IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 7, July 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

The key aspects of atmospheric air environmental monitoring concept formation at the urban systems level

Volodymyr Bakharev [1], Peter Sankov [2], Andrey Marenych [3] and Vladimir Hilov [4]

[1] Kremenchuk Mykhailo Ostrohradskyi National University, Kremenchuk, 39600, Ukraine
[2] Prydniprovs'ka State Academy of Civil Engineering and Architecture, Dnipro, 49005, Ukraine
[3] Kremenchuk Mykhailo Ostrohradskyi National University, Kremenchuk, 39600, Ukraine
[4] Prydniprovs'ka State Academy of Civil Engineering and Architecture,Dnipro, 49005, Ukraine

Abstract

The paper's purpose is to analyze the key aspects of the atmospheric air environmental monitoring concept formation on the urban system specifying the components of the concept. The key aspects of atmospheric air environmental monitoring concept formation on the urban system have been analyzed. The principal scheme of concept construction has been proposed. It has been defined that the concept has to be built on the anthropocentric approach. The samples of the atmospheric air environmental monitoring unsolved issues on the urban system of the town of Kremenchuk (Ukraine) have been taken to concretize the integral parts of the concept with defining the goals, the objectives, the statistic results and the dynamic indicators of the concept implementation

Keywords: concept, environmental monitoring, atmospheric air, urban system, monitoring system;

1. Introduction

Nowadays in Ukraine the state system of environmental monitoring is operating, including the monitoring of atmospheric air quality. Since 2014 the State Hydrometeorological Service (State Emergency Service) has been carried out the observation of atmospheric air pollution in 53 cities of Ukraine on 162 stationary observation posts, 2 routing observation and 2 transboundary transfer stations. The sanitary and epidemic service of the Ministry of Health Protection is carried out the observation of atmospheric air quality in residential and recreational areas [1]. It should be noted that in Ukraine where by January, 1, 2014 there were 460 cities that were inhabited by 60.5% of the total population of the country (excluding settlements subordinated to city Council), thus there is a kind of dissonance between the number of the cities where the monitoring is carried out – that is only 8% of the total number. Such state is not acceptable taking into account the process of power decentralization and European integration of Ukrainian environmental legislation (including the sphere of the monitoring of atmospheric air quality). Sanitary and epidemic service has been eliminated de jure [2]. State environmental inspectorate is severely limited in its audit functions and according to the announced "Concept of reforming the system of state supervision (control) in the sphere of environmental protection in Ukraine" must also be eliminated. This way, at the level state under conditions of European integration the atmospheric air quality monitoring is carried out only by State Hydrometeorological Service (Statehydromet). It is common under such conditions that the local municipalities (especially those of technically loaded cities) have to solve these problems themselves.

The drawbacks in the system of State Hydrometeorologic Service (Statehydromet) observations have been highlighted and analyzed in a number of research's [3], where, in particular, the following drawbacks have been specified:

– the determination of the observation posts number and places of their location is carried out on the basis of the older

