

THE DISPOSAL OF SEWAGE IN RURAL DISTRICTS.*

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THE subject-matter of the paper, I am sure you will allow, is very important. "The disposal of sewage in rural districts" is not only a matter for serious consideration, as regards the health of individuals residing in the country, but from the fact that large towns draw their water-supplies from a distance, and that the gathering grounds for such water-supplies are situated in rural districts, and are subject at times to pollution from defects connected with disposal of sewage. Again, too, as towns obtain their milk from rural districts, it is necessary that the sewerage in connection with farms should be above suspicion. All wells and ponds should be protected from pollution by sewage, because often water from such sources is used for washing churns and cans, such water not being at all times boiled. During summer months also persons from towns seek rest and quiet in the country. It is necessary, then, that the question of sewage disposal in rural districts should receive great attention. From my experience, I cannot say that rural sanitary authorities are behind the times as regards sanitary matters. They are keenly alive to the necessities of the advance of sanitation, and find their duties in relation to providing means for dealing with the sewage of a district extremely onerous and likely to bring them into bad odour with their constituencies.

The expense entailed in connection with any scheme for dealing with sewage, however small, is usually enormous in comparison with the rateable value of the district. The decreasing population and the depreciation in value of land are factors which no doubt have the effect of slackening the zeal of sanitary authorities, and allowing their enthusiasm to grow cold. Moreover, I am afraid that in many instances the want of uniformity of opinion among sanitary experts, as regards the treatment of sewage and the elaborate and costly schemes put forward by engineers, have a deterrent effect on the activity displayed by rural district councils. It is not always possible to demonstrate to a council with a very small rateable value that the expenditure of a sum of from £3,000 to £4,000, even when borrowed for a long period of time, is a good investment from a sanitary point of view. The question of finance in such a case is a serious matter to face.

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The legal aspect of the subject of disposal of sewage in rural districts is as follows : By Section 23 of the Public Health Act, 1875, a rural sanitary authority is empowered to enforce the drainage of undrained houses. Either the house must be drained into a sewer, cesspool, or other place. It is unfortunate that the word "cesspool" is used, because rural authorities have no power to make bye-laws dealing with the construction of cesspools unless they adopt Part III. of the Public Health Acts Amendment Act, 1890.

By Section 40 of the Public Health Act, 1875, every sanitary authority must provide that all drains, water-closets, privies, and cesspools within its district are constructed and kept so as not to be a nuisance or injurious to health.

As to scavenging and cleansing : By Section 42 of the same Act every local authority may, and when required by the Local Government Board shall, itself undertake or contract for the removal of house refuse, faecal matter, and other filth ; and Section 44 gives power to sanitary authorities where they do not remove refuse, etc., or contract for removal, to make bye-laws imposing the duty of cleansing earth-closets, privies, etc., on the occupiers of the premises.

It is undesirable that the removal of refuse, etc., from houses should be undertaken by individuals in places where a number of houses are situated, for the following reasons :

1. The work is not done satisfactorily.
2. Supervision, which must be constant, is objected to, unpopularity follows the inspector, and time and energy are wasted.
3. Constant litigation is the result of compulsion.

In districts where the houses are few and far between, it may be just not to saddle the cost of scavenging, cesspools, etc., on the rates. Where this is the case, bye-laws should be made dealing with these matters under Section 157 of the Public Health Act, 1875, where Part III. of the Public Health Acts Amendment Act, 1890, has been adopted by rural sanitary authorities.

Where one water-closet, earth-closet, or privy is sufficient to the satisfaction of the sanitary authority for two cottages, there is no power given to provide one for each house. The definition of an earth-closet in the Public Health Act includes any place for the reception and deodorization of faecal matter, constructed to the satisfaction of the sanitary authority. By Section 11 of the Public Health Acts Amendment Act, 1890, ash-pail-closets, so frequently in use in the country, are included in the term "ash-pit."

