237	9.0845	7.92
		II(04)	52.62	6.5830	62.8990	24.9526	5.2440	9.1862	9.79
		Media	51.80	5.910	64.672	18.338	5.517	9.135	8.86
13.	Szőreg	I (03)	41.02	3.3680	16.2264	23.5078	0.3797	0.1085	7.10
		II(04)	41.77	7.6121	75.1751	19.7378	7.4170	0.1824	6.09
		Media	41.39	5.490	45.70	21.623	3.897	0.145	6.60
14.	Szeged	I (03)	20.85	4.0427	27.6616	18.5448	2.6275	2.1438	11.20
		II(04)	22.40	8.1651	57.4063	27.5066	7.0179	2.0385	15.92
		Media	21.63	6.104	45.867	23.026	4.823	2.091	13.56

Having in view the correlation of the content of contaminants in water there were collected 12 surface water samples and a sample from river Bega.

The data obtained after the chemical analyses are presented in table 5.

Table 5

Chemical composition of the samples of surface water and from Bega River

No.	pH	NO_3^- ppm	NH_4^+ ppm	Cl^- ppm	SO_4^{2-}ppm	Ca^{2+} ppm	Mg^{2+} ppm
AS_1	7.17	0	8	5	8.3	26.3	58.6
AS_{12}	7.11	0	7.3	5.2	7.25	27.6	55.3
AS_3	9.32	2.8	7.5	0.19	6.5	22.2	54.2
AS_4	7.04	1.3	8.6	1.84	8	26.5	57.3
AS_5	6.81	1.3	7.6	1.84	7	27.5	47.3
AS_6	6.98	1.2	8.5	2.19	5.5	22.2	52.2
AS_7	6.91	2.3	7.3	2.04	8	23.5	57
AS_8	6.88	3.9	5.1	3.04	7.9	27	54.6
AS_9	7.68	0	7	4	7.8	24.3	56.6
AS_{10}	7.83	0	8.3	6.2	8.25	23.6	57.3
AS_{11}	7.35	2.2	8.5	0.19	7.5	25.2	52.2
AB_{12}	7.51	5.8	4.1	10.84	19.1	36	66.6

There were applied instrumental analysis techniques: spectrometry, applying of some standardised methods (ISO, ASTM *etc.*) or of other validated methods.

In table 6 are presented the results obtained after the analysis of the samples of drilling

Available on-line at http://dse.usab-tm.ro/en/bjb.html
Banat's Journal of Biotechnology
2010, I(2),

water.

Table 6

Results of the analysis of the samples of drilling water

Test		Measurement unit	Sample symbol / Determined values						Testing method	Allowed values, L: 458 / 2002, HG: 100/ 2002, STAS 1342 - 1991
			F1	F2	**F3**	F4	F5	F6		
Total metals	As	µg/ dm³	9	32	**14**	1	1	1	SR ISO17294 – 2 / 2003	10
	Bi	mg/dm³	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD		-
	Cd	µg/dm³	1	< 0.5	**< 0.5**	< 0.5	< 0.5	< 0,5		5
	Cr	µg/dm³	17	5	**5**	3	13	5		50
	Co	mg/dm³	0.004	0.001	**0.005**	0.001	0.001	0,005		-
	Cu	mg/dm³	0.751	0.095	**0.021**	0.017	0.019	0,017		0.1
	Mn_T	µg/dm³	466	2.160	**765**	330	400	3,575		50
	Mo	mg/dm³	0.013	<LOD	**0.002**	<LOD	0.001	0,001		-
	Ni	µg/dm³	33	11	**13**	15	15	17		20
	Pb	µg/dm³	<LOD	6	**24**	3	3	2		10
	Se	µg/dm³	<LOD	1	**< 0.1**	1	<LOD	<LOD		10
	Sn	mg/dm³	0.007	0.001	**0.002**	0.001	0.001	0,002		-
	Zn	µg/dm³	202	44	**76**	90	81	16		5.000
	Hg	µg/dm³	<LOD	<LOD	**12**	<LOD	<LOD	<LOD	STAS 10267 – 1989	1
Conc. H^+		pH unit	7,15	6.94	**6.99**	7.23	4.93	5.34	SR ISO 10523–97	6.5 – 9.5
Residue		mg/dm³	926	864	**954**	754	138	568	STAS 9187 – 84	100 – 800
NH_4^+		mg/dm³	1,43	1.87	**8.72**	0.30	14.6	5.44	SR ISO7150/1–2001	0.5
Cl^-		mg/dm³	7,47	20.3	**2.86**	21.5	2.26	3.77	SRENISO10304 –2/2003	250
NO_2^-		mg/dm³	0,25	<0.02	**<0.02**	<0.02	0.18	0.18	SR ISO 6777 – 1996	0.5
NO_3^-		mg/dm³	0,77	0.17	**0.13**	0.26	0.68	0.86	SR ISO 7890/3–2000	50
Oxygen		mgO_2/dm^3	13	16	**36**	4.0	20	10	SREN ISO8467/2001	2.5

Discussion

The preliminary results of the identified indoor case studies show that some of the indoor topics are more pronounced than others, in terms of number of case studies.

