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STUDY OF THE RADIOECOLOGICAL SITUATION AT THE SITES OF EMERGENCY UNDERGROUND NUCLEAR EXPLOSIONS IN THE 70S IN YAKUTIA

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In the 70s of the XX century, 12 underground nuclear explosions (UNE) were carried out in the Yakut Autonomous Soviet Socialist Republic (ASSR, now the Republic of Sakha (Yakutia) –RS(Ya)). Two UNE became emergency –"Kraton-3"with a capacity of 22 kt produced on August 24, 1978, and "Crystal"with a capacity of 1.7 kt produced on October 2, 1974. The explosion of "Kraton-3"was produced 40 km from the village of Aikhal on the border between Oleneksky and Mirninsky regions on the banks of the Markha River, which flows through the Vilyui region. As a result of the accident, radionuclides were released into the atmosphere and onto the soil surface. The explosion of the "Crystal"was made 2.5 km from the town of Udachny near the border of Mirninsky region. Rehabilitation works were carried out on the burial grounds of both facilities, which were built in 1981 for the first time after the explosions: in 2007, a protective screen was installed at the "Kraton-3"facility and soil 1.5 m thick was poured without fencing the area; In 1992, the "Kristall"explosion site was filled up to twenty meters high with a fence and a protective drainage shaft with a height of 0.9 m was erected to prevent the burial ground from being washed away by spring meltwater and summer rainwater. And 3 control wells were drilled with a diameter of 132 mm and a depth of 3 m below the burial ground [1]. In this paper the study of the migration of radionuclides from the cavity of the explosions "Crystal"and "Kraton-3"into the environment. In July 2023, an expedition was organized to the sites of emergency UNE, during which measurements of the radiation background and collection of environmental samples were carried out: samples of soil and local vegetation: moss, lichen, cypress (Ivan tea). To determine the degree of contamination of the environment with radionuclides and identify the approximate boundaries of the radioactively hazardous zone, an ORTEC semiconductor gamma spectrometer with a detector made of extremely pure germanium GEM-40 and a low-background liquid scintillation alpha-beta spectrometer HIDEX SL-300 were used. Artificial radionuclide 137Cs and natural radionuclides such as 212Pb, 214Pb, 214Bi, 228Ac, 232Th were found in soil and vegetation samples from both sites of the UNE. The 241Am, traces of 60Co were found in samples from the "Kraton-3"locality. The values of the specific activity of 137Cs in soil samples from the "Craton-3" explosion sites exceed the permissible levels by more than 10 times. The obtained values for the volumetric activity of tritium in water samples from both localities correspond to background values, taking into account the influence of thermonuclear reactions on the Sun, generating tritium rain for northern latitudes. According to 2004 data, the value of the exposure dose rate (EDR) in the area of the "Kraton-3"nuclear power plant reached 1.6 mSv/h [2], and as a result of dosimetric measurements carried out during the 2023 expedition, the maximum value of the EDR turned out to be 1.2 mSv/h. I.e., the EDR exceeds the value of the EDR of a safe gamma background by 2.5 times in the area of the Kraton-3".

Thus, currently there is a high level of radiation pollution in the area of "Kraton-3", unlike "Crystal", which may be explained by insufficient rehabilitation work. In the nearby regions from the area "Kraton-3", the incidence of malignant neoplasms (MN) and mortality from them are higher than the average for RS(Ya). Perhaps the increase in MN is a long–term consequence of emergency UNE - additional dose loads leading to an increase in MN. The results of this study, in conjunction with the level of heat, can be considered as a basis for recognizing the need to develop recommendations and regulations as measures to comply with radiation safety when conducting similar tests in the future and during mining with the release of radionuclides to the surface.

List of literature:

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Section

Applications of nuclear methods in science, technology, medicine and radioecology

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