In rural districts where the water-carriage system has been adopted, no provision is made for keeping water-closets supplied with sufficient water for flushing purposes. A water-closet cannot

be a proper and sufficient water-closet unless it is supplied with a flushing cistern; therefore if such a building is certified by the proper official not to be provided with a flushing apparatus, and not a sufficient water-closet, the sanitary authority may in the first instance decide whether the water-closet is sufficient, and may take action to enforce a flushing cistern. Action may also be taken under Section 94 if the closet can be shown to be a nuisance by reason of the want of a flushing cistern. Under the Public Health Acts Amendment Act, 1890, bye-laws may be made with respect to keeping water-closets supplied with sufficient water for flushing, provided Part III. of such Act has been adopted by the sanitary authority.

Thus, a rural sanitary authority may obtain all the powers possessed by an urban authority in regard to sewerage and scavenging by an easier process than formerly.

If a local authority fails to perform its duty in regard to the matter of sewerage, complaint may be made to the Local Government Board under Section 229, or similar complaint may be made to the County Council by the Parish Council or the Parish Meeting. In the former case, if the Local Government Board, after due inquiry, is satisfied that there is need of sewerage works, they may order the work to be carried out, and enforce their order by mandamus. In the latter case the County Council may do the work themselves.

An important matter in a rural district is the cost of works. If a village has to be seweraged, who is to pay for it—the whole district or that portion benefited?

Money may be borrowed through the Local Government Board for a period of fifty years when for purchase of freehold land, and thirty years for construction of sewers. Shorter periods are fixed for various works, such as laying out farms, etc. If the land be leasehold, the loan will not be granted for a longer period than the term of the lease. On the recommendation of the Local Government Board the money may be advanced at a reduced rate of interest by the Public Works Loan Commissioner.

As a rule, in rural districts the cost of sewerage and sewage disposal works are charged on the separate parishes or parts of parishes. The areas formed are called contributory places. There are four kinds of contributory places:

1. A rural sanitary authority, by resolution approved by the Local Government Board, may constitute any portion of its area a "special drainage district";

2. Where no part of a parish is situate in a special drainage

district or in an urban district, the whole parish is a contributory place ;

3. Where no part of a parish is in an urban district, but part is in a special drainage district, the part not in such special drainage district is a contributory place ; and

4. Where part of a parish is in an urban district and part in a rural, that part not in an urban or special drainage district is a contributory place.

The expenses in each contributory place are termed "special expenses"; and in any rural district, after the adoption of Part III. of the Public Health Acts Amendment Act, 1890, the Local Government Board may on application declare any expenses incurred by the sanitary authority special expenses. Such expenses may be a charge on any contributory place. In considering the question of making contributory places, it should be borne in mind that it is difficult to create an area, except by exercising great care, without causing hardship to some. Care must also be taken to make the area wide enough to allow for future developments. Land-owners are charged at the reduced rate of one-fourth. These considerations considerably affect the question of sewage disposal in rural districts.

In the disposal of the sewage of villages and isolated houses, a clear idea must be first had of what the sewage consists of. There are the ordinary solid and liquid excreta, together with house-slops, washings from dairies and yards, and liquid and solid manure with litter from cowstalls, stables, and pig-pens.

The filth from farmyards is, as a rule, allowed to gradually soak away in an unpaved and undrained yard, or is washed by repeated rains into the nearest watercourse or pond. Farmers consider it necessary that cattle should thoroughly tread the straw and other litter into liquid manure, in order to render straw more easy to undergo decomposition in the ground. While such process is taking place, the cattle may be seen standing in the liquid filth. If milch cows, the splashing of this water adheres to the udder, and at milking-time may easily become mixed with the milk. There is little chance for the beneficent forces of Nature to purify the condition of such a yard, it being a constant swamp. That alternate wetting and drying of the soil so essential for the complete oxidation and renewal of living organisms never takes place. The farmer will not listen to the suggestions that stinks and the evaporation of ammonia mean direct monetary loss. The land is deprived of the value of manure as long as it is kept off the fields. It is reasonable to believe what the farmer says: the manure must wait until the land is ready to receive it, or the time convenient to remove it.

