REGARDING NATURAL AND ARTIFICIAL RADIOACTIVE BACKGROUND

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Abstract: the article describes natural and artificial radioactive background, their sources, background levels, its annual increase, its causes, nuclear reactions, biological effects, and in conclusion, appropriate conclusions are drawn.

Key words: radoactive background, artificial radioactivity, primary cosmic rays, secondary cosmic rays, soft component, hard component, cosmogenic radionuclides, radioactive families.

Throughout human life, the radioactive background lives under the influence of radiation. The radioactive background is conditionally divided into two, namely: natural radioactive background and artificial radioactive background. Of these, the natural radioactive background gives rise to the uranium-thorium family and natural radionuclides, which are scattered mainly in nature, without dependence on man. The artificial radioactive background, on the other hand, is directly related to human activity, and its formation is inextricably linked with the creation of nuclear weapons by man and the development of nuclear energy. The intensity of the artificial radioactive background increases over time and can pose a certain environmental risk. It is advisable to observe and control this background in a constant state.

The factors that give rise to a natural radioactive background are: cosmic radiation, uranium-thorium families, natural radionuclides, natural radionuclide aerosols. Taking cosmic radiation from these, they arrive from distant areas of the universe. Cosmic radiation and cosmic radiation are generated by explosions that occur in the Galaxy and in The Sun. The flow of charged particles coming from the universe to Earth is called primary universe radiation, as is customary. Primary cosmic radiation consists mainly of nuclei of protons (around 90%), alpha particles (the nucleus of a helium atom), and atoms of chemical elements with an ordinal number less than 30. Primary cosmic radiation interacts with the nuclei of atoms of chemical elements that made up the Earth's atmosphere to form secondary particles-secondary cosmic rays. Secondary cosmic radiation occurs mainly in the Uralic from 20 km altitude to the Earth's surface, is drastically different from primary cosmic radiation, and consists mainly of high-energy mesons, neutrons, protons, and “soft” component electron and uamma-Quanta. At sea level, the intensity of soft components is about 1/3 of the full intensity of cosmic radiation.

Gamma and X-rays are divided into soft and hard organizers. The part of cosmic radiation that is almost absorbed in a 10 cm thick lead is called soft, and the part that passes without absorption is called hard components. Investigations have shown that the division of cosmic rays into soft and hard components has a deep physical meaning and is inextricably linked with the nature of the particles that made up the components. For example, a soft component consists of strongly absorbent particles-electrons and gamma-Quanta-and a hard component consists mainly of relativistic myons. The mass of Myon is 206.8 times larger than the mass of electron, which are swallowed weakly in matter. The reason is that their braking radiation is small and consumes its energy mainly at the expense of ionization. There are two main species of Myon, with an average living time of 2.2 mks.

Radionuclides produced by nuclear reactions that cause cosmic radiation are called cosmogenic radionuclides. In this case, the function of bombarding particles is performed by particles contained in primary and secondary cosmic rays, and as a target by chemical elements that are part of atmospheric air, namely nitrogen, oxygen and argon. These processes produce tritium, carbon-14, beryllium-7, and sodium-22 cosmogenic radionuclides. The isotope tritium is formed in air and falls to the surface of the earth as a result of precipitation. Participates in air-soil-water exchanges in nature.

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The concentration of tritium in living organism tissues averages 0.4 BC/kg. Carbon-14 is oxidized and participates in biotic cycles with normal carbon dioxide gas through photosynthesis. The average concentration of this radionuclide is 27 BC/kg. The amount of beryllium-7 radionuclide that gets into the organisms of plants, vegetables, humans and animals by rainwater will be equal to 50 BC / year.

Let us dwell in detail on the process of formation of cosmogenic radionuclides tritium and carbon-14. Under the influence of primary cosmic radiation, radioactive isotopes tritium and carbon-14 are formed from the nitrogen atom in the atmosphere. This is a much more complex process, which occurs in the following order: primary fast protons knock out neutrons from the nuclei of the nitrogen and oxygen atom, which in turn interact with the nucleus of other nitrogen atoms to form a proton and triton (nucleus of the tritium atom). This process is written in the form of the following equations:

$$N_7^{14} + n_0^1 \rightarrow C_6^{14} + H_1^1 \quad (1)$$

$$N_7^{14} + n_0^1 \rightarrow C_6^{12} + H_1^3 \quad (2)$$

Radioactive carbon-14 enters human respiration into its body with corbanad dioxide gas, as well as through water and various food products. Including tritium, which is present in the body, these radioactive isotopes form a common radioactive background. The environment, Man and other creatures will be under the influence of this radioactive background. The intensity of cosmic radiation increases with respect to the geographic location of the object and as it rises above sea level. For example, in the geographical latitude of Tashkent, the average annual dose absorbed in human tissues compared to the equator will be about 1.3 times larger and will increase as it approaches the pole.

One of the factors that give rise to the natural radioactive background is the uranium-thorium family. The Half-Life period among natural radioactive isotopes is the age of the Earth (4,5· 10^9 yil) ga the next three isotopes are known. These include uranium -238 (T=4,5· 10^9 yil), uranium -235 (T=7· 10^8 yil) and thorium -232 (T=1,4· 10^{10} year) are examples. All of these isotopes are located from the end of the periodic table, starting three radioactive families. Uranium families are most stable in the periodic table of lead Pb^{206} and Pb^{207}, while the thorius familyPb^{208} ends with isotopes. Radioactive families are listed in Table 1.

Table 1.

