

100° of superheat. From this data it can be seen that the total pumping capacity of the two stations is about 380 millions, and by the addition of three more pumps we could furnish over 400 million gallons of water.

Distribution System

The distribution is through two systems—the high and low. The initial pressure on the high service ranges from 80 to 90 pounds and on the low service 42 to 50 pounds. The high-pressure system, in general, takes care of the newest and highest sections of the city, while the low, the older and lowest sections. In all, water is distributed through over 600 miles of pipe, from 1½ to 60 ins.

As a gauge to the rate of pumping and to minimize the pulsations of the pumps there is located in the north-eastern section of the city a steel water tower 40 ft. in diameter and 85 ft. in height. It stands on an elevation of 106.31 feet above the lake level, and when filled to a depth of 75 ft., holds 704,970 gallons. In the eastern section of the city, we have what is known as the Prospect reservoir. It covers 20 acres of land, and when filled to a depth of 30 ft., holds 116,313,827 gallons. At this stage the water surface is 113 ft. above the pumping station. The tower is supplied by the high service and the reservoir by the low, and by keeping the water in them at certain levels, a constant and uniform pressure is obtained throughout the city. In other words, the speed of the pumps and number in use at any time is dependent upon the height of the water in these reserve supplies. This information is phoned to the pumping stations every half hour and action taken thereon accordingly.

As to the purity of our water supply I think I am quite safe in saying that, without any treatment at all, it is as good as any that is available to cities having Lake Erie as their source of supply. The greatest contamination occurs during the summer months and a large percentage is due to freight and passenger vessels, which generally use the north channel entrance to Buffalo harbor, which course takes them within less than 1,000 feet of the inlet crib and on the upper side.

Contamination by Excursion Boats

Upon the opening of the summer resorts, a short distance above on the Canadian shore, several excursion boats ply back and forth from Buffalo hourly. These boats carry thousands of people daily and with no restrictions or discrimination for the disposal of their sewage. This constitutes a great menace, as excreta from this source may easily pass into the water supply and in a fresh and virulent state. The shore drainage adding to the pollution, while considerable, is not necessarily excessive, as there are no cities of any size above us whose sewage might find its way into our water supply. There are several streams flowing into the lake within easy radius of Buffalo, but they are small and tendency is for them to follow inshore as the extensive use of floats has proven. In the winter time, after navigation closes and especially after the ice has formed, the water is of a most excellent quality. The bacteria count obtained on 37° agar is very low. There is one aspect, however, which has to be given weight, and that is with reference to the condition arising as a result of the hundreds of fishermen who go out on the ice to fish. The excreta which these people leave upon the ice is a constant menace to the water supply, more so at thaw periods and acutely so when upon the coming of spring the ice breaks up and all is carried in the direction of the crib. It can be seen, therefore, how most of the contamination occurs at uncertain periods. This condition makes it necessary that chlorine be added to the water in sufficient quantity to take care of the high wave at all times even though the dose may be in excess of that actually essential three-quarters of the time.

Chlorinating Apparatus

Owing to the fact that the chlorine treatment has been elucidated many times before on occasions similar to this, I have not gone extensively into details. Our chlorination apparatus is located at the intake pier, where the chlorine

solution is injected into the mouth of the 12-ft. arched tunnel. This, therefore, affords a run of over a mile in a leak-proof tunnel and ideal conditions for sterilization. We are using a chlorinating apparatus formerly manufactured by the Electro Bleaching Gas Co., and is the float meter type. The float in this apparatus is about 3 in. long, and has never caused us any trouble from sticking, as has been the case where the small indicator was used. Our chief trouble with this apparatus has been caused by the clogging up of the pressure reducers, which require taking apart every once in a while and cleaned. Generally, it is necessary to replace the old diaphragms with new ones when this is done.

The amounts of chlorine used ranges from an average of .16 parts per million to an average of .28 parts per million. These figures are equivalent to about 1 pound and 2½ pounds per million gallons.

Standards of Safety

I do not believe in any set and fixed standard for a safe water. In other words, the same standard is not applicable to any two waters, and when such is aimed at there is certain to be a variation, one from the other, in actual practice. A set standard will be hard to abide by because of the great difference in the kind and character of the pollution, or, while the standard may be too severe in some cases, it is not severe enough in others, and, therefore, misleading. A standard is no sooner proposed for certain conditions than it is at once grasped and applied to a great variety of conditions. Our standard and procedure is that the bacteria count on 20° agar is a gauge of the efficiency of the sterilization plant, and means nothing as to whether the water is safe or not. The real knowledge is obtained from the test for organisms of the Bacillus group. Of the different kinds of media in use, I do not believe we are far enough advanced to say standard media—I prefer lactose peptone bile. Our own standards are that we aim to eliminate gas formers to the extent that negative tests are obtained on four out of five 5 c.c. samples of the treated water.

To sum up the various points which have been gone over, it is evident that we have a most excellent water system, in that we have an adequate distribution system, an abundant supply and of fine quality, from the bacteriological and chemical viewpoints. Physically, the condition of the water is open to severe criticism from 10 to 15% of the time. This brings us to the subject of filtration. A glance at a map will show that Lake Erie lies to the west by south-west from Buffalo. It is from this direction that come the winds which render our water supply turbid, and when we are told that we need a filter plant. These winds prevail principally during the fall months, when our highest turbidity occurs. Compared to some waters, this is not at all bad, as 250 parts in a million is about the maximum. It consists principally of very finely divided clay, the percentage of organic matter being very small. Generally, the sediment is offensive for from three to six days at a time, for the sediment is quite heavy and settles rapidly as soon as the disturbing element is removed, and the second day after a blow the water has improved 50%. In all, the water is noticeably turbid from 30 to 60 days of the year.

Suggested Filter Site

In planning for a filtration plant in Buffalo, consideration must be given to the following points: First, do the prevailing conditions of the water as herewith set forth warrant such an expenditure? Secondly, the water consumption must be reduced to a reasonable figure and waste reduced to a minimum before such a project is feasible. Lastly, and perhaps the most difficult problem, is the suitable location for a filter plant. When the waterworks were originally laid out it seems the idea that Buffalo might have such a plant was not thought of, or at least no provision was made for its possible location. As to the proposition that the water be pumped to an elevation outside of the city and returned by gravity, I would explain that we are here handicapped by the flat nature of the country around us. To secure an

(Concluded on page 559)