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ENVIRONMENTAL ISSUES OF RADIOACTIVE CONTAMINATION

Madraim Khasanovich Sarikulov

Associate Professor, Almalyk State Technical Institute, Almalyk, Uzbekistan

sarikulov.madraim4@gmail.com

Abstract: This article examines the environmental issues of radioactive contamination against the backdrop of the spread of radiation across the globe, the potential dangers of nuclear energy in the modern world, nuclear weapons testing and its consequences in the last century, and areas with high levels of radiation exposure. It also highlights the negative consequences of radioactive contamination, which, when exposed to radiation, can have tragic consequences for the human body.

Keywords: Terrestrial radiation levels, hot spots, radioactive substances, radiation dose, radiation sickness, radiation injuries, acute radiation exposure, radioactive contamination, ionizing radiation.

INTRODUCTION

The environmental challenge will be a pervasive and difficult to resolve problem in the 21st century. The environmental crisis manifests itself in a variety of ways, posing numerous dangers to humanity and threatening a global environmental catastrophe. Soils are becoming contaminated with harmful substances, particularly radioactive substances and dioxins. Soils are degrading, losing their humus, and desertification and salinization are spreading. Freshwater shortages are growing. Pollution of the ocean, surface water, and groundwater with harmful substances, primarily petroleum-based ones, is increasing. Phytoplankton, the foundation of the ocean food chain and an important source of oxygen, is dying.

Atmospheric pollution continues, temperature inversions are occurring, oxygen starvation in cities, and acid rain is occurring. Global climate change is occurring, and the El Niño phenomenon is becoming increasingly catastrophic. The ozone layer of the Earth's atmosphere is being depleted. Irreparable damage is being caused to the planet's biosphere, depleting its gene pool. Many animal and plant species are declining, even disappearing, and biodiversity is declining. Forests, a crucial regulator of the natural environment, are being cleared. Environmental problems have also affected near-Earth space, which is saturated with "space debris"—decommissioned artificial celestial bodies.

LITERARY RESEARCH

Ecology as a science can suggest solutions to the growing crisis. It reveals the laws of relationships that form the basis for the sustainable development of society. At the same time, it is essential that the population consciously understand the importance of improving its relationship with nature and strictly adhering to the rules and principles of proper management of the Earth's resources and wealth. Only by strictly adhering to all precautionary measures will a high level of environmental awareness be formed and developed in society.

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The phenomenon of radioactivity has led to significant breakthroughs in medicine and various industries, including energy. However, at the same time, the negative properties of radioactive elements have become increasingly apparent: it has become clear that exposure to radiation on the human body can have tragic consequences. The more information has been gathered about the effects of radiation on the human body and the environment, the more controversial opinions have become regarding the role radiation should play in various spheres of human activity.

According to A.A. Gorelov [1], the modern environmental crisis is the flip side of scientific and technological progress. It was precisely its greatest achievements that triggered the crisis and led to catastrophic environmental consequences on the planet. The atomic bomb was created in 1945. In 1954, the world's first nuclear power plant was built in Obninsk. In 1986, the largest man-made disaster in Earth's history occurred at the Chernobyl Nuclear Power Plant, a consequence of an attempt to harness the power of the atom. This accident produced more radioactive substances than the bombings of Hiroshima and Nagasaki. The release of long-lived radionuclides into the biosphere was 66 times greater than that from the Hiroshima explosion. The Chernobyl accident affected more than 7 million people and will affect more – the descendants of those who survived the radioactive contamination.

Source [2] provides (Fig. 1) a breakdown of the contributions of various sources that contribute to the spread of radioactive contamination. It also states that, despite the development of the nuclear industry, the main contribution (over 80%) comes from various natural sources.

