

DOSIMETERS EXAMINATIONS IN A SYSTEM OF RADIATION MONITORING

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Abstract

The development of an atomic industry and atomic engineering was accompanied scientifically - are justified by conceptual approaches, directional on security of a radiation safety of the personnel and occupied items, where the serving staff lived. It has allowed receiving the enough complete information on radiation doses, comparative performances of illnesses and is brave origins of stochastic effects.

Last years on the foreground began to go out problems of influence on the population of ionizing radiation natural, and also engineering changed hum noise. The probability of origin of negative consequences at origin concerning small doses, characteristic for the term, which has usually to the present time, of an exposure of the population of large industrial canters and cities, depends not only from individual, but also on collective doses considerable on number of groups of the people in view of duration of action of the radiation factor.

The generalized material of long-term examinations on medial individual doses obtained by population from natural radionuclide, medical procedures in long-term dynamic is obtained. On the basis of long-term data the calculations of stochastic effects among the population of the Moscow region of Russia are given. These effects come from technological radiances of radiation, medical examinations and procedures, from radiation incidents and other radiances of an exposure of the population. It is shown, that nominal coefficient of probability of aggregate stochastic effect matters 5,9 unities on 0,01 inverse Sv that is compounded with literary data.

Keywords: *radiation, population, small doses, effective radiation doses*

BACKGROUND

The averaged global radiation loading can not be applied to each separate individual, as a loading from each radiant have wide individual allocation.

Thereof, in each region the effective doses obtained by the population are combined in different combinations depending on specific concentrations of radio nuclides in a surrounding medium and in a skew field of the man, latitude both height of terrain and many other factors.

So, in requirements of urban building of large cities, a considerable role plays architecturally - scheduled solution of territory used building materials and amounts of architectures using in the technological processes ionizing radiation sources.

Building constructions of buildings, their design and the used systems of ventilating can render considerable influence to contents of gas radon and yields of his (its) decay in locations.

The particular role is played by (with) radionuclide were in an atmosphere, yield of a feed and drinking water supply.

The considerable place in the averaged radiation loading of the population is borrowed (occupied) by (with) examinations and procedure of medical character.

In Moscow we during many years operate (exploited) a system of ecological monitoring, capable to gain the necessary information on shaping dose dates of loadings at the population of city, besides the keeping track of is included in monitoring by radiation doses from medical examinations and procedures, exposure of the population from gas of radon and affiliated yields of his (its) decay in inhabited and public locations, and also technology by radiates.

The system, created and operated (exploited) by us, of ecological monitoring of a surrounding medium has allowed creating a database about a content of radionuclide in components of a surrounding medium.

Filed integrated absorbed dose and potency of an equivalent dose in a self-acting condition. The generalized data's are reduced in the table 1.

Table 1: Content of radioactive substances in components of ecological systems of Moscow

Inspected parameters	A content of radioactive substances in components ecological system / year
Ground of Bq/kg	$\sum\alpha$ 550 $\sum\beta$ 650
Snow cover Bq/km ²	$\sum\alpha$ 15 $\sum\beta$ 20
Foliage of trees of Bq/kg	$\sum\alpha$ 100 $\sum\beta$ 1165
Grass of Bq/kg	$\sum\alpha$ 165 $\sum\beta$ 1270
Surface waters of Bq/L	$\sum\alpha$ 0,02 $\sum\beta$ 0,15
Ground depositions of Bq/kg	$\sum\alpha$ 340 $\sum\beta$ 420
Free air of mBq/m ³	$\sum\alpha$ 320 $\sum\beta$ 330
Atmospheric shadings of mBq/km ² .day	$\sum\alpha$ 1,0 x 10 ⁻⁴ $\sum\beta$ 2,8 x 10 ⁻⁴
Integrated absorbed dose of mGy/year	0,71
Potency of an equivalent of mSv/h	0,11

The calculations, carried out (spent) by us, display, that the individual effective dose on magnitude of an integrated absorbed dose for one year makes $\gg 0,58$ mSv. To the obtained magnitude it is necessary to add 0,4 mSv /years of space radiation, that in the total will make an individual effective dose equal 0,98 mSv /years.

