

HYDROGEOLOGIC ASPECTS OF LIGNITE STRIP MINES NEAR FAIRFIELD, TEXAS

Author: Lawrence Nelson French

The Big Brown lignite strip mines, northeast of Fairfield, Texas, are operated by Texas Utilities Generating Company (TUGCO). The lignite is mined from the lower Calvert Bluff Formation (Eocene), a 300-meter thick sequence of interbedded sand and shale with lignite. Discontinuous sand units in the Calvert Bluff Formation yield ground water suitable for domestic and agricultural purposes.

Strip mining produces a sandy clay-loam spoil. Two field tests yielded hydraulic conductivities of 10^{-4} cm/sec at the "A" area test site and 2.6×10^{-3} cm/sec at the "B" area test site. The older spoil of the "A" area may be less permeable owing to post-reclamation compaction. The hydraulic conductivity of the compacted spoil is approximately equal to the hydraulic conductivity of undisturbed minor silty sand units in the Calvert Bluff Formation.

The rate of leachate generation is controlled mostly by the rate of infiltration of surface water. The calculated water budget shows that 13 cm of water, about 13% of the average annual precipitation, will percolate into the spoil. This equals an infiltration of about 1.7×10^7 liters of surface water per day over the area of the mines. Flow of ground water into the mines will be most significant where mining of the "C" area intersects a major sand unit of the Calvert Bluff Formation. Eventually about 2.3×10^4 liters per day of ground water will flow from this major sand unit into the adjacent "C" area.

No acid-mine drainage has been found at the Big Brown mines. The pH of mine waters range from 5.1 to 7.3. The lowest pH values measured were in water emerging from a spring in the spoil near the west boundary of the "B" area. Most of the acidity has been neutralized by calcium carbonate in the spoil. Oxidation of pyrite has created large concentrations of sulfate in the unsaturated and saturated zones of the spoil. Concentrations of sulfate may be further influenced by precipitation and dissolution of gypsum, leaching of soil-sulfate compounds, and sorption by the soil. Most of the ground water is oversaturated with respect to gypsum. Large concentrations of dissolved solids and hardness occur in all waters, and concentrations of ferrous iron as large as 25.0 mg/l may occur in water of the saturated zone.

As a saturated zone develops in the spoil, leachate will move into adjacent, unmined, sand units in the Calvert Bluff Formation. Ground water in the confined Simsboro Sand aquifer in Freestone County moves downdip to the east and a small amount moves upward to

the surface through confining shale units. Hydraulic communication may exist between the major sand units of the Calvert Bluff Formation and Simsboro Sand aquifer. The "C" area intersects a major sand unit of the Calvert Bluff Formation; mining will partially dewater the sand unit and will cause ground water to flow through the spoil. This will prevent drainage of the mine effluent into the Simsboro Sand aquifer.

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Department of Geological Sciences
The University of Texas at Austin
Austin, Texas 78712*