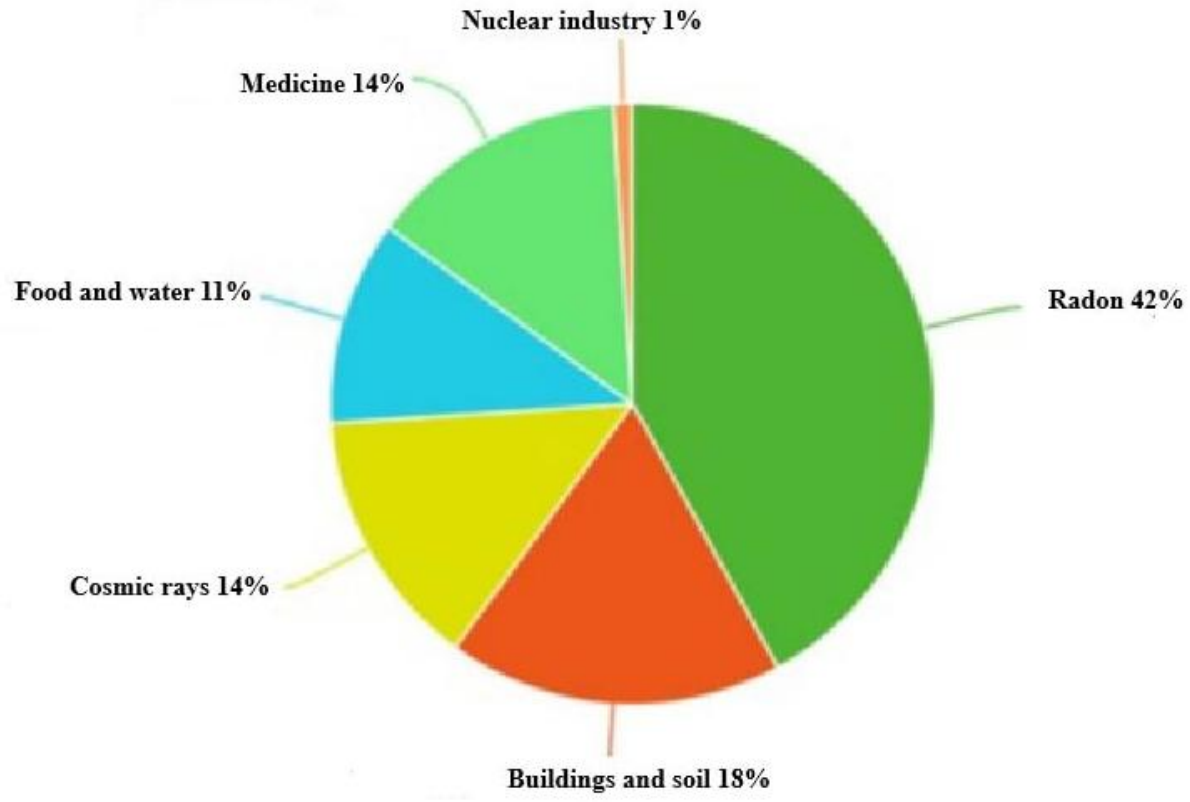

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Figure 1. Illustration of the distribution of radiation from various sources.

The authors' work [3] notes that radiation is generated by radioactive substances or specially designed equipment. Radiation itself, when acting on the body, does not form radioactive substances within it or transform it into a new source of radiation. Thus, a person does not become radioactive after an X-ray or fluorographic examination. Incidentally, an X-ray (film) also does not contain radioactivity. An exception is the situation in which radioactive drugs are intentionally introduced into the body (for example, during a radioisotope examination of the thyroid gland), and the person briefly becomes a source of radiation. However, such drugs are specifically selected to quickly lose their radioactivity through decay, and the radiation intensity quickly decreases.

According to source [4], in the case of radioactive contamination of an area from nuclear explosions or accidents at nuclear power plants, it is difficult to create conditions that would completely eliminate radiation exposure. Therefore, when working in areas contaminated by radioactive substances, certain permissible radiation doses are established for a given period of time. All this is aimed at eliminating radiation injuries to people. It has long been known that the degree of radiation injury depends on the dose received and the time during which a person is exposed to radiation. It is important to understand: not every radiation dose is dangerous for a person. You get a fluorography, an X-ray of a tooth, stomach, a broken arm, you watch television, fly on an airplane, undergo radioisotope research – in all these cases, you are exposed to additional radiation. But these doses are small and therefore not dangerous. If it does not exceed 50 R, then radiation sickness is excluded. A dose of 200-300 R received over a short period of time can cause severe radiation injuries. However, if this dose is received over several months, it will not lead to illness. The human body is capable of producing new cells, and fresh ones are created to replace those destroyed by radiation. The recovery process occurs. A radiation dose can be single or multiple. A single dose is considered to be one received within the first four days. If it exceeds four days, it is considered multiple. A single exposure of a person to a dose of 100 R or more is called acute irradiation. Compliance with the rules of conduct and the limits of permissible radiation doses will help prevent mass casualties in radioactively contaminated areas.

