EURASIAN JOURNAL OF ACADEMIC RESEARCH
Innovative Academy Research Support Center
IF = 7.899 www.in-academy.uz

METHODS OF MEASURING RADIONUCLIDES IN ATMOSPHERIC AIR

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https://doi.org/10.5281/zenodo.14288107

ARTICLE INFO

Received: 29th November 2024
Accepted: 03rd December 2024
Online: 04th December 2024

KEYWORDS

In the world, scientific and research work is being carried out on the rational use of underground resources as a source of energy, increasing the accuracy and reliability of radiation control, and reducing the natural and man-made effects of natural radioactivity on the environment.

ABSTRACT

In the article, radionuclides in atmospheric air, radionuclides in natural and underground water, scientific research and scientific research of foreign scientists about the sources of ionizing radiation affecting the human body from medical diagnostic tools and the metrological basis of radiometric determination. Also, the metrological basis of radiometric determination, the results of studies with radionuclides in atmospheric air and natural and underground water are presented. From the analysis of the scientific research works studied by the scientists, the information on measuring the level of alpha and beta radiation in the atmospheric air with a radiometer was studied, mainly the damage caused by radio-technogenic losses was discussed. At the same time, information is given that x-ray diagnostics, which corresponds to approximately 90% of the total medical dose in terms of medical use of all sources of ionizing radiation affecting humans and radiation exposure to the population. From the analysis of the studied scientific research works, the information on measuring the level of alpha and beta radiation in the atmospheric air with a radiometer is presented, mainly the damage caused by radio-technological losses is discussed.

In this regard, special attention is being paid to the improvement of the set of modern radiometric methods for assessing the radiation factors of environmental objects, the analysis of the value of radiation damage in natural and man-made objects, and the development of effective methods for monitoring the radioecological condition of production industrial zones.

Several of our scientists have pointed out that atoms of chemical elements in the natural environment consist of a nucleus (positively charged) and electrons around it (negatively charged).

Until now, the product of radiochemical research, scientists believe that the nucleus consists of nucleons, which include neutrons and protons (Figure 1.1). The number of protons determines the number of an element, and the sum of the number of protons and neutrons equals the mass number. Atoms with the same number of protons, but different mass numbers, are called isotopes of a chemical element.

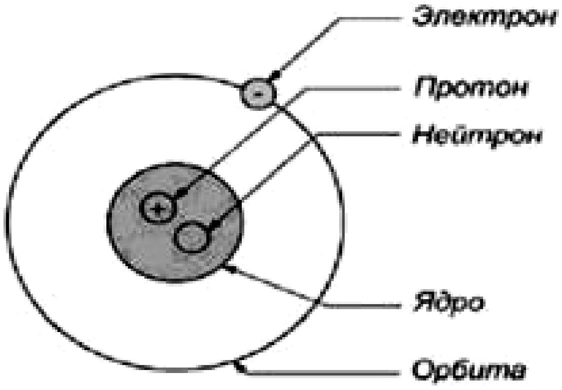


Figure 1.1. The structure of the atom

The phenomenon of natural radioactivity is the spontaneous transformation of unstable atomic nuclei of some elements into the nuclei of other elements as a result of radioactive decay. A radioactive element emits alpha-, beta- and gamma particles during its spontaneous decay. More than 230 radioactive isotopes of various elements are known, called radioactive nuclides (radionuclides), but the most important isotopes for radiometric studies are potassium, thorium, and uranium.

As we know, in the SI system, the unit for determining the activity of radionuclides is the becquerel (Bk) - the activity of any nuclide in which 1 nucleus decays in 1 second. The unit of measurement is named after the French physicist, Nobel laureate Antoine Henri Becquerel [1]

Often in practice, the unsystematic unit of radioactive activity - Curie (Ku) - is 3.7x1010 Bk (part/sec). This unit is historically derived from the fact that this unit of activity is equal to the equilibrium of one gram of radium-226 in decay with its by-products. Mainly Nobel prize winners, French scientists Pierre Curie and Maria Sklodovskaya-Curie have been conducting research with radium-226 for many years [3]. Before conducting research, we refer to the methods used by scientists of the whole world community to identify radioactive substances.

Radiometric analysis methods. As we know, radiometric analysis methods are based on measuring the radiation spectrum of the sample taken from the studied radioactive source according to two factors: radiation nature and intensity.

