Strategies to Avoid AMD in Active Lignite Mining

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Extended Abstract

One task during the groundwater re-rise in the future dumps of MIBRAG lignite open pits is the influence on surrounding water bodies as a result of the pyrite weathering in the overburden. This sulphide weathering is caused by the excavation and mass movement of sediments by ventilation and leads to a geochemical change with a release of iron, sulphate and acidity into the tipping water (figure 1, left) and is embedded in a variety of hydro-geochemical buffer reactions, such as the important carbonate buffering [1].

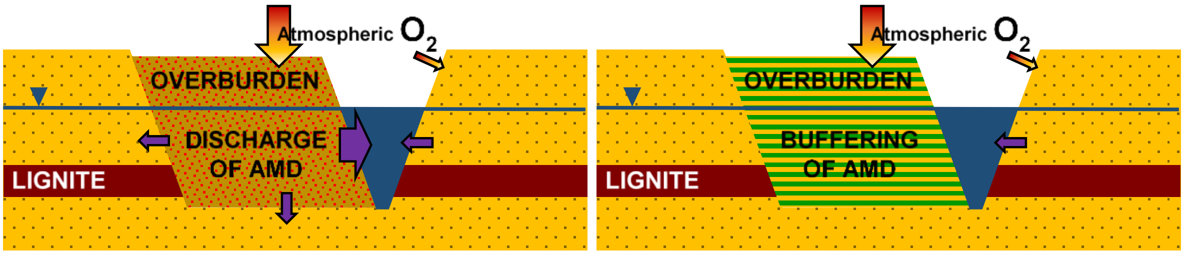

Figure 1*: uncontrolled discharge from AMD (left) or structured buffering (right) in lignite opencast [4]*

Modern surface mining is carried out in a manner, which prevents or minimizes future AMD problems as much as possible. For this purpose, an approach was developed, where geological, geochemical and technological aspects are examined [2], [4]. By superposing geochemistry and geology, problem areas were marked and countermeasures introduced by changing the mining technology. Thus in future, there will be a significant reduction of AMD from the dump bodies (figure 1, right) [2], [3], [4].

Weathering tests were performed to characterize the AMD potentials geochemically by measuring the parameters “Hydrolytic Acidity” and in eluates pH-level, conductivity, and the discharge of iron, trace metals and sulphate. Figure 2 (left) shows the sediment and time dependence of the weathering. The cohesive and sandy Quaternary/Aquifer #1, releases nearly no iron, sulphate and acidity. The Aquifer #2 (lower part) and Aquifer #3 are the main AMD-polluters with a high release of iron, sulphate trace metals and acidity. The other tertiary materials show a smaller release of AMD-pollutions. The weathering tests show the relevant oxygen exposure time during normal operation (up to 3-4 month) and in boundary areas (up to years).

Blending the planned mining technology by mixing the buffering marl (solid carbonate contents) with the main AMD-polluters of Aquifer #2 (lower part) and #3 in various ratios, buffering tests were implemented for normal operation times. Figure 2 (right) shows that for shorter weathering time (~50 days) a mass addition of 10 to 20% of glacial till is necessary to prevent the release of iron, trace metals and acidity and to reduce the sulphate release; for longer time periods a mass addition of 40% glacial till.

In the current central German opencast lignite mines, enough buffer material is available to tilt dump sides with good geochemical conditions.

With structured tilting, an optimal use of the buffering potential is possible. The future mine water runoff from the dump bodies will only have low concentrations of iron and heavy metals.

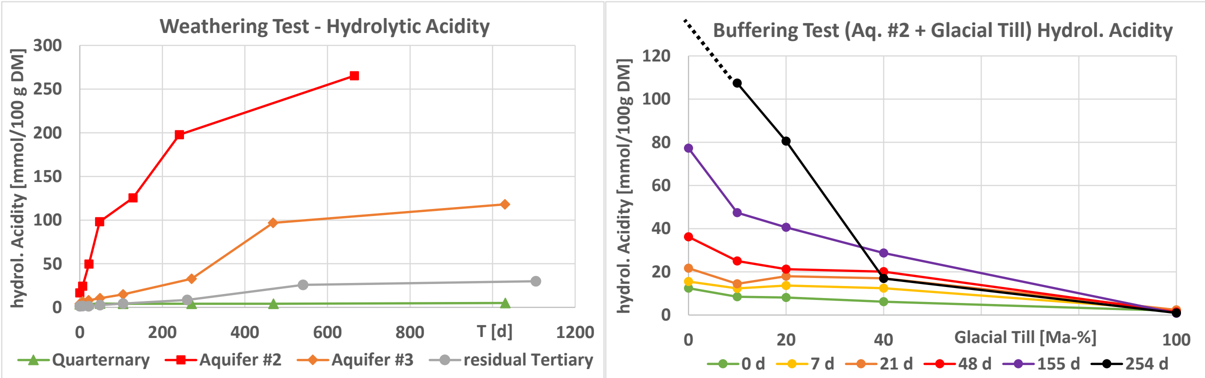

***Figure 2**: Hydrolytic Acidity in Weathering Tests of different Investigation Units (left) and Buffering Tests Aquifer #2 + Glacial Till (right) [3], [4]*

During the research activities, a new dump structure was created. Rather than in unstructured blocks or conical strips, the overburden will be dumped now in fine layers to enlarge contact area between buffering and acidifying sediments. Based on the investigation, the exposure times of the problematic sediments to atmospheric oxygen should be as short as possible and glacial till or geochemically neutral sediments should promptly cover them.

In sum of all measures, it is possible to save the cost-intensive admixing of buffer materials such as lime or dolomite.

Key words: acid mine drainage, advanced mining technology, buffering, dump structure, geochemistry, glacial till, groundwater, mine water, pyrite weathering, trace metals

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