

## HYDROGEOCHEMISTRY OF THE UNSATURATED ZONE AT BIG BROWN LIGNITE MINE, EAST TEXAS

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The amount of ground-water recharge and movement of dissolved ions through the unsaturated zone is negligible in unmined interdistributary-mud facies in the Calvert Bluff Formation (Wilcox Group, Eocene). Strip-mining of lignite in the unsaturated outcrop of the Calvert Bluff at Big Brown Mine, Freestone County, Texas will not degrade ground-water quality in the Wilcox-Carrizo Aquifer. Overburden at Big Brown Mine primarily consists of claystone and mudstone. A thick aquitard separates most of reclaimed facies from the subjacent aquifer. Water in the Wilcox-Carrizo Aquifer moves only a short distance past Big Brown Mine before being discharged into the Trinity River Valley.

The amount of recharge to unmined distributary-sand facies and to reclaimed mud facies is at least 10 times the recharge to unmined mud facies, based on estimates of the water budget for the period from mid-1979 to mid-1981. Water content of reclaimed mud facies is not different from water content of unmined facies. The brecciated deposits of reclaimed mud are still rewetting 4 to 7 years after reclamation, and a saturated zone eventually will form in reclaimed facies.

Ca, Na, Mg, C1-type water with a concentration of dissolved solids of as much as 8,000 parts per million in interdistributary-mud facies is interpreted as old marine water that has been changed in composition by dilution with rain water and by ion exchange. Water chemistry changes through a 6-m section of the unsaturated zone from a Ca, Na, HCO<sub>3</sub>-type to a Na, HCO<sub>3</sub>-type in unmined distributary-sand facies and from a Ca, Mg, SO<sub>4</sub>C1-type to a Ca, Na, Mg, HCO<sub>3</sub>, C1-type in reclaimed-mud facies. Argillation of feldspar, evapotranspiration, and movement of brackish water from unmined mud facies account for changes in water chemistry in distributary-sand facies. In reclaimed-mud facies, the chemical changes are due to dilution of formation water by rain water, ion exchange, solution of calcite, and oxidation of pyrite. Total dissolved solids (t.d.s.) in reclaimed mud facies is less than t.d.s. in unmined mud facies because of the increased rate of flushing in the reclaimed deposits.

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