The estimate (estimation) of an individual effective dose on magnitude of a potency of an exposition dose has shown, that she (it) makes 1,00 – 2,00 mSv /years.

Averaging the indicated two magnitudes, we obtain an estimate (estimation) of an individual effective equivalent dose of an exterior exposure equal 1,00 - 2,00 mSv/years.

During many years we carried out (spent) examinations of a content of radon -222 in free air, inhabited locations, children's preschool establishments and schools.

The operations on study of processes of selection of radon - 222 from ground and regularities of his (its) inflow in inhabited and public locations, bound from them architectural - планировочными by singularities will be carried out (spent).

The obtained data's on more than 3000 inhabited buildings, 2000 schools and preschool establishments have allowed to analyze frequency allocation of magnitude a equivalents dose of radon.

Is established (installed), that in years the value a equivalents dose of radon in inhabited locations makes 20 Bq/m³; a potency of a dose of a gamma-ray - 0,09-0,20 μ Sv/ч; a equivalents dose of radon in free air 4-5 Bq/m³. Is shown, that:

- In 68 % the inspected locations the average levels of an exposure of the people do not exceed 2 mSv/years;
- In 30 % of cases of a radiation dose make 2-5 mSv/years;
- In 2 % of locations of a radiation dose exceed 5 mSv/years.

The radiation action at radiology examinations in the medical purposes is one of the conducting populations, component an aggregate exposure, from all aspects of ionizing radiation sources. Medical examinations and the procedures shape about 20 % of an aggregate radiation loading on the population.

Moscow enters number of the largest megalopolises of a world, where the medical examinations with application of X-ray and other radiology procedures with the лечебно-диагностическими and preventive purposes will widely be utilized. Radiating from the concept of the International commission on radiological protection about rushing to the greatest possible drop of levels of an exposure of the population, we analyzed dynamic dose dates of loadings on the population of. Moscow from a medical exposure since 1980 till the present time. In figures 1, 2 the data's on dynamic dose dates of loadings of the population from medical examinations and procedures are submitted.

In the table 2 the dates on a medial individual radiation dose from global shedding of yields of nuclear detonations are reduced during 1963-2000 years. And it's (her) contribution to a common individual aggregate radiation dose of the population of Moscow from all radiant of an exposure.

Table 2: Medial individual radiation dose from global shadings [1]

Year	A radiation dose (global origin), μ Sv	the contribution to a common radiation dose, %
1963	430	10,7
1980	20	0,13
2000	5	0.03

As the contribution of a dose of an aggregate exposure from global shadings in a common aggregate radiation dose follows from the table 2 now is extremely inappreciable. It gives the foundation to consider (count), that the global shadings can not be an immediate reason of violation of health of the population, which can be revealed by modern clinical methods of examinations.

