

Abatement of Abandoned Mine Drainage Requires Characterization of Interaction Between Surface Water and Underground Mine Water (Abstract #6670)

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More than 100 years of underground and surface mining of anthracite have contaminated water in the Nanticoke Creek Basin, Luzerne County, Pa. Extensive areas of spoil and refuse from mining operations have not been reclaimed, and the abandoned underground workings are flooded and collapsed in places. Surface water from headwater streams that crosses mined areas infiltrates and becomes contaminated with acidity, iron, and sulfate.

From April 1999 to March 2000, the influence of abandoned mines on water quantity and chemistry in Nanticoke Creek and its tributary Leuder Creek was investigated. During most of the study, both streams lost all flow in the vicinity of the coal outcrop along the boundary of the mined area. However, on February 29, 2000, after heavy rainfall and snow melt, streamflow in Nanticoke and Leuder Creeks was maintained or increased along upper reaches that had lost water or were dry earlier in the study. Nevertheless, along an intermediate reach where Nanticoke Creek flowed through a refuse bank across the channel, more than 80 percent of the streamflow was lost. Water quality downstream of the refuse bank was degraded compared to upstream; specific conductance increased from 270 to 430 $\mu\text{S}/\text{cm}$, and pH decreased from 6.1 to 3.6. In contrast, Leuder Creek gained flow along its entire reach. From the headwaters to the mouth of Leuder Creek, specific conductance increased from 40 to 200 $\mu\text{S}/\text{cm}$, and pH decreased from 6.5 to 4.7; most water-quality changes were in the lower reach. Interflow from Nanticoke Creek or upwelling water from the mine pool probably degraded Leuder Creek along its lower reach.

Recently, interest has grown for abating water losses and passively treating contaminated water in the Nanticoke Creek Basin. Constructed wetlands currently treat a portion of flow that discharges from the Askam Borehole, but efforts have not been made to prevent stream leakage to the mines or to prevent contact of surface water with mine refuse. Episodes of acidic water flowing in normally dry reaches of Nanticoke and Leuder Creeks are poorly characterized because they are short lived and difficult to predict. Streambed sealing or passive treatment that is implemented without knowledge of such episodes may fail to be effective during ephemeral high-flow conditions. Additional data on the frequency, quantity, and chemistry of streamflow over the complete range of flow conditions and the effects of abandoned mines on these variables are needed to characterize the interaction between surface water and underground mine water. The improved characterization can be used to evaluate and implement appropriate remediation.

Hydrologic Data for Nanticoke and Leuder Creeks 02/29/00				
Location	Flow (cfs)	Temp ($^{\circ}\text{C}$)	SC ($\mu\text{S}/\text{cm}$)	pH
Leuder Cr at RR Bed	2.39	5.83	37	6.50
Leuder Cr ab silt pond	3.06	5.81	47	6.57
Leuder Cr at Hanover Street	3.47	5.03	72	6.20
Leuder Cr at Mouth	4.01	5.77	201	4.73
Nanticoke Cr ab refuse, 20 yd ab gage	8.45	5.96	273	6.22
Nanticoke Cr ab refuse, 75 yd bl gage	9.51	5.77	267	6.24
Nanticoke Cr ab refuse, 110 yd bl gage	10.29	5.47	262	6.45
Nanticoke Cr ab refuse, 260 yd bl gage	10.28	5.75	265	6.02
Nanticoke Cr ab refuse, 380 yd bl gage	10.97	6.06	266	6.06
Nanticoke Cr bl refuse, 1,930 yd bl gage	1.64	5.9	433	3.61