THE WATER SUPPLY OF DAIRY FARMS.*

By A. E. PORTER M.A., M.D., D.P.H.,

Medical Officer of Health of the Reigate Rural District.

THE object of these meetings is, I take it, as much for the purpose of exchanging ideas and obtaining assistance as for giving information on any branch of our work in which we happen to be specially interested, and I am very glad to have an opportunity of ventilating a subject which has been exercising my mind for the best part of a year, namely, the degree of purity desirable in water supplies of existing milk farms.

As regards buildings newly occupied, the powers of a local authority are fairly ample, since, not only is a cowkeeper required to give a month's notice of his intention to begin to occupy a new shed, but also he must first make provision to the reasonable satisfaction of the local authority for a proper water supply. If the former requirement is known and enforced, no intending cowkeeper is likely to contemplate the erection of new sheds unless he is fairly certain that the water will be sufficient both in quantity and quality.

There are, however, probably few dairy districts where this section of the Order has been sufficiently enforced in the past, and those of us whose work lies in such a district, are faced with the difficulty of advising our authorities as to which farms are unsatisfactory in this respect, and as to what steps can and should be taken to improve matters.

Section 8 of the Dairies Order is fairly clear on this subject, stating that the supply shall be such as is necessary and proper (a) for the health and good condition of the cattle, and (b) for the cleanliness of milk vessels, and (c) for the protection of the milk against infection or contamination.

Ample though the powers may appear to be, those of us who are in charge of rural districts have to face the fact that a large number of farms rely on wells which, on analysis, would be at once condemned as unfit for drinking purposes, whilst many others would be classed as being of doubtful purity.

Unless we adopt the attractive policy of letting sleeping dogs lie, we have first to make up our minds as to what degree of pollution is sufficient for us to advise our authorities to

insist on a purer supply, and, having solved this problem, we probably find that in some instances there are no reasonable facilities for obtaining a supply that shall be above suspicion. If water mains run through the district it is necessary for someone to decide what constitutes a reasonable distance from which a cowkeeper can be required to lay a service pipe. Opposition on the part of the cowkeepers certainly, and on that of the local authority possibly, can be anticipated if our activities are too pronounced, and it is, therefore, probably a wise policy to take as lenient a view as is compatible with the public safety. It is on subjects such as these that I should be grateful for the opinions of the Branch, and, having briefly stated such facts as I have been collecting for some months, I propose to ask for your views on certain specific points.

In all, there are about 100 dairy farms in my rural district; forty-four of these rely partially or entirely on well water, three more on rain water tanks, and one on piped pond water. So far, I have had samples from thirty-four of the supplies, and have examined them bacteriologically. Wherever the result has been unsatisfactory, I have examined the sample chemically as well.

The standards that I usually adopt for well waters are sufficiently lenient. When a considerable number of samples have to be examined in the small amount of spare time available, the quickest and most convenient methods are necessary, and I put 1 and 10 cc. respectively into tubes of McConkey's bile-salt glucose broth in the first instance. If acid and gas is produced, I plate the lowest dilution showing this change on bile-salt lactose neutral-red agar, and apply the so-called "flaginac" test to likely colonies, and also grow the organisms on gelatine for a couple of months. At the same time I test 500 cc. of the water for *Bacillus enteritidis sporogenes*. One ought also, I suppose, to search for streptococci, but I do not. A sample that contains flaginac bacilli in 10 cc. or less, and also *B. enteritidis sporogenes* in 500 cc., I regard as unfit for drinking purposes, and more especially so if *B. coli* is present in 1 cc. If there is no evidence of *B. enteritidis sporogenes*, but *B. coli* is present, I look upon the water as being of a suspicious character, especially if *B. coli* is present in 1 cc. If the McConkey medium is unchanged, I consider the water to be reasonably pure,

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unless *B. enteritidis sporogenes* is present in 500 cc., when the sample is labelled doubtful.

As regards chemical standards, I consider that a reasonably pure well-water ought to contain less than 0.005 parts of free ammonia, and 0.01 parts of albuminoid ammonia per 100,000 nitrates, and the amount of nitrites, are taken into consideration, but the chlorine figure in my district is too variable to be of much service. I do not often estimate the oxygen-absorbed figure. It seldom, if ever, gives a more valuable indication than the albuminoid ammonia, and iron is frequently present in the samples as they reach me.

On this basis, of the thirty-four samples, four only can be considered as pure. Eighteen are bad bacteriologically, and twelve doubtful.

Of the eighteen bad samples fifteen are bad, two good, and one doubtful on a chemical basis. The question arises—should a supply be condemned when the chemical examination is satisfactory, on the bacteriological result?

Of the twelve samples of doubtful bacteriological purity, six were bad, four good, and two doubtful chemically. The question now arises—should a supply be condemned because the chemical results are bad, when complete evidence of pollution is not forthcoming bacteriologically?

