Mine-Sealing Program to Reduce Acid Pollution in Streams

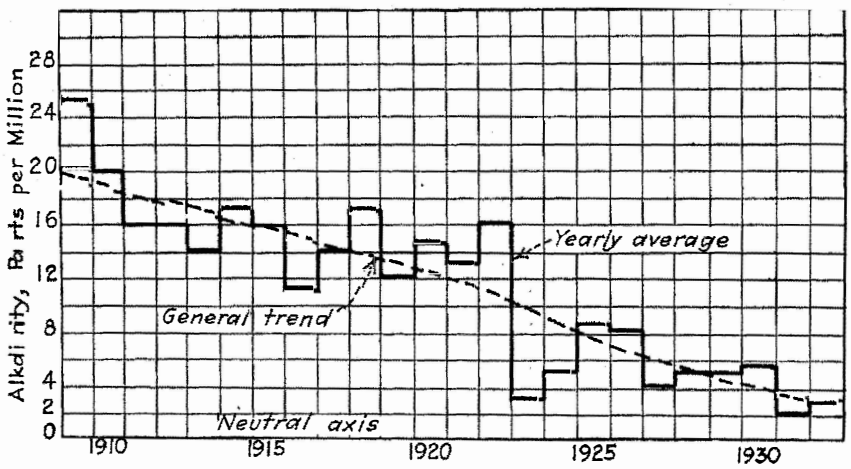
Discharge of 3,000,000 tons of sulphuric acid per year from abandoned coal mines in the Ohio River Basin to be curtailed with funds provided by WPA

WITH the objective of effecting a material reduction in the estimated flow of 3,000,000 tons of sulphuric acid which pour each year from abandoned coal mines into the streams and rivers of Pennsylvania, Ohio, Kentucky and West Virginia, an allotment of $2,500,000 has recently been approved to carry on a large-scale mine-sealing program under the direction of the Works Progress Administration.

The present undertaking is a continuance of work inaugurated by the CWA in the winter of 1933 and carried on by FERA during the past year in a region where the toll exacted by mine-waste drainage is conservatively estimated at $10,000,000.

Acid is created in the mines through the oxidation of iron pyrites, which are present in large quantities in the ore materials of most coal veins. The iron sulphate thus formed is taken up in solution by water seeping in from the surface and converted into sulphuric acid. This acid-laden water occurs in such large quantities that mechanical means have to be employed to pump it from most active mines, and in inactive or abandoned mines it simply accumulates until it overflows at the mine portal. In either event the poisonous waste flows unhindered into the nearest stream and finds its way eventually into the Ohio or one of its main tributaries. It often has a concentration of as much as 5,000 p.p.m. of free sulphuric acid.

FIG. 1—EFFECT of acid mine drainage is graphically shown by the decreasing alkalinity values of the Alleghany River water at Aspinwall, Pa. It reached its greatest proportion in 1931, when the yearly average of alkalinity was only 2.0 p.p.m.



Acid pollution surveyed

The total acid discharge for the four-state area was estimated by the U. S. Engineers Corps in 1925 to approximate 3,000,000 tons annually. This was arrived at through an intensive study of acid pollution in the Pittsburgh district, where accurate measurements (using the methyl-red indicator method) showed a burden of 404 tons of free acid in the waters of the Monongahela River passing Dam No. 2 each day. The engineers concluded that there were between 40,000 and 50,000 abandoned mines in the area as a whole, and that these were responsible for not less than 70 per cent of the pollution. Active and marginal mines accounted chiefly for the remainder, with sewage and industrial waste making only a small contribution to the total.

The damage caused by this pollution has mounted progressively each year, and experts of the U. S. Public Health Service feel that the engineers' 1925 estimate of $10,000,000 may be short by 50 per cent of the actual loss to public and private property which the acid each year exacts. The damage toll is reflected in the increased costs of purification of public water supplies, corrosion to boiler tubes and other industrial equipment, destruction of the metal parts of dams and locks and of highway culverts and bridge supports. In addition, streams have been made totally unfit for stock watering, and the toxicity of the acid has destroyed all fish life.

