

Hydrochemical changes induced by Underground Pumped Storage Hydropower: influence of aquifer parameters in coal mine environments.

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Abstract

Underground Pumped Storage Hydropower using abandoned mines is an alternative to store and produce electricity in flat regions. Water is pumped from an underground reservoir (abandoned mine) using the excess of electricity generated by other energy sources during low demand periods. When the energy demand increases, water is discharged from an upper reservoir into the lower one through turbines producing electricity. Water chemical composition evolves during this process to reach chemical equilibrium with the atmosphere and with the surrounding medium. The resulting pH variations and mineral precipitations and dissolutions can be very important for both environmental impact and efficiency. Hydrochemical changes are especially relevant when pyrite is present in the geological medium, which is common in coal mine contexts. As abandoned coal mines are potential candidates to be used as UPSH underground reservoirs,

it is of paramount importance to investigate these hydrochemical changes. This will serve to define the criteria or guidelines for choosing those mines where consequences of hydrochemical changes will be low.

Coupled hydro-chemical numerical models are used for investigating influence of the aquifer parameters on the hydrochemical changes induced by UPSH activity when pyrite is present in the surrounding medium. Results allow to understand how the aquifer parameters influence the hydrochemical changes and their consequences on the environment and on the UPSH plant efficiency. These results allow to deduce guidelines for minimizing environmental impacts and in the same time increasing efficiency of future UPSH plants.

References

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