document [4] depending on the population and with a focus on gathering information on the impact of specific sources of environmental contamination with the location of stationary points in the vicinity of the impact sites;
– observations program (the full is at 1a.m., 7a.m., 1 p.m. and 7p.m. local time, the partial one is at 7 a.m., 1p.m. and 7p.m. according to [5] that is justified by the departmental instructions and the ability of the existing technical base for measurement implementations leaves a significant amount of time to an industrial facility for the intensification of processes the realization of which may cause significant contamination level, and can also result in difficulties while analyzing large amounts of data, finding correlations and subsequent forecasting of air pollution state;
– the assessment of the physical factors influence on air pollution environmental danger forming is not carried out as a result of the contamination levels dynamics and therefore the inexpediency of these parameters fixing at stationary posts of the observation network;
– cooperation between different institutions at the municipal level is not coordinated.
In other analyses [6] concerning the imperfection of the monitoring system, it has been specified the following: "...the state system of environmental monitoring with its structure, the level of organization, the capabilities the environmental state quantitative and qualitative parameters measurements, the method of data transmission and aggregation does not correspond either to the tasks set in front of it or to the modern requirements".
The authors [7] have analyzed the drawbacks of the atmospheric air monitoring system at the level of the technically loaded urban system of Kharkiv. In particular, it has been stated that the main drawbacks of the existing monitoring system are the following: the absence of coordination and commonality of information technologies, the lack of networks maintenance with information exchange means the absence of unified integrated observation networks at the regional level, which should include the monitoring entities network, the automated stations network and the center of collecting and processing information on the monitoring results; the insufficient level of technical and methodical provision of the observation networks functioning.
The authors [8] have made an analytical review of the issue of public access to monitoring systems information. It has been concluded that this issue in Ukraine has positive examples of solutions to this challenge. However, there is no unified conceptual approach of the state power in this matter.
Consequently, the vast majority of the drawbacks mentioned above has certain organizational and technical nature and it can be eliminated by reforming the legislative framework and the automated informational and analytical systems creation. Meanwhile the theoretical basis of monitoring systems improvement at the level of the urban systems (urban areas) is not sufficiently developed and does not have a conceptual approach.
Thus, the work goal is to analyze the key aspects of the atmospheric air environmental monitoring concept formation on the urban system specifying the components of the concept.

2. Theoretical part

It is worth mentioning that conceptual approach in solving issues of environment quality control is the decisive one, as it has been confirmed by the results of different scolars' studies. Thus, [9] it has been noted that ecosystems are multi-faceted and certain conceptual structures should be built to show the relationship between them. These conceptual frameworks should determine the development of urban systems and motivate comprehensive studies of the environment component state in urban ecosystems. However, [10] researches of natural and technogenic processes in the urban environment should be carried out in accordance with the main provisions of the concepts of sustainable development, with mutual regard for the economic and social components. It is also worth considering that the concept of the environment components control within urban systems [11] should have a descriptive indicator system to ensure more complete understanding of mechanisms which show the interrelation between the urbanization processes and the environment. Besides, [12] indicator systems determine the effectiveness of the urban system development concepts implementation in the face of growing demands of the society regarding the immediate control of decision-making

processes by the local authorities. But, at the same time [13] the choice of indicators, which on one hand will reflect the state of relationship between the environment component and the level of impact on the environment and, on the other hand, will concretize the conditions determined by the concept, is a complex process.

Taking into account the mentioned above, we assume that the concept is a structured document that combines specific tasks the settling of which requires to achieve the objectives aimed at solving actual problems. It determines the direction of the strategy implementation as a plan for achieving a certain goal. Unlike the strategy, the concept has the variability signs in the process of solving the assigned tasks and it does not indicate the specific timetable for achieving the goal set. Besides, it is peculiar for strategies in contrast to concepts to determine not only the results but also the indicators that actually have to reflect the process of problem solving. However, it should be noted that the unit indicators addition to the concept structure will create the conditions for a clearer understanding of strategic goals and will allow while in the process of the strategy formation implementation not only to define the terms, but also to set the numerical indicators values.

The fact that the basic philosophical thought while constructing environmental concepts has to be the following: their clear focus on the human rights protection of clean environment, health protection, protection of the environmental natural components from the effects of anthropogenic and, especially, anthropogenic activities of the society should be clearly understood. This fact is especially important for developing of environmental monitoring concepts as the main objective of monitoring system implementation at the urban systems level should be the environmental and health protection, but not the gaining of information in order to support the activities of the state monitoring system. Also it should be taken into account that social factor of environmental danger forming, such as: environmental awareness, environmental knowledge, environmental culture in most cases is crucial in the process of environmental security control. Thus, the systematic sociological researches for enquiring the level of the mass environmental awareness are the necessary prerequisite for the concept task formulation and the interpretation of the results of their decisions.