To save complications, I will omit from consideration the samples which are doubtful, either chemically or bacteriologically, but passable on the other basis, and will assume that the twenty-four samples that are bad in one or both respects, would be condemned as unfit for *drinking* purposes. A further question now suggests itself—are these twenty-four supplies also unfit for *dairy* purposes? In only two of them is there any obvious source of pollution of human origin, and in the remainder the probability is that the pollution is derived ultimately from the sheds or manure yards, with the exception of the three rain-water tanks, where the collecting areas are no doubt at fault, and of the piped pond-water supply (bad chemically, and only doubtful bacteriologically) where the organic matter is presumably derived from the surroundings.

It will probably be submitted that a water supply contaminated by the drainage from cowsheds is totally unfit for washing cans and similar purposes, and personally I agree, but I can imagine a defence that might succeed in a Court of Summary Jurisdiction, namely

that milk, collected in what must be considered as at least a moderately cleanly manner, on a farm, the water-supply to which is above suspicion, invariably contains bovine foetal bacteria in abundance, and that the minute number of such organisms that can be introduced into a can or churn, which has been simply rinsed out with water slightly polluted by cowshed drainage is of little if any moment. That the first proposition is correct is an undoubted fact. Houston suggests as a standard of clean milk a sample containing not more than 1,000 specimens of *B. coli* per cc., or more than one spore of *B. enteritidis sporogenes* in the same quantity. Dr. Orr, in an extended series of observations in Yorkshire found that 77 per cent. of samples of milk taken at the cowsheds contained one or more *B. coli* in 1 cc., 35 per cent. contained ten or more, and 18 per cent. contained 100 or more specimens of this organism in the same quantity. His suggested standard is ten members of the *B. coli* group per cc. He found that 75 per cent. of the cowshed samples contained *B. enteritidis sporogenes* in 10 cc.

In some experiments in connection with a clean cooled milk supply in Leeds, we found that 24 per cent. of samples as taken from the cow in a specially selected dairy contained ten or more organisms of the *B. coli* group per cc.

With these facts before us, it is obvious that the number of foetal organisms introduced by the rinsing out of pails and churns and the cleansing of cows' udders and milkers' hands with water polluted by cowshed drainage is comparatively negligible in a numerical sense, and, unless it can be proved that the virulence of such organisms is increased by passage through the soil, or storage in a cesspool or well, it seems to me that the defence might be accepted by a magisterial bench. The only obvious answer that suggests itself to me is that without a pure water supply, a pure milk supply is impossible, an answer that might or might not be convincing. If the water is contaminated by *human* sewage, the matter is, of course, a different one.

Another point that I wish to raise is, assuming that the supply is unfit for dairy purposes, what is to be done if there is no obvious prospect of getting a better one? If the mains of a public company run near the farm, the solution is an easy one; but, even in the few rural districts so favoured, the nearest

main may be half-a-mile, a mile, or even further away. On a sandy or gravelly soil, a new well, protected from surface washings, and rendered watertight for the upper fifteen or twenty feet, would presumably yield a water from which most of the sewage organisms had been removed by filtration; but what is to be done in the case of a farm situated on a soil like the Weald Clay, which obtains in the greater part of the district I am considering? Firm pressure will probably result in the farm being closed for dairy purposes, and few rural authorities will be parties to such a procedure. One great difficulty arises from the fact that the Dairies Order throws the responsibility on the occupier, and not the owner, and a large proportion of the farms in my district are held on short leases.

The following two instances may serve as examples:—

No. 1.—A farm of thirty to forty cows, situated on the Weald Clay, fully half-a-mile from a water main, supplied from a well close to the yard round which the sheds are built. The water contains: free ammonia 0.01, albuminoid ammonia 0.03 parts per 100,000, and a large trace of nitrites. *B. coli* is present in 1 cc. and *B. enteritidis sporogenes* in 500 cc. The sheds themselves are well constructed, lighted and ventilated, and have recently been redrained.

No. 2.—A farm also situated on the Weald Clay, 1,400 feet from a water main. Twenty-six cows kept. Supplied from a well about 100 feet deep, and thirty yards from the sheds. Free ammonia 0.03, albuminoid ammonia 0.004, nitrates 1.1 per 100,000, a heavy trace of nitrites. *B. coli* in 1 cc., *B. enteritidis sporogenes* in 500 cc.

Both farms are held on three-yearly leases, and neither of the owners are wealthy. The chances of procuring a suitable supply of water from a new well at any spot conveniently situated would be doubtful, and, under such circumstances, the owners would probably prefer to let the farms for breeding or grazing purposes only.

With your permission, I will now recapitulate the points that seem to me to be of chief practical importance in the form of questions:

1. Is a water supply that shows material signs of pollution, of bovine origin only, necessarily unfit for dairy purposes?

2. If so, should the water be condemned

on the chemical results alone, complete evidence of pollution bacteriologically being absent?

3. Similarly, should the water be condemned on the bacteriological finding, the chemical results being within the limits of a potable water?

4. Assuming that the water is unfit for washing out cans, etc., is it also unfit for cooling purposes? The temperature of a well water in summer is often below that of a public supply, and there is a considerable saving to the farmer, who pays for water by meter.

