**COST SAVING AND PERFORMANCE ENHANCEMENTS AT THE RUSHTON AMD PLANT**

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**Extended Abstract**

 The Rushton Acid Mine Drainage (AMD) Treatment Plant is located near Phillipsburg, Pennsylvania. The Rushton AMD Treatment Plant treats between 2,500 and 5,000 gpm of pumped mine water from a partially flooded underground coal mine complex, which is pumped to control water levels and prevent mine water from breaking out at unwanted locations in the Moshannon Creek watershed. The pumped Rushton AMD characteristics are provided in the table below, and as shown varies with season and inflow in the underground mine complex. The primary differences in the AMD chemistry is a decrease in pH and a corresponding increase in dissolved aluminum that follows the pH dependent solubility curve.

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| **Rushton Mine AMD Characteristics**  |
| **Temp****°C** | **pH** | **Conduct.****µS** | **Hot Acidity** | **Cold****Acidity** | **Iron****mg/L** | **Manganese****mg/L** | **Aluminum****mg/L** |
| **mg/L (as CaCO3)** |
| **Late Winter through Early Summer** |
| 10.4 | 3.3 | 1950 | 400 | 600 | 121.5 | 13.5 | 24.0 |
| **Late Summer through Early Winter** |
| 10.6 | 4.7 | 1650 | 196 | 356 | 105.2 | 8.0 | 9.4 |

 Active treatment of AMD at the Rushton Mine involves the use of hydrated lime to raise the pH, neutralize acidity and precipitate dissolved metals in the AMD. Mechanical mixing and aeration are provided to solubilize the hydrated lime (as a slurry) and oxidize soluble Fe(II) iron and Mn(II) manganese to insoluble and oxidized metal precipitates. The Rushton AMD Treatment Plant also uses polymer addition to flocculate small particles into rapidly settling larger particles and large quiescent settling ponds for suspended solids removal. Handling of the settled solids in the large ponds includes collection and removal by automated submersible pumps mounted on cable driven floating rafts. Collected solids are disposed within the deep mine via injection wells. The Rushton AMD Treatment Plant has operated since closure of the coal mine with minimal changes in treatment system components and its operation over the past 30 years.

 This presentation will provide background and implementation information related to the modifications made at the Rushton AMD Treatment Plant over the past several years to improve the performance of the existing treatment system and lower the overall costs of treatment. The primary modification efforts focused on pre-aeration to remove carbon dioxide present at high concentrations in the mine water in order to lower lime use, treatment costs, and sludge production. As part of the modification effort, the existing aeration/mixing tank, which follows the pre-aeration system, was evaluated to determine if aeration could be eliminated to provide additional benefits in treatment costs and sludge production, and potentially improve iron and manganese removal.

 The pre-aeration system was installed in the summer of 2013 and the aeration/mixing tank modifications were completed in the spring of 2014. The pre-aeration system effectively removed carbon dioxide acidity between 80% and 90% at maximum treatment flows and greater than 95% at average treatment flows. In conjunction with the aeration/mixing tank modifications, the treatment system modifications has decreased overall operating costs by $0.25 million associated with reductions in lime usage and electricity consumption. In addition, the volume of sludge has also decreased by approximately 50% by minimizing the precipitation of calcite associated with the carbon dioxide contained in the mine water and the added carbon dioxide from aeration previously provided in the mixing/aeration tank. This decreased sludge production was not included in the direct operational costs savings, but could have substantial benefits and savings by decreasing sludge handling and increasing the sludge storage capacity within the deep mine injection locations. From an operational standpoint the removal of the carbon dioxide also benefited the Rushton AMD Treatment Plant by not only lowering current operational costs, but also by minimizing the required lime dose to achieve more stringent manganese effluent limits that require increasing the operational pH from 8.5 to 9.5.