The method allows to determine the nature, energy and intensity of radiation at the same time. Radiometry is divided into two types: direct and by activation.

Direct method. If the sample contains particles of a radioactive substance, the amount, concentration and activity of this particle is determined by direct measurement of the intensity of radioactive radiation. Among ordinary natural substances, radioactive particles are very rare, since most of the elements of the periodic table are mixtures of stable isotopes. To study a system with a mixture of stable isotopes under natural conditions, attention is paid to its radiochemical activation, that is, it causes radioactive decay reactions. Activation method consists of irradiating a substance that does not have radioactive radiation under normal conditions by holding the sample to a strong source of radioactive radiation for a certain time.

The received radiation level and temperature allow to restore four important meteorological parameters of the ocean-atmosphere system:

Determines the speed of the incoming wind, the amount of vapor in the air, the amount of water in the clouds and the intensity of precipitation. SSMIS (Special Sensor Microwave Imager/Sounder) SSMIS is a radiometer designed for remote sensing of the earth in the microwave range, performing the functions of three types of devices simultaneously: SSM/T-1 Temperature Sounder, SSMI/T-2 Moisture Sounder and SSM/I (Kunkee et al., 2008).

The radiometers mentioned above can detect radiation in large frequency (GHz) and sensitivity ranges, so it is not possible to use them in all studies. Because determining the dose of radiation in natural sources (atmosphere, water and soil) that have been gradually irradiated over the years due to natural radioactivity is important from the point of view of human health.

Types of radiation: The types of radiation are as follows: α-particle - a particle with a nuclear charge of 2 and an atomic mass of about 4, which is doubly ionized helium Ne2+ ions; b-beta-particle consists of a stream of electrons, while b+-+beta-particle is a stream of positrons; The γ-particle consists of an electromagnetic vibration with a shorter wavelength than X-rays with a strong absorbing effect; r – proton particle, ionized hydrogen atoms; n - neutron particle, particles with one mass and zero charge (the number of neutrons is determined by n = A-z); Also, in the nucleus of the atom there are many, microparticles, for example, meson flow.

The amount of energy of any radiation is described in electron volts (Ev). eV is the energy of a particle with an elementary charge in a field with a voltage of 1V/cm2. The greater the energy of the particle, the greater its ability to enter the material and the half-life, the longer the radioactive isotope is stored in the natural source. According to scientists, during the half-life period, half of the mass of radioactive isotopes decays. For example, if the half-life of radioactive uranium is 4.5 billion years, 1 g of uranium will decrease to 0.5 g over 4.5 billion years. But during this period it is a source of strong radioactive radiation.

Isotopes are nuclides that have the same charge but different masses, while isobars are nuclides that have the same mass number. Isotons -are particles with the same number of neutrons - nuclides.

Radiation intensity- is the number of radioactive decays per unit of time. As a unit of radiation intensity, 1 curie was taken and it was considered to be equal to 3.7·1010 decays per second. In practice, studies were conducted on objects whose radiation does not exceed 100 microcuries [9]

Many scientists used the Geiger-Muller plotter to measure radioactive radiation. The meter consists of a tubular tube made of aluminum foil filled with molecules of gaseous (usually organic) substances, the outer covering of which is connected to the negative pole of the electric current source. In the center of the tube there will be a metal fiber to connect to the positive pole of the high voltage electric current source.

Processes that occur in a Geiger-Muller counter. Electrons entering the meter wall fall into the cylindrical electric field due to the positive charge created by the fiber, and the intensity of this field increases as the electrons approach the center. It follows that the electron is accelerated and has energy at a level that can ionize molecules of gaseous matter near the fiber. As a result, there is a flow of ions ionized by them rather than electrons approaching the fiber. When discharged, an electric current voltage occurs in the external circuit. This point is recorded by the sketcher. Modern radiometers use mechanical or electrical pulse counters instead of a galvanometer that records this pulse. To fully understand the radiometric detection method, it is necessary to know the basic concepts and quantities:

Reference sample – it is a known amount of the substance under investigation, in which the physical or chemical parameters of the test are measured using radiometric devices based on the requirements of the established method, and the reference sample is calculated.

Radionuclide activity (A) - measurement of the radioactivity of any amount of radionuclide at a given time and in a given state of intensity:

$$A = \frac{dN}{dt} \quad (1.1)$$

where dN is the number of spontaneous nuclear changes in this energy state during the time interval dt. The unit of activity is the becquerel (Bk).

