

## THE PRESENT STATUS OF SANITARY ENGINEERING.\*

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THE sanitation of cities is fast becoming an art, and the various features of sanitary work are being by degrees reduced to a science, so that certain steps can now be taken by a municipality for the collection and reduction of wastes—the collection and disposal of sewage—and for improvement of public water supply with positive assurance of success. Some difficulty has been experienced in the reduction of city wastes and disposal of sewage, partly by reason of the attempt to realize a profit on the operations and partly by the complex character of the substances to be handled. Setting aside profit and adopting the reduction processes to the materials to be destroyed or rendered innocuous, and allowing the sanitary rather than the commercial interest to prevail, satisfactory results can now in nearly every instance be expected.

Some cities, like Boston and New York, can impound water from unpolluted watersheds, in great reservoirs, at an elevation which will furnish gravity pressure for a low service supply, and this water will be purveyed in its natural condition, while other cities like Cleveland, Cincinnati, Chicago and St. Louis are compelled to draw from nearby polluted sources.

Gravity water supplies are not always pure and wholesome, and pumping sources of great capacity are not always impure and unwholesome, although the exceptions to the latter proposition are rare. The water supplies of Cincinnati, Philadelphia and Hamburg are obtained from seriously polluted sources, but by filtration the water is made safe for domestic use.

The Ohio River at Cincinnati, the Schuylkill and Delaware Rivers at Philadelphia and the Elbe River at Hamburg are badly sewage polluted streams at the intakes of these several waterworks. But by resorting to methods of purification which long time and broad experience have shown to be reliable, these polluted waters have been rendered as safe as the water flowing at the headwaters of these streams.

Surface water from unprotected watersheds is seldom safe to drink without boiling or filtration, and as the water supply of a whole city cannot conveniently or cheaply be boiled before use, filtration is the only recognized method by which purification and clarification can be accomplished. The use of slaked lime and iron, as at St. Louis, or of hypochlorite of soda or bleaching powder, as at Cleveland, cannot at this time lay claim to be considered as substitutes for filtration, although both are at times and under some conditions useful and valuable adjuncts of filtration. Free chlorine as applied at the Cincinnati filtration works, or chlorine gas as used at Wilmington and Delaware, and ozone as used at St. Petersburg, Russia, and on a small scale in some of the waterworks of Holland, are safeguards to doubtfully filtered waters, and are to be commended as aids to the broader and older methods of water purification.

The removal of all, or even of the pathogenic forms of bacteria from a polluted water by ozone or chlorine or by an electric current does not satisfy the requirements of modern sanitation. People will not drink dirty water,

even if it is certified as pure and safe, and filtration is the only recognized method capable of broad application, which will render a turbid water clear, safe and attractive. Filters of the slow sand or of the rapid type are capable when skilfully managed, of converting a polluted water into a safe drinking water, but the skilful management is not always forthcoming, so that some additional treatment to supplement filtration has come to be considered as desirable in some instances, and necessary in others, to render public water supplies absolutely safe.

The purification of a previously polluted water supply, however, does not solve the whole problem of the safety of the water as regards typhoid fever at least, nor perhaps as regards some other diseases known to be water borne. Pure water cannot be distributed through foul mains and remain pure, and some thought must be given to the influence of old water pipes containing deposits from polluted water which has flowed through them for years before the water supply was filtered or before pure water from a natural source was substituted.

The writer and others who have had to operate large city filtration works have sought information and have speculated on this point, and in the case of the filters for West Philadelphia, the typhoid statistics of that district of the city, seemed to show that ninety days after the distribution system began to receive the filtered Schuylkill water, all external evidence indicated that the old deposits were washed out of the pipes or that all noxious matters had been removed from them. Similar experience at various places, including London and Hamburg, have been received from abroad. But later experience elsewhere than Philadelphia, convinces me that complete safety from typhoid fever from a water source requires that the old deposits from a polluted water supply should be wholly and certainly removed from the mains, before they can be regarded as safe carriers of a purified or pure water. Recent experience seems to show that even seven years is not enough to eliminate the danger which may arise upon sending pure water through previously foul distribution pipes.

Water mains can be cleaned and deposits removed by several mechanical methods which have stood the test of time, and where the quality of a public water supply is about to be improved this cleaning of the mains should go hand in hand with filtration or other improvement in the quality of the water. What boots it to advance the standard of water to a high degree and then destroy its sanitary quality by sending it to the consumer through dirty pipes? Experience has come to me in a very serious way, both in filtering the water supply of Philadelphia and otherwise, which convinces me that some of the typhoid fever vagaries from a filtered water are not chargeable in some instances to poor operation of the filters, but rather to the stirring up of old deposits in the mains which contain the necessary matter for the development of the typhoid organism in the human system. A considerable increase in the rate of flow through water mains will start these old deposits and destroy the wholesomeness of a well filtered water. The evidence of the change is manifested to the consumer by the turbidity of the previously clear water and very unfortunately sometimes by typhoid fever in his family.

The prompt removal of sewage from premises is necessary to health but in effecting this removal we should have some regard for the health of others who may become victims of our carelessness or indifference. Aside from the desire to keep our streams free from pollution they should not be used to carry sewage pollution from

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