

Algorithm of Research of Influence of Professional and Ecological Risk Factors for Various Groups of the Population

E V Omelchenko, E A Trushkova, G N Sokolova, A V Nikhayeva,
A G Hvostikov

Architectural and construction academy of the Don State technical university
st. Socialisticheskaya, 162, Rostov-on-Don, Russian Federation, 344000

E-mail: ayurvedaom@mail.ru

Abstract. The article is given algorithm of research of influence of professional and ecological risk factors for various groups of the population, considering professionally caused diseases as polietyology group of diseases, a natural environmental risk as probability of manifestation of many adverse natural phenomena by means of two components, and expediency of application in a security system of a method of stochastic management is proved.

1. Introduction

In the last decades the Russian hygienists, ecologists, pathologists study questions of influence of separate production factors at some enterprises of the Russian Federation, in total researches of a professional and environmental risk in the conditions of the Russian Federation aren't carried out. Development of systems of safety demands the solution of a number of problems of big dimension, constant increase in adequacy of mathematical models, the accounting of uncertainty and accident when using initial information. Today initial information for planning, design and management of security systems needs completion.

2. Technique

Continuous change of public requirements, change of climatic conditions, natural disasters, opening of new fields, the work of equipment accompanied with unforeseen emergencies which statistical regularities can be not always defined and considered at calculation of the operating influences define existence of a factor of uncertainty.

Carrying out the stochastic analysis allows to study indirect communications - the mediated factors (in case of impossibility of definition of a continuous chain of direct link). The stochastic analysis can act as the instrument of deepening of the determined analysis of factors [1-10].

Stochastic modeling of interrelations and quantitative estimates of various parties of safe activity of the enterprise is based on generalization of regularities of a variation of values of various indicators – quantitative characteristics of factors and results.

Quantitative parameters of communication come to light on the basis of comparison of values of the studied indicators in total of objects of the enterprise and the periods.

Thus, the first prerequisite of stochastic modeling is opportunity to make set of supervision, i.e. opportunity repeatedly to measure parameters of the same phenomenon in various conditions [3]. We



at creation of algorithm of research of influence of professional and ecological risk factors used model of the stochastic analysis which gathered by removal of empirical data, considering coincidence of numerical characteristics of communications and initial supervision. It is established that change of values of indicators happens within unambiguous definiteness of the qualitative party of the phenomena which characteristics are the modelled technological indicators (within a variation there shouldn't be a quantum leap in character of the reflected phenomenon).

Generally ecological danger to the population living in the territory with the industrial enterprises is defined by two factors: damage from the actual danger and risk (potential danger) in case of emergencies. Therefore the size of ecological danger in relative indicators it is possible to present functions [1] in the form:

$$G_d = f(Y_d, R_d), \quad (1)$$

where G_d – risk of ecological danger in relative (dimensionless indicators); Y_d – damage in dimensionless relative indicators; R_d – risk in dimensionless relative indicators.

The choice of concrete weight coefficients of direct $P_{Y.dir}$ and indirect $P_{Y.indir}$ depends on extent of influence of environment on activity of the population living in this territory. In case of noticeable influence of environment on a condition of human life it is possible to accept model of equivalent factors where weight coefficients are equal and matter 0.5. In case of weak influence of environment on a condition of human life it is necessary to choose model of the allocated factors and to accept in particular: $P_{Y.dir} : P_{Y.indir} = 9 : 1$. [5, 12, 23].

Objects of ecology are: systems of organisms, population systems and ecological systems (ecosystems), and, each of these groups is analyzed as system of the live organisms interacting with each other and with the environment of their dwelling and components such unity (system) within which process of transformation of energy and organic substance is carried out. The ecosystem is the unity including all organisms on this site of the territory and interacting with the physical environment in such a way that the stream of energy creates accurately expressed trophic structure (power-supply circuit), a specific variety and circulation of substances. The concept of an ecosystem very wide, and not its size, but functional unity of the components existing on this site of the territory and shown in relationship, interdependence and relationships of cause and effect, determines key parameters of ecosystems. The main task of biological systems of any level is their survival at this conjuncture.