Percentage of radionuclide activity (by volume) - is equal to the ratio of the radionuclide activity in the substance to the substance mass m (volume V).

$$Am = \frac{A}{m} \quad (1.2)$$

$$A_V = \frac{A}{V} \quad (1.3)$$

The unit of activity fraction - is Bk/kg becquerel divided by kilogram. The unit of volumetric activity is the becquerel division, which is equal to a cubic meter, Bk/m3.

Radiometric equipment (radiometer, spectrometer)- is a technical device that checks the activity (activity percentage) of radionuclides in a sample.

The minimum measurable activity, A_(min)- is the smallest activity of the sample to be tested, and the relative error is 50% when measuring in radiometric equipment for one hour.

The dose limit- is the annual average value of the equivalent dose of man-made radiation that has a negative effect on human health and should not exceed the specified amount under working conditions.

The level of control -is the standard and level of control that conducts rapid radiation monitoring of the value of the controlled dose, power, radioactive pollution, etc. in order to reduce the radiation exposure of workers and the population, prevent radioactive pollution of environmental objects, strengthen radiation safety in the area.

Radiation monitoring - divided into dosimetric and radiometric monitoring types, collection and analysis of all information about the general and local radiation situation in determining the level of radiation of the organization, environmental object and residents of a certain area.

Random (statistical) measurement error- is an error in the difference of the measurement result that changes during repeated measurements of the same value by chance.

Systematic measurement error- is a measurement error that is constant or changes slightly during repeated measurements of the same value.

Based on the functions of radiometers, they are included in the class of devices with the most types. According to the regulatory document UQ 2.6.1.14-2001 "Radiation situation control. General requirements" and their application in practice, their main directions are as follows:

- in controlling the volumetric activity (HF) of radioactive aerosols, gases (vapours) in atmospheric air;
- monitoring of volume activity of beta-active gases and aerosols, including 3N and 14C;
- control of contamination of liquids and environmental samples with radionuclides;
- control the level of contamination of the earth's surface and soil bioresources with radionuclides.

Portable and stationary radiometers are used in radiometric measurements, which are easy to use and carry. Radiometers of the first type are mainly used for operational (inspection) monitoring. Stationary radiometers are used to monitor individual points (including emergency monitoring) or to monitor the contents of the radiation system with standard interfaces using detectors.

The main tasks performed during radiometric measurements are as follows:

- consists in determining the parameters of the radiation field (climate, wind direction, temperature, etc.) and the characteristics of the radiation source (aggregate condition, temperature, scale, etc.).
- The radiation source for radiometric measurements can be a specially selected sample. Instead of a sample, a radiometer device is installed opposite the pipes through which technological solutions or gases pass, and selective measurements can be made without a sample. The values measured here are almost identical to the sampled measurements, except for aerosols. The second task is to determine the properties of the radiation field. The value measured here is related to the direction or density of the flow of ionizing particles or photons at the location of the detector, as well as the temporal or spatial activity of the radiation source or the distribution of the density of the radiation flow. In determining the characteristics of the radiation field, the radiation recorded can be alpha, beta, and gamma radiation, as well as neutron radiation. Radiometers can measure only one type of radiation, or they can be designed to measure radiation together, that is, to measure the neutron and gamma radiation flux density at the same time, or to measure the volumetric activity of alpha and beta radioactive isotopes at the same time.

The researchers noted that in some detectors, light and heavy charged particles generate pulses of different shapes. For example, the track of a heavy alpha particle in the detector material is very densely ionized, and there are few ionization pulses along the track of a lightly charged particle (electron). Therefore, the return of the detector substance to its initial state, where a current pulse or voltage is generated at the output of the detector, is different. Such pulses can be separated using electronic circuits. For this, the radiometer will need to be connected to a portable computer and controlled with the appropriate software. For example, there are radionuclides that emit other particles and photons in addition to the emission of light from the source and the emission of positrons. Positrons are slowed down in the detector substance, and two identical photons flying in different directions move with an energy of 0.511 MeV

Measure the percentage of activity of the sample. There are two main methods of measuring radionuclide activity in recording facilities: нисбий ва мутлақ. Радионуклид активлигини ўлчашнинг нисбий усулининг моҳияти шундаки, манбадан чиқаётган номаълум активлик эга бўлган нурланиш саноқ тезлигини маълум активлик билан манбадан чиқаётган нурланиш саноқ тезлиги билан таққослашдан иборат. Радионуклиднинг фаоллиги қуйидаги формула билан аниқланган:

$$A_x = A_{изв}\, N_x / N_{изв} \qquad (1.4)$$

where, Nizv and Nx: - calculation speed of the known and unknown activity of the source, imp./min; Aizv - the activity of the source, Bk.