Why is it necessary to make provision for the disposal of excrement? Those of us here present know, in the light of recent investigation, the dangers arising from the soil near dwelling-houses being continually polluted with sewage matters. It has been especially demonstrated by the investigations of Dr. Sydney Martin and others, that the *Bacillus typhosus* grows and spreads in ground sodden with the contents of privies, leakage of sewage, and overflows from cesspools, and that it will not grow in virgin soils, either sandy or peaty.

The prevalence or absence of typhoid fever in a district will frequently guide us in forming an opinion as to the relative advantages or otherwise of a partial form of sewage disposal. Although it has been stated that a continual residence in a filth-sodden soil produces an immunity, it has been recently shown by Dr. Boobyer that the incidence of typhoid fever is heavier on houses with dry-closets than on those with water-closets, and among the former on those with middens than on those with pails, the difference being more marked the poorer the class of inhabitant. In rural districts typhoid fever is not so prevalent as in urban districts, and it has been shown by experiment that vegetation prevents the growth of the organisms, such as the *Bacillus typhosus*.

Of the 26 cases of typhoid fever which occurred in 8 rural districts with a population of over 94,000 persons during the year 1898, in the East Sussex Combined Sanitary District, in 5 the probable cause was traced to infection from other districts; in 6 the cause could not be assigned; and 15 were attributed to direct personal infection from previous cases in the same family or village. The first of these 15 cases was probably contracted through emptying an old privy which was known to have received, three years previously, the excreta of persons ill with the disease. The privy was of the soak-away pattern, and had not been cleaned out during that period.

Of these 26 cases, 7 occurred in houses with water-closets, flushing cisterns, and drains; 5 in houses with hand-flushed water-closets and cesspools; 9 in houses with privies and middens; and 5 occurred in houses with pail-closets, where the excreta were buried in various parts of the garden. Such diseases as diphtheria, diarrhoea, and perhaps scarlet fever, may be favourably induced by a state of pollution of soil.

The common form of disposal of sewage in rural districts, both for isolated houses and some villages, is that known as the midden-privy system, a form of conservancy. Such privy consists of a wooden building, provided with a seat, under which is an excavation in the ground, extending some 2 feet beyond the rear of

the building. This space is at times loose-bricked, at times covered with a few old rails, or iron sheets. It is generally full and overflowing, the solids, liquids, and paper flowing down the garden into a ditch or a stream, and the air permeated with a strong smell, consisting of organic vapours with H_2S , CH_4 , CO_2 , and H gases. The house slops of all sorts are thrown, as the housewife tells you, just outside the back-door. The place can easily be identified, for the hot water, mixed with soda and soap, kills vegetation, and produces a slimy appearance on the ground. The house is usually occupied by a number of exceedingly poor persons, who find little time for anything but work and sleep. The garden varies in size, sometimes large, at times small, at others a mere yard. Now, in such a typical example as above in a detached cottage, provision must be made for disposal of solid and liquid excrement and house slop-water. The privy should be constructed according to the model bye-laws, viz., at least 6 feet from any dwelling, and 40 or 50 feet from any well, spring, or stream, with means of access to allow of its being emptied. The privy must be roofed to keep out rain, and provided with ventilating openings as near the top as practicable. That part of the floor which is not under the seat must be not less than 6 inches above the level of the adjoining ground, must be flagged or paved with hard tiles, and must have an inclination towards the door of the privy of half an inch to the foot. The capacity of the receptacle under the seat of the privy must not exceed 8 cubic feet, a weekly removal being thus necessitated. The floor of the receptacle must be in every part at least 3 inches above the level of the adjoining ground, and the sides and floor of impermeable material. They should be flagged, asphalted, or constructed of 9-inch brickwork set and rendered in cement. The seat must be hinged. It is somewhat difficult to persuade an owner to expend sufficient money in order to build a proper privy. He tells you that the property does not pay, and that he would prefer to close the houses. Frequently a pail is substituted. If this pail be kept emptied and clean it is sufficient to meet the necessities of the case, when the gardens are large enough to allow the contents to be buried. For the treatment of house slops and kitchen water it is necessary to provide a gutter leading to a pipe that at some distance from the house discharges into a grip cut in the ground and allowed to soak away, or a filtration gutter as suggested by Dr. Poore should be built. The slops are collected in a channel which may vary in length from 10 to 20 feet, and then discharge on this filtration gutter. The construction of this gutter is as follows: Dig out a trench 2 feet deep, 18 inches wide, and of a length vary-

