--- THE SEWERS, SEWAGE, AND ---

SEWER-MEN OF LONDON

—— by ——

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I.

S E W E R S.

London and its suburbs are drained on what is known as the combined system of drainage, i.e. the sewers receive both the rainfall and the sewage proper. This extensive area, amounting to nearly 120 square miles, contains over half a million water closets, with from seven to eight million yards of house-drains. These, along with more than a thousand miles of sewers which are under the control of the various local boards, discharge their contents into the main intercepting sewers of the London County Council. The general direction of the flow of sewage is, naturally, towards the river; and the main sewers, of which there are three on the north and three on the south of the Thames, run parallel to that stream, and at right angles, therefore, to the other sewers, the contents of which are thus intercepted.

The main intercepting sewers on the north side

of

of the river are named the high level, middle level, and low level respectively, the last being in close proximity to the river throughout the greater part of its course. The three sewers converge, and meet at Abbey Mills in the east of London, where the contents of the lower sewer are pumped up to the level of the upper and middle sewers, these having already become united at the distance of a little over a mile from the common junction. The low level drains the western suburbs, and has its origin at Pimlico, where the sewage from the whole of that low-lying district is pumped up to a height of 17½ feet before it can enter the main sewer. On reaching the terminus at Abbey Mills it has again to be raised 36 feet by pumping, after which the whole of the sewage of the northern part of the city enters the Northern Outfall sewers to be conveyed to Barking Creek, three miles away.

Similarly, the main intercepting sewers on the south become united at Deptford Creek, where the contents of the low level are raised to a height of 18 feet by pumping before entering the Southern Outfall sewer along with the sewage of the other main drains. It is then conveyed to its destination at Crossness, a distance of 7¾ miles.

The

The total length of the main sewers is 82 miles, and they are capable of intercepting daily 400,000,000 gallons of sewage, the normal discharge, both north and south of the Thames being just half of that quantity. Even this large reserve is insufficient to provide for sudden heavy rainfall, so that there are, in addition, thirty-four storm overflows provided, by which storm water is discharged direct into the river, so as to prevent the flooding of the lowlying districts which would otherwise occur.

The main sewers vary both in dimensions and in shape. Taking them seriatim it may be stated shortly that the Northern High level is mostly circular, varies from 4 ft. diam. to 9½ by 12, and has a fall of from 1 in 71 to 1 in 376 at the upper end to 4 to 5 feet per mile at the lower. It is made of brick varying in thickness from 9 inches to 2 feet 3. The Middle Level ranges in size from 4 feet 3 to 9½ by 12. Its fall averages from 17½ feet per mile at the upper end to 2 feet per mile at the lower. The Low Level varies from 6 ft 9 to 10 ft 3 diam. It has a fall of from 2 to 3 feet per mile. The Northern Outfall sewers consist of three culverts, each measuring 9 feet by 9, and laid side by side; they have upright sides

with

with semicircular crowns and segmental inverts, and have a minimum fall of 2 feet per mile. The Southern High and Middle Level sewers are for the most part egg-shaped with the small end downwards, vary in size from 4½ feet by 3 to 10½ feet by 10½, and have a fall of from 53 feet per mile at the upper end to 2 1/3 feet per mile at the lower. The Low Level varies in size from 4 ft diam. at the upper end to 7 feet by 7 at the lower, and it has a fall of from 4 to 2 feet per mile. The Southern Outfall Sewer consists of one barrel-shaped conduit, 11½ feet in diameter, with a fall of 2 feet per mile.

As regards the other sewers, the egg-shaped with the small end downwards are gradually taking the place, when practicable, of those with upright sides, both on account of the increased velocity of the current which is obtainable, and of the superior strength and diminished initial cost as well.