The essence of the absolute method of measuring the activity was compared to the determination of the total activity of the source. The counting rate (N, imp./s) at which the source activity is measured is determined by the following formula for a series of correction coefficients from the source:

$$A = K_i N, \qquad (1.5)$$

where Ki is the overall correction factor, or in other words, the estimate of splitting one pulse. The resource's data document lists the following values:

1) flow of beta (alpha) particles at an angle of 180o;

2) source activity (to calculate the activity of Ax, current values for the decay of this source are used).

According to the researchers, radiometric methods are mainly used to detect and study the natural radioactivity of minerals and rocks. Radiometric methods can be divided into field and laboratory methods. All radiometric field search methods are geochemical, because they deal with determining the geochemical fields of radioactive elements and their distribution. In laboratory conditions, radiometric methods are used to determine the content of radioactive elements in minerals, rocks, water and gases in environmental objects. The following tasks can be performed using radiometric methods:

- creating geological maps based on the difference in radioactivity of different types of rocks and the increase in radioactivity of rocks in the zone of tectonic disturbances;
- separation of rocks into lithological parts. In this case, researches are carried out in conjunction with the gamma method of well drilling in combination with other geophysical methods when the core sample of wells is not taken when drilling wells;
- radiometric methods are widely used in all kinds of exploration and research of genetic and paragenetic minerals related to uranium and thorium. For example, increased content of thorium is associated with deposits of rare earth elements, bauxite, tin, and beryllium; to tantalum, tungsten, molybdenum-uranium deposits where niobium is formed; potassium minerals are detected in some polymetallic deposits;

- to carry out prospecting, to determine the depth and thickness of ore bodies, and to determine the limits of occurrence. The maximum value of the radioactivity of elements in the Earth's crust is limited to the upper part of the granite geosphere, which is 25-30 km thick;
- determining the age of rocks.

In this literature, the intensity of beta radiation with a large ionizing power, and less often gamma radiation, was measured in ionization chambers. A voltage of several hundred volts in the ionization chamber (Fig. 4).

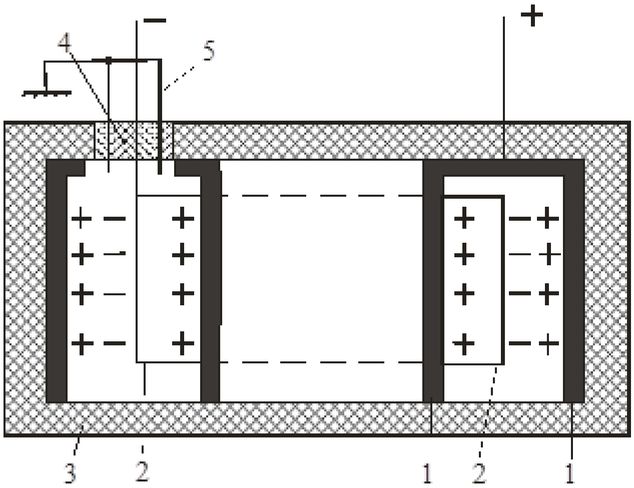


Figure 1.4. Diagram of the ionization chamber: chamber 1 wall made of lead (positive electrode); 2 - metal fiber (negative electrode); 3rd chamber outer cover; 4-amber insulator; 5th safety ring.

The Geiger-Muller counter consists of a cylindrical glass balloon inside which two electrodes are installed (Fig. 1.5). One of the electrodes is a thin (diameter 0.1-0.5 mm) metal (tungsten, iron, etc.) wire passed through the center of the balloon, which is connected to the positive pole of the current source, and this electrode is called the anode electrode. The second electrode-cathode was connected to the negative pole of the current source, which formed the inner metallized surface of the balloon.