Taking into account everything mentioned above, the basic structure of the environmental monitoring concept presented in *figure 1* has been proposed.

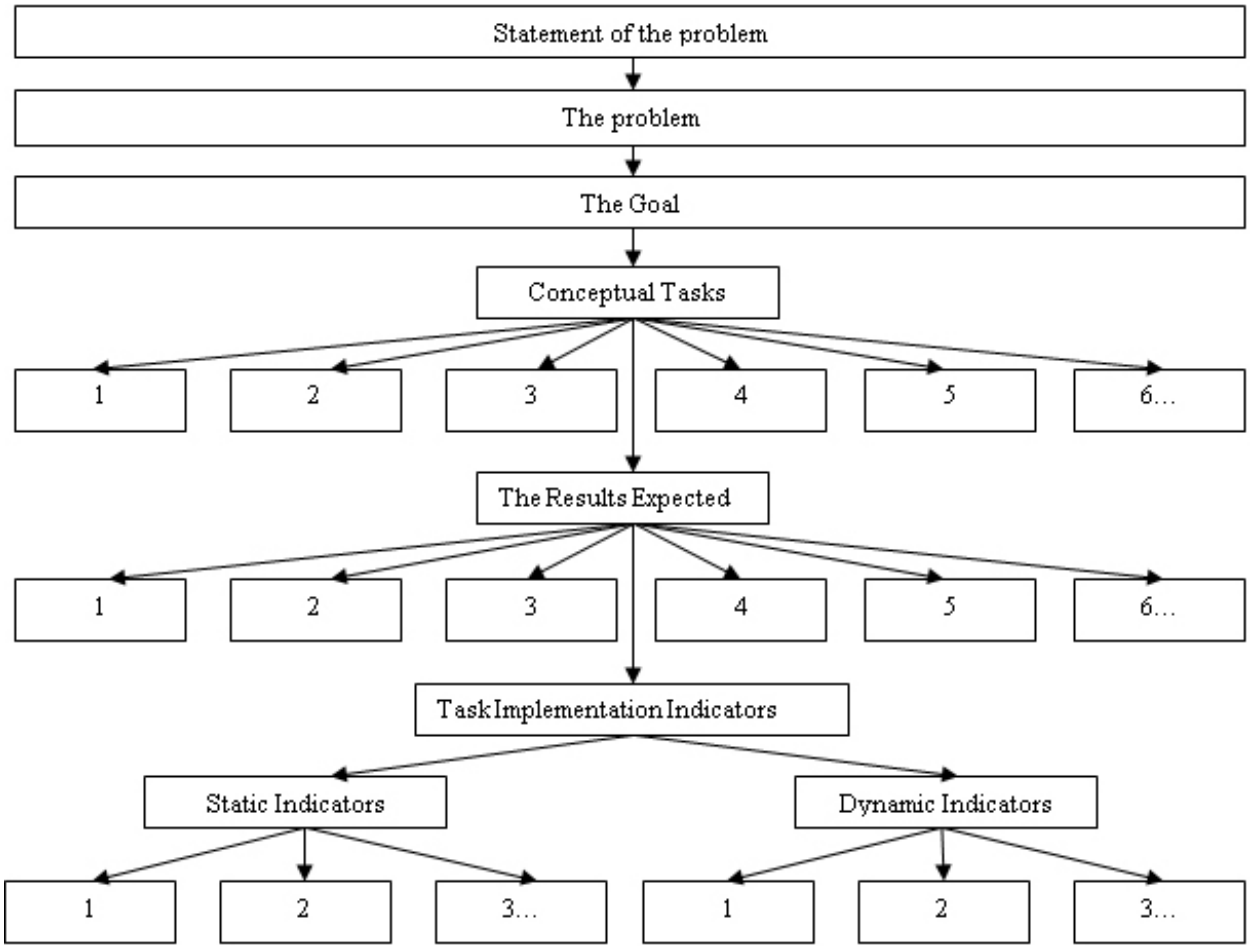

Figure 1. The basic structure of the environmental monitoring concept

Therefore, the structure of the concept of environmental monitoring at the level of urban system, which should determine not only the objectives of the concept, but also the guidance and indicative outcomes of their decisions has been proposed.