The practicability of mine sealing as a corrective for this form of acid pollution was demonstrated fifteen years ago by the Engineers Corps and later by the U. S. Bureau of Mines. It has long been advocated by these two agencies as well as the U. S. Public Health Service, which sees in the situation a serious menace to public health. It was not until the CWA was organized, however,

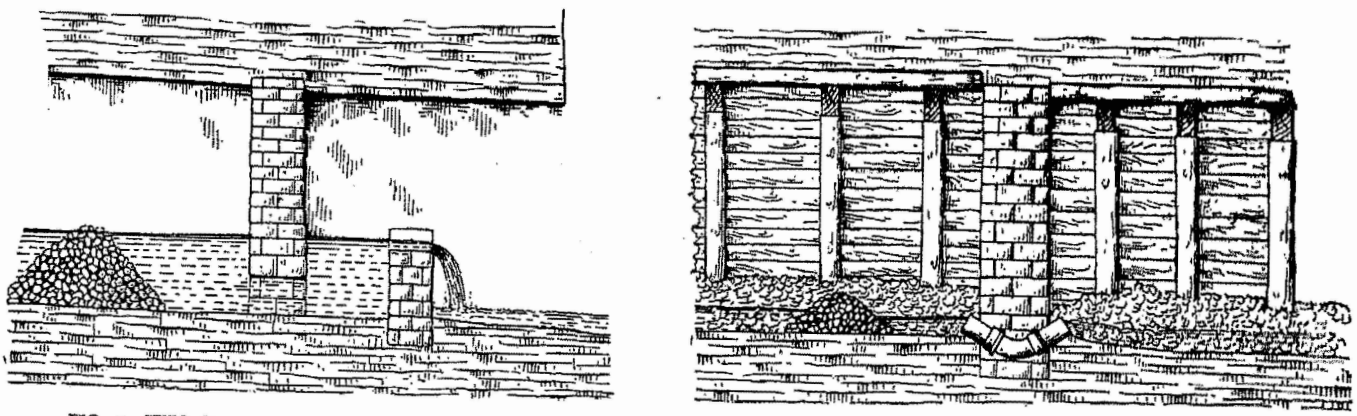


FIG. 2—TWO METHODS used to exclude air from the mines and thus to check the formation of sulphuric acid. In both, a masonry wall just within the shaft entrance is sealed tightly on all sides save for an opening at the bottom. The water trap formed at this point, either by a small dam or a curved pipe, prevents the entrance of air but permits water to flow out freely.

FIG. 3—JOBLESS MINERS, paid with WPA funds, are employed in building these masonry walls used for sealing abandoned coal shafts. The average cost per seal throughout the Appalachian field has been about $40.

with its abundance of funds and man power for public works, that a beginning was made.

Air sealing has been adopted as the most practical means of combating the formation of acid. This is based on the theory of excluding air from the mines and thus checking the oxidation of the pyrites. The practice usually followed is to build a heavy masonry wall just within the mine entrance, sealing it tightly to the walls on all sides save for a portion about 2 ft. square at the bottom. A water trap is built around the outside of this aperture. Thus, water is permitted to flow freely out of the mine as it accumulates, but the air is prevented from getting in.

There are numerous variations of this type of seal, such as using a curved section of sewer pipe under the wall or building a simple enclosed pit and dam to catch the flow, but air sealing is the basic principle followed. Flooding has been abandoned because of the obvious hazard of a break-over into neighboring shafts where men might be working. Naturally, sealing the entrance is the most important part of the job, but air shafts and other surface openings also have to be closed if oxidation is to be completely checked.

It has been found that waters coming from mines that are properly sealed in this manner lose as much as 50 to 80 per cent of their acidity in the first 60 days.

The mine-sealing program of the WPA is under the technical supervision of the U. S. Public Health Service, as were the CWA and FERA programs. Officials of this agency predict that if the program is carried out according to plan, the problem of acid pollution in the Ohio River Basin will be largely solved.