The cleansing of sewers is accomplished in a variety of ways. At one time the solid material which has accumulated in the interior was removed by manual labour, but this was a costly process and created a serious nuisance. At the present time the channels are cleaned for the most part by flushing with water in one of the

following

following ways. The smaller sewers are flushed by sending into them a powerful current direct from the Water Company's mains; or the same thing is accomplished by discharging a large quantity of water from brick tanks, or from water vans, or from shafts with water-tight valves holding from 600 to 700 gallons. Temporary wooden dams are also used in some cases, the pent-up sewage, when the obstruction is removed, sweeping onwards the contents of the sewers beyond. The larger sewers are flushed by means of flushing gates, behind which a large body of water is collected and suddenly discharged; or the side entrances and manholes of the sewers are filled with water and instantaneously emptied in the same way. Many sewers are now fitted with one of the automatic siphon flushing arrangements similar to those used in public urinals, by which the time and frequency of the discharge of water can be regulated according to the season of the year, and the necessity for purifying the channel. In some districts the whole of the courts and alleys are periodically washed down, the water being subsequently used for flushing and cleansing the sewers. In some cases, where the gradient is slight and the inequalities marked, it is found necessary to employ manual labour in addition, to remove the hard material which gradually accumulates in certain localities.

localities.

Ventilation is carried on by means of gratings and ventilating shafts. The gratings are inserted in the crown of a sewer which passes along the centre of a wide road, so that the gases which are generated by the decomposition of sewage have free access to the external air by which they are diluted and rendered innocuous. It may be said that the majority of London Sewers are now ventilated by these gratings, though great variations exist in different districts in regard to the distance between each ventilator. Those in the city are 150 feet apart, and in other localities the distances vary between 100 feet and a quarter of a mile. The majority of these gratings at the present time are fitted with trays, which prevent dirt and gravel falling into the interior of the sewer, while they allow of the free passage of air either way. The area of the ventilating aperture varies in different cases from 24 to 72 square inches - the usual measurement being from 40 to 50.

The smaller sewers, and those situated in courts and narrow road-ways are, in an increasing number of instances, ventilated by means of shafts which are connected with the sewers by brick flues, stoneware, or drain pipes, these

these shafts being carried up along the wall of a house to a point usually 3 or 4 feet above the ridge, or, where that can be effected, fixed to a neighbouring tree. The capacity of these shafts at the narrowest point in square inches, varies from 6 to 96, the average area being about 20. It is found that the use of cowls on these ventilators is, on the whole, beneficial, although at the present, it is only in a minority of instances that they are employed. The experiment of placing charcoal in trays in the ventilating aperture may be said to have proved a complete failure. It answers very well for the first three or four days, but as soon as the charcoal becomes moist, not only is its function as a deodoriser abolished, but it acts as an obstruction to free ventilation.

II.

SEWAGE.

The sewage of London is purified entirely by precipitation, which is accomplished by the following process. On reaching its point of exit from the outfall, the crude sewage passes through an iron grating fixed over the mouth of the sewer, which detains the bulkier portion of the

suspended

suspended matter. There are two of these gratings, one in front of the other, which are alternately raised and lowered, the clean one being put into position before the other, with its filthy cargo, is raised. All sorts of rubbish, comprising paper, fat, rags, animal refuse, &c. are removed by this means, though it is unusual to find recognisable faeces among the débris. This material is removed from the barriers by men provided with rakes, after which it is gathered into heaps, and, when the moisture has to some extent drained off, shovelled into trucks and transferred to a 'destructor' some 80 or 100 yards off, in which it is burned.

The partially purified sewage is then treated with lime water which is manufactured as follows. From 2 to 3 tons of lime are slaked in a tank by the addition to it of crude sewage and of the liquor which separates from the precipitated sludge as will be explained further on. When the lime is converted into a thick paste, the full supply of sewage is turned on, and the lime thoroughly incorporated with the water by means of 'mixers' with which the tank is provided. The milk of lime so formed is transferred to the 'lime-ponds' where it is allowed to settle for a few hours, and the resulting lime water is then pumped up into a large tank from which it flows into the

sewers,

sewers, from 4 to 6 grains of lime being thus added to each gallon of sewage. A little later on a solution of protosulphate of iron of a strength sufficient to represent the addition of one grain of the salt to each gallon is added, and the whole of the liquid conveyed to the precipitating tanks.