3. Results

The approximate structure of the concept based on the analysis of the environmental monitoring system problems of technically loaded urban system of the town of Kremenchuk [14] has been developed. The need to develop the environmental monitoring concept for the town of Kremenchug, like for the most industrially loaded cities in Ukraine, is caused by the failure of the current monitoring system to determine reasonably the contribution of different sources of environmental hazards to the general level of atmospheric air pollution of urban system. So, for Kremenchuk the decisive is the fact of determining the results of the work of stationary monitoring stations network, mobile sources of emissions of transport as the main pollutants of atmospheric air while 100% of the complaints of the town inhabitants come to the municipal crisis line from town areas that are located within industrial junctions. Besides, it occurs mainly at nighttime when the observations are not carried out.

The basic problem is the lack of systematic and operational observing system to develop actionable recommendations and making effective management decisions to prevent, ban and minimize the effects of air pollutants on environmental components and human health.

The purpose of the concept is considerate upgrade of the observing system and the formation of informational and analytical system of town atmospheric air quality estimation to ensure the rights of each resident for clean air and for

access to quality environmental information.

Conceptual tasks are the following:

1) the improvement of standard (systematic) monitoring system;

2) the development of an effective operational (crisis) monitoring system;

3) the creation of photo and video monitoring;

4) the improvement of the warning system on the occurrence of climatic conditions conducive to air pollution;

5) the introduction of expert analysis practice of the primary information operative monitoring systems and secondary operational information standard monitoring systems;

6) the anthropocentric reorientation of sociological monitoring (with the problem that is considered);

7) the upgrade the informational system displaying the results of the monitoring system work.

The results expected:

1. The optimization of the atmospheric air pollution monitoring system at the level of urban system with the provision of obtaining high quality operational and statistical information methods of stationary and routing observations and predictive modeling.

2. The establishment of the informational and analytical system of atmospheric air monitoring at the local level ensuring broad Web oriented hierarchical and differential access to environmental information.

3. The organization of the expert and analytical system work for the development and making management decisions for providing the reduction of the environmental risk level.

4. The creation of a systematic public survey sociological system dealing with the environmental problems in order to ensure the enhancement of environmental awareness and culture levels.

The indicators of conceptual objectives implementation.

1. The modernization of observation stationary posts system location over air pollution state in order to perform tasks of European integrated state monitoring system.

2. The support of informational and analytical system with round the clock observation network operational information.

3. Photo and video fixation of the results of environmental danger sources operations to evidence the excessive impact on air quality.

4. Supplying the effective operation of the short-term forecasting system in order to adverse weather conditions which can contribute to air pollution.

5. Analytical data processing system of observations in the crisis (emergency) situations through the independent public expert evaluation.

6. Completeness and representativeness of the analytical data obtained from the sociological research results.

7. The Web-based visualization of the monitoring system components work with the information differentiation of and access to it.

The concept performance indicators.

Technical *static* indicators:

– the averaged value of pollutant concentrations, the standard and complex index values of atmospheric air pollution obtained from the observations results on the urban "background" observation post in comparison with the other urban network posts;

– the actual values of the pollutants concentrations fixing the exceeding sanitary and hygienic standards and meteorological conditions under which these exceedances have been recorded;

– photo and video materials to accompany the excessive pollutants concentrations facts fixed in town atmospheric air;

– relevant experts conclusions with clear definition of the exposure objects contribution to the air pollution general level.