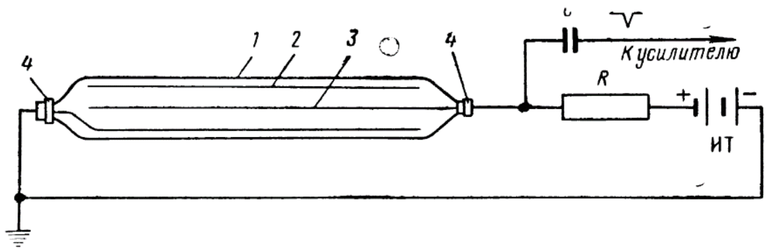


Figure 1.5. Geiger-Muller counter

1-glass tube; 2-the metallized inner surface of the cathode-glass tube; 3-anode; 4-insulating coating and connecting wires; IT-constant current source; S-capacitor; R-resistance.

The glass tube is filled with a mixture of inert gas (argon or helium) and vapor of high molecular compounds at low (100-200 mm Hg) pressure.

A current of 900 V was sent to the electrodes from the current source IT.

When gamma-rays hit the counter, they strip electrons (secondary electrons) from its cathode. These electrons ionize the gases inside the glass tube. How does ionization occur? Due to the fact that the moving electron has an electric charge, when it collides with the gas atoms inside the balloon, it snatches electrons from its electron shell. A molecule with an electron removed from its atom has a positive electric charge and becomes a positive ion.

An electron that is removed from an atom turns into an independently moving negative ion.

The light quanta generated in the scintillator (luminophore) are received by the photocathode of the FEU. FEU-photocathode, anode and the system of electrodes located between them consists of dynodes. The number of dynodes in modern FEUs is 8-14. A constant current of 1000-1500 V is supplied to the electrodes. This voltage is divided by the 8th divider (Fig. 1.6) to all electrodes.

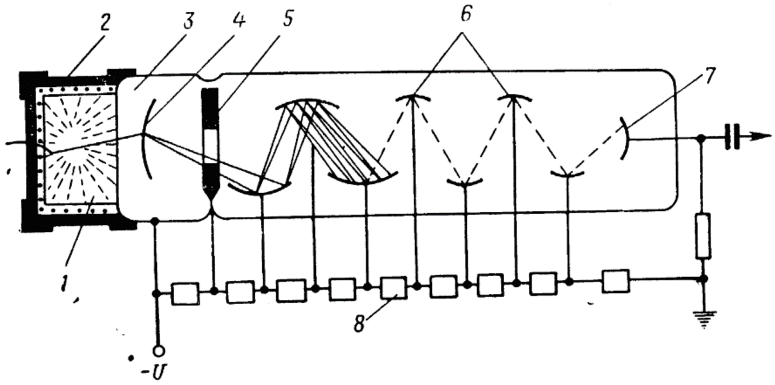


Figure 1.6 Scintillation counter

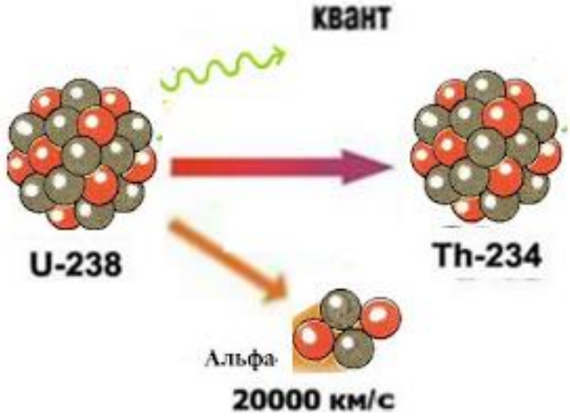
1-scintillator (luminophore); 2nd returner; 3-FEK; 4th photocathode; 5-fructing dynode; 6-collecting electrode (anode); 8- voltage distributor.

As reported in the literature, the light quanta (photons) generated in the luminophore knock out electrons from the photocathode of the FEK. These electrons are accelerated between the photocathode and the first dynode due to the presence of an electric field, knocking out several more secondary electrons than the first dynode. This process is repeated for the rest of the diodes and each electron ejected from the photocathode of the FEK forms a flow of electrons at the anode. As a result, a current pulse is generated at the output of the FEK, and the number of pulses counted depends on the intensity of gamma rays.

