ACADEMIA | Letters

Utilization of Abandoned Coal Mines as Sources of Municipal Water

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Population growth, industrial development, urbanization, and increased water consumption have contributed to an increasing scarcity of potable water. Traditional methods of providing water are sometimes inadequate, leaving many municipalities searching for alternative sources.

There are over 22,000 abandoned coal mines sites in the U.S. (Department of Interior, 2021). Many of these abandoned mines contain water of sufficient quality and quantity to be considered as sources for municipal supplies. Examples of successful use of flooded mines as public water supplies come from the states of West Virginia, Washington, Kentucky, Pennsylvania, and Virginia in the U.S., and internationally from the UK and Slovakia (Cicmanova et al. 1999, Dinger et al, 2021).

Seventy communities in West Virginia use mine water for public supply, providing water for over 81,600 people (Hobba 1987; Pack 1992). For example, the city of Buckhannon, in northern Upshur County, WV, found that they could not provide enough water from the Buckhannon River during drought periods. The city investigated local mines and identified three that had the greatest potential for water production. During testing, it was discovered that these mines simply acted as conduits that drained and stored good quality groundwater. Subsequently, the decision was made to utilize the water (Hobba 1987). Similarly, Kentucky and Eastern Oklahoma have several communities obtaining water from coal mines (Dinger et al, 2021).

Research conducted by the AWRC of the University of Arkansas has indicated that there are several sites in Arkansas and surrounding states that could benefit from using easily assessable water located within abandoned coal mines (Brahana and Varnell 2003). The city of

Corresponding Author: Curtis Varnell, curtis.varnell@wscstarfish.com
Citation: Varnell, C. (2021). Utilization of Abandoned Coal Mines as Sources of Municipal Water. *Academia Letters*, Article 535. https://doi.org/10.20935/AL535.

Greenwood, Arkansas has three interconnected underground coal mines that contain sufficient quantities of water to meet the expanding city needs for at least the next two decades.

Using these abandoned coal mines as a water source can have many benefits. The mine is a ready-made reservoir and requires minimal infrastructure construction. Most of the utilities that use water from mines simply pump the water from wells drilled into the pooled water and then run it through their current treatment plant. Since it is covered, it is easier to protect the well from contamination from surface sources and is not affected by algae blooms, turnover, or other problems associated with climatic changes. Most important though is the low cost. Research conducted in Greenwood, Arkansas indicates savings in the next decade to exceed $20 million if the mine water is utilized (Brahana and Varnell 2003).

The greatest concerns in using coal mine water for municipal use is the possibility of health hazards posed by trace elements and the often high acidity rates that result from the oxidation of iron pyrite.

The composition of coal is highly variable, a product of the chemistry, the biota, the geology, and the conditions under which it was formed and modified. Of special concern are a small number of trace elements that have the potential to pose serious health hazards if the existing water treatment facilities are not prepared to test for and treat water containing these contaminants. Studies (Demchak et al. 2001, Robb 1994, Cravotta et al, 2021) indicated that drainage and recharge of a mine over time greatly reduce both the acidity levels and the presence of heavy metal (Kresse 2003).

The conclusions derived from our extensive research (Brahana et al, 2003) include:

- The use of older mines as water sources would be advantageous. Extensive buffering action occurs as mines recharge and result in increases in pH, and decreases in contaminants.

- When the mine recharges with fresh water, the concentration of trace elements and pyrite decrease. In the case of pyrite, these rates may decrease as much a 50% with each recharge event (Demchak et al 2001; Robb 1994).

- Water from coal bearing fields with low pyrite levels are preferable. The composition of coal is highly variable, a product of the chemistry, the biota, the geology, and the conditions under which it was formed. In the Arkansas coal fields, variations of several per-cent pyrite concentrations existed within very short distances.

- Mines buffered by carbonate materials are less likely to be contaminated by pyrite rich coal (Cravotta et al, 2021).

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- Raw water should be monitored on a regular basis in order to detect any changes that might occur in water quality.
- Public perception and support is a major factor to consider in using water from coal mines. Although adequate sources for public water are very difficult to find in many communities, the public perception of using "dirty water" or "coal water" from the mine must be dealt with.

In many regions, abandoned coal mines offer a viable alternative to meeting the water needs of a community. As with any research dealing with public health, adequate research should be conducted to determine the viability and safety prior to utilization.

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WQ03-03-01

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