

## MANAGEMENT OF RADON SAFETY AT A LOCAL LEVEL

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### ABSTRACT

The problem of radiative safety, which community tries to solve in a context of steady development (SD), (the basic document "Agenda XXI"), immediately mentions regions of the active mining and processing of iron ore where anthropogenous ecosystems with negative influence of natural sources of ionizing radiation are formed. Krivoy Rog sets down on the Ukrainian crystalline board with the boosted content of transuranium devices which product of decay is radon - 222.

Thereof the population obtains additional high dose loading from natural radionuclides (NRN) that has an adverse effect on a state of health.

The Ukrainian Research Institute of Industrial Medicine researches a problem of natural resources of ionizing radiation. In order to prevent a harmful influence it is necessary to solve a problem of the exact perception in the usual sense by population the question of radiative safety of a surrounding medium. In the developed countries antiradon programs are implemented as the most effective way of an irradiative influence decreasing.

One of the first countries where the similar program was introduced, was USA. In the program the considerable attention was given to a question of education (at schools and among the population), preparation of materials for mass media, preparation and diffusion of bulletins etc.

Similar programs will be spent in the Czech Republic, Germany, Austria, Belgium, Great Britain and Russia.

In Ukraine antiradon program is realized since 1988, and since 1991 - in the reduced variant.

We consider, that in Ukraine prominent feature of process of an intrusion of SD may be the potent block of educational programs, and realization of State antiradon program may be connected to introduction of the concept at a local level.

To solve this problem, it is necessary:

- Detailed survey for an establishment of radon danger in region;
- To give the objective information to the population;
- To acquaint the population with prime actions of protection of residential buildings from inflow of a radon - 222.

### INTRODUCTION

In June, 1992 in Rio de Janeiro Conference of the United Nations on an environment and development which has given the political status to steady development (SD) - concepts of natural resources using so that not to deprive future generations of an opportunity to use them [1]. The major result of a conference is the document "Agenda XXI" which is the coordinated program of actions for achievement of interrelation of interdependent components of SD: ecological, economic and social development. Ukraine was among the first who has signed in Rio de Janeiro in 1992 "Agenda XXI".

Ukraine aspires to SD and unconditionally, the purpose in the concept of SD of Ukraine should correlate with the set purpose. Such situation gives chance of active formation of macroeconomic model and structure of the supply and demand which conforms the priorities of SD [2], such as:

- Standard of human living;
- Health of the population;
- Resources (energy) savings;
- Low-waste manufacture, etc.

Thus, development should be connected to realization of such actions which will improve conditions and quality of human life.

Proceeding from priorities of "Agenda XXI" it is necessary to recognize, that a point of the application of efforts becomes **not area** or economy in general but **the person** and his needs. Therefore it is important during an introduction of the SD concept in Ukraine, together with common "purpose-process" as "Agenda XXI" reflection, to select the real purpose on protection directly a human.

The problem of a radiation safety which community tries to solve in SD context [3], directly mentions a problem of its introduction in regions of active extraction and processing of mineral raw materials where anthropogenous ecosystems with negative influence of natural sources of ionizing radiation are formed.

As numerous medical and biologic data have shown, a measure of possible negative influence ionizing radiations is the doze irrespective of, is she generated by natural or artificial sources [4]. In structure of dozes of an irradiation of the population as the Earth in a whole so Ukraine, the greatest contribution to a total average of effective annual doze gives radon - 222 - natural radioactive gas, a product of decay of natural uranium-238. In Ukraine isotopes of radon define up to 80 % of an average effective doze of the population irradiation with the sources of a natural origin, and radon - 222 - about 60 % of its size [5].

## METHODS

$\gamma$ -radiation dose power was measured using DBG-01N dosimeter, and radon volume activity was studied by ionizing method using radon-monitor Alpha GUARD P30 (Germany). Radiometer Alpha GUARD P30 is used for measuring radon-222 volume activity in the air for parallel control of atmospheric air parameters (pressure, temperature, humidity) and for recording the results of measuring into memory of the unit with their following displaying. Statistical method of studying of cancer was applied.

## RESULTS AND DISCUSSIONS

Krivoy Rog iron-ore basin has the technogenic- disturbed environment and is characterized by the natural increased concentration of radon in soil. Accumulation of high concentration of radon in residential districts of Krivoy Rog is connected to their locating in industrial zones of extraction and processing of mining rocks, where the offset of radionuclides ( $\text{Ra}^{226}$ ,  $\text{Th}^{232}$ ,  $\text{K}^{40}$ ,  $\text{Rn}^{222}$ ) takes place [6]. Owing to that the population receives in addition high dose loading from natural radionuclides (NRN), which has an adverse effect on a health state. Thus, the morbidity on a pulmonary cancer in 2002 was 53,0 cases on 100 000 residents, and in 2001 - 44,8 cases on 100 000 residents, at the same time the parameter over Ukraine is 41,9 on 100 000 residents. The morbidity on a stomach cancer (2001) was 27,3 cases on 100 000 residents (over Ukraine - 25,5 on 100 000), a rectum cancer - 17,0 on 100 000 (17,9 on 100 000 over Ukraine), a large intestine cancer - 22,1 on 100 000 (17,7 on 100 000 over Ukraine).