Understanding ecology as science about the relations of vegetable and animal organisms among themselves and with the environment surrounding them, considering also, as the person is a live organism, it is possible to allocate a number of the scientific directions. Within bioecology is an ecology of individuals and the types made by them (physiological ecology); ecology of populations and communities (biocenoses) – a demoecology; ecology of ecosystems (biogeocenoses) – a sinecology. From the point of view of biology as set of sciences about wildlife in this scheme should consider also the person (as a look and as society). However in safety issues and risk there was a division of concepts: the risk for health of the person caused by a state of environment – medicobiological (medico-ecological), and for environment components – an environmental risk and ecological safety. Sometimes instead of the term "medicobiological risk" use "an environmental risk for health of the population" that does the term clear in this developed look. Thus the conceptual framework of the legislation existing in the sphere of industrial safety treats risk for the certain person as individual, and for group of people – as collective and (or) social [20-25].

At the present stage the ecology from strictly biological science turned into a considerable complex of the knowledge including sections of geography, chemistry, geology, sociology and other sciences. Thus, technosphere safety questions in general and ecological – in particular, – demand application of a number of disciplines that confirms our judgments about interdisciplinary nature of safety.

Ecology subject – preservation of functional and structural integrity of that central object which is allocated in the course of researches. It can be both a microstructure, and macro - and even the

megaphenomenon. Classification of bioecology by hierarchical levels of biotic systems begins with an molecular ecology, including at the gene level, and ecology of cages and comes to an end with an individuals, groups, types, – to global ecology of level of the planet and space communications.

Reckoning to a classical ecological cycle of sciences about conservation and environmental protection made ecological knowledge extensive set of disciplines. Development of ecological subject put forward concepts of ecopolicy, ecodevelopment, ecological safety. Communication of ecological sciences with economy generated emergence of a number of hybrid disciplines, including an economy of environmental management. In the international practice of existence of society such tendency partly corresponds to strategy of a sustainable development. [6,14,15].

According to a number of scientists fundamental environmental problems are in area of social culture and structure of society and are united by one general science – social ecology. Now a subject of social ecology is studying of interaction of society with global environment in all variety of its technogenic transformations. The purpose of this science consists in developing the theory of compatibility of society with environment of its existence. The social ecology is connected not only with interaction of the nature and society in general, but also with groups of people and with each person separately. As the directions of human activity are extremely diverse, the social ecology, besides the general-theoretical section of knowledge, is subdivided into a number of applied areas. First of all, the ecology of the person with its medicobiological, sanitary, economic, social and psychological and other aspects is allocated here. Below we will speak about social sources and the reasons of accidents, in particular, about social risk (risk for a certain group of people), about social and psychological causes of failures (mistakes) of the person operator. Important social problems of ecological education and education of culture of health and safety arose and are solved.

Such types of applied ecology as geocology, agricultural, transport, industrial (engineering) are separately considered. The last can be defined as discipline which investigates technogenic impact on environment. The wide range of sources, types and levels of the dangers generated by technical objects in the form of emissions and drains of emergency or usual operational character is the one side of the problem. Natural objects recipients of a biotic and abiotic origin with which environment is sated now, are numerous and various. Aspects of influence of "stressor" on them (the influencing factors) technospheres and protection against the last in many respects are beyond the scope of known and set serious problems for the decision to environmental engineers, probably, not of one generation.

In this connection, we developed the algorithm of research of influence of professional and ecological risk factors for various groups of the population allowing to reveal the main criteria of diseases and to determine their professional origin due to allocation of the following investigation phases:

- establishment of existence of communication with concrete production factor (for example, dust – dust bronchitis);
- definition of existence of relationships of cause and effect with the production environment and a profession (for example, a dust aerosol - the miner);
- identification of excess of the average level of incidence at a certain professional group of persons (frequency rate in relation to full amount of this category).

