Modelling the Geochemical Impact of Uranium Mine Flooding on Adjacent Aquifers for the Königstein Mine Site

Thomas Metschies, Ulf Jenk, Wismut GmbH, Germany

Remediation of the Uranium mining legacies in Eastern Germany has been ongoing for nearly 30 years. Physical remediation of waste rock piles including their partial relocation into the former Lichtenberg open pit are for the most part are finished with an ongoing transition of the objects into the long-term monitoring, care and maintenance phase. On the other hand remediation of tailings piles will last up to the end of the next decade mainly due to geotechnical reasons. While surface openings and mine workings of the deep mines are closed at nearly all sites the flooding process is still in progress with pump-and treat operations implemented as temporary measures.

Reliable predictions characterising the impacts of mine water outflows on the adjacent aquifers and receiving streams are required to obtain the necessary permits for the final flooding of the underground mines. A final flooding without technical measures is generally aimed for as sustainable solution for the long-term.

As an example, the case of the former Königstein ISL-mine is presented where stringent requirements to minimize the impacts of potential inflows of mine water into the adjacent aquifer have to be met. A comprehensive modelling concept was developed based on the understanding of the main hydrogeological and geochemical processes. An extensive set of hydraulic and geochemical monitoring and exploration data is available from both the mining and remediation period. However, during flooding of the mine new hydraulic and chemical conditions develop with comparable conditions yet not monitored. To reduce the respective uncertainties a stepwise approach for the mine flooding was implemented allowing to verify and validate model predictions based on the monitoring data and thereby to expand the spatial and temporal scale where the uncertainty of the predictions are further reduced.