Case Study

The information in this case study is reprinted from the American Cyanamid AM-9 technical manual. AM-9 was American Cyanamid's acrylamide grout product. Avanti's AV-100 Chemical Grout matches the chemical formulation, usage and performance of AM-9.

Title: Sealing Sandstone to Permit Shaft Sinking

Location: Monktonhall Coal Mine, Midlothian, Scotland
Owner: National Coal Board, Scottish Division
Contractor: Cementation Company, Limited

PROBLEM:

In one of the deepest drilling operations in British coal mining history, plans called for the sinking of two 3,000-foot shafts, one to be used as a main coal-hoist shaft with skips, the other to house a conventional cage hoist. The main contractor for shaft sinking, tunnel driving and associated works, including grouting, was Cementation Company, Limited. Circular shafts were to have a finished diameter of 24 feet with a concrete lining ranging from 12 inches to three feet. Slightly below the 2,000-foot level, a 90-foot thick strata of porous sandstone was encountered. Water flow into the sump from open holes drilled 60 feet into the sandstone layer was measured at 114 gpm. The need for treatment was apparent.

SOLUTION:

All recognized techniques were considered. Due to its low viscosity, only AM-9 was deemed capable of penetrating all the sandstone strata; therefore, it was decided to use a sodium silicate-bicarbonate grout to seal the large openings followed by treatment with AM-9 to make the final closure.

APPLICATION:

Treatment of the sandstone bed to its entire depth was carried out from the bottom of the shaft excavation through injection into three series of holes. The first series of sixteen holes was drilled on a 27-foot diameter to a depth of 40 feet, with a dip of one in eight from the perpendicular. These holes were then deepened to 55 feet and grouted with a sodium silicate-sodium bicarbonate solution. They were again redrilled to 70 feet and injected with the same mixture to close large fissures and prevent loss of AM-9.

The second series of sixteen holes also had a dip of one in eight and, in addition, a spin of one in three on a 22-foot diameter. These holes were drilled to 40 feet and each grouted with 100 gallons of AM-9 Chemical Grout set to gel in a half hour. Pumping rates were from two to four gpm at pressures rising from 1,200 to 2,500 psi.

A third series of sixteen holes was drilled at a dip of one in seven on an 18-foot diameter circle to a 50-foot depth. Each hole was grouted with AM-9 with volumes ranging from zero to 300 gallons. This third series was then re-drilled to 90 feet and grouted again with AM-9.

RESULTS:

When the shaft was sunk through the entire stratum of sandstone, total water inflow from the walls was about 40 gpm, two-thirds of which was believed to come from the untreated portion above the sandstone. As a result of the use of AM-9, shaft construction completion was assured, with water inflow from the treated area reduced by 95%.