water discharges. The unstable salts present in the solution hydrolyze—decompose—and in some cases oxidize to form free hydrogen ions. To the chemist, an "acid" condition exists in a solution containing an excess of hydrogen ions. A common indicator of water condition—acid, alkaline, or neutral—is pH, which is merely a measurement of the concentration of hydrogen ions in solution. When the concentrations of hydrogen ions (acid) and hydroxyl ions (alkaline) are equal, water is neutral and has a pH 7 on the scale. The more "acid" the water, the lower the pH number; the more alkaline, the higher.

The pH measurement is a useful indicator of mine water quality but does not establish the true polluting quality. The average cola soft drink, for example, has a pH 3.5.

Mine water is not in chemical equilibrium but changes with variations in pH, temperature, contact with alkaline materials, and dilution. All "acid" mine discharges, then, do not result in stream pollution. Mine drainage can contaminate a stream—so does any foreign matter—but it does not become a pollutant until it causes a quality change that makes a stream unsuitable for defined uses. The free hydrogen ion content of coal mine discharges can range from less than 10 p.p.m. to as much as 10,000 p.p.m. Also, many streams have a natural ability to neutralize mildly acidic mine discharges—for example, vast sections of Kentucky, Ohio, Indiana, Illinois, Missouri, and other midwest States are underlain by limestone, and the natural leaching of the limestone makes streams highly alkaline. This alkaline condition accounts for the many sales of water softeners in the Midwest.

The control of mine drainage need not be stretched in all cases to balancing acidity and alkalinity in a neutral condition. Aside from the fact that pH measurement in the field is complicated by such variables as the temperature and composition of water, mine water acidity is more than just pH. All metal ions that hydrolyze in water contribute to acidity; in many cases sulfuric acid is not involved at all. A laboratory procedure is needed to determine the degree of neutralization required to control the acidity of a given mine drainage discharge. Meanwhile, standardization of analytical methods for measurements of acidity and other mine water properties is a major research job in itself.

BCR is attempting to develop and standardize mine water analysis, on its own and through membership on an American Society for Testing and Materials technical committee on industrial water. BCR has planned field study of mine water characteristics to guide analytical procedures it is developing, including a spectrographic method for analyzing metal ions in mine water. Cooperating with BCR in funding this effort are the Pennsylvania Coal Research Board and the United Mine Workers of America. BCR is also seeking support from the Federal Water Pollution Control Administration to aid the research on the basic chemistry of mine water control.

DRAINAGE FORMATIONS: THRESHOLD QUESTIONS

If the precise mechanism of mine water formation were certainly known, steps to prevent or control it would be more surefooted. After years of investigation, including on-site studies in bituminous coal