The action of the precipitants is said to be as follows. The lime, combining with the free and partially combined carbonic acid, and also with some of the organic matter of the sewage, forms salts which entangle the suspended matter, while "the addition of a small quantity of protosulphate of iron as an additional precipitant is highly beneficial ..... The lime secures the precipitation of a highly flocculent hydrated peroxide of iron" which acts as an oxidising agent and as a precipitant as well. (Stevenson, quoted in Corfield's Treatment and Utilisation of Sewage p.345, 3rd. Edit.)

The following description applies to the precipitation works at Barking, those at Crossness being, in all important respects, of a similar character. There are 13 precipitating channels or reservoirs into which the sewers discharge their contents through 26 weirs or penstocks, the apertures of which each measure 7 feet by 6, and are closed and opened by hydraulic pressure. The

precipitating

precipitating channels, which are situated underground, are each 30 feet in width, and from 860 to 1210 feet in length, and are capable of holding nearly 200,000,000 gallons. In each tank a wall or weir of solid masonry, 8½ feet in height, is built near the end furthest from the sewers, and they are brought into use in rotation as they are required. The sewer penstock having been opened, the chemically charged sewage rushes in until the reservoir is full, when the penstock is closed sufficiently to regulate the balance between the ingoing sewage and the outgoing effluent. In this way the contents of the reservoir are rendered practically stagnant, the solid material sinks, and the purified effluent trickles over the weir and so into the river. When this process has continued for from 24 to 48 hours, the inflowing sewage is cut off by closure of the penstock, the watery portion below the level of the weir is drawn off, and the precipitated sludge is pumped up into the settling channels where it remains for about 12 hours. At the end of this period, the supernatant liquid, which is excessively foul, is pumped back to the liming station, where it again undergoes treatment and re-enters the sewer with the lime water. The remaining sludge, which contains 90 per cent. of water, is conveyed

veyed to a large chamber near the river bank, from which it is pumped up by sludge engines and discharged into the sludge steamers for conveyance out to sea. It is hardly necessary to remark that the tanks are thoroughly cleaned out after each charge of sludge has been removed, and it should be added that the effluent is treated with permanganate of potash during hot weather, on account of its oxidising and deodorising qualities.

At the present time there are 5 steamers employed in the removal of the sludge, each carrying a cargo of 1000 tons, which is ultimately discharged into the estuary of the Thames fifty miles from the Sewage Station. The engineers of the London County Council report that the total cost of the present treatment of sewage is "$27/9^{d}$ per million gallons, of which about $^{9}/-$ is due to the cost of manipulating and pumping the sludge from the stores into the ships, and conveying it fifty miles down the river to Barrow Deep" (Joint Report on the Main Drainage of London by Sir B.Baker and the Chief Engineer of the London County Council.)

The practical result of all this is that the Thames, instead of being an open sewer as it was while the whole of the sewage was discharged into it unaltered, is

now

now a comparatively clean river. The beach which, until the beginning of 1892, was hidden for miles under a deposit of foul mud averaging in places many feet in depth, is now becoming visible and will shortly be uncovered; and the smell, for which the locality was famous, has entirely disappeared. As a matter of fact the effluent contains a smaller quantity of suspended matter than the water of the river itself, and during a recent cruise in the immediate neighbourhood of the two outfalls, so far as the evidence of the senses was concerned, one might have been many miles distant from the Metropolis.

III.

SEWER MEN AND THEIR DISEASES.

