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GROUND LAYER AS A GEOCHEMICAL BARRIER FOR PROPAGATION OF GROUND WATER POLLUTANTS

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Accumulation of industrial wastes leads to intensive pollution of groundwaters. For instance, at ash-slag storage sites, as well as at sites where wastes of mining and processing industry and gold-extracting industry are stored, the first water-bearing layer is polluted by such elements as Cu, Pb, Zn, Cd, As. Se, V. Cr, Mn, Ni, Co. F. Industrial wastes can be composed of solid phase only and of both solid and liquid phases The first case is characterized by groundwater pollution as the result of infiltration of atmospheric precipitation The atmospheric moisture dissolves toxic matter of wastes. In the second case, the liquid phase itself contains toxic substances and serves as the source for groundwater pollution. There are possibilities to prevent such a pollution by different ways, like first of all, by film and combined screens These ways are effective, but expensive

The effective methodology of groundwater protection against pollution with minimal investments was elaborated in the Moscow State University by geologists, geochemists. chemists and mathematicians. The essence of the suggested method is the use of absorbing capacity (sorption. sedimentation, co-sedimentation) of the ground layer of aeration zone below the planned site for waste storage. Investigations implemented in the MSU before revealed, that the ground layer of aeration zone composed of loamy matter can be considered frequently as the reliable geochemical barrier for heavy metals during decades. In this case the concentration of toxicants in the infiltrating through the ground bottom liquid can exceed the maximal permissible level required for potable water hundreds times. Obviously, the effectiveness of such a natural barrier depends on the ground mineral content, composition and forms of toxicants in infiltrating liquid. The proposed paper covers the methodology of preliminary engineering-geological zoning of a territory during the process of selection of the optimal storage site. Basing on the results of zoning, the quantity and sites of ground sampling are defined in order to obtain characteristics of each undisturbed lithological variety as a geochemical barrier.

The set of laboratory studies necessary to obtain the migration parameters of revealed toxicants is discussed. This set includes creation of «output curves» for filtration of the liquid phase through ground samples. The «output curves» are understood as changes in toxicant concentration (c) depending on the volume (V) of liquid infiltrated through the ground sample.

The «output curves» serve as the basis for further calculations. Their character enables to define the optimal mathematical model. The solution of equations of the model allows to calculate migration parameters and to forecast the process of propagation of toxicants. The report covers also the scheme of computation of maximal time period (Tm) of exploitation of the storage site, during which the possibility of groundwater pollution is excluded. These computations take into account the work of each lithological variety as a geochemical barrier, as well as the planned technogenic load.

The case, when at different places of the selected storage site the natural protection of the first water-bearing horizon is not adequate is considered separately It is recommended to use the artificial screen made of local loamy material at such sites. The complex of laboratory works, necessary to implement to select loamy materials for the screen is discussed. The option of calculation of the minimal thickness (M) of a screen, used as a geochemical barrier excluding the possibility of groundwater pollution is considered.

The proposed method of groundwater protection was tested at eleven objects in Russia and two object in Slovakia.