Therefore, scintillation counter crystals According to this study, scintillation counters are much more efficient than Geiger-Muller counters. If Geiger-Muller counters can detect only 1-3% of the gamma quanta falling on the counter, scintillation counting. despite its small size, it is greater than the intensity of gamma rays obtained in several Geiger-Muller counters.

In this work, the gamma meter uses a variety of portable radiometers with an output radiation axis indicator. Using the earpieces of the radiometer, it is possible to determine the sound indication of pulses. The device consists of dry anode batteries, a portable probe and a control panel. The intensity of gamma radiation is determined on the scale of the measuring microammeter. To calibrate the radiometer, a standard radium sample is placed in the collimator to determine the intensity of narrow gamma radiation. In addition to scintillation counters, these devices also use amplitude discriminators that determine the intensity of gamma rays at different energy levels.

In this study, it was studied that the determination of emanation concentrations is based on the registration of beta particles emitted from radioactive elements of the sample using an open scintillation detector. The device works with dry anode batteries. According to the type of radiation used, radiometric methods are divided into alpha-, beta- and gamma-radiometric methods. Alpha radiation is a stream of positively charged particles (nuclei of helium atoms) whose energy ionizes the environment along a path length of about 10 cm in air and is found in rocks and their penetration is very low. That is, α-fission is the release of an α-particle from the nucleus of an atom of a radioactive element, an α-particle is the nucleus of a helium atom with a mass of 4 and a charge of +2. The speed of the alpha particle exiting the nucleus is from 12 to 20 thousand km/sec. For example, during the α-decay of uranium, thorium is formed, during the α-decay of thorium isotope-radium, radium isotope-radon, then polonium, and finally lead is formed. At the same time, thorium-234 is formed from a specific isotope of uranium-238 (Fig. 1.7), then from radium-230, radon-226, etc.



Picture. 1.7. decay of a-uranium with the formation of thorium isotope

According to scientists' research, beta radiation consists of a flow of electrons (β-radiation) or a flow of positrons (β+radiation) that occurs during radioactive decay (Fig. 1.8). Currently, about 900 beta-radioactive isotopes are known. The mass of beta particles is several tens of thousands of times less than the mass of alpha particles. Beta radiation, depending on the nature of the source, their speed can lie in the range of 0.3-0.99 of the speed of light. The maximum cost for beta radiation is 4 million. is equal to the electron volt (MeV). β-particles mainly lead to the ionization of the environment, that is, the formation of positive ions and free electrons due to the escape of electrons from the outer shells of atoms.

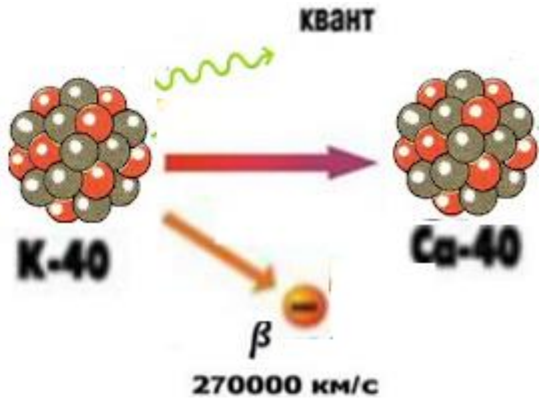


Figure 1.8. Conversion of the radioactive isotope potassium-40 to the stable isotope calcium-40 from β-decay

Using the beta method, mobile field analyzes designed to determine the limit of scattering of radioactive elements in the surface layer of rocks or soils are carried out. Beta radiation is usually measured by ionization, but it is often more convenient to use the pulse method in laboratory radiometers. In laboratory conditions, this method was considered the main method for determining the amount of uranium in uranium ores. The β-ray radioactivity of the ore sample was compared with the radioactivity of a standard uranium sample under the same measurement conditions. The beta method was used together with the g-method.

Gamma radiation is a stream of very high frequency electromagnetic radiation (Figure 1.9). Although they are scattered and absorbed by the environment, but due to their electrical neutrality, they have a high penetration ability (hundreds of meters in air and up to one meter in rocks). The number and concentration of long-lived elements (U, Th, 40K) in rocks are determined by their mass and percentage (or equivalent content of uranium).