Ukrainian Research Institute of Industrial Medicine studies a problem of natural sources of ionizing radiation. Researches of radon - 222 activity in the air of dwellings of Krivoy Rog and measurements of capacity of  $\gamma$  -radiation [6,7] are carried out. The quantity of dose loadings from NRN changes here from 1,4 up to 12,1 mSv/year [9,10].

In the publication ICRP-65 [11] it is recommended in excessing dozes of an irradiation from the technogenic-strengthened sources of natural origin (TSSNO) - 10 mSv per year.

It was determined by the Scientific Center of radiating medicine of AMS of Ukraine that average annual total effective doze (ED) of an irradiation from sources of natural radiating background and TSSNO is 6 mSv per year [12].

According to NRSU-97 [8], the permissible limit of an effective doze for the population is 1 mSv per year.

As it is shown there is an improbable risk for the population of Krivoy Rog to undergo to action of a large dozes of artificial ion  $\gamma$ -radiation. However it is necessary to know real risk of the nearest and remote effects from action of natural ion radiations.

At the same time, exists a problem of correct perception of this question. In Krivoy Rog an incorrect introducing about radiating situation in usual sense occurs at the population. There is no information about really harmful factors of radiation. In the developed countries of the world this problem is solved through realization of antiradon programs as most effective measures of population irradiation reduction [5] and use of principle of ALARA (least reasonably achievable level) in view of economic and social factors. Politics of ALARA is the tool of management of a doze and its optimization

One of the first countries where such program was introduced, have been USA. The state antiradon program under the initiative of Agency on environmental protection, Service of Public Health and the Congress was initiated in 1985 [4].

The significant attention in the program was given to a problem of "Risk Communication". This part of the program is financed by the government, and is carried out by the Public Association (American Lung Association) which propagandizes a way of living with healthy lungs. This activity includes a question of education (at school, among population), preparation of materials for mass media, preparation and distribution of different bulletins, postcards etc. [5]. Due to this the level of perception of this risk by the population has significantly changed: the problem which was not perceived first as serious, meets now, according to sociological researches, concern of 70 % of the population. New types of designs "resistant" to radon etc. have appeared. All this specifies high efficiency *of the strategy of risk management* applied in USA.

Similar programs are realized in Germany, Austria, Belgium, Great Britain, Czech Republic, Russia.

In Ukraine the antiradon program is realized since 1988, and since 1991 - in the reduced variant (mainly on radioactively polluted territories after Chernobyl Atomic Power station accident) at financial support by the Ministry of extraordinary situations. Within this period it was possible for the first time to show scales and features of an irradiation of the population of Ukraine with natural radioactive gas radon and its decay products, as well as to schedule main ways of irradiation doses reduction. The obtained experience in realization of this program allowed to substantiate scientifically the State antiradon program "Radon" directed on reduction of an irradiation of the population of Ukraine.

Certainly, the important element of effective functioning of the program is attraction of the population. It may considerably reduce the share of state expenses. For this purpose in all programs large-scale work with the population (sanitary - educational activity) [5] is provided. In Ukraine there is a necessary normative-legal base for its realization:

- the law of Ukraine "About human protection against ionizing radiation";
- the law of Ukraine "About use of nuclear energy and radioactive safety".

These laws determine legal bases of maintenance of preservation of the environment and radioactive safety of the population. In the Law of Ukraine "About human protection against ionizing radiation" it is told: "Every person who lives or temporarily stays in territory of Ukraine, has the right to protection against ionizing radiations action. This right is provided by a complex of measures on prevention of action of ionizing radiations on an organism exceeding fixed dose limits of irradiation and by the compensation of injury caused by ionizing radiation action".

Except of these laws "Norms of radioactive safety of Ukraine" (NRSU-97) are elaborated in which demands of laws as a base dose limit, the allowable levels of ionizing irradiation and other demands on restriction of an irradiation of the person are regulated. The official manual to State Structural Norms (SSN) B.1.4-2.01-97 where measures on "antiradon" protection of constructions are developed.

## **CONCLUSIONS**

Thus for reaching SD of radon safety, the radiation protection of the population should make an integral part of development and may not be considered apart from it. According to real-life situation, prominent feature of providing of the concept in Ukraine may be the powerful block of educational programs and the following steps of realization of State antiradon programs should be connected to introduction of the concept at a local level.

So, the questions of knowledge of the population concerning radon safety, monitoring of radon concentration due to anthropogenous activity and actions of preventive maintenance of harmful influence of the radiating factor are of a special value.

As we have specified, this problem is studying by research institutes in region, there is a scientifically based data, but, unfortunately, only a few number of experts is acquainted with it, and the population is not informed.

To solve this problem it is necessary:

- Detailed inspection for an establishment of radon danger in region;
- Allocation of the objective information to the population;
- Acquaintance of the population with simple actions of protection of residential buildings from receipt of radon - 222.

In view of the above the main direction in the maintenance of radon safety is increase of a level of knowledge, consciousness of the population concerning radon safety; an estimation of doses which the population receives from natural radionuclides; development of measures for decrease of levels of radon in houses.

Summing up, it is possible to ascertain, that at a national level the certain alterations were held. Legal and program bases of realization of the SD concept are incorporated. But unfortunately a level of awareness concerning this problem at a local level is very low.

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