The Complicated Role of CO_2 in Mine Drainage Treatment[1]

Robert S Hedin and Benjamin C Hedin[2]

Abstract: Mine waters often contain high concentrations of carbon dioxide. In lime treatment systems CO_2 reacts with CaO or $Ca(OH)_2$ to form calcite ($CaCO_3$) resulting is inefficient use of lime. To counter this inefficiency, mine water is often aerated prior to lime addition so that calcite formation is minimized. In passive treatment systems the degassing of net alkaline water raises pH which can promote Fe and Mn oxidation reactions. However, degassing CO_2 does not always increase treatment efficiency. The passive treatment of acid waters with limestone often involves limestone and relies on calcite dissolution which is increased by CO_2. We will present field and experimental data from two sites where the differential management of CO_2 has affected alkalinity generation. Both systems treat acidic water with oxic limestone beds. The influent to the Fall Brook limestone bed is pre-aerated and the system produces 50-60 mg/L net alkalinity. Alkalinity-generating experiments show that the system would discharge about 150 mg/L net alkalinity if the CO_2 was preserved. The influent to the Woodlands limestone bed is not aerated and the system produces 200 mg/L net alkalinity. Alkalinity generating experiments show that if the Woodlands influent was aerated, alkalinity generation would decrease to 125 mg/L. The results can explain variability in the alkalinity generation of existing passive systems, suggest easy ways to increase the alkalinity generation of poorly performing limestone beds, and provide new guidance for the handling of water in passive systems.

Additional Key Words: calcite dissolution; passive treatment.

---

1. Oral paper presented at the 2017 National Meeting of the American Society of Mining and Reclamation, Morgantown, WV: ***What's Next for Reclamation?*** April 9 - 13, 2017. Published by ASMR, 1305 Weathervane Dr. Champaign, IL 61821.

2. Robert Hedin, Hedin Environmental, Pittsburgh, PA, 15228; Benjamin Hedin, Department of Geological and Environmental Sciences, University of Pittsburgh, Pittsburgh, PA (student).