5. What is to be done in the case of farms, for which there is no better supply reasonably available? What, for instance, may be taken as a reasonable distance from a water main to which the occupier may be required to connect? Farms outside such a distance would presumably be left alone if there were no prospect of improvement in other ways. In connection with Sec. 62 of the Public Health Act, 1875, I believe that the Local Government Board have decided that a quarter of a mile is a reasonable distance.

In taking action that may lead to the abandonment of a farm, the importance of the dairy industry to a rural community must not be lost sight of.

6. Finally, what degree of purity is essential for the health of milch cows, and for the quality of the milk they produce? I have put this last because I am without any information on the point. The average farmer will tell you that cows prefer a stagnant pond water to the finest filtered public supply, and they certainly appear to flourish on beverages that would be condemned by any analyst. Are the bacteria they imbibe excreted in the milk, and do they lose such virulence that they may possess in the process?

The only reference that I can remember to have seen bearing on the subject is from the *British Medical Journal* of as old a date as 1880. A household of a Yorkshire village, ten in number, had lingering illnesses of a typhoid character. They kept their own cow, and her water supply was from a stream into which a water-closet discharged. The cow had had a tedious illness accompanied by wasting. As soon as the cow was sent away the illness in the house stopped. This is, of course, very vague, and does not indicate what is likely to happen when a cow drinks water

polluted by farm drainage. Theoretically, no doubt, a cow ought to have as pure a water as is possible, but even in farms where the general supply is above suspicion, any source seems to be considered good enough for the unfortunate animal.

The points I have raised have been in my mind for a considerable time, and I have not as yet managed to find a solution which gives me entire satisfaction. Consequently I shall be very grateful for any views which will throw light upon them.

POLLUTED OYSTERS.—At the Mansion House on February 15th, William Henry Gunn, of Hillside, Malpas, Truro, was summoned for being the owner of 1,000 oysters exposed for sale in Billingsgate Market, which were unwholesome and unfit for human food. The defendant pleaded "Guilty." Mr. Muskett, solicitor, who prosecuted on behalf of the Fishmongers' Company, said this was the second case of polluted oysters dealt with in that Court during the last two months. Last year the Company stopped the sale of oysters from the Falmouth and Truro districts, as the Truro river had become grossly polluted with the sewage of that city, and the oysters taken from the river proved, on bacteriological examination, to be dangerously unwholesome. Afterwards oysters from Lamouth and Coombe Creeks were allowed to be sold, as they were not infected. The defendant was found dealing with oysters not emanating from either of these creeks and sending them to London for sale. He had written to a salesman saying that, as he heard there was a little complaint, he must, if asked, say they came from Coombe Creek. Of these particular 1,000 oysters all were detected and destroyed, Dr. Klein's examination of twelve samples showing they were gravely polluted. At the same time 9,000 other oysters found elsewhere at Billingsgate and coming from the same locality were condemned and destroyed. The Company had no wish to press for a severe penalty, but the defendant admitted that he had been sending away 4,000 or 5,000 oysters per week. He was in a small way of business. Mr. Davey said his client regretted what he had done and would promise not to offend again. The Lord Mayor said the community ought to feel indebted to the Fishmongers' Company for their action in the interests of the public health. He fined the defendant £50 and £10 10s. costs, with the alternative of two months' imprisonment.

MILROY LECTURER FOR 1910.—Mr. G. R. Foulerton, F.R.C.S., D.P.H., Medical Officer of Health to the East Sussex County Council, and lecturer on bacteriology and public health at the Middlesex Hospital Medical School, has been appointed Milroy Lecturer to the Royal College of Physicians for the year 1910.

WATER SUPPLIES ON DAIRY FARMS.*

By H. DROOP RICHMOND, F.I.C.,
Chemist to the Aylesbury Dairy Company, Ltd.

IN the course of my ordinary duties I have to examine the water supplies on the farms from which the Aylesbury Dairy Company draw their supplies of milk.

The system adopted is briefly as follows:—When a farmer wishes to supply the Company, he fills up a form giving *inter alia* particulars of the water supply; if these particulars indicate that the supply is likely to be suitable, the farm is inspected on behalf of the Company by the medical officer of health for the district in which it is situated, whose report contains his observations as to the character and position of the supply or supplies, and the likelihood or otherwise of contamination. The medical officer of health takes samples of the water for chemical and bacteriological examination, which are forwarded to me. In the event of the water supply being passed, particulars of the water are entered in the contract, it being specified that no other water may be used under heavy penalties in the case of breach; samples of the water are regularly taken half-yearly so long as the contract continues. If the water is condemned, and no other good supply can be obtained within a reasonable space of time, no contract is of course made, and the farm is rejected. In many cases it happens that a new supply is easily available, and in others that there is more than one supply on the farm, one being passed and the other condemned; in these cases the condemned supplies must be cut off, if they are sufficiently near the dairy to afford any possibility of their being used.

In the table of statistics that follows, the column "Good" refers to farms which have only water supplies that have been passed; the column "Bad" refers to farms on which no good water was available, and which were consequently rejected; while the column "Good and Bad" indicates those farms on which a good water was found after the first supply had been condemned, which was subsequently cut off.

On looking through my books I find particulars of 278 dairy farms, on which there are altogether 447 water supplies; of these, 146 farms with a total of 210 water supplies

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