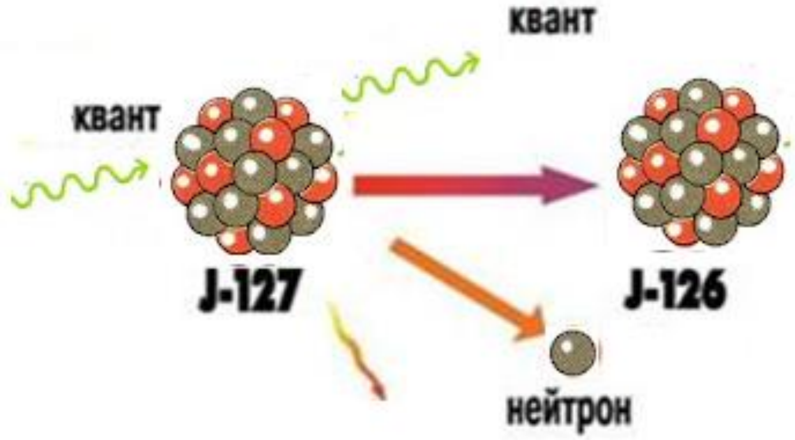


Figure 1.9. Emission of excess energy in the form of gamma radiation during neutron decay

Gamma-radiometers include various devices with different sensitivity to radiation. The choice of the optimal device depends on the conditions of the gamma survey and the requirements for its results.

RADIONUCLIDES IN ATMOSPHERIC AIR

One of the methods of monitoring the atmospheric air is based on the concentration of radionuclides from the volume of the aqueous sample by evaporation until it rises into the air, measuring the level of alpha and beta radiation formed with a radiometer, and comparing it with the calculation. Total activity is an indicator of radioactive activity when the same indicator is detected when measuring in a radiometer.

The results of the authors' research showed that radioactive substances released into the atmosphere from the Leningrad NPP resulted in a total annual radiation dose of 1.6 μSv/year to the population. Mainly due to the consumption of local agricultural products, the content of radionuclides such as 210Pb (36%), 137Cs (30%), 90Sr (24%) and 210Po (8%) was found to be high. The authors detected radionuclides in agricultural products, but this data does not give an opportunity to estimate the degree of contamination of the atmospheric air.

RADIONUCLIDES IN NATURAL AND GROUNDWATER

In this work, the authors conducted a 40-year monitoring of freshwater in the Urals and Western Siberia. They determined the presence of 60So, 90Sr, 137Cs and 239,240Pu radionuclides in the main composition of fresh waters. They proved that these radionuclides were the result of the activities of the "Mayak" production association located in the South

Ural region. According to scientists' analysis, the radioactive waste of the "Mayak" production association was directly spilled into the waters of the Techa River in 1949-1952. The second large-scale radiation contamination was due to this enterprise, due to defects in the equipment of the first storage tank, which caused radiation heating when the liquid contained high-level waste. As a result, on September 29, 1957, an explosion occurred from nitrate-acetate salts in the tank. As a result of the explosion, 740 Pbk (20 million Cu) of radioactive substances were released into the environment, of which 74 Pbk (2 million Cu) of radioactive substances damaged the atmospheric air of Chelyabin, Sverdlov and Tyumen regions located in the north-eastern regions of the wind direction.

In this work, the author studied how the radio brightness temperature of the atmosphere containing water in the form of condensate in the short-wave part of the centimeter wavelength range tends to its thermodynamic temperature, regardless of the rain intensity. According to I.N.Rostokin, he analyzed that the absorption and radiation spectra of the atmosphere in the microwave range in the presence of clouds depend on their phase structure, radio wave temperature, spatial configuration (height and strength) and precipitation falling from them. The physical-mathematical model of the microwave radiometric method of remote sensing of the cloudy atmosphere includes: the equation of radiothermal radiation transfer in the atmosphere; molecular absorption models in atmospheric gases (water vapor and oxygen).

SOURCES OF IRONIZING RADIATION AFFECTING THE HUMAN ORGANISM FROM MEDICAL DIAGNOSTIC TOOLS

Analysis of energy consumption in developed countries shows that by 2030, global energy production may increase 2-3 times, so the issue of fuel shortage has come to the fore. Nuclear energy provides an inexhaustible resource with a closed fuel cycle, which seems likely to lead to the widespread use of nuclear energy in the future. However, increasing nuclear capacity requires ensuring nuclear and radiation safety at all stages of the life cycle of nuclear facilities. Among all sources of ionizing radiation affecting humans, medicine takes the leading place. Among them, diagnostic x-rays account for approximately 90% of the total medical dose in terms of use and radiation exposure to the population.