The occupations engaged in by the men employed in sewerage work vary in kind, and in the degree to which they expose the workers to the emanations from sewage. Flushers, penstock-men, valve-men, weir-men are brought into actual contact with the sewage to a greater extent than engineers, fitters, blacksmiths, carpenters, cleaners, drivers, stokers, watchmen, store-keepers, time-keepers, iron-mixers, and lime-mixers who, nevertheless, are constantly inhaling

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the effluvium which is so characteristic a feature of the atmosphere of sewage works. The work which, of all others seems the most unpleasant, is that of removing the filth which accumulates on the gratings placed over the mouths of the sewers; though some of the penstock-men who bend for hours at a stretch over the flap-valve of a sewer, in a space in which they can hardly stand erect, are not to be envied. The duty of the penstock, valve, and weir-men consists in regulating the flow of sewage through certain apertures, while the flusher assists onwards the muddy material with which the invert of the sewer becomes coated, and removes the sand which also accumulates at various points to a very considerable extent. He also cleans out the precipitating channel after the sludge has been disposed of; and all these men work in a warm, damp, evil-smelling atmosphere, the temperature of which is seldom below 70°F. The functions of the remainder of the workmen hardly require explanation, though it must be remembered that they are all in more or less close contact with the sewage, and are liable to the deleterious consequences, if such exist, of breathing sewer air.

The workmen who are actually engaged in the sewers are provided by their employers with the following articles

of clothing, viz:- a thick serge coat coming down to the middle of the thigh, thick woollen stockings which are worn over the usual boots and trousers, and strong thigh-boots made of hide, which are, or ought to be, impervious to moisture. The penstock-men work 47 hours per week, and the flushers 52½, while the fitters, engineers, and blacksmiths work 54. The minimum wage is 30/- per week, which, taking into consideration the fact that it is earned by unskilled labour, will bear favourable comparison with the pay which other untrained workmen receive. During sickness not traceable to the nature of the occupation, and not dependent on intemperance or misconduct, the men receive half pay; if due in any way to the work in which they are engaged, full pay is allowed. It was stated to me that one half of the sewer men employed at Barking are total abstainers; but almost to a man they have a strong belief in the health-preserving properties of tobacco, smoked and chewed. With the exception of the foremen and a few of the responsible officials who live on the premises, these men have their homes at some distance from the works, though there are rooms and appliances provided for washing, cooking, and eating. The actual time that the flushers spend in the sewers without coming to the

surface

surface varies very much according to the nature of the work, but it is seldom for more than three or four hours at a stretch, and often for a much shorter period. There is never any difficulty experienced in finding men ready to undertake the work, the applicants being always more numerous than the vacancies.

The question as to whether sewer-men are more liable to disease than other workers is one which has never been satisfactorily determined. The literature of the subject is scanty. Thackrah in his book on the effects of Trades on Health, published in 1832, looks upon the occupation as a healthy one, and states that it has no tendency to shorten life. Parent Duchâtelet in a treatise published in Paris in 1836 is of a similar opinion. Dr. E.A.Parkes (Practical Hygiene p.166) says that "It does not appear, therefore, that workmen connected with fairly-ventilated sewers show any excess of disease; at the same time it must be allowed that the enquiry has not been very rigorously prosecuted". Dr.L.Parkes (Hygiene & Public Health p.203) states that "Inquiries have been made from time to time into the health of sewer-men ..... The result of such investigations lead rather to the belief that the constant breathing of sewer air is not injurious

to

to health and life. But it must be remembered ..... that these enquiries have not been very exhaustive." In the London Medical Record for 1877, p.161, there is a report to the Academy of Medicine in Paris by M.Bouley to the following effect". 1. The workmen employed in the sewers, exposed to all the morbid influences supposed to emanate from sewage, have very good health; and it is not found that, during epidemics, the number of cases of prevailing disorders occur amongst these workmen in the increased proportion which would show an increased intensity of the influences to which they are exposed. 2. No cases of disease have been described as occurring among persons visiting the sewers, such as might be attributed to the inhalation of sewer-emanations. 3. The workmen who are employed at the sewage depôt at Bondy remain free from the prevailing epidemic diseases." In the latest work on Diseases of Occupations, that, namely, by Dr.Arlidge, there is no mention of the subject.