In a basis of classification of occupational diseases we underlie the principle of etiology. Besides, allergic diseases and new growths are separately allocated.

As a result of application of algorithm - it is proved that professionally caused diseases - group of diseases - polietyology by the nature in which emergence production factors make an essential contribution [16,19].

For these diseases are characteristic: big prevalence; insufficient study of quantitative indices of the working conditions defining development of diseases; considerable social consequences - negative influence on demographic indicators (mortality, life expectancy, frequent and long diseases with temporary disability).

The developed automated complex by a hygienic assessment of working conditions included an assessment of parameters of a microclimate, levels of production noise, local and general vibration, air

pollution of a working zone aerosols of mainly genetic fibrosis action and toxic substances, weight and intensity of work on ergonomic indicators. The assessment of risk of professional incidence of the working was made according to "The guide to an assessment of professional risk for health of workers. Organizational and methodical bases, the principles and criteria of an assessment", an environmental risk for health of the population - according to "The guide to a risk assessment for health of the population at influence of the chemicals polluting environment" [17, 26].

By us it was established that the natural environmental risk is connected with probability of manifestation of many adverse natural phenomena, such as earthquakes, a volcanism, mudflows, floods, a tsunami. The algorithm of research of influence of ecological risk factors considers features of a geological structure (property of rocks, existence or lack of breaks, etc.), a relief (strengthening of risk of pollution in hollows), landscapes (degree of their resistance to technogenic loadings), the neighbourhood of valuable and unique natural objects, territories of a specific mode of protection, population density, nature of perception the population of events. It is known that catastrophic consequences of accidents and the spontaneous natural phenomena sharply increase in result of emotional and psychological unavailability of the population to such events. As the frequency of realization of a potential environmental risk creates a real environmental risk, it has two components:

1. the bioecological - risk for wildlife;
2. the anthropoecological - risk for the person.

At research negative impact of technogenic factors on human health with formation of professionally caused pathology (is revealed by production of tanning products and textile fiber glass). For the XX century of change of life expectancy, a state of health and death rate in the Russian Federation, as well as in other countries, were defined by the universal process which received the name of epidemiological transition. The former diseases of acuity which had more often the exogenous nature and affecting representatives of all age groups, especially children are replaced ecologically caused, mainly endogenous etiology, first of all cardiovascular, allergic and oncological. Continuous growth of number of patients of a hay fever is noted around the world, and especially fast – in economically developed countries.

The analysis of influence of industrial pollutant on incidence of a hay fever revealed a direct connection unsuccessful on a dust content and a gas contamination of the environment with growth of an allergic pathology. The comparative characteristic of number of the patients who addressed concerning respiratory allergic diseases in various allergic office of the Russian Federation confirms adverse influence of pollutant of environment on properties of pollen of plants. As a result the number of patients with the respiratory allergosis including caused by influence of pollen anti-genes increases [10, 13, 18].

It is established that the most favorable is the regional approach to a problem of hay fever assuming complex acquaintance with local climatic conditions, allergenic properties of pollen and features of a clinical course of diseases. A taxonomical variety and quantitative balance in air of pollen and dispute depend on climatic conditions: character of a vegetable cover, pollen efficiency of plants, mode of meteorological factors. Therefore hay fever are estimated as group of diseases which distribution should be studied from the point of view of the integrated knowledge of geography, biogeometeorology and ecology [6-8].

In the analysis of the emotional sphere of the worker the analysis was made on an assessment of emotions, feelings, a self-assessment, uneasiness. Studying of emotional development has the theoretical importance and is defined by need of detection of the general regularities of ontogenesis of human mentality and creation of the complete concept of mental development. Still the problem of emotional development remains theoretically the least developed.

The behavior of the person is always followed by emotions. The abundance of emotions provokes the nervous psychological tension (NPT). According to T.A. Nemchin, NPN happens three types: NPN-1 (weak), NPN-2 (average expressed), NPN-3 (which is sharply expressed, excessive).

