

THE Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND
WATER PURIFICATION

POLLUTION OF WATER IN SHALLOW WELLS.

The question is often asked:—

"How far must sewage-polluted water travel underground in order to become harmless?"

The question does not admit of a definite answer. Much depends on the character of the material through which the water passes. Pollution has been known to travel very long distances in limestone rock or rock characterized by fissures, forming open underground channels. On the other hand, water is very readily purified to a high degree by passage through soil, especially of a sandy nature.

The question is of great importance in connection with municipal shallow wells, or wells which obtain their supply from sand in gravel layers situate near the ground surface.

Charles B. Burdick (sanitary engineer, Chicago), has collected some interesting and instructive data on this subject which tend to show that municipal shallow wells may exist in certain localities surrounded by contaminated influences, and yet show very little signs of pollution, either by analysis or in the typhoid rate.

Well pollution (even with comparatively shallow wells) is much more generally due to direct surface pollution through lack of protection, than to underground sources.

Burdick refers to two pointed illustrations, the water supplies of Winona, Minnesota, and of Manistee, Michigan. In both cases municipal wells are located on the banks of rivers at a depth of less than sixty feet. They are practically within the towns, and are surrounded on all sides by possible sources of sewage pollution to such an extent that the sites have been condemned by the State Boards of Health as dangerous.

With reference to the Winona wells, the Minnesota State Board of Health states: "No wells could be recommended which receive surface water in relatively thickly-settled portions of the town, and situated as close to a badly-polluted water as that of the Mississippi River." Practically the same conclusions were arrived at in the case of the Manistee supply. Yet in neither case could it be shown that the water was bad, or that the typhoid rate was abnormal.

Periodical analyses of Winona water showed bacterial counts from 3 to 50 per c.c. The typhoid rate per 100,000 in fifteen years has never exceeded 40, and has been less than 10 for over 50 per cent. of that time.

Manistee water usually showed bacterial counts of less than 50 per c.c., and in about 140 observations the presumptive test by B. Coli was negative in all tests in .1 c.c.; in 1.0 c.c. it was positive only once. The typhoid rate per 100,000 in a ten years' period has exceeded 40 only once, and has been less than 10 four times, or 40 per cent. of the time.

Burdick confesses surprise that the continued public use of water from such sources has apparently done so little harm.

There is very little data relating to possible extension of underground pollution. In the year 1909 an experiment was made at Berlin, Europe. The tests were made in order to ascertain the safe distance which may exist between a well used for water supply and a broken, leaking sewer pipe. The well was located in a water-bearing material of sand and gravel. Two distinct tests were made, one by inoculating the soil below the level of sub-saturation, and the other above this level. In both cases bacillus prodigiosis was inoculated.

In the first experiment the well was 177 feet deep, and water was drawn for thirty days at the rate of 380,000 gallons per day. The inoculated water was introduced sixty-nine feet distant from the well through a special well-point at the rate of 1,000 gallons per hour. Tests of the well water were made with great care, and the inoculated bacillus made its first appearance in the well water after nine days, and at several times thereafter. It was concluded that one in 40,000 of the bacilli reached the well, and, inasmuch as dangerous bacteria are more sensitive to cold water, they would be less likely to survive.

The second experiment was made upon a well 140 feet deep. The inoculated water was introduced fifty-eight feet from the well and four feet above the level of sub-saturation. The test occupied a period of one and a half months. Water was drawn from the well at the rate of 85,000 gallons per day. In this test no trace of bacteria was found in the well, although 8,240,000 millions of the bacillus were poured into the soil.

A comparative study of the above experiments points to the conclusion **that polluting influences, as represented by bacteria, travel less distance in subsoil, when they enter above the level of sub-saturation, and not direct into the subsoil water.**

The Burr-Hernig-Freeman Commission also conducted an experiment upon the travel of pollution in connection with the water supply of Greater New York. This experiment consisted in constructing a cesspool in connection with a camp of about three hundred Italians and noting the quality of the ground water at varying distances from it. The subsoil was of sand, and showed negative tests for B. Coli at all depths up to seventy-two inches.

The bottom of the cesspool was located about eight feet above the level of sub-saturation. The test wells were sunk ten feet from the cesspool drawing water two feet, seven feet and seventeen feet below the sub-water level. Analyses continued for over a month showed greatly contaminated water.

Wells were also sunk 50 feet, 130 feet, 160 feet, 220 feet and 300 feet distant from the cesspool. All wells