

# MUNICIPAL DEPARTMENT

## PURIFICATION OF SEWAGE BY RIVER-WATER SUPPLIES.\*

Coming more particularly to the discharge of sewage into rivers which are sources of water supply, and the consequent objection to such supplies on account of impurity, we are immediately brought face to face with the fact that in such circumstances the self-purifying power of rivers cannot be relied on to remove all cause of danger, and that no amount of dilution will render sewage polluted water safe,† but that a safeguard must be sought in a process of efficient filtration previous to supply. This fact has been demonstrated in this country only so recently as within the past few years. In the last report of the medical officer of health to the Local Government Board, attention is drawn to the pollution of the River Trent and the water supplies of populations on or near the banks in connection with the occurrence of enteric fever, which shows clearly the danger incurred by drinking unfiltered river water. And the experience which we have from America is equally convincing. The river water which is supplied to the city of Lawrence was, previous to the year 1893, unfiltered, although largely contaminated by sewage discharges from towns situated above that point. The consequence of this was that "for many years the death-rate from typhoid fever was three times higher than that of others towns of the same size." That the disease was water-borne was clearly shown by it invariably appearing at a later date at Lawrence than at Lowell—a town higher up the river and this was still more conclusively proved by the fact that a preliminary process of filtration through sand resulted in a reduction in the death-rate from typhoid fever "to 40 per cent of the former mortality, and it has also been shown that of this remaining 40 per cent nearly one half of the cases are attributable to the use of unfiltered water drawn from the canals."<sup>††</sup>

But while the ordinary effect of sand filtration is to minimise danger by reducing enormously the number of organisms, which number may be still further reduced by sedimentation in storage reservoirs, and while we have on record many cases in which it has been productive of highly beneficial results in times of disease, yet there are certain reasons why absolute reliance cannot be placed upon its uniform efficiency. Under the most favourable conditions, sand filtration does not entirely remove the bacteria which are so abundant in river water, and it is quite possible that among such number remaining after that process some may be of a pathogenic

character. Apart from this possibility, the entire removal of these organisms is not necessary. Dr. Koch is of opinion that water containing not more than 100 germs per cubic centimetre is sufficiently pure, while Migula, after a large number of examinations of water from various sources, maintains that when the number of species does not exceed 10, there is no reason to regard the water with suspicion, unless such species differ from those ordinarily met with. The percentage of organisms commonly removed by the several water companies in London varies from 93 to 99, the actual number of bacteria per cubic centimetre in the water supplied varying from a very small number to several hundreds, sometimes rising during winter months to thousands, and in the report of the last Royal Commission on the Water Supply of the Metropolis, after reference has been made to a general removal of 98 and 99 per cent., the following expression occurs: "Occasionally the efficiency falls far short of this, and the water is delivered in an unsatisfactory condition.

Further, the process of purification being a vital one, time is necessary for the formation of colonies of bacterial life in number sufficient to remove the organic matter contained by the water passing through the filter, such time being found to vary from two to three days; and supposing that the filter has attained such maturity as to ensure a good result under ordinary conditions, yet the water flowing from it may be unsatisfactory, owing to it having been allowed to pass through at too rapid a rate and under too great a pressure, with a consequent high percentage of organic life. Added to this, the operation must be conducted with regularity or with but slight variation, any striking increase in the volume of water supplies being found to have a disturbing influence on the action of the purifying organisms, which require time to adjust themselves to altered conditions. Moreover, every care must be taken to save the surface layer from disturbance, as it is upon this layer, consisting as it does, of nitrifying organisms in the zooglyca condition, that the successful action of the filter depends. But while the above facts are sufficient to show that the process of sand filtration is one which at all times requires great care and attention, without which the filters quickly get out of order, yet the factor which most seriously interferes with their proper working is a period of frost, at which times it will be noticed that water which has presumably been passed through contains an abnormally large number of organisms. During the past winter Dr. Frankland, in one of his monthly reports to the Registrar-General, while remarking that the purity of London water confessedly depends upon the perfection of its filtration, stated that the very low temperature had prevented most of the filters from working efficiently, and he further drew attention to the fact that "while in both December and in February alike the deep-well water of the Kent Company contained only eight microbes per cubic centimetre, the filtered water of the East London Company contained in

February 5,200, and that of the Southwark Company 6,260." And he also stated that it was only in some of the filters of the Grand Junction Company that the number was brought within the standard limit of 100 per cubic centimetre. That this uncertain action of filters during times of frost may have fatal results has already been demonstrated. In connection with the outbreak of cholera in Hamburg and Altona in 1892-93, which has been so largely quoted as showing the immense advantages consequent upon filtration through sand, it will be remembered that a sudden and unaccountable outbreak occurred at Altona—which town had been almost entirely free from cases during the time the disease was rampant in Hamburg—and that such outbreak was ultimately found to have arisen from the failure of a filter to keep back the bacillus during a season of frost. It may be here mentioned that the results of experiments recently conducted at the Paris Municipal Laboratory confirm others already obtained in showing that frost has but little influence as regards the destruction of pathogenic organisms, and the fact would seem to be firmly established, at any rate so far as the microbes of typhoid and anthracis are concerned, that even long and repeated periods of frost will have little or no appreciable effect upon them.

It is also further necessary in considering the effect of frost upon sand filters to remember that it is during the winter months that the number of organisms present in unfiltered river water reaches the maximum, and an examination of reports for some years will reveal the fact that they are far more abundant in the months from November to March than during the milder seasons of the year, and consequently it is at this time that (disregarding the seasonal curves of mortality peculiar to various diseases) danger from a river-water supply is most to be feared.

(To be Continued.)

## AUSTRALIAN WOOD PAVEMENT IN NEW YORK.

Alfred Marks has been authorized to put down a pavement of West Australian wood on certain streets in New York City designated by the Commissioner of Public Works. If the pavement is not a success at the end of six months it must be taken up and the street repaved by Mr. Marks. In our issues of August 27, 1892, and April 15, 1893, some mention was made of experience in London, England, with pavements of Australian jarrah wood. It was found to wear well, and in Fulham, blocks which had been down four years stood from one-half inch to 1 inch above deal pavements laid at the same time alongside and subjected to the same wear. The karri, another Australian wood, is considered by English experimenters to be superior to the jarrah as a pavement.

The Construction and Paving Co. have laid down a sample of a new kind of pavement at the intersection of York and Wellington streets, Toronto, which is called asphaltina. It is claimed that it can be laid on any good macadam road without preparing a foundation of concrete, thus materially reducing the cost.

\*Abstract of paper by Stuart H. Davies in the Contract Journal.

†See report, Massachusetts State Board of Health, p. 283.

††Knowledge, April, 1895.