

ACID MINE DRAINAGE TREATMENT WITH THE AQUAFIX SYSTEM

Mike Jenkins

and

Jeff Skousen

INTRODUCTION

Mary Ruth Corporation was formed in 1955 by Milford Jenkins. Mary Ruth Corporation has operated surface and some deep mine operations in northern West Virginia and Maryland for the past 38 years. In 1972, Mike Jenkins returned home from the Air Force to take part in the mining operations and has been working with his father, Milford Jenkins, for the past 20 years.

During the 1970's, Mary Ruth Corporation operated as many as seven active mines and a coal preparation plant, which employed nearly 100 people.

PROBLEM

Several of Mary Ruth's surface mining operations were in the Upper Freeport seam of coal which generally produces acid mine drainage (AMD) in northern West Virginia. Some of our sites required constant water treatment. In the mid to late 1970's, we used caustic soda to treat the water on these sites. However, within a few years we found this to be too costly. We then started using hydrated lime wherever possible. Lime was a much cheaper chemical to purchase, but application of the lime required a pump to circulate the pond plus a man to feed lime slowly to the pump for mixing. These two factors made the use of hydrated lime very labor intensive. Also, about 50% of the lime that was applied still did not dissolve or react and ended up on the bottom of the pond. We decided that if we could reduce or eliminate the labor costs, treating AMD with hydrated lime would reduce our chemical treatment costs by 50 to 80%.

DEVELOPMENT OF THE AQUAFIX MACHINE

We realized, as time went on, that if we could find a way to introduce hydrated lime to the pond continuously, we could better control the water quality. Close to 95% of our sites where we were treating AMD had no power to operate any kind of feeder or mixing system. So we decided to use a water wheel which could be driven by the flowing water itself. Through the efforts of Darwin Ringer (Mary Ruth's first employee in 1955), his son, Robbin Ringer, Milford Jenkins, and Mike Jenkins, we built our first water-powered lime feeder in 1980. We tried to use hydrated lime in the machine, but even though we modified it several times, we were unable to keep the hydrated lime feeding continuously without bridging and plugging in the

hopper. After approximately one year of working with this original machine, our water problems lessened due to reclamation and so we put the machine behind our shop to collect rust.

In 1989, we found ourselves treating acid drainage once again, so we pulled out our rusted old lime feeder and started looking for a pelletized lime material to use in our machine. We didn't find pelletized lime, but we did find calcium oxide (pebble quicklime) which solved all of our bridging and feeding problems.

After modifying the machine several times, application of pebble quicklime through the Aquafix machine became very reliable. Quicklime is highly reactive, economical, easy to handle in 50 pound bags (or can be bought in bulk if necessary), and feeds well without sticking in our system. In addition, the AMD sludge generated with quicklime is denser and precipitates quicker than caustic-generated AMD sludge.

In 1991, Milford and Mike Jenkins formed the Aquafix Company and applied for a U.S. Patent for the Aquafix Machine, which was issued (#5167800) December 1, 1992. Since 1991, we have been manufacturing and selling the Aquafix Machine to coal, clay, and sand mining companies in West Virginia, Maryland, Louisiana, Pennsylvania, Ohio, Kentucky, and Indiana. We have received very favorable reports from virtually all users. Tables 1-3 document some of the treatment cost savings from several companies using the Aquafix Machine.

CONCLUSION

On sites where the Aquafix Machine has been used, companies have realized a AMD treatment cost reduction of 50 to 80%. The Aquafix Treatment System may not be suitable for every site, but any sites where it can be used can expect similar cost savings.

Table 1. Treatment costs for treating acid mine drainage on a site in northern West Virginia with ammonia, caustic, and lime with Aquafix Machine.

Year/Month	Ammonia \$	Caustic \$	Lime \$	Total \$
1991 Apr	63	5,195	0	5,258
May	63	1,870	0	1,933
Jun	101	2,375	0	2,376
Jul	57	2,047	0	2,104
Aug	88	903	0	991
Sep	6	148	0	154
Oct	13	0	0	13
Nov	69	0	0	69
Dec	269	3,740	0	4,009
1992 Jan	13	2,635	0	2,648
				\$ 19,547
1992 Apr	32	0	862	894
May	82	96	578	756
Jun	13	62	445	520
Jul	19	44	387	450
Aug	95	57	560	712
Sep	0	74	139	213
Oct	13	151	0	163
Nov	13	82	0	95
Dec	334	1,560	540	2,434
1993 Jan	126	564	473	1,163
				\$ 7,400
				62%

Table 2. Average monthly costs for caustic vs lime for treating AMD on three sites on a Kentucky mine.

Site Year	Caustic \$	Lime \$	Total \$	Difference %
Site 1				
1991	2600	0	2600	
1992	0	726	726	72
Site 2				
1991	2080	0	2080	
1992	0	605	605	71
Site 3				
1991	2080	0	2080	
1992	0	484	484	77

Table 3. Average monthly costs for treating AMD on sites in Preston and Monongalia Counties.

Site	Ammonia \$	Soda Ash \$	Lime \$	Total \$	
Site 1					
1990	900	0	0	900	
1991	0	0	160	160	82%
Site 2					
1990	0	5,000	0	5,000	
1991	0	0	600	600	88%
Site 3					
1990	2,400	0	0	2,400	
1991	800	0	560	1,360	43%