CASE STUDY

Bituminous Coal Mine
Southwest Pennsylvania

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Prepared by
The Interstate Technology & Regulatory Council
Mining Waste Team

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1. SITE INFORMATION

1.1 Contacts

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1.2 Name, Location, and Description

A bituminous coal mine operator located in southwest Pennsylvania is using longwall mining operations to remove the Pittsburgh Coal seam. The Pittsburgh Coal seam has been room and pillar mined in the southwest corner of Pennsylvania since the mid to late 1800s, and longwall mining began in the early to mid 1960s. The coal seam can range 400–1000 feet in depth and is approximately 6 feet thick. The closest town to this operation is Wind Ridge, Pennsylvania in Greene County. Southwest Pennsylvania also contains a few small surface stone quarries, but the primary mining activity is underground coal mining.

2. REMEDIAL ACTION AND TECHNOLOGIES

The site involves water quality impacts on a private well and several localized springs. The well supplies drinking water to the main residence of the private well owner and the springs supply drinking water to a second residence located on the property, as well as to livestock. During post-mine water quality assessment investigations, untreated water (as tested prior to delivery to the main residence) averaged a total dissolved solids (TDS) concentration of 609 mg/L over a three-month period (monthly grab samples collected between August to October 2008). The untreated water sent to the reverse osmosis (RO) system for the main residence is derived from one of two new wells drilled by the mine operator. The untreated water (as tested prior to delivery to the second residence RO system) averaged a TDS concentration of 929 mg/L over the same three-month period. This water is derived from one of two new wells drilled by the mine operator. Untreated water from the springs delivered to the cattle trough was found to have a TDS concentration of 834 mg/L in one sample. These TDS concentrations exceed PADEP's secondary drinking water standard for TDS of 500 mg/L.

The initial remedial investigation sought to assess potential human health risks in the localized groundwater. Because of the investigation initiated by PADEP, the mine operator, and the private well owner, the mine operator and the private well owner reached an agreement on compensation (i.e., new wells and whole-house RO systems). Subsequent to this agreement, PADEP is no longer involved with this site.

The site is fairly small. Conventional treatments for the water supply were investigated by the mine operator in consultation with PADEP as part of the initial remedial investigation. Conventional water treatment technologies were found not to be an option. The mine operator approached the private well owner about installing a whole-house RO system for the main residence and a point-of-use RO system for the second residence. PADEP rejected the point-of-use treatment unit because it did not treat all the water supplied to the second residence. Hence, final agreement was reached on the construction and implementation of two whole-house RO units as the primary technologies. The two new extraction wells deliver untreated water to the two RO systems (each is a Crane EPRO 3000) that can produce treated water that complies with the PADEP's primary and secondary drinking water standards. The two wells in combination with the RO systems were found to satisfy premining water use conditions.

The main residence RO system was installed in the winter of 2007 and consists of a sediment filter, the RO unit, an ultraviolet disinfection unit, and a pressure tank. The second-whole house RO system was installed in the spring of 2007 and consists of a carbon filter (for the removal of chlorine), the RO unit, and a pressure tank. Both RO units are capable of producing 1 gal of treated water to every 4 gal of wastewater. Due to the mine operator and the private well owner reaching an agreement, PADEP has not been on site since the monitoring performed between August and October 2008. The functionality and effectiveness of these two RO systems has not been evaluated by the PADEP since implementation of the RO systems.

3. PERFORMANCE

As mentioned, the Crane EPRO 3000 RO units used in the treatment systems were found able to produce 1 gal of treated water to every 4 gal of waste. During monitoring between August and October 2008, the systems were found to produce water in compliance with the PADEP's primary and secondary drinking water standards (see Table 3-1 and following note about pH in the treated water.

