Evaluation and Refurbishing Passive Treatment Systems

Presented by: Tim Danehy & Ryan Mahony
Coauthors: Cody "Buck" Neely, PE, Cliff Denholm, Dan Guy, PG[1]

The use of passive treatment systems to abate coal mine drainage became very popular in the late 1990s and early 2000s. The technology was relatively new and provided a potentially low-cost and long-term alternative to standard and labor-intensive chemical (a/k/a "active") treatment. The former US Bureau of Mines was instrumental in performing early research and providing basic design criteria, suggesting that some passive components could perform for up to 50 years with little maintenance. Groups including mining companies, government agencies, and watershed organizations began to construct a myriad of passive treatment systems to address discharges ranging from low flow alkaline-iron to high-volume acidic containing iron, manganese, and aluminum. As with any new technology, early work yielded mixed results. Many of the passive systems installed c. 2000 had a projected design life of 15-25 years. As we approach the year 2020, a good number of these decades-old treatment components are past, at, or near their estimated life expectancy.

Our team has had the opportunity to revisit dozens of passive treatment systems over the past decade to evaluate performance issues, conduct regular and periodic maintenance, as well as implement complete system overhauls. We have found that common issues can include: Simple hydraulic problems (i.e. the water is not getting into the system); short circuiting; as well as treatment systems that have met or exceeded their useful life and require partial and significant refurbishment.

One major aspect to reviewing a system's performance is gaining an understanding of what the original design parameters included and comparing them to current conditions. We have found that a passive system may have the appearance of "failing" based on effluent water quality, but when the current pollutant load is compared to the initial design parameters, the actual performance is greater than anticipated. Many systems are designed based on a pre-construction pollutant load and it is unreasonable to expect a vertical flow pond designed to treat 30 gpm, to treat 200 gpm.

Basic maintenance procedures can breathe new life into systems that were once thought to have been "dead". These include pipe cleaning, sludge removal, treatment media stirring, limestone washing, piping upgrades, as well as treatment media replacement and total system rehabilitation. With many sites, cleaning the media can lead to broken pipes, and we have had success with the use of HPDE pipe that is more amenable to maintenance activities. As the underdrain piping in the treatment ponds is a non-pressure application, using flexible couplings and other low-cost fittings has proven to help reduce maintenance efforts and costs. The various treatment systems evaluated have been found to be over-performers at mid-life, in need basic of maintenance to restore functionality, require significant effort to attain treatment goals, as well at occupy other points along the treatment spectrum. Meanwhile, other systems never really had a reasonable chance of success to begin with.

---

[1]Tim Danehy, QEP, Principal, Ryan Mahony, Environmental Technician, Cody "Buck" Neely, PE, Environmental Engineer, Cliff Denholm, Sr. Environmental Scientist, Dan Guy, PG, Geologist, BioMost, Inc., Mars, PA.