The samples were collected in duplicate from all the research points in conformity with the methodology for the collection/preservation, and from every sample were determined three replicate samples, the final result being the average of the three measurements. The soil samples were collected to be quantitatively determined values in 2010 were collected soil samples to be quantitatively determined amounts of heavy metals collected from the green perimeter location of the land fill site listed in Table 1.

In this study, heavy metal content of samples analyzed are caused by heavy traffic (5.67 ppm for Pb in soil and 9665, respectively 23.5078 and 0.1862 ppm for Cu, Cr and Cd) and pose a risk to humans.

Study results showed overall values of the heavy metal content in soil samples higher in April.

In this study, heavy metal content of samples analyzed are caused by heavy traffic (54.85 ppm for Pb in soil and 9665, respectively 23.5078 and 0.1862 ppm for Cu, Cr and Cd) and pose a risk to humans. Table of values is apparent that a metal values are determined by place of harvest but also the period in which it was collected. The sites for the evaluation of the state of the underground water bodies must to have a correspondent in an area at the soil surface from that is coming the nitrates flow (the equivalent of the basin in upstream in the case of the surface water). Generally, for the underground water bodies there are executed drillings for the evaluation of the water quality. [BARRY, 2009] Excepting the case then the anterior control exercise for monitoring has demonstrated that the respective water body was in a good state and the study regarding the impact of human activities in conformity with the present regulations doesn't indicating the change of the impact on the water body. In these cases the supervision control is done once at every three management plans of the hydrographical district. [BARRY, 2009 HECK, COWLING and SIMS 1998] The results of the laboratory analyses are reported to the actual Romanian low regulations as is following: drilling waters and waste water from the waste water purifying station. [ANDRETTA, 2006]

Heavy metals have a toxic action on the aquatic organisms, meanwhile inhibiting the self-purification processes. The nitrogen and phosphorus salts are determining a rapid development of the algae at the surface of the water. The mineralization of the underground waters is linked by the hydrological regime of the rivers and their pollution level.

Referring to the lows 458/2002, HG: 100/2002, STAS 1342–1991–Drinking Water–the standards on that base is done the interpretation of the results after the monitoring and analysis of the water samples from drillings the situation of the over-passing of the limits allowed by standards are presented as is following:

- regarding the 12 determined indicators the obtained values in all the 16 samples of drilling water they aren't passing over the allowed limits mentioned in the law 458/2002 and law 100/2002 regarding the quality of drinking water, modified and completed through the law 311/2004: bismuth (Bi); cadmium (Cd); total chrome (Cr_T);copper (Cu); selenium (Se); mercury (Hg); the concentration of hydrogen ions (pH); chlorides (Cl^-); nitrites N–NO_2^-; nitrates N–NO_3^-;
- the other determined parameters have values that are over-passing the allowed values;
- the samples from the drilling F3 situated near "Continental" A.G. have increased values in the case of: arsenic (As), cobalt (Co), total manganese, nickel (Ni), lead (Pb), mercury (Hg), residue dried and filtered at 105^{0}C, ammonium (NH_4^+) and Oxygen consumption–Winkler test;
- values greater then the ones allowed by low were determined and in the drillings F1–S.C. Detergents S.A., F2–S.C. Solventul S.A., F4–S.C. NGR Company S.R.L. (former S.C. Fratelia Oil S.R.L.), F5–CET and F6–the Industrial south-west area (S. Vidrighin).

To do risk analysis due to environmental pollution generated by specific equipment on activity the proposed methodology is divided into modules, interrelated, each with a series of steps and stages of work. These modules will establish:

- The main sources that can generate negative effects on the environment (sources);
- How are generated these negative effects on the environment (pollution causes);
- The type of substance that affects the environment (pollutant);
- Migration paths (routes) of pollutant reaching the target (receptors submitted to risk);
- Environmental risk by assigning "grades" to the factors that underlie (probability and frequency), correlated with the risk criteria;
- Measures to reduce the degree of the environmental risk to an „acceptable level".

Conclusions

The researches and the analytical measurements realised have evidenced the interaction of the environmental and anthropic factors in the defining of the state of the quality of the water resources from Bega River basin. During the researches it was used the usual methodology for the evaluation of the quality of the environment in the hydrographical basins, there being followed the interrelations between the human activities, natural processes and their results on the quality and quantity of water resources.

The evaluation was inter and trans-disciplinary there being considered the particular aspects regarding every hydrographical basin, especially the Bega

River basin, these representing the background for the elaboration of a management plan of the hydrographical basin.

