



Estimation of the modern state of the Novaya Zemlya Archipelago shallow bays radioactive contamination

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A study of radionuclide contamination of the shallow bays of the Novaya Zemlya Archipelago was performed in the period of 2002-2005 in areas of the solid radioactive waste dumping places (Tzivolky, Stepovoy and Abrosimov Bays). On-board investigation was combined with the visual study of the objects, the bottom water and sediment sampling close to and away from the dumped objects, the laboratory gamma-spectrometry, radiochemistry and analytical chemistry analysis including extraction, membrane filtration and ultra-filtration to study radionuclide species and sorption characteristics in the sediment-water system.

Examination of the Tzivolky Bay site including location of the buried former reactor block of the nuclear icebreaker "Lenin" showed no radionuclide contamination exceeding background concentration. In the Stepovoy Bay where a nuclear submarine with spent fuel was dumped no increase in radioactivity level was found either. Both facts proved the efficiency of safety protective barriers.

However in the inner parts of the Stepovoy and Abrosimov Bays near containers with the solid radioactive waste localities of contaminated bottom sediments were detected. At one of the sites in Stepovoy Bay cesium-137 and cobalt-60 were registered.

Laboratory experiments proved a rather fast (1-2-day) establishment of equilibrium between radionuclide concentrations in the sediment-water system. Obtained equilibrium distribution coefficients for radiocesium in this system witnessed higher cesium-137 diffusion abilities in the Stepovoy Bay as compared to sediments sampled in the Bays of Abrosimov and Stepovoy. Desorption experiments treating sediments with different solutions showed that cobalt-60 was present in readily soluble and mobile forms while a big portion of cesium-137 was in acid-soluble form and the insoluble

residue that supported results of sorption experiments showing significant fixation of cesium in bottom sediments.

Measurement of cesium-137 activity in the two top horizons (0-2 and 2-4 cm-deep) showed the lower one to have higher specific radioactivity. Estimation of sedimentation rate using lead method in column dating analyses equaled to the rate value ranging from 0.1 to 0.12 cm/yr. That means that the bottom surface layer formed during the last 20-30 years (after the waste disposal) exhibits no significant additional radioactive pollution due to the buried containers.

Comparison with our previous data allowed to reveal the decreasing tendency in radionuclide activity in the top layer of the bottom sediments at the burial sites in the Stepovoy and Abrosimov Bays within the ten-year period. One of the reasons for this activity decrease especially for cobalt-60 is the radionuclide decay. Another and probably more important factor of the activity decline can be the absence of the new pollution in the layers formed on top of the bottom sediments during last years.