PASSIVE TREATMENT OF COAL MINE DRAINAGE[1]

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Abstract. Passive treatment systems utilize chemical and biological processes to neutralize acidity and decrease concentrations of metals. These systems have been successfully applied at numerous coal mine discharges over the past 20 years. The three most commonly applied passive unit operations are aerobic ponds/wetlands, anoxic limestone drains (ALDs), and reducing and alkalinity producing systems (RAPS). The selection of the most effective unit operation, or combination of unit operations, is based on water quality. The unit operations are sized based on flow or contaminant loads. Net alkaline water is treated with ponds and aerobic wetlands that promote iron oxidation, precipitation, and settling. Empirical data have shown that 10 - 20 grams of iron is typically removed per square meter of surface area of the pond or wetland. Net acidic water with low ferric iron and aluminum levels can be treated with ALDs, which are used to add bicarbonate alkalinity (typically 100 - 300 mg/L of alkalinity as $CaCO_3$). To attain near maximum levels of alkalinity, ALDs are sized to maintain a 12 –15 hour detention time. Net acidic water containing ferric iron or aluminum is treated using RAPS, which add bicarbonate alkalinity via sulfate reduction and limestone dissolution. The amount of alkalinity generated is dependant on influent water quality, but empirically has been found to range from 15 - 60 grams of alkalinity (as $CaCO_3$) per square meter of pond surface. Many of these systems are constructed to facilitate flushing of retained metals, however, the ability of these systems to maintain adequate permeability has not been determined.

Additional Key Words: acid mine drainage, wetlands, anoxic limestone drains, reducing and alkalinity producing systems, metal removal, limestone dissolution, sulfate reduction.

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