ing with circumstances; fill this trench with broken crockery, builder's material (rubbish), old tins and stones, and upon this rubbish, previously rammed, walls of cement concrete or honey-comb brickwork are formed, provided with a ledge sufficiently wide to support a perforated tile. The porous material reaches to within an inch of the under surface of tile, and the sides of the gutter are planted with shrubs. It is necessary that the gutter should have sufficient fall. It is stated that such a gutter does not become foul, and that the water at the far end is, to all appearances, not unpleasant to sight or smell.

Other conservancy systems which are in use in villages and detached houses are: (1) Earth-closets in better-class houses, and (2) pail-closets.

The objections to these are that they do not provide means for disposal of slop-water, and that they require attention and ground for disposal of contents. This attention is ineffective unless a man is employed by the sanitary authority to supply suitable dry earth and to empty pails. It is difficult to find labour in the country to deal with these matters. Farmers will not have anything to do with human excreta, although the estimated value of the solid matters of night-soil may be greater, weight for weight, than rotten farmyard manure. A form of material which has been used at times in connection with pails and privies to absorb liquid materials and give a better appearance to the sewage when it is carted away is peat or peat moss litter. Farmers may be induced to take the material when thus mixed.

Cesspools.—This form of sewage disposal is looked upon with favour by modern builders on account of taking away all the liquids and solids. Formerly cesspools were not made watertight, but in later years it has been, and now is, more the fashion to build these in conformity with the model bye-laws. In old houses cesspools are to be found under houses and in all directions around houses. Now cesspools are placed at a distance from houses. Cesspools are generally arranged so that one retains the solids, and the liquid overflows into others, from which the liquid is pumped to manure ground. As a rule, overflow pipes are provided leading into the nearest ditch or stream. This overflow is the weakest part of such a system. The plan of the modern drainage of country houses is to copy as near as possible the water-carriage system of towns, with water-closets, baths, and gully-traps. The very essence of such a town system is that all noxious matters are quickly removed from and about the house to a distance. But in the country, where such a system is adopted in connection with cesspools, all the disadvan-

tages of the conservancy system are to be found. In such a variable climate as England, the irrigation of liquid sewage from cesspools throughout the year is impossible, except where there is a large quantity of land. If cesspools are constructed, they should be made watertight; the opening of the inflow pipe should be carried to the bottom of the cesspool. It may be noticed what a small amount of solids remains in a cesspool after a certain time. It may also be noticed that in the cesspool for solids a scum forms on the surface which appears to have the power of arresting the decomposition, as judged by the sense of smell, of the fluid beneath. If this scum is constantly broken up by the inrush of the liquids when the inlet-pipe is placed above the level of the stored sewage, then decomposition quickly takes place, with unpleasant odours. Probably in the scum the active anaerobic class of microbes absorb oxygen from the rapid breaking up of solid remains on the surface of the liquid, and pass it on to the fluid beneath, there to supply the needed oxygen. Again, if odours from cesspools are to be restrained, the less air admitted the better. Of course, all drains leading to cesspools should be well ventilated and trapped.

If country houses are provided with water-closets, baths, etc., then the liquid should be discharged on to filtration-beds, and not retained in cesspools.

Some villages near the sea discharge sewage by means of water-carriage direct into the sea. Such a system is objectionable unless account be taken of the varying currents, so that faecal matter be not returned on to the beach after the lapse of a few hours.

Among the modern systems of sewage disposal on biological lines for detached houses and groups of houses are the septic tank and the bacteria-beds of Dibdin. The cost of construction of the bacteria-beds is not great, and they appear to be effectual. The material may be almost any simple material to be got in the district. Coke, burnt ballast, coal, limestone, shingle, and flints have been used with good results. In the septic-tank system two processes are carried out—liquefaction in the cesspool, and filtration in the bacteria-beds afterwards. This appears to be a disadvantage.