Table 3-1. Average TDS concentrations in treated water

Main residence	19 mg/L (monthly grab samples collected between August and October 2008)
Second residence	88 mg/L (monthly grab samples collected between August and September 2008)

During the treatment of water by the second residence's RO system, product water was found to have an elevated pH (PADEP's secondary drinking water standard for pH is 6.5–8.5). As determined through analysis of grab samples, the pH reading for the month of August 2008 was 9.9 and for the month of September 2008 was 10.8. PADEP never determined why the product water from the second residence RO system had the issue of elevated pH. Secondary treatment components were being considered by the mine operator, but under agreement between the mine operator and the private well owner, pursuit of adding these components was never detailed to the PADEP.

Discharges from the two RO systems are directed to the local sewer lines for the two residences. Table 3-2 summarizes the TDS concentrations in the waste water from the two treatment units.

Table 3-2. Average TDS concentrations in wastewater

Main residence	969 mg/L (monthly grab samples collected between August and October 2008; August TDS concentration was an average of readings from two samples)
Second residence	975 mg/L (monthly grab samples collected between June, August, and September 2008)

Treatment efficiency of these units was calculated by the ITRC Mining Waste Team Reverse Osmosis Group. Based upon these calculations, the two RO systems had efficiencies of 97% and 91%, respectively, for the removal of TDS from the feed water. These efficiencies were judged to be comparable to typical commercial benchmarks.

4. COSTS

Not reported.

5. REGULATORY CHALLENGES

Because the impacted party (private well owner) rendered a private agreement with the mine operator, the regulatory agency (PADEP) had limited involvement with the implementation of the proposed RO systems. PADEP was involved on a consultation basis with both parties during the initial investigation into the suspected impacts to groundwater and did take some samples of the feed water, product water, and wastewater streams from the constructed RO systems initially. No significant regulatory barriers were encountered by the two negotiating parties (mine operator and private well owner) because it was resolved as a private matter.

6. STAKEHOLDER CHALLENGES

The parties that were involved at this site were primarily the mine operator and the private well owner. PADEP involvement was negated once an agreement was reached between the other two parties. The mine operator submitted plans of the RO systems to PADEP and the private well owner. The evaluation by the state determined that the RO systems would supply the private well owner's two residences an adequate water supply. The private well owner felt that the two RO systems would be able to handle his needs and thus reached an agreement with the mine operator. Since the agreement PADEP has performed no further oversight work.

PADEP acknowledged the limited knowledge the private well owner had in terms of operating and maintaining the proposed RO systems. When the pH of the product water of the second residence RO system was raised as a concern, the proposed additional components to lower the pH of the product water were beyond the operational knowledge of the private well owner. Long-term maintenance of these secondary treatment components was also beyond the knowledge of the private well owner and the occupants of the second residence.

7. OTHER CHALLENGES AND LESSONS LEARNED

PADEP requires that premining water samples be taken once a month for six months prior to any mining activities being initiated near or under private properties. During this sampling period, mine operators are required to sample for primary and secondary drinking water standards including analysis for sulfate, iron (as precursors to the development of acid mine drainage), and TDS. PADEP has learned that requiring this level of prescreening prior to startup facilitates the assessment of suspected post-mine impacts.

General public knowledge of how RO systems operate and how to maintain them can be limited. Though commercially available RO systems are basic and simply to operate, characteristics of the feed water and (in the case of this site) product water may require more complex components be added to the system to ensue compliance with primary and secondary drinking water standards. Operation and maintenance of these systems can be challenging to some who are not familiar with their engineering.

As a result of experience with this site, PADEP has begun to reevaluate the usefulness and protectiveness of the use of whole-house RO systems. PADEP is beginning to discourage the use of whole-house systems in private residences because such systems require extensive maintenance to function properly. Nevertheless, PADEP is not stopping any residents from signing private agreements with coal companies to install such systems. Recent and subjective information has begun to suggest that local residents are beginning to turn down the coal companies' offer to construct whole-house RO systems because of the maintenance concerns.

8. REFERENCES

None provided.