Technical dynamic indicators:

– decrease of fixed cases of the atmospheric air regulatory purity criteria values exceedance in adverse weather conditions;
– increase of the expert opinions number taken into account on the cases on legislation violations in the atmospheric air protection sphere.
Social dynamic indicators:
– decrease in the percentage of sociological surveys system respondents which determine the "lack of information" indicator of as a local environmental problem;
– increase in the percentage of respondents satisfied with the level of information on the air pollution state of in the town;
– increase in the number of the local citizens appealed the informational and analytical systems Web resource;
– decrease in the number of citizens on the municipal authorities crisis and information lines on the air pollution issues.

4. Conclusions.

The basic scheme for the development of the atmospheric air environmental monitoring concept at the level of urban systems has been proposed. The need to display concept forming static and dynamic results in the indicators form that will clearly respond to the problematic conceptual issues with a focus on the prevention of the techno sphere objects negative effects on the environment and human health, the generated environmental hazards reduction, the environmental security improvement at the local level through the social factors management has been specified.

References

[1] Report on the State of Environment in Ukraine. (2014), available at: http://menr.gov.ua/docs/activity-dopovidi/NacDopovid2014.pdf

[2] CMU Resolution, no. 442, 10.09.2014, On optimization of central executive power bodies, Kiev, Ukraine

[3] Fedonuk, M. (2013). To the question of improvement of state environmental monitoring air quality. Public administration, improvement and development, electronic edition, available at: http://nbuv.gov.ua/UJRN/Duur_2013_2_6

[4] RD 52.04.186-89 "Guide to atmosphere pollution control", available at: http://ohranatruda.ru/ot_biblio /normativ/data_normativ/44/44486/

[5] CMU Resolution, no. 343, 09.08.1999, On approval of the organization and environmental monitoring in the field of air, Kiev, Ukraine

[6] Potapenko V. G., Shevchuk I. V. (2016). The problems of the state system of environmental monitoring in Ukraine and ways to overcome them. Policy Brief of National Institute for Strategic Studies, electronic edition, available at: http://www.niss.gov.ua/articles/1038/

[7] Nekos, A. N., Molodan, Ja. Ue. (2011). Status, problems and deficiencies of the system of monitoring air of Kharkiv. Ludyna ta Dovkillya. Problemy Neoekologii, 1-2, 47-53

[8] Radovenchyk, V., Radovenchyk, Ja., Kachula, I. (2016). Access to environmental information in Ukraine. Visnyk NTUU “KPI”. Seria: Chimichna engineeria, Ekologia ta Rosursozbereghennya, 1, 75-80

[9] Pickett S. T. A., Burch, W. R. jr., Dalton, S. E., Foresman, T. W., Grove J. M., & Rowntree, R. (1997). A conceptual framework for the study of human ecosystems in urban areas. Urban Ecosystems, 1, 185–199

[10] Alberty, M. (1996). Measuring urban sustainability. Environmental impact assessment review, 16, 381-424

[11] Minx, J. C., Creutzig, F., Medinger, V., Ziegler, T., Owen, A. and Baiocchi, G. (2011). Developing a Pragmatic Approach to Assess Urban Metabolism in Europe. A Report to the Environment Agency, Climatecon, Working Paper 01/2011

[12] Effective Modelling of Urban Systems to Address the Challenges of Climate Change and Sustainability. OECD Global Science Forum, October, 2011

[13] Percy, K. E., Ferretti M. (2004). Air pollution and forest health: toward new monitoring concepts. Environmental Pollution, 130, 113–126.

[14] Bakharev, V. S., Marenych, A. V., Zhuravska, M. K. (2016). The adequancy of the existing network and justification of proposals for the of stationary atmospheric air state observation posts location in Kremenchuk. Transactions of Kremenchuk Mykhailo Ostrohradskyi National University, 4(99), 80-87.

Bakharev Volodymyr (ORCID ID: 0000-0001-9312-654X).