In some rural districts, added to the disadvantage of storing sewage in cesspools near houses, is the system of emptying these cesspools by means of a hose, van, and pumps. The stirring up of the sewage gives rise to unpleasant smells which cannot be subdued by using deodorants. The system is known as the Bexley system. Although necessary, this emptying of cesspools at times in the day, at others during the night, only emphasizes the disadvantages of the cesspool system. These systems dependent on manual labour

are not to be relied upon. Such labour must always be well organized and supervised, and is, moreover, costly.

Rural sanitary authorities are keenly alive to the advantages to be gained to a district by the adoption of the water-carriage system, but its disadvantage is an expense out of all proportion to the number of houses within that portion of the district to be drained.

The essentials of success for a good system of water-carriage are :

1. Well-laid and watertight sewers ;
2. Good water-supply, with flushing cisterns to each closet ;
3. Good fall for sewers, with small-sized pipes, so that sewers may be self-cleansing ;
4. Sufficient land for erection of biological filters ; and
5. Good and continuous management.

This last item is most important.

To summarize. In small groups of houses and detached houses in rural districts there can be no doubt that a well-organized system of pails supplied with dry earth or peat, assuming that the local authority is willing to pay the cost of labour for collecting and disposing of the contents of such pails, is the best system.

On the other hand, where individuals are left to do as they please with the pail-closets, a nuisance invariably follows, harmful to the whole community. Persons, through carelessness or otherwise, are disinclined to take the necessary steps to keep these utensils clean and emptied. It has been calculated that a plot of land of 600 square yards, equal to about one-eighth of an acre, is sufficient for the disposal of the excreta of 600 persons per annum. Any of the various systems of dry earth where properly managed will meet the requirements of a group of houses. The slop and waste water must be got rid of by discharge on to land away from houses or on to filtration-gutters.

Privies and middens properly constructed may be used for detached houses.

In larger villages, and where there is good water-supply, "water-carriage" is the cheapest and most effectual system for dealing with sewage. The disposal of sewage should be on the bacteria-bed system.

Broad irrigation or farming requires a large quantity of land and labour.

Cesspools are an abomination, and should not be tolerated. Overflows from cesspools should not be permitted.

In the disposal of sewage in the country broad irrigation is

generally used. Many acres of land have to be purchased at a large price.

From want of proper ground and sufficient labour, sewage farms are costly and unsatisfactory as a rule.

Chemical precipitation of solids from sewage is a thing of the past, and is not now resorted to.

Intermittent downward filtration on prepared land is sometimes adopted, but the preparation of ground is as costly as the preparation of filter-beds.

Subirrigation is not to be recommended, on account of danger to water-supplies.

Upward filtration, as used in the Scott-Moncrieff cultivating tank, does not appear to give satisfactory results. It is used at times when the nature of the ground prevents any other method being adopted, except by means of pumping.

The septic tank and bacteria-beds of Dibdin, chiefly the latter, are at present looked upon with great favour, and likely to solve a difficult question.

In the paper before me I have briefly touched upon the various systems of sewerage and sewage disposal works in use in the rural districts under my charge. The subject is a wide one, and no doubt others will discuss the various points in the different systems. The failure of a given system is frequently due to imperfect workmanship and bad management.

In regard to cottage property and sewage disposal I have omitted one point. I am convinced that gully-traps in connection with slop-water drains are unnecessary and dangerous to health. They become by neglect miniature cesspools. Open channels should take their place.

I cannot help before closing drawing your attention to that admirable paper in the *Lancet*, the Report on the Water-supply and Disposal of Sewage in Rural Districts (the *Lancet* Special Commission).

A NEW HEALTH RESORT.—It is no small journey to New Mexico, but those requiring a large amount of sunshine in a dry atmosphere at a medium altitude, free from extremes of heat and cold, might do well to try Las Vegas Hot Springs. The springs are situated at an altitude of 6,767 feet; the mean humidity of the air for the past year was 40·82, the total rainfall 15·87 inches, and the mean temperature 49·1° F. On an average twenty-five days' continuous sunshine were recorded in each of the months from September, 1898, to May, 1899. (The meteorological data are from an extract from the Government Weather Bureau.)