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THE WATER SUPPLY OF PHILADELPHIA.

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A STUDY of the literature of hygiene, especially its periodical literature, will show very clearly that while, perhaps, in some fields of research, laboratory methods are most important, the great problems of sanitation are now so largely engineering problems, that no sanitarian can afford to neglect this feature of the question. While on a small scale, in isolated residences, for instance, the simpler principles of physics and chemistry may afford a solution of a given sanitary problem, the methods of dealing with the enormous aggregations of population so characteristic of the present day, and which are in this country, at least, the products of such rapid growth that it is almost impossible to adapt a natural condition, *pari passu*, to the development, require the