LEACHATE GENERATION, QUALITATIVE TRENDS AND GROUNDWATER CONTAMINATION POTENTIAL IN DRY DEPOSITS OF FLY ASH

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Abstract: Globally, coal conversion solid residues (CCSRs) currently pose a potentially serious environmental problem due to the increasingly large volumes to be disposed of and the complexity of chemical and physical behavior. During the past 5 years, several experimental field test cells were designed and constructed under the sponsorship of the U.S. Department of Energy using conventional industrial landfill practices as guidelines. Two 2.5-m-thick cells containing approximately 700-1000 tons each of waste were emplaced. Advanced process residues from Ohio (LIMB combustion process) were used in this study. The experiments focused on 1) engineering behavior, 2) diagenesis of buried advanced process residues, and 3) long-term impact of natural leaching processes on the surrounding environment. An intensive monitoring effort generated a substantial project database consisting of baseline chemical characterizations of initial and buried fly ash; x-ray diffraction (XRD), x-ray fluorescence (XRF), and scanning electron microscopy (SEM) analysis of mineral composition and transformations within the cells; American Society of Testing and Materials (ASTM) leachate chemistry; physical properties of soil and ash drill cores; water chemistry of runoff; and pore waters from soil vacuum pressure lysimeters and groundwater in surrounding monitoring wells. On-site meteorological, borehole permeameter, and moisture density data also support quantification of the extent of percolation and flushing. Although permeabilities of $X.10^{-7}$ ms^{-1} initially slowed downward migration of strongly alkaline pore waters (pH of 10 to 12), with time, sufficient water was collected in the vacuum pressure lysimeters. A time-dependent decrease of Na, K, SO_4, and Cl concentration, with an attendant decline in pH and EC, indicates intensive leaching near the top of the ash profile and downward displacement toward the cell base. Monitoring wells used to assess leachate transport to the saturated zone did not indicate significant change in groundwater chemistry; however, pore-water chemistry in base soils beneath the cells reflects an impact from cell leachate.

Additional key words: contaminant migration, mobility, environment

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