The proposition that sewer air, under certain conditions, is poisonous to men is one which experience has shown to be incapable of contradiction. The nature of the poison varies in different cases, and depends greatly on the character of the material discharged into the sewers, and on their ventilation, and the rapidity of flow

of

of their contents. The oxygen of the air may be normal, or diminished in amount, while the carbonic acid may be increased. Hydrogen sulphide and ammonium sulphide, both of which are highly poisonous gases, are sometimes present (Letheby, Encycl: Brit: 8th.Ed. Article Sanitary Science). The most important constituents, however, are the organic vapours, and living organisms, (bacteria and fungi) whose presence has lately been demonstrated by the researches of Carnelly and Haldane. They have shown (Phil. Trans. CLXXVIII page 61. 1887) that in sewers where ventilation is good, the number of bacteria is small and may even be less than in the outer air; and that this depends on the moisture invariably present, which as it were, fixes the germs to the sides of the channel, and prevents their diffusion through the atmosphere. Where there is defective ventilation and rapid fermentation, however, accompanied by stagnation of the sewage, the bursting of bubbles of gas is very apt to send a shower of bacteria into the surrounding air, which is productive of serious consequences to those inhaling it. "The organic vapour is carbo-ammoniacal; and the putrid substance in the water appears, from Odling's observations, to be allied to the compound ammonias" (Parke's Pract: Hygiene, p.164.)

The diseases to which sewer-men are supposed to

be

be especially liable are throat affections, diarrhoea, dysentery, digestive disorders, enteric fever, pyrexia, pneumonia, erysipelas, anaemia, lumbago, sciatica, opthalmia, and skin diseases; while according to Parent Duchâtelet venereal disorders are exceptionally dangerous and troublesome.

It may be as well, first of all, to discuss the question of the liability of sewer-men to contract enteric fever, and the state of opinion cannot be better expressed than by quoting Prof. Parkes (p.168 loc.cit.) "It has been denied by Parent Duchâtelet and by Guy that enteric fever is more common among sewer-men than others, and later enquiries among the sewer-men of London seem to bear out the assertion. But, as already stated, the air of London sewers is really tolerably pure; and some of the men may be protected by previous attacks, for enteric fever is a most common disease among the poorer children in London. Murchison and Peacock also stated, on the other side that enteric fever was not uncommon among sewer-men". On this point also M. Gueneau de Mussy stated (L.M.Rec.1877 p.161) that "of 32 workmen in sewers, whose health he had under observation for six months, four (or one in eight) got typhoid fever". In 1872 the London Metropolitan Board of Works instituted an enquiry into the

number

number of men employed in the Board's sewers who had been attacked by fever. An analysis of this return shows that of 283 men so employed, eight had intermittent fever, four typhus, and two enteric, during the period they were employed by the Board. The average duration of service of these men amounted to 9½ years each; and of the two medical officers in charge at that period, one stated that in his 4 years' service he had not seen one case of enteric among the men or boys employed on the works, while the other had only seen one, who, nevertheless, was able to return to his work at the end of a fortnight.

Of 51 men whom I examined personally, of whom 37 were employed in the sewers and 14 on the works outside, and whose average term of employment amounted to 5 years, not one had ever had the disease; and the same state of matters appears in the case of 199 men employed at Barking, the data including all illnesses from Jan.1 1891 to Oct.30 1892. It thus seems to me, that regarding enteric fever at all events, the liability to contract it is not in any way increased by working among the sewage; for of the men that I examined, certainly two-thirds were between the ages of 25 and 35, during which there is, perhaps, a greater tendency to be affected by the disease than at any other period of life. It is impossible to suppose that all

these

these men could have had, without being aware of it, a previous protective attack.

