Separating of Radionuclides Component in Technogenous Ecological Influence on Health of the Population

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INTRODUCTION

It has become one of the lessons of the Chernobyl disaster that the small levels of radioactive contamination which was treated as not dangerous for the population had imposed over the old non-radiation contamination that led to outbreak of nonspecific morbidity. A new term "Chernobyl syndrome" has appeared which consists of a lot of symptoms suffered by a frequently sick child [1, 2]. This is a new term, used for describing the state of children's health, suffering from frequent diseases on the territory that was contaminated as a result of the Chernobyl accident. "Chernobyl syndrome" is characterised most often by a high level of respiratory diseases in spite of the lack of connection of these pathologies with the direct radioactive influence. It's worth mentioning that frequent respiratory diseases are characteristic for the child population living in the territories with a high level of chemical contamination [3]. That is why this class of morbidity can be used as an indicator of unfavourable ecological conditions.

In present methodical documents the comparison with the morbidity in the analogous inhabited territory or with the morbidity of the unexposed group of population is the decisive argument about the dominating influence factor on the level of morbidity. It is supposed that all the other conditions are equal. Unfortunately to collect such pairs for comparison is practically impossible nowadays. As an example, the choice of control territory of Chernobyl influence can be illustrated by the choice of Poltava and Sumi regions where there is no radioactive contamination. But as the continued research of the Institute of Geography demonstrated conclusively, these regions were admitted with the highest level of oncological morbidity in that period in Ukraine [4]. The results of comparing oncological morbidity levels can be underestimated greatly under these conditions. In addition, analyzing the simultaneous influence of several factors can be done in 2 ways: 1) sorting out of isolated factors or 2) with the help of an estimating system.

Not to mention the little attention paid to the analysis of the territorial distribution of morbidity and contamination at the investigated territory.

DISCUSSION

The development of natural particularities on contaminated territories to a great extent and its landscape geochemical peculiarities for forming of doses of irradiation became the other

important lesson of the Chernobyl emergency. Under the same density of radiocesium contamination of soil (Kiev region for example), its contents in milk may differ as much as 2-10 times [5]. This means that different natural geochemical conditions have levels and kinds of technological contamination (industrial wastes, transport of waste, radionuclides, pesticides, mineral fertilizers) from ecological unfavourable zones on Ukrainian territory which are characterized by the increasing of substances of natural and technological nature.

Selection of ecologically unfavourable zones in the condition of combined pollution of radioactive and chemical substances of environment demands considerable time and finance which is not realistic for Ukraine nowadays.

Taking into account that the modern human is under the influence of a great number of ecological agents and that is why it's sometimes almost impossible to discover the reason for changes in human health. To pinpoint this or that factor, it's necessary to use a new methodical approach.

For this purpose, during 1991-1995, a group of specialists of different profiles and different institutions (NAS Ukraine, Russia and Belorussia, Ukraine State Committee of Geology and Agrochemical Service), under the leadership of Academician V. Shestopalov held the detailed polygon investigation of the northern part of the Kiev region, attached to the zone of the Chernobyl accident, and also screening research of the territory of "west trace".

The new-found information allowed scientists to formulate and publish "Methodical recommendations on radioecological assessment of territories by mapping", (all the participants were co-authors) in 1995 [6]. They include the following suggestions:

- Account and analysis of territorial distribution of all possible unfavourable ecological factors of population health, which is under state monitoring.

- The mathematical analysis of factor-dependent conditions and modeling of risk morbidity for definition of the contribution of each investigated factor;

- Zoning of territory in accordance with the risk from each studied factor.

In these recommendations, our presentation of ecological risk was introduced as a combined criteria action of all pathological ecological factors including radioactivity as an integral part of common ecological risk. "Ecological risk" means the quantity of the undesirable declining in the population's health which was calculated with the definite probability and the level for this territory, caused by the influence of investigated factors of morbidity per 10,000. The child population morbidity (from 0 to 14 years of age) is the most vulnerable under the influence of unfavourable factors [7] and that is why it was used as an indicator of the territory state. Because it has a sufficient number for receiving true statistical marks studied on the territory of the former

USSR, using only one method for many years, it allows the comparison of different territories for different periods, and they are available for each person.