It is established that for weak NPN emotional processes aren't strongly expressed, mood usual, sensitivity isn't changed, a dream, the speech, mental qualities – in norm. The average expressed NPN

the positive emotions promoting activation of adaptable mechanisms, mood thus raised characterize, sensitivity increase – moderate, a dream - strong, refreshing, there is a sense of responsibility, positively painted "rage", resistance to stress raises, speech activity amplifies, working capacity grows, mental qualities: memory, attention and others improve. At excessively expressed NPN the bright prevalence of negative emotions accompanied with strong deterioration of adaptation, mood - lowered, suppressed is observed, are observed sensation of fear, despair, continuous expectation of failures, sensitivity sharply increases, a dream – uneasy, resistance to stress – is lowered, the speech - silent, with pauses, slowed down, mental qualities – worsen, tension doesn't fall down even after disappearance of a difficult situation.

3. Result

Therefore when studying influence of professional risk factors objective registration of emotional states on resistance of skin and heart rate was carried out. Such simple methods, possessing objective character, help to carry out reliable diagnostics of shift of an emotional state during a production activity and at the correcting influences: pharmacological (medicinal) influence, physiotherapeutic means and by methods of psychocorrection.

4. Conclusions

Thus, application of algorithm of research of influence of professional and ecological risk factors allows to establish that it is possible to reduce incidence in various ways: primary prevention of an illness, early diagnostics and improvement of medical actions. Prevention of the professional and professionally caused diseases at the enterprises of the Russian Federation needs to be systematized and directed on decrease in risk of development of deviations in a state of health and diseases of workers, including actions of medical, economic and legal characters.

References

- [1] P 2.2.2006-05. Guide to a hygienic assessment of factors of a working environment and labor process. Criteria and classification of working conditions.
- [2] P 2.2.1766-03. The guide to a risk assessment for health of workers. Organizational and methodical bases, principles and criteria.
- [3] Professional risk for health of workers (The management under the editorship of N. F. Izmerov and E. I. Denisov. M.: Trovant. 2003. 196 p.
- [4] Balabanov I.T. Analysis and planning of finance of an economic entity. M.: "Finance and statistics". 1998. 236 p.
- [5] Omelchenko E.V., Trushkova E.A., Sidelnikov M.V., Pushenko S.L., Staseva E. V. Algorithm research exposure dust emissions enterprises of building production on the environment //IOP Conference Series: Earth and Environmental Science. 2017 Vol. 50, Article number 012018. p. 1-5
- [6] Trushkova E.A. Development of measures on preventing injures and occupational diseases on JSC 'Rostvertol' / E.A. Trushkova, N.Y. Volkova. Scientific review. 2014. 10. P. 550-553.
- [7] Artem'eva A A 2014 Ocenka vlijanija faktorov proizvodstvennoj sredy na sostojanie uslovij truda i professional'nuju zaboлеваemost' rabotnikov Federal'noe agentstvo zheleznodorozhnogo transporta, FGBOU VPO «Moskovskij gosudarstvennyj universitet putej soobshhenija (MIIT) ed A.A. Artem'eva 15-18
- [8] Staseva E.V., Pushenko S. L., Strakhova N. A. Improvement and increase of efficiency of the organization of labor protection in construction on the basis of a control system of risks: Monograph. Rostov-on-Don, 2012. 240 p.
- [9] Demyanova V S 2006 The disperse filled cements on the basis of lithotripsy. Ecological aspects of production M.: The Young Guard ed V S Demyanova and G N Kazin
- [10] Pushenko S.L. Health and Safety. Part 2 Production Sanitation and health: Textbook. S.L. Pushenko, D.V. Deundyak, E.V. Omelchenko, A.V. Nihaeva, A.S. Pushenko, E.A. Trushkova,