Radioactive families

Radioactive families	radioactive Family Head	Half-Life of Family Head	final product
Thorium	Th_{90}^{232}	1,39· 10^{10} yil	Pb_{82}^{208}
Neptunium	Np_{93}^{237}	2,2· 10^6 yil	Bi_{83}^{209}
Uranus-radius	U_{92}^{238}	4,5· 10^9 yil	Pb_{82}^{206}
Uranus-Actinium	U_{92}^{235}	7,8· 10^8 yil	Pb_{82}^{207}

In addition to these radioactive families, there are also five radioactive nuclei that have a radioactive husk, and as a result of their decay, stagnant nuclei are formed:

$$K_{19}^{40}\ (\beta^-, \beta^+, \varepsilon), T = 1{,}28 \cdot 10^9 \text{ yil}$$
$$Rb_{37}^{87}\ (\beta^-)\ , \text{T=4,7}\cdot 10^{10} \text{ yil}$$
$$Sm_{62}^{147}\ (\alpha), T = 1{,}06 \cdot 10^{11} \text{ yil} \quad (1)$$
$$Lu_{71}^{176}\ (\varepsilon, \beta^-), T = 5 \cdot 10^{10} \text{ yil}$$
$$Re_{75}^{187}(\beta^-),\ T = 4 \cdot 10^{10}\ \text{ yil}$$

The most common of these is potassium-40 radionuclide, which is found in plants and in human and animal jusses. Natural Potassium consists of a mixture of three isotopes, potassium-39 (93.08 %),

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potassium-40 (0.01%), and potassium-41 (6.91%). These include the isotope potassium-40, which is radioactive. Since the isotopic composition of Natural Potassium is constant, any compound has a potassium-40 radioisotope. 89% of the potassium-40 radioisotope is converted to the ground state isotope calcium-40 by electron radiation.

$$K_{19}^{40} \rightarrow Ca_{20}^{40} + e_{-1}^{0} + \tilde{\nu}_e$$

In this $\tilde{\nu}_e$- electron antineutrino. The electrons emitted by the Kaly-40 isotope have a continuous spectrum from zero to 1330 KeV, meaning that the maximum kinetic energy of the electrons they emit is up to 1330 KeV. This maximum energy, also called the boundary energy of the eta-spectrum. The nucleus of potassium-40 forms a stationary argon-40 nucleus in an excited state, covering an orbiting electron at 11% (K-coverage, i.e., k-shell electron coverage):

$$K_{19}^{40} + e_{-1}^{0} \rightarrow Ar_{18}^{40} \quad (2)$$

This argon nucleus emits a gamma-quantum of energy E_y=1461 keV from the awakened state to the ground state:

$$^{40}_{18}Ar \rightarrow \grave{} Ar_{18}^{40} + \gamma \quad (3)$$

So, the isotope potassium-40 emits beta particles with a continuous spectrum with a maximum energy of 0.585 MeV. It also emits 1461 keV-energy monoenergetic gamma-radiation.

Now, based on this data, we calculate the number of beta particles and gamma Quanta that 1 g of Natural Potassium emits in 1 second. To do this, we produce an expression in which the activity of a radioactive substance with a mass of m is determined. The number of radioactive nuclei in a substance with a mass of m:

$$N = \frac{m}{\mu} N_A \quad (4)$$

Since the activity expression is A=**λ**N, we consider **λ**=0.693/T and write the expression that determines the activity of a monoisotopic source with mass m:

$$A = 0{,}693 \cdot \frac{mN_A}{TM} \quad (5)$$

If activity is calculated in curies rather than BK, then the expression (5) is written as:

$$A = \frac{0{,}693}{3{,}7 \cdot 10^{10}} \cdot \frac{mN_A}{TM} \text{ Ku} \quad (6)$$

1 g to overcome the number of beta particles emitting natural potassiumK^{40} it is necessary to take into account the percentage of radioisotope in the natural mixture and the proportion of erasures in which the release of beta particles occurs. Mass 1 g in natural potassium$m' = 10^{-4}\ g$ there is a potassium-40 radioisotope in quantity, β^-— output size for decay $I_\beta = 0{,}893$ considering that is equivalent to (6) the expression comes to the following view:

$$A_\beta = 0{,}693 \cdot m' \cdot \frac{N_A}{TM} I_\beta \quad (7)$$

If we calculate this expression by putting the values mentioned above, we get a value A_ß=28 Bk. In other words, it turns out that 1 g of Natural Potassium emits about 28 electrons at 1 s. Doing a similar calculation for K-coverage, we determine that 1 g of Natural Potassium emits about 4 gamma-Quantum at 1 S. Knowing the number of beta particles and gamma Quanta emitting natural potassium with a mass of 1 g, it is possible to find the number of beta particles and gamma Quanta emitting any potassium compound with an arbitrary mass.

In conclusion, it can be said that while we live on the surface of the Earth, our organism is affected by a radioactive background, whether we are hoxhaul. Only it will also be necessary to take into account that at different places on the Earth's surface, the radioactive background may differ. In addition, the radioactive background also depends on altitude, for example, the higher the radioactive background we live at above sea level. We explain this by the abundance of cosmic rays of this height or by the presence of radionuclides coming from the environment with the wind. It should also be noted that in some places the radioactive background can be abnormally high. This is explained by

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the fact that the same surrounding radioactive elements have a wealth of fossils or may be close to the site where nuclear bombs are tested.

It is also worth noting separately that acquaintance with such articles is important for military cadets, which, by their duty, can also be in different places and, most importantly, in places with a high radioactive background, it is important how they should behave at those times. At the same time, the level of knowledge of the officer personnel on these issues causes several tens, several hundred and even several thousand military personnel to be teran-protected from radioactive radiation.

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