MOBILITY OF ARTIFICIAL RADIONUCLIDES IN SOILS OF SEMIPALATINSK TEST SITE UNDER VARIOUS CONDITIONS OFRADIOACTIVE CONTAMINATION

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The specific nature of tests, the characteristic natural and climatic conditions of the region, as well as the time factor, in the aggregate, have led to the formation of objects at the STS with unique radioecological characteristics. The STS objects (the main test locations and conventionally ‘background’ territories) differ in the level and qualitative composition of radioactive contamination. A various pattern of radioactive contamination in the STS territory may result in the non-uniform contamination of the soil cover with radionuclides and to varying degrees of their mobility and migration ability.

As research progressed, speciation of 137Cs, 239+240Pu and 241Am and 90Sr were studied in soils of the main STS objects. The objects of research were: the epicentral and interepicentral area of the air and ground explosion site ‘Experimental Field’; fallout plumes from ground explosions (24.09.1951 (38 kt) and 12.08.1953 (400 kt); the vicinity of the excavation explosion – ‘Atomic Lake’ object; conventionally ‘background’ areas of STS (areas beyond test locations that were affected by the global fallout and depositions due to ground nuclear tests); impact sections of radioactive water streams at the Degelen test location; test areas of radiological warfare agents (RWA) at the 4a site. Research was undertaken by the sequential extraction as per a modified procedure offered by F.I. Pavlotskaya.

Based upon findings, differences were revealed between STS objects. The lowest mobility of ARN is specific to test locations of ground and excavation explosions, and, next, it increases on fallout plumes from ground tests, in conventionally background areas. The peak mobility was defined in impact zones of radioactive water streams and at RWA test locations. It was found that the speciation of ARN in soils of STS objects is mainly attributed to the origin and conditions under which the radioactive contamination is formed in the soil cover, as well as to the physic-chemical properties of radionuclides. A low mobility of ARN in soils of fallout-impacted sites and ground and excavation sites is attributed to the initial state of ARN in the fallout from ground and excavation explosions. The behavior of ARN in soils of conventionally ‘background’ areas, in sections impacted by the radioactive water steams and at the RWA site is defined to a greater degree by physico-chemical properties of radionuclides and mechanisms of their interaction with soil components. Of the radionuclides studied, research data on 90Sr covers best the difference in the pattern of the radioactive contamination of the soil cover at STS objects, and the fraction of the water-soluble form of 90Sr may vary from <0.47 to 1.3 %, the exchangeable one – 0.78 to 78.8 %, the mobile one – 0.34 to 38.2 %, the tightly bound one – 7.0 to 99.0%. The content of the exchangeable and acid-soluble form of 90Sr was revealed to correlate with its accumulation by zonal plants (steppe motley grasses).