

# Impact of Coal Mine Reclamation Using Coal Combustion By-products (CCBs) on Groundwater Quality: Two Case Studies

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## ABSTRACT

Two coal mine reclamation demonstration projects, Conesville Five Points and Cardinal Star Ridge, of varying constructability scales and fill material combination were carried out to promote beneficial use of Ohio FGD by-products in the reclamation of abandoned Ohio coal mine sites. The total amounts of FGD by-products to be placed at the Conesville Five Points and Cardinal Star Ridge demonstration sites are estimated to be about 1,100,000 and 200,000 tons, respectively. The impacts of reclamation using FGD by-products on the water qualities of the upper-most aquifer systems underlying the sites were assessed. Groundwater and surface waters around the reclamation sites were collected monthly or quarterly and analyzed for 34 parameters and constituents. Over eighteen-month worth of background water quality data were collected before reclamation began. To evaluate the impact on water quality, the water monitoring data were analyzed for upper prediction limits (UPLs), Mann-Kendall trend test, principal components, and by geochemical modeling. It was found that, at both sites, the water qualities were statistically affected by the reclamation activities carried out at the sites. The concentrations of a number of water quality monitoring parameters exceeded the background UPLs in one or more of the sampling locations, such as pH, calcium, sulfate, thallium, and manganese. In addition, incline or decline trends of a number of major monitoring parameters were also identified in more than one sampling locations at both sites during the reported reclamation period. However, the observed water quality impacts were unlikely due to the leakage of the leachate from the backfilled FGD materials. It is plausible that the reclamation activities have altered the hydrogeological conditions of the underlying aquifers and varied the extent of the hydrogeochemical processes, causing the observed changes of water qualities. The water qualities are to be continuously monitored during the reclamation and after completion.