

Complex of Geophysical and Geochemical Methods for Environmental Assessment of an old pyrite-rich tailing in Karabash town, Russia

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Karabash town and surrounding areas have been affected by gaseous and particulate emissions from the smelter, acid drainage from abandoned mine workings, leachates and dusts from waste dumps and contaminated stream sediments. Multipurpose studies of the Karabash mine wastes allowed the determination of the composition of the wastes, the acid mine drainages, and the affected groundwater. The authors determine the composition of an acid mine drainage, evaluate dominant geochemical processes controlling the composition, and assess dissolved metal speciation and saturation indexes using a combination of laboratory, field and modelling studies. Deep electrical resistivity tomography techniques were used to trace the geoelectric zoning of the wastes to a depth of 40 m, expressed as a consistent change of the electrical resistivity specific electrical resistance from zone to zone and to clarify of drainage infiltration to groundwater horizon. Layers with low resistivity indicate areas with pore spaces filled by highly mineralized solutions. These layers extend to depths of 1–15 m, indicating the penetration of toxicants into the groundwater horizon. The pollution of groundwater was confirmed by chemical analysis, according to which the concentrations of Zn, Pb, Ni, Cu and Cd in water samples from the wells are two to three orders of magnitude higher than the Maximum Permissible Concentration.