

Short and Long-Term Groundwater Impacts Associated with the Reclamation of Acid-Water Seeping Historical Tailings in the Central and West Rand Basins, South Africa¹

R.A. Gebrekristos* and G. Trusler²

Abstract: Gold mining has been ongoing in the Eastern, Central and Western Rand Basin of South Africa since the 1880s. The region was the largest gold producer in the world for many years until the 1980s after which large scale mining started to decrease. This has generated many tailings storage facilities (TSFs) in the region with estimated 3 - 4 billion tons of tailings. Most of the TSFs are acid-generating owing to their high sulfide content combined with limited neutralization potential. The TSFs are almost all unlined and have contaminated the nearby shallow aquifers (e.g., sulfate up to 3500 mg/L), deeper aquifers where they overly workings or dolomites and surface streams where surface erosion continues. The old tailings often contain gold and uranium with economic value. There are a number of companies reclaiming and reprocessing these surface deposits. These reprocessed tailings are deposited on a combination of large new facilities, back onto old TSF footprints or in pits and underground. The interconnections between old working areas are not easy to determine neither is the ability of the tailings to flow underground. In addition to economic contributions, the reclaiming and removal of the unlined TSFs from surface has positive impact on the groundwater environment as the sources of contamination are removed. This contribution is only net positive if the impacts from where the tailings are deposited are understood and better than where they were before. Filling underground voids with tailings minimizes the available space for oxidation reactions and acid generation and should improve geotechnical stability. The tailings have a high pH (10-11), and this increases the pH and alkalinity of the mine void water in one case from a pH of about 2.8 in 2013 to 6.5 in 2021. This has a knock-on effect on reducing the total dissolved solids (TDS) as many of the metals have precipitated from the mine water (e.g., Fe decreased from 520 mg/L to 0.01 mg/L during the same period). This paper looks at the net benefit to be gained from reclaiming and depositing tailings into old mine voids.

Additional Key Words: groundwater, aquifer contamination, AMD, TSF.

-
1. Oral paper presented at the 2022 National Meeting of the American Society of Reclamation Sciences, Duluth, MN. June 12-16, 2022. Published by ASRS; 1305 Weathervane Dr., Champaign, IL 61821.
 2. Robel Gebrekristos (*presenter), PhD, Hydrogeologist at Digby Wells Environmental and Graham Trusler, Chemical Engineer and CEO at Digby Wells Environmental. Turnberry Office Park, Digby Wells House, 48 Grosvenor Street, Bryanston, South Africa.