Commonly recognized community and population doses aimed at rationally reducing individual radiological exposure. According to the United Nations, reducing medical radiation doses to the population by only 10% is equal to the complete elimination of radiation exposure from all other artificial sources, including nuclear energy. The medical radiation dose to the population of Russia can be reduced by about 2 times, i.e. to the level of 0.5 MeV/year, which the most industrialized countries have.

Although the contribution of sources to radiation is decreasing, neither the consequences of nuclear weapons tests nor the development of nuclear energy could significantly affect the dose load. Natural background stock is permanent. As a result of fluorography and X-ray diagnostics, the effect of radiation on a person is also permanent.

Life on Earth originated and continues to develop under conditions of constant radiation. It is not known whether our ecosystem could exist without constant (and some harmful) exposure to radiation. Nor is it known whether we can reduce the dose received by the population from various radiation sources with impunity. There are areas on Earth where many generations live under natural radiation conditions that exceed 100% or even 1000% of the global average. For example, the natural gamma background level in China is 385 MeV over a 70-year population lifetime, which exceeds the level that would require population relocation after the Chernobyl disaster. However, these areas have relatively low leukemia and cancer death rates compared to other areas, and some of the area's residents live longer. These facts are moderate radiation levels for many years confirms that even an excess cannot have a negative effect on the human body; moreover, in places with a high background radiation, the level of health is significantly higher.

Even in uranium mines, the incidence of lung cancer is significantly increased only at doses above 3 MeV per month.

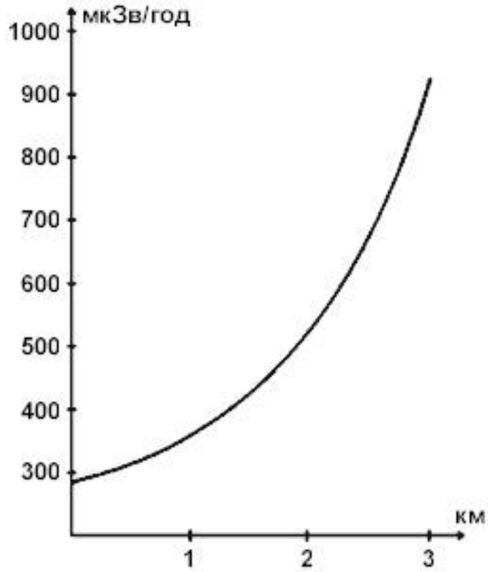


Figure 1.11. Altitude dependence of dose from cosmic radiation

It has been determined that the main radiation background on our planet (at least for now) is created due to natural radiation sources. According to scientists, the share of natural radiation sources in the total dose accumulated during the life of an average person is 87%. The remaining 13% is accounted for by man-made resources. 11.5% of them (or almost 88.5% of the "artificial" component of the radiation dose) is generated due to the use of radio waves in medical practice.

Among natural sources of radiation, the "dominant palm" is radon, which accounts for up to 32% of the total radiation dose. Radon is a radioactive natural gas, completely transparent, tasteless and odorless. Radon-222 is a gaseous radionuclide (with iodine-131, tritium (3N) and carbon-14) that cannot be detected by standard methods. If there is reasonable doubt about the presence of the aforementioned radionuclides, in particular radon, special equipment should be used for measurements. As a gas, it enters the human body when inhaled and can cause harmful health effects, primarily lung cancer. According to the US Department of Health, radon is the second most serious cause of lung cancer in humans after smoking.

Conclusion. By examining the scientific research conducted by scientists so far, we can conclude as follows: From the analysis of the studied scientific research works, information on measuring the level of alpha and beta radiation in the atmospheric air with a radiometer is presented, mainly the damage caused by radio-technological losses is discussed. As a result of natural and man-made factors in the atmospheric air, the amount of radon 222 has been little studied, therefore, Surkhan oasis requires monitoring of the amount of radon 222 in the atmospheric air.

Long-lived radionuclides are in exchangeable and non-exchangeable forms in the soil, and many of our scientists have worked on identifying radionuclides that are irreversibly absorbed, as well as radionuclides that are part of groundwater, but it turned out that little information was given about radionuclides released from water and soil into the atmosphere.

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