GEOLOGY AND GEOGRAPHY

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ABSTRACTS

Geological Conditions Related to Longwall Coal Mining, Pike and Warrick Counties, Indiana. C.T. HUANG and T.R. WEST, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.——Pennsylvanian coal-bearing rocks of the Spurgeon coal field, in southern Pike County and northern Warrick County, Indiana cover about nine square miles in the southeastern part of the Illinois Basin. Coal beds occur throughout the Dugger and Petersburg Formations, the most extensive and valuable one being the bituminous Springfield Coal Member V in the upper Petersburg Formation.

The feasibility of longwall mining is dependent on the geologic and mining conditions of the site. An assurance of a uniform thickness and continuity for coal seam V encourages the possibility of adopting the highly mechanized longwall mining methods. The successful operation of longwall mining is also dependent on the continuous and regular caving of the roof after coal removal. The thickness of the immediate roof is measured as the distance between the top of coal seam V and the first contact of sandy shale and gray sandstone in the cores. Based on the drill core strength, the evaluation of the caveability behavior shows that the immediate roof is classified as "fairly good/good, easy caving".

Laboratory Testing of Indiana Shales. C. W. LOVELL, Department of Civil Engineering, Purdue University, West Lafayette, Indiana 47907.——Indiana shales may be used in fills, provided that the material properties have been properly assessed prior to construction. Necessary tests fall into three categories (1) durability classification, (2) degradability and other compaction responses, and (3) strength and compressibility in service.

The primary hazard is that of placing nondurable materials in large pieces as a rockfill. Such pieces will break down (slake) under service conditions, producing undesirable settlement, or even shear failure, of the fill. An indicator of the slaking tendency is afforded by the slake-durability test.

Nondurable shales must be thoroughly degraded and compacted in thin dense layers. Tests have also been developed to allow the appropriate construction control for this purpose. Finally, principal in-service properties of the fill may be predicted from laboratory tests which saturate compacted shale samples under simulated fill confinement.

The paper briefly describes the requisite laboratory testing.

Engineering Geological Evaluation of an Earth Rock Fill Dam, Greene-Sullivan State Forest, Indiana. IGNATIUS O. OKONKWO and TERRY R. WEST, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.——The earth-rock fill dam that impounds Reservoir 29 in Green-Sullivan State Forest has an active seepage zone in the right abutment area. The dam also has undergone severe erosion on the upstream face during high water levels, typically in spring.

Built in the 1930s and enlarged in the early 1960s, the dam was built without

engineering design and was not properly compacted in place (no standard specifications for compaction were considered). It also lacks a clay core or other impervious zone to resist seepage.

Construction material for the dam was obtained from cast over piles resulting from three episodes of mining. Coal extraction in this area has been from Pennsylvanian age rocks, consisting primarily of the Dugger formation, which is overlain and underlain respectively by the Shelburn and Petersburg formations. The Dugger Formation is composed mainly of shale, sandstone and limestone in alternating sequences with three distinct coal members, that is, the Hymera Coal Member (coal VI), the Bucktown Coal Member (coal Vb), and the Springfield Coal Member (coal V). Coal has been removed both by stripping and underground mining in this general area.

Stability of the dam apparently is related to 1) the engineering properties of these geologic materials which comprise it, 2) the mode of construction of the dam, 3) the ongoing seepage of acidic water from the upstream reservoir.

The last mined coal member contains abundant pyrites, and this was separated from the coal, by gravitational settling. Enormous piles of the separated material constitute the source of acidity in the upstream reservoir, as runoff from these piles feed directly into that reservoir. pH measurements in the upstream reservoir range from 3.0 to 3.5 and from about 4.5 to 5.0 in the downstream reservoir.

Deterioration of embankment material in addition to other factors, could be related to the reaction between the acid water and limey shale, limestone, and dispersive shale. Field and laboratory testing have been key factors in the performance evaluation of the earth rock fill dam. Input data obtained from these investigations will be utilized in a computer analysis (STABL Program) to determine the present stability condition of the dam.

Poor performance is likely to result from inadequate seepage control, upstream erosion of dam face and instability owing to the removal of fines from the dam by the seepage process (piping). A geophysical field survey (self potential and electrical resistivity methods) plus borehole data, hopefully will define areas of potential failure or piping. Remedial action may include all or some of the following: design of a spillway, rebuilding of the upstream face, stabilizing the toe area and placement of a toe drain on the downstream face.

Engineering geology studies continue on this project. Grants to provide some of the field expenses have now been received from the Indiana Academy of Science and the Indiana Department of Natural Resources, Division of Reclamation.