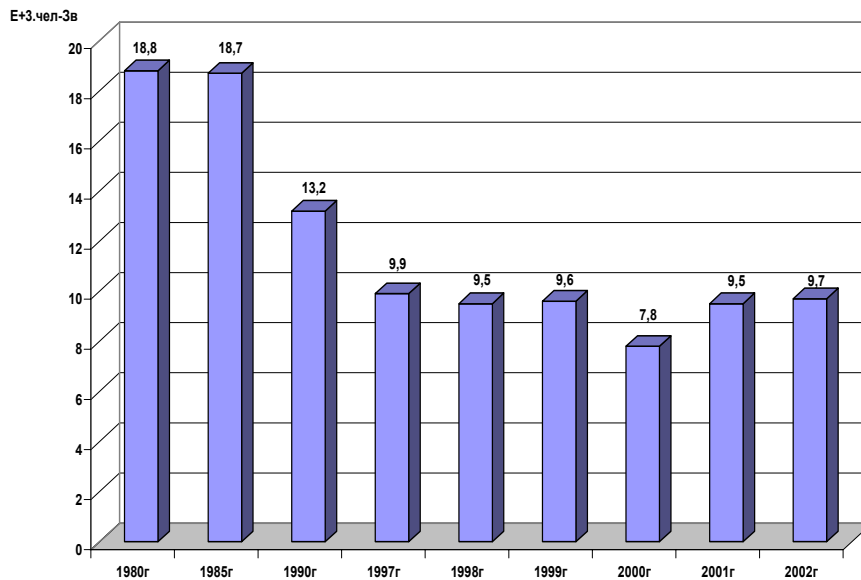


Figure 1: Medical exposure of the population, collective effective dose

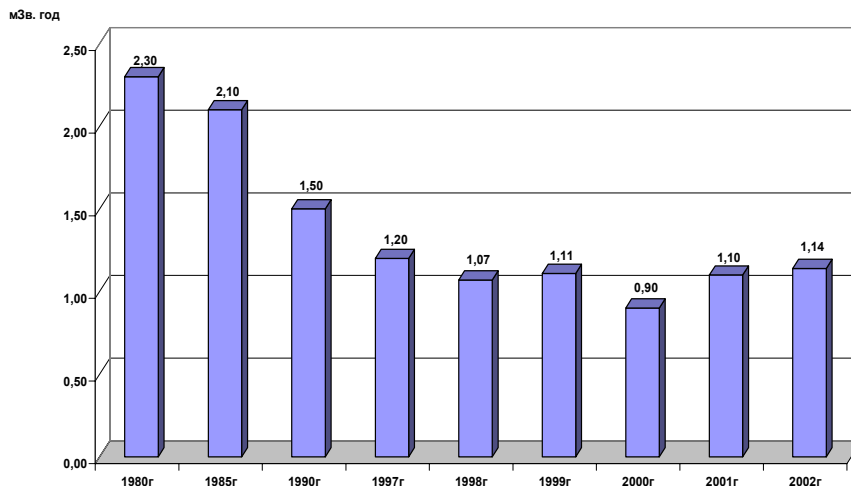


Figure 2: Medical exposures of the population, medial individual effective dose

As follows from reduced dates, with 1980 for 1997 the considerable drop of medial individual and collective effective doses was scored. Within the framework of radiation - hygienic passports. Moscow the dynamic of the indicated indexes with 1998 for 2003 was analyzed which specifies stabilization dose dates of loadings on the population from medical procedures (look also dates of the table 3) for the last few years.

Table 3: Individual and collective radiation dose the population

Reasons of an exposure	A medial individual effective dose for one year, mSv	An annual effective collective dose, A man-Sv 10.3	The contribution, %
Activity of the plants using ionizing radiation	0,002	0,02	0,07
Global shedding and last radiation accidents	0,001	0,01	0,03
Foodstuff, including water	0,02	0,2	0,7
Natural radiates, including: <ul style="list-style-type: none">• Equivalent dose• Radon	1,94 1,01 0,93	16,8 8,9 7,9	60,8 32,2 28,6
Medical examinations	1,06	9,2	33,4
Radiation accidents and incidents	0,16	1,38	5
<i>Total</i>	3,18	27,61	100

On the basis of values of individual and collective radiation doses of the population in view of the operating methodical recommendations Norms of a radiation safety we calculated hazards of origin of stochastic effects (fatal crawfishes and serious heritable imperfections). On the average, for last five years they have made:

- from all radiant technologic of an exposure: collective hazard - 775 cases per one year, individual - $9,0 \cdot 10^{-5}$, including
- from medical examinations and procedures - the collective hazard makes 671 cases per one year, individual - $7,8 \cdot 10^{-5}$;
- from radiation accidents and incidents - the collective hazard makes 100 cases per one year, individual - $1,2 \cdot 10^{-5}$.
- from global shedding and activity of the plants using radiant of ionizing radiations: collective hazard - 4 cases per one year, individual - $5,1 \cdot 10^{-7}$.

CONCLUSION

In the report the materials of long-term observations and examinations of both quality and quantitative indexes, which are the most significant in shaping population exposure radiance, are shown. It is shown, that the contribution of Radon to an annual effective collective dose reaches 28,6 %. Activity of the plants using ionizing radiation sources and the global radiation accidents practically does not render influence to this parameter.

REFERENCES

- [1] Marey, A. N., «Global shedding of yields of nuclear detonations as the factor of an exposure of the man », Moscow: Nuclei Press, 1980, ch 4, pp 45-57