The cases of intermittent fever occurred exclusively among the men employed at Crossness, which, at that time, was a regular swamp; but since its drainage and consequent drying, ague has become a thing of the past.

Regarding the other diseases it may be as well at once to give the results of the investigations I have made. These approach the subject from two different standpoints:- the first embracing an enquiry into, and analysis of, all cases of illness among 199 sewer men employed at the Barking works over a period extending from Jan.1, 1891 to Oct.30, 1892; the second being a personal examination of 51 men at the Barking and Crossness Works as to their general health, the length of time they have been employed, the diseases they have suffered from during their service, and the diseases from which they have been exempt.

As regards the first, the results can easily be seen by an examination of the following Tables:-

Number

Number of Men Employed,

199

In the Sewers		Outside the Sewers	
Flushers and Penstock-men..	60	On the Destructor	3
Filth-hoist and grating men	27	Engine-drivers & cleaners...	12
Handy men	6	Engineers	3
		Lime-Mixers	15
		Iron-Mixers	9
		Men employed in unloading lime	12
		Labourers, carpenters, store-keepers, cleaners...	52
	93		106

During these 22 months there were 178 cases of illness of sufficient severity to enable the Medical man in attendance to certify that the sufferers were unable to follow their employment; and of these 97 occurred in 1891 and 81 in the first 10 months of 1892. The 97 attacks of illness in 1891 were distributed over 76 men, and the 81 in 1892 over 66 men, from which it will be seen that, taking as the basis of calculation the number of illnesses, these amount to 48 per cent. per annum; while reckoning according to the number of men attacked, the percentage is 38.

Further, of the 76 men who, in 1891, had 97 attacks of sickness, 44 were outside and 32 inside the sewers; of the 66 affected in 1892, 35 were out and 31 in; while

among

among a total of 106 employed outside there were, in these 22 months, 102 cases of illness, the 93 men who were working inside the sewers being laid aside only 76 times.

This can be made more intelligible by reference to the following Table:-

	Jan 1st to Dec 31st 1891		Jan.1 to Oct.30.1892	
Number of men employed	199	Inside 93 Outside 106	199	Inside 93 Outside 106
" " ill	76	Inside 32 Outside 44	66	Inside 31 Outside 35
" " illnesses	97	Inside 41 Outside 56	81	Inside 37 Outside 44
Percentage per annum of illnesses	48	Inside 44 Outside 53	47	Inside 45 Outside 48·6
Percentage per annum of men ill	38	Inside 34·4 Outside 41·5	38	Inside 38·7 Outside 38·7

Deducting from the above, 38 cases of influenza which may be looked upon as an accidental occurrence, and which affected equal numbers of men in each period, a reduction of 10 per cent. must be made both as regards the number of illnesses, and the number of men who suffered.

In

In that case the final result will be 38 per cent. for the former, and 28 per cent. for the latter.

Among a body of men numbering 433, with which I am personally connected, and representing all kinds of trades, I find that during 1892 there were 125 separate attacks of illness causing cessation of work, the average duration of each being 3 weeks. This makes a percentage of 29 illnesses as against 48 for the sewer-men, for of course both bodies of men suffered equally from exposure to the Influenza poison.

The average duration of each case of sickness among the sewer-men was $14^{1}/3$ days; among the other men it was 3 weeks. There were 2 deaths in nearly two years among the former, and four among the latter in one year. The fatal result in the 2 sewer-men who died was caused by pneumonia in the one case and what is called colic in the other - probably some form of acute intestinal obstruction. Among the sewer-men during the period under consideration, one man was pensioned off on account of chronic bronchitis, another left because of ill-health, another became insane, and four were discharged through drunkenness.

The following is a Tabulated account of the diseases under discussion:-

Diseases

Diseases affecting the Alimentary Tract

14·7 per cent.

