



Technology of the prediction of the tectonic processes at a selected areas for dispose radioactive waste

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The possibility of using deep geological formations to dispose of high-level radioactive waste (HLW) is a subject raising heated debate among scientists. In Russia, the idea of constructing HLW repository in the Niznekansky granitoid massif in Krasnoyarsk area is widely discussed. One of the major problems is prediction of natural isolation properties persistence of the geological environment for a period of time of 10^4 – 10^5 years. In such a period of time geodynamic processes may radically change engineering geological and hydrogeological conditions (variation of underground water level, water-bearing horizons head, new infiltration channels formations and others) and result in HLW repository destruction causing environmental disaster.

To solve this problem we are elaborating a technology associated with time – space stability prediction of the geological environment, which is subject to geodynamic processes evolutionary effects. It is based on the prediction of isolation properties stability in a structural tectonic block of the Earth's crust for a given time. The danger is in the possibility that the selected structural block may be broken by new tectonic faults or movements on a passive fault may be activated and thus underground water may penetrate to HLW containers.

Prediction technology elaboration is based on the following prerequisites.

1. The evolution of the Earth's crust (velocity) is determined by the intensity of the tectonic process development in a region. The determining feature is the level of active tectonic stresses as well as physical and mechanical characteristics of rocks.
2. The tectonic stresses field varies in space and time, retaining tendencies inherited in the preceding period of the region tectonic development.

3. Modern stress – strain state of the environment in combination with the inherited tendency of time – space variation of the local fields tectonic stresses is the basis of geomechanical processes development in structural tectonic blocks.
4. The direction in which developing active tectonic faults spread is determined by inherited directions that depend on the tensor of active tectonic stresses.
5. The possibility of formation or development of tectonic faults (weak zones and others) is determined by the location of the fault as related to the major stresses axes.
6. The local zone of increased concentration of stresses makes potential places that initiate a likely development of the processes of geological environment destruction.

The technology comprises the following complex of research methods.

1. Structural geology, engineering geology and geomorphology methods of fault block tectonics.
2. Heterogeneous finite-element modeling of stress fields distribution in structural blocks.
3. Paleotectonic reconstruction of stress – strain state of the areas under investigation for a period of time of up to 1 million years.
4. Zoning of the area and separation of deep linear zones from geological and geophysical data that can be potential zones of tectonic faults on the basis of artificial intelligence methods.
5. GPS-observations of modern movements of the Earth's crust.
6. The method of rock destruction time calculation on the basis of the kinetic theory of solid bodies strength.

At present, research is being conducted to elaborate the above-mentioned lines of research in the frame of a number of projects.

The work is pressing because at present the decision of the construction of an underground laboratory is to be made and this stage is obligatory according to the concept of HLW repository construction. The prediction of geological environment evolution in the selected areas will allow us to avoid unjustified financial loss and reduce the

risk of environmental pollution with extraordinary toxic elements if the selected sites do not meet the requirements of geoecological safety.

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