

uncertain meaning. The speaker believes that much of the prevailing discussion with respect to the advisability of adopting this or that method of guarding water supplies against infection and of preserving the quality of the water in our waterways has been confused in the minds of many on account of the use of the term "sewage purification" to cover methods and processes that do not make the sewage pure.

It is gratifying to observe that there is an increasing tendency among sanitary engineers to substitute for the term "sewage purification" the words "sewage treatment." Notably, George W. Fuller has adopted this language in his recent admirable treatise on sewage disposal. It is to be hoped that its use will become general. If not, the term "sewage purification" will inevitably become degraded, as people come to learn, as they must, that not all so-called purification plants really purify the sewage. The term "sewage treatment" does not imply complete purification and is, therefore, the more general and the better term.

Using the words in their most obvious meaning, let us ask the question, ought the sewage of our American cities to be purified? Generally speaking, no. To do so would be enormously expensive, and in most cases the results accomplished would not be commensurate with the cost. Ought the sewage of our American cities to be treated in some way before being discharged? Generally speaking, yes. There are relatively few instances where raw sewage can be discharged into streams or lakes without causing objectionable local conditions or dangers of a sanitary character. The nature of the treatment required will vary all the way from a mere straining out of the grosser solids to a combination of processes that results in actual purification.

We hear it said that in England practically all of the sewage is purified. Is this true? Yes, if it is meant that the sewage is submitted to some process that improves its character, but no, if it is meant that these processes completely remove the organic matter and free the sewage of its dangerous bacteria. For example, we like to refer to the interesting sewage works at Manchester and Salford with their great septic tanks and contact beds and sprinkling filters, and we speak of them as purification plants. Do we realize, however, that analyses of the sewage effluents show that during a large part of the time they fall below the standard of purity established by the Mersey and Irwell Joint Committee, a standard that cannot be regarded as too strict if we maintain a reasonable meaning of the word "pure." The biennial report of Hugh Stowell, chief inspector for the Mersey and Irwell district, dated May, 1912, states that out of 126 sewage works, 23 per cent. were non-efficient, this being an improvement over 34 per cent. as shown by his previous report. At Manchester 22 per cent. of the samples were below the established limit for organic matter of "one grain of oxygen absorbed per Imperial gallon in four hours," at Salford 12.8 per cent. of the samples were below standard. This is not intended as a criticism of English methods of treatment, which, on the whole, are well adapted to their particular needs, but merely to illustrate the danger of using loose phraseology.

Or to take another illustration, can the water-supplies of our lakes be protected by purifying the sewage that enters them? Many laymen think so, and ardently advocate the construction of sewage-purification plants and oppose water filtration. Would they say the same if they realized that most so-called sewage-purification plants only partially remove the dangerous substances from the sewage, and that complete removal is impracticable on account of the expense and the almost insuperable difficulty of treating all of the sewage at times of storm? Would not these well-meaning people have a clearer conception of the problem if instead

of using the broad misleading word "purification," we used the term "sewage treatment," or still better, some term that described definitely the results accomplished by the different processes.

With laws being framed in various States, to control the pollution of rivers and waterways, it is high time that popular misconceptions should be corrected and that the different phases of this complicated problem should be made clear. In the first place it should be more definitely understood that in the treatment of sewage there are two very different functions to be considered. One is to get rid of the foul, putrescible matter with its accompanying offensive smell; the other is to get rid of living disease-producing organisms. One is very largely a physical and biochemical problem; the other is chiefly bacteriological. One does not directly concern the public health; the other may. In practice, these functions overlap but they may be kept separate.

Is it not the popular conception of the function of sewage-disposal plants that they are intended primarily to protect the public health? Is not this the theory upon which some of the recent legislation is based? It certainly appears so. But is this idea correct? Does the treatment of sewage by the ordinary process materially improve the public health? Are sewage works a success from the hygienic point of view? It is a vital question and one that has not been sufficiently considered from the standpoint of cost and result.

Sanitary history has shown that when polluted water-supplies have been purified by filtration, the typhoid fever death rate of the community has lessened and the public health has otherwise materially improved. And it is a matter of easy reckoning to tell that the financial benefits represented by the saving of human lives and the prevention of sickness have far exceeded the cost of filtration. Taking the cost of efficient water purification at \$10 per 1,000,000 gallons, and allowing a per capita water consumption of 100 gallons per day, the process pays for itself if it reduces the typhoid fever death rate by 4 per 100,000.

No such record can be shown for the purification of sewage except perhaps in the case of a few small plants built for the protection of the water-supply of some large city, and even here it is difficult to measure the number of lives that have been saved. The complete diversion of sewage from the drainage area of a public water-supply has repeatedly been of hygienic benefit. So has the introduction of sewer systems in cities and towns where none existed before. But the purification plants that have been constructed for the large cities of the world have not the saving of many human lives to their credit, so far as the best available evidence shows. The reason is obvious. They have not, as a rule, been built for that purpose, popular ideas to the contrary notwithstanding.

Sanitarians abroad have long recognized the fact that river water-supplies cannot be protected against the danger of infection by any of the known methods of purifying sewage discharged into the river above the waterworks intake. Instead they depend upon the filtration of the water-supplies themselves. In Germany the filtration of surface water-supplies is required by law and no difficulty has been found in building water-filtration plants capable of purifying water after it has received what would be regarded in this country as a large amount of sewage. In Germany and in England sewage-disposal works are built primarily to remove organic matter and prevent streams from becoming foul. Therefore, when public health authorities in this country compel large cities to construct sewage-purification plants for the avowed purpose of protecting water-supplies taken from the rivers below them, they are attempting to accomplish the impracticable, and are compelling the expenditure of money with-