Candidate of Technical Sciences (2006), Associate Professor (2007), Dean the Natural sciences faculty, Kremenchuk Mykhailo Ostrohradskyi National University, Ukraine, Kremenchuk, 39600, from 1999 to the present; Member of the editorial board of scientific publications: Scientific Journal "Transactions of Kremenchuk Mykhailo Ostrohradskyi National University", (Kremenchuk, Ukraine); Scientific journal «Ecological safety», (Kremenchuk, Ukraine). He has more than 100 publications. Area of scientific research: urban development, environmental safety, environmental monitoring, fighting noise in cities.

Peter Sankov (ORCID ID: 0000-0002-0898-7992) Candidate of Technical Sciences (1989), Associate Professor (1998), Associate Professor of Architecture, Prydniprovs'ka State Academy of Civil Engineering and Architecture", Ukraine, Dnipro, 49005, from 1981 to the present; (2006) - Academician of the International Academy of Life Safety; (2015) - Corresponding Member of the Academy of Construction of Ukraine, (2015) Professor of the Russian Academy of Natural Sciences, European Scientific and Industrial Consortium - Medal of Socrates №636 / 072/2015), Gold medal "European Quality" No. 861/2016); (2014) - Participated in the development of: DBN V.1.1-31:2013 «Zahyst terytorij, budynkiv i sporud vid shumu», DSTU - N B V. 1.1-33: 2013 «Nastanova z rozrahunku ta proektuvannja zahystu vid shumu sel'byshhnyh terytorij» and DSTU - N B V. 1.1-32: 2013 «Nastanova z proektuvannja zahystu vid shumu v prymishhennjah zasobamy zvukopoglynannja ta ekranuvannja», DSTU - N B V. 1.1-35: 2013 «Nastanova z rozrahunku rivniv shumu v prymishhennjah i na terytorijah», Certificate of attendance for the Qualification enhancement programme for the professors of higher educational establishments «Publishing and project activity in the European Union countries: a bedside approach »(Czech Republic, Prague; Prague Institute for Qualification Enhancement; 20th -27 th of November 2016); Certificate for participation in the International scientific and practical conference "Problems and perspectives in European education development"(Czech Republic, Prague; Prague Institute for Qualification Enhancement; 20th -27 th of November 2016); Member of the editorial board of scientific publications: «Mezhdunarodnyj nauchnyj zhurnal» (Kiev), b) Publishing House «Problemy nauki» (Moscow); Scientific journal «Bjulleten' nauki i praktiki», (Nizhnevartovsk). He has more than 250 publications, including two collective monographs (2012 «Ekonomika prirodokoristuvannja ta ohoroni navkolishn'ogo seredovishha» Kremenchuk: Printing House Madrid), (2014 Novosibirsk, RINC «Vlijanie tehnogennyh faktorov na jekologiju») and one monograph (1998) «Ozelenenie gorodskih i rekreacionnyh territorij» with the signature of the Ministry of Education and Science of Ukraine. Area of scientific research: urban development, environmental safety, life safety, fighting noise in cities.

Marenych Andrey (ORCID ID: no)

Postgraduate student, Kremenchuk Mykhailo Ostrohradskyi National University, Ukraine, Kremenchuk, 39600, from 2014 to the present. He has more than 15 publications. Area of scientific research: environmental safety, environmental monitoring.

Hilov Vladimir (ORCID ID: 0000-0002-3014-5820)

Candidate of Technical Sciences (2016), Associate Professor of the Department of Ecology and Environmental Protection, Prydniprovs'ka State Academy of Civil Engineering and Architecture", Ukraine, Dnipro, 49005, from 1998 to the present, (2003-2014) Deputy Dean of the Faculty of Ecology and Life Safety. He has more than 100 publications, including collective monograph (2014 Novosibirsk, RINC «Vlijanie tehnogennyh faktorov na jekologiju»). Area of scientific research: urban development, life safety, environmental safety, fighting noise in cities.