Taking into account the detailed investigation, including the registration of morbidity on the level of countryside, medical district (some inhabited districts) and an insufficient number of children, who were living in these territories for receiving representative data in "Methodical recommendations". We offer to hold analysis only on the base of indexes of general and respiratory morbidity. In addition, it's necessary to analyze the level of medical care provided to the district by doctors in the investigated territories. This will permit analysis of the influence of medical service among all the investigated factors. For example: the production of radioactive factors contribution characterizes the radioecological risk.

The level of ecological risk and the contribution of each factor out of the investigated complex is defined with a help of multi-factor regressive models. The choice of models is created after the analysis of outcome information, which reflects the real interrelation of "factors" and "states" of organisms in a concrete ecological system (in this case - contamination of the environment and morbidity of children's population and morbidity of children's population living on this territory).

We define a "state" as the numerical characteristics of the biological bodies peculiar to anthropogenosis and biogeocenosis over a given area (in our case it is the local population morbidity). We define "factors" as the numerical characteristics that show the contents of artificial and natural components over a given area. We consider the spacial distribution of a risk parameter marked on a basic map (administrative, landscape-geochemical, etc.) of correspondent scale, as a ecological risk map.

Zones of high ecological risk (over the average for a given area) are shown by red and yellow colors (the "traffic light principle"); green and blue are the colors for zones where the risk is below the average. Let us consider, as an example, the research that has been carried out in the territory of the Kiev region in Ukraine, bordering on the alienated Chernobyl zone in the North. The research allowed estimations of the degree of influence of the complex environmental factors of radioactive and non-radioactive nature on somatic morbidity of the child population.

The investigation of the territorial distribution and the degree of influence of the complex environmental factors of radiating and nonradiating nature on somatic morbidity of the child population have been carried out in the territory of the Kiev area in Ukraine, bordering on the Chernobyl alienated zone in the North. The following factors of environmental contamination were studied: pollution of soil by radiocesium and by strontium - 90, of milk (from individual farms), the annual summary of equivalent effective radiation dose, as cumulated pesticide load, chloro-organic pesticide load and others, nitrogen, phosphoric and potassium fertilizer load, loading in soil of heavy metals and microelements Pb, Ni, Cu, Cr, Cd, Co, Ba, Mn, Sn, Zn, Zr, V for 1989-1994. Twenty-seven factors were investigated and landscape-geochemical characteristics on investigated territory.

The mathematical analysis has shown that influence of all investigated factors achieved 30-40%, variation in different zones of supervision. The influence of radioactive factors in the Northern part of Kiev test site is six times more than the risk caused by heavy metals and agrochemical pollution, taken together. The greatest influence of heavy metals was found in the centre of the Kiev region. The result of mapping analysis gave the evidence, that the zones of maximum influence of each investigated factors coincide in some cases.

The zones of maximum radioecological risk were marked, which exceeds the average level for investigated territories as follows: 1) by 3-10 times, 2) by 3 times; and areas where the radioactive risk is on average 10 times less than the average. It was concluded that the mathematical probability of this influence was insufficient, which is why research was conducted towards improvement of the mathematical risk model.

Taking into account the presence of trend and nonlinearity, different nonlinear dependencies were investigated with the help of the software package STATISTICA for Windows. The square law model turned out to be the most optimum (on a criterion of multiple regression R=0.65 against R=0.52), the most reliable (the significant majority of regression coefficients has a generally accepted confidence interval not less than 95%), and the most adequate, after the analysis of residual remainder. During the process of model construction, the procedure of reducing a nonlinear model in linear was used, due to which the implementation of the model has become possible, as above mentioned linear. It can be considered as one more lesson of the Chernobyl accident.

CONCLUSION

Thus, it can be stated that as the lessons of the Chernobyl accident that are necessary to be considered under other ecological accidents, we have:

- A splash of somatic morbidity of the child population, particularly the respiratory diseases. That is why this class of morbidity can be used as an indicator of unfavourable ecological conditions;

- The considerable influence of natural particularities of contaminated territories, its landscape geochemical characteristics on the level of pollution entering into the human organism. That is why it's necessary to take them into account for assessment of accident consequences for humans.

- The action of ecological factors in small doses on the contaminated territories displayed not only directly, but as interacting with other factors. Thus, in making analysis of ecological accident consequences it's necessary to take into account the complexity of environmental factors.

- The method scheme for the assessment of ecological risk is recommended for a complex analysis of the factor influence and separating radioecological component in technogenic and ecological influence on population health [6].

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