Name	Number of men attacked	In Sewer	Outside Sewer
Perityphlitis	2	1	1
Diarrhoea	11	8	3
Dyspepsia	4	4	-
Colic	4	1	3
Gastritis	3	2	1
Intestinal Catarrh	2	-	2
	26	16	10

Rheumatic Disorders

11·2 per cent.

Name	Number of men attacked	In Sewer	Outside Sewer
Sciatica	3	3	-
Lumbago	7	3	4
Artic. Rheumatism	3	-	3
Musc. "	2	-	2
Neuralgia	3	-	3
Pleurodynia	2	1	1
	20	7	13

Diseases affecting Respiratory Tract

30.6 per cent.

Bronchitis	13	3	10
Pleurisy	2	-	2
Pneumonia	1	1	-
Congestion of lungs	1	-	1
Laryngitis	1	-	1
Asthma	3	-	3
Catarrh (Feverish cold)	16	9	7
Tonsillitis	10	5	5
Sore throat	7	4	3
	54	22	32

Zymotic diseases 21·9 per cent

Influenza	38	18	20
Ague	1	-	1
	39	18	21

Various diseases

23 per cent.

Inflamed Salivary glands	2	1	1
Piles	3	1	2
Alveolar abscess	2	2	-
Urethral stricture	1	1	-
Congestion of Kidney	1	1	-
Carbuncle	2	2	-
Conjunctivitis	2	-	2
Varicose Ulcer	1	1	-
Epilepsy	1	-	1
Gout	7	1	6
Injury	19	5	14

The names of the diseases are those on the certificates furnished by the medical men in attendance.

The second investigation, as already remarked, embraces an enquiry into the general health, length of service, and nature of the diseases, of 51 sewer men employed at Barking and Crossness. The following tabular statements speak for themselves.

Number of men examined 51 (Inside the sewers 37
(Outside the sewers 14.

Never off work through illness

IN			OUT		
No.	Number of years employed	Remarks	No.	Number of years employed	Remarks.
1	2		20	3	
2	2		21	3	
3	24		22	1½	Indigestion occasionally
4	45		23	3	
5	3	Occasional colds	24	½	
6	3	do.	25	3	
7	1½	Bad appetite	26	3	Sore throat occasionally
8	1¼	do.			
9	2	Sickness & diarrhoea			
10	1/3				
11	4	Occasional giddiness			
12	12	Diarrhoea at first			
13	½				
14	2	Sore throat at times			
15	2	Sick occasionally			
16	¾	Suffers from boils			
17	3	Colds, diarrhoea at times			
18	2	Colds			
19	2	Diarrhoea			

Once off work through illness

IN			OUT		
No.	Number of years Employed	Nature of illness	No.	Number of years employed	Nature of illness
27	3	Influenza	36	3	Sore throat
28	17	do.	37	2½	Sickness & diarrhoea
29	3	Quinsy	38	3	Sore throat, occasional
30	3	Pleurisy	39	3	Influenza (colds
31	3	Influenza: colds at times			

Once off work through illness (continued)

IN			OUT		
No.	Number of years employed	Nature of illness	No.	Number of years employed	Nature of illness
32	3	Rheumatic fever, colds at times			
33	3	do. do.			
34	15	Piles			
35	14	Diphtheria: diarrhoea at times.			

Twice off work through illness

40	3	Influenza: Diarrhoea	No.45	3	Abdominal pain.
41	3	Sore throat: do.			
42	8	Boils: sore throat			
43	4	Lumbago			
44	½	Lumbago: sore throat.			

Off work through illness more than twice.

46	2	Rheumatism, 3 or 4 times	No.50	3	Diarrhoea 3 times
47	3	Diarrhoea 4 times	51	3	'ulcerated throat' 4 times
48	3	Do. 3 times			
49	27	Gout several times.			

