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Clay minerals are found in almost all geological objects, they are formed under very different conditions, due to their sensitivity to changes in the environment (composition of pore water, temperature, pressure, etc.), they can easily experience structural transformations. It is certain that clay minerals can answer a great many questions, but their study must be approached with due care, with accurate sampling, using the most modern methods of data acquisition and processing, carrying out the most detailed studies of the composition and structure of clay minerals and not sparing time for sample preparation and experimentation. Minerals of smectite group, unlike other groups of clay minerals, by virtue of peculiarities of composition and structure are distinguished by high sorption and waterproofing properties, which causes urgency of study of their possible transformations in technogenic processes. On the basis of rocks with a high content of smectites are created engineered barrier systems (EBS) when isolating radioactive waste in near-surface and deep storage facilities, and are considered when developing natural geological barriers. Disposal of radioactive waste is a complex technological task with the need to analyse the evolution of the environment and the system of natural and engineered barriers for the entire period of potential waste hazard, i.e. for tens and hundreds of thousands of years.

Most of the current concepts for the isolation of radioactive waste, especially high-level waste, are based on the use of a multi-barrier system in which bentonites are one of the important components of the EBS. At the moment, the Russian Federation is considering the concept of building a facility for deep geological disposal of radioactive waste in the crystalline massif (Krasnoyarsk Territory), which precedes the creation of an Underground Research Laboratory (Exploratory Rock Laboratory In Krasnoyarsk region - ERLIK) with full-scale experiments. Due to various historical events, in our country, in addition to RW storage facilities used in world practice, there are many nuclear and radiation hazardous facilities that are currently included in the Federal Target Program - "Nuclear and Radiation Safety - NRS-2" and require special procedures of monitoring and/or decommissioning. If we consider the most dangerous burial sites with the most different technogenic conditions at the moment, then the following should be mentioned. 1) Disposal of liquid radioactive waste (LRW) in reservoir sands at depths of 300-350 meters and limited by thick clayey horizons. Disposal was carried out by injecting specially prepared liquid RW through well systems according to the principle of oil and gas fields. The composition of injected solutions (usually acidic) is a highly reactive environment in relation to the composition of reservoir sands and inevitably leads to technogenic changes. 2) Solid radioactive waste (SRW) buried in the form of cement slurries at the landfill of the Angarsk Electrolysis Chemical Plant (AECC JSC) in sandstones is currently affected by highly alkaline mineralized groundwater, which can also lead to changes in the underlying and surrounding rocks and potentially increase the risk of spreading contamination. Including in the course of the research, long-term experiments (up to 6-12 months) were carried out, in which the most aggressive impact was simulated: acid and alkaline solutions, high temperature.

Thus, rocks and technogenic soils (clay materials) can be affected by solutions of high salinity and different pH, which can potentially lead to changes in the composition and structure of clay minerals and affect the insulating properties of rocks and safety barriers. This report discusses the options for the development of technogenic processes during the isolation of radioactive waste (RW) in the conditions of real disposal sites in acidic and alkaline conditions, as well as in the course of laboratory experiments simulating environmental transformations to assess the safety of deep RW disposal facilities. The results of the research are based on a comprehensive study of samples using modern methods for obtaining and processing data (X-ray diffraction, infrared spectroscopy, thermal analysis, various methods of chemical analysis, etc.). It is shown that, under the influence of liquid radioactive waste, technogenic smectite is synthesized in the pore space of sand reservoir rocks, which favourably affects the forecast of the long-term safety of this facility. The impact of groundwaters on a number of low-level solid radioactive waste disposal sites can lead to the formation of ammonium illites, which requires additional studies at similar sites. The transformation of smectites under acid treatment depends on the ratio of cis-/trans-vacant octahedra in the 2:1 layer structure, while under alkali treatment it also depends on the presence of amorphous silica. The obtained results are used in modelling the evolution of disposal sites for a long-term perspective and to assess the safety of newly created RW isolation facilities.

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