According to B. Nebel [5], terrestrial radiation levels vary across different regions of the globe. High levels of radioactivity are typically found in coal, phosphate, oil shale, and certain types of clay and sand, including beach sand. According to Nebel B., there are several hotspots with significantly higher radiation levels. These include several areas in Brazil: the vicinity of Poços de Caldas and the beaches near Guarapari, a city of 12,000 people, where approximately 300,000 vacationers come annually, where radiation levels reach 175 and 200 millisieverts per year, respectively. This exceeds the average by 500 to 800 times. A similar situation has developed on the southwest coast of India; this phenomenon is caused by the increased thorium content in the sand. The above-mentioned territories in Brazil and India are the most studied in this aspect, but there are many other places with high levels of radiation, for example, in France, Nigeria, Madagascar, the Trans-Urals, the Polar Urals, Western Siberia, the Baikal region, the Far East, Kamchatka, and north-east Russia.

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Methodology

With the development of new technologies, humanity is increasingly confronted with the concept of "radioactive contamination." The earliest mention of radioactive contamination came after the atomic bombings of Hiroshima and Nagasaki, when Japanese cities were bombed and massive amounts of radiation spread across the earth. Later, in the USSR, with the advent of so-called "peaceful nuclear energy," one of the largest man-made accidents in human history occurred at the Chernobyl Nuclear Power Plant, releasing large amounts of radiation into the environment.

Radioactive contamination is the negative impact on humans, nature, and the environment following a nuclear explosion, the destruction of facilities designed to generate or store radiation, or an accident at such facilities. It occurs when large quantities of radioactive elements are released into the atmosphere.

The effect of radiation on the human body is called irradiation, and people exposed to high doses develop radiation sickness. It is dangerous because it damages the structure of DNA and other cells in the body, leading to serious illnesses such as cancer, body burns, nausea, vomiting, and ultimately, death.

People in the modern world are exposed to varying degrees to ionizing radiation. Its sources can be very diverse. For example, people are exposed to radiation during X-ray examinations, certain diagnostic procedures using short-lived radioactive elements, nuclear weapons testing, air travel, smoking (tobacco smoke contains a number of radioactive substances), and even in their homes, as building materials can be sources of low-level radiation. We are constantly exposed to natural background radiation.

As is well known, the main contributors to pollution from artificial sources are various medical procedures and treatments involving radioactivity. An essential device in every clinic and medical facility is an X-ray machine, but there are many other diagnostic and treatment methods involving radioisotopes. The exact number of people undergoing such examinations and treatments and the doses they receive are unknown, but it is safe to say that for many countries, the use of radioactivity in medicine remains virtually the only man-made source of radiation.

In addition, a huge number of commonly used items are sources of radiation. These include, first and foremost, watches with luminous dials, which deliver an annual expected effective equivalent dose four times greater than that caused by leaks at nuclear power plants—specifically, 2,000 Sv. Workers at nuclear facilities and airline crews also receive equivalent doses. Radium is used in the manufacture of such watches. The owner of the watch is the one who is exposed to the greatest risk.

Conclusions

In conclusion, I would like to note that one of the components of quality of life, and even the culture of quality of life, is social stability. Unfortunately, a rather negative attitude toward the use of nuclear energy has become entrenched in society and among the population. As already

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mentioned, this negative attitude arose historically after the horror of the bombings of Hiroshima and Nagasaki, including under the influence of distorted perceptions.

Based on the above, it can be concluded that radioactive contamination of the environment will indeed cause significant harm to humans and other living organisms. The more people participate in solving the environmental problems of radioactive contamination, the greater the benefit to society. I believe that if we want to live in an ecologically healthy country, breathe fresh air, and drink clean water, then everyone on planet Earth needs to change their attitude toward radioactive contamination.

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