The majority of sewer men are more or less anemic and sallow, this being, no doubt, partly due to their working under conditions which exclude the sunlight. It may also be in part due to the deleterious effects of the gases which are inhaled, upon the red blood corpuscles, or to the diminished supply of oxygen which is present in the air. A common experience when a man first enters upon the work is that he is affected by a peculiar feeling of breathless-

ness

ness and giddiness, attended by what is described as a 'sinking sensation', which pass off in the course of two or three days, and seem to be dependent on deficient aeration of the blood. Sickness and diarrhoea are not uncommon, and a loathing for food is often felt which seems to be due to the indescribable odour which pervades the whole atmosphere. But having overcome these preliminary discomforts, the men attach the very slightest importance to sewage or sewer air. As an example of this the Manager of the works informed me that one of the foremen was frequently in the habit of showing to visitors his contempt for the fluid by drinking a tumblerful of raw sewage. The man is now dead, but from causes unconnected with his fondness for that kind of liquor. I am told, also, that it is quite a usual thing for the workmen to eat their meals in the sewers, to save themselves the trouble of coming up to wash their hands.

The only thing of which any serious complaint is made, is the great tendency exhibited to what is called 'catching cold'. This is not apparent from the Tables to anything like the extent to which it exists in reality, for few of these men could think it worth their while to lose half a week's pay on account of a common cold. With

very

very few exceptions the workmen examined by me testified to the truth of this, and the reason is not far to seek, for the temperature of the air in the sewers, owing to the constant entry of hot water &c., is considerably above that of the outer atmosphere, being seldom below 70°F.

In the foregoing Tables the principal causes of inability to work are

Injury	11	per cent.
Pulmonary disorders	20	"
Tonsillitis and sore throat	10	"
Rheumatism, Lumbago & Sciatica	11	"
Diarrhoea, gastric & intestinal disorders	14	"
Influenza	22	"
Various	12	"

Of these, of course, injury is not specially due to working among sewage, and influenza, as already said, is an accident, and may not occur again for years. Regarding the others it may be said that by proper attention to clothing, and the avoidance of draught and cold as far as possible, the cases of bronchitis and catarrh, lumbago, sciatica, and rheumatism might be very greatly diminished in number.+

Tonsillitis, sore throat, and diarrhoea prevail to a considerably greater extent among the men inside the

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+ Parkes (loc cit.p.164) observes "Bronchitic affections are frequently produced, which are often attributed to the change from the hot room to the cold air, but are really probably owing to the influence of impure air on the lungs".

sewers

sewers than among those outside; and are in all probability due to the entrance into the system of some poisonous bacteria or other accompaniment of decomposition. Another point to note is the almost total absence of zymotic disease, with the one exception of influenza, which does not show a larger proportion of victims among sewer-men than among other classes of the community. There was no erysipelas, no enteric fever, and only one case of diphtheria which occurred at Crossness, and does not therefore appear in the first series of Tables.

I could find no trace of skin disease of any kind, though the lime-mixers complain of a slight dermatitis on hot and windy days. Boils and carbuncles on the wrists and arms were complained of in three or four instances. Ophthalmia is almost unknown though carefully enquired for, the only two men who suffered being, respectively, an iron-and a lime-mixer. Dysentery had not existed in any of the cases examined, while of venereal disease, whether owing to an excess of virtue or a disregard for truth, I could only find one case of gonorrhoea, which seemed to have pursued a normal course.

The conclusions at which I have arrived may be stated shortly as follows:-

That

1. That there is a larger proportion of illness among sewer-men than among other bodies of workmen.

2. That there is a remarkable freedom from diseases to which sewer-men might, prima facie, be considered liable; the absence of bacterial agencies being due, no doubt, (a) to the moisture in the sewers preventing diffusion of the organisms, (b) to the care exercised in regard to sewer ventilation.

3. That a majority of the other affections might, with increased knowledge and care on the men's part, and attention on the part of the authorities to the proper clothing and shelter of their workmen, be considerably reduced in number.