- E.V. Staseva, E.V. Fedina, E.S. Fil - Rostov n / D: Height. state. building. University Press, 2014. 94 p.
- [11] Professional risk for health of workers (The management under the editorship of N. F. Izmerov and E. I. Denisov. M.: Trovant. 2003. 196 p.
- [12] Zeljaeva N V 2014 Ocenka zabolevaemosti rabotnikov promyshlennyh predpriyatij i puti ee snizhenija (na primere predpriyatij otrasli mashinostroenija g. Nizhnego Novgoroda) Fundamental'nye issledovanija ed N V Zeljaeva 698-705. 7-4.
- [13] Habibulina V M 2015 Zdravoohranitel'naja politika: pragmatichnost' na osnove otkrytyh dannyh medicinskoj statistiki Materialy Mezhdunarodnoj mezhdisciplinarnoj konferencii ed V.M. Habibulina 380-390.
- [14] Trushkova E.A. Harmful factors of production environment. Part I: tutorial. / E.A. Trushkova, E.V. Staseva, N.Y Volkova Rostov-on-Don: Rostov State Civil Engineering University, 2014. 103 p.
- [15] Kislicyna O A 2015 Nezashhishhennost' v sfere truda rabotnikov v Rossii kak faktor riska plohogo zdorov'ja i povedenija s riskom dlja zdorov'ja: gendernyj aspekt Upravlenie zdravoohraneniem ed O.A. Kislicyna 66-77 1 (43)
- [16] Andreeva E E 2016 K ocenke riskov dlja zdorov'ja rabotnikov pri klassifikacii ob#ektov sanitarno-jepidemiologicheskogo nadzora i planirovanii proverok (na primere g. moskvy) Analiz riska zdorov'ju ed E.E. Andreeva 84-92. 2 (14)
- [17] Daviglius M.L., Liu K., Yan L.L. et al. Body mass index in middle age and health-related quality of life in order age: the Chicago heart association project in industry study. Arch. Intern. Med. 2003.Nov. 10; 163 (20):2448-55.
- [18] Kannel W B 1991 Left ventricular hypertrophy as a risk factor: the Framingham experience J. of hypertension 9. P. 3-9
- [19] Resnik L M 1993 Ionic basis of hypertension, insulin resistance, vascular disease and related disorders Am.J Hypertens. 6 P. 123-134
- [20] Zaharenkov V V 2013 Ocenka professional'nogo riska dlja zdorov'ja rabotnikov promyshlennyh predpriyatij na osnove medicinskoj tehnologii Akademicheskij zhurnal Zapadnoj Sibiri 9 ed V.V. Zaharenkov, A.M. Oleshhenko, I.P. Danilov, D.V. Surzhikov, V.V. Kislicyna and T.G. Korsakova 8. 2 (45)
- [21] Denisov Je I 2013 Problema real'noj jeffektivnosti individual'noj zashhity i privnosimyj risk dlja zdorov'ja rabotnikov Medicina truda i promyshlennaja jekologija ed Je.I. Denisov, T.V. Morozova, E.E. Adeninskaja and N.N. Kur'erov 18-25. 4
- [22] Haustov A P. Management of environmental management / Haustov A P, Redina M M. M.: The higher school, 2006.
- [23] Trushkova E.A. Results of researches of acoustic safety equipment problem on JSC 'Mechanical Repair Factory of Krasnokamsk' / E.A. Trushkova, N.Y. Volkova // Scientific review. 2014. 11. P. 528-531.
- [24] Oleynikov P.D. The main constructive and technological actions for decrease in noise level on workplaces / E.A. Trushkova, Oleynikov P.D. //Urgent problems of health and safety and ecology. The collection of scientific works of the second international scientific and practical conference with school of sciences for youth. Tver state technical universitet.2016. P. 66-68.
- [25] Izrael Yu. A. Review of the status and pollution of environment in Russia in 2012 / Yu. A. Izrael, G. M. Chernogaeva. Moscow: Roshydromet, 2013. 176 p.
- [26] Tatyanyuk T.K., Sineva E.P. Influence of working conditions on the health of workers at the enterprise experimental mechanical engineering // Regional problems of hygiene and public health strategy: Sat. scientific. tr. StaryOskol, 2004. P . 382-385.