The synthetic specific aspects identified in the development of the researches are:

- the hydrographical basin of the River Bega presents through its features lakes their genesis being assumed to natural causes, anthropic lakes created with centuries ago, new created lakes, a relatively constant land use during the centuries, those being a good lab for the study of the complex interactions from a landscape dominated by the existence of the small stagnating water bodies;
- to the natural influences due to the geologic substrate, the soil cover and spontaneous vegetation are added the anthropic influences due to the arrangement of the sewage system and to the activities developed in the area;
- the history of the pressure on the environment in the basing of River Bega is governed mainly by the evolution of the land use.

Good practices can be in the form of a policy, an administrative, a technical or an educational solution. In this project, potential practices in indoor environment and transport, resulting in exposure reduction, are reviewed for their effectiveness and implementation efficiency. These practices can be divided into three categories, which are discussed below.

The *first* category consists of policy measures. By introducing new policies and adjusting already existing ones, positive effects on environment and health can be achieved. For example, by banning unvented gas boilers in private houses, a decline in pollution from combustion products can be obtained and hence less health effects will occur. Policy measures can be introduced by (regional) governments.

Second, technical solutions are possible adjustments. Introduction of technical adjustments in infrastructure or living conditions can also improve the health of the public. An example of this kind of solution is removing certain building materials from the construction of buildings, resulting in a reduction of exposure to certain chemicals of people living there. Technical solutions can be introduced by (regional) governments, usually in cooperation with (commercial) non-governmental organisations.

Third, educational measures can be introduced. The aim of education is to change behaviour of a target population, which in turn results in a health improvement. For example, an information package for healthy ventilation can be spread among the public or schools. Educational measures can be introduced by (regional) governments or non-governmental organisations. In addition, attention could be paid to improve the indoor environment in the regular educational programmes of the various disciplines in the building industry, including architects, designers and builders.

Acknowledgements

The authors would like to thank the European regional development fund (ERDF) for financing the project "Environment–Biochemical Cooperation for prognosis of natural water and soil pollution in the Hungarian and Romanian cross–border region to Shun Catastrophe" acronym "R & D SZTE, BAÁE, no. HURO/0801/038.

References

1. Andretta, M., Serra, R., Villani, M., **2006**. A new model for polluted soil risk assessment. *Computers and Geosciences*, 32, Issue 7, 890–896.
2. Barry, L., **2009**. Environmental Studies& Management. *Human and Ecological Risk Assessment*, vol. 15, 214-215.
3. Gopal D, Singh R P and Kapoor R C. Ground water pollution by solid wastes. A case study, pollution Research, *Enviro media* 10: 111–116(**1991**).
4. Heck WW, Furiness CS, Cowling EB and Sims CK **1998** Effects of ozone on crops, forest and natural ecosystem: assessment of research needs. In EM: *Magazine for Environmental Managers*, pp 11–22.
5. IUPAC (**1997**) Compendium of Chemical Terminology–IUPAC Recommendations, compiled by McNaught, A.D. and Wilson, A. International Union of Pure and Applied Chemistry, Blackwell Science Ltd, Oxford
6. Jeevan Rao K and Shantaram M V. Heavy metal pollution of agricultural soils due to application of USW. *Indian Journal of Environmental Health* 36(1): 31–39(**1994a**).
7. Jeevan Rao K and Shantaram M V. Soil properties at landfill sites used for USW disposal at Hyderabad, India. *Proceedings 15th World Congress of Soil Science, Mexico,*

Symposium 1(b) vol. 2b 255–256, Acapulco Mexico (**1994b**).

8. Kester, G.B., Brobst, R. B., **2005**. Risk Characterization, Assessment, and Management of Organic Pollutants in Beneficially Used Residual Products. Journal of Environmental Quality, 34: 80–90.
9. O'Connor, G. A., Elliott, H. A. **2005**. Sustainable Land Application: An Overview. *Journal of Environmental Quality*, 34: 7–17.
10. Shendell, D.G. and Pike–Paris, A. (**2007**) 'Environmental exposure assessment, pollution sources, and exposure agents: a primer for pediatric nursing professionals', *Pediatric Nursing*, Vol. 33, pp.179–182.
11. Van den Hazel, P., Zuurbier, M., Bistrup, M.L., Busby, C., Fucic, A. and Koppe, J.G. (**2006**) 'Policy and science in children's health and environment: recommendations from the PINCHE project', *Acta Paediatrica. Supplement*, Vol. 95, pp.114–119.
12. ***WHO (**2002**) Reducing risks, promoting healthy life. The World Health Report 2002, World Health Organization, Geneva. http://www.who.int/whr/2002/en/index.html
13. ***WHO (**2008**) *National Environment and Health Action Plans*. Available online at: http://www.euro.who.int/envhealthpolicy/Plans/20020809_1
14. ***Romanian Standardisation Association (A.S.R.O.)
15. ***ISO–190.11.46.6 (**1999**) Soil quality. Extraction of microelements soluble in aqua region.
16. ***ISO–190.11.04.7 (**1999**) Soil quality. Spectrophotometric determination of atomic absorption of metals: Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn.
17. *** Monitorul Oficial al Romaniei (**1997**) 303 bis/6.11.1997, 23–9.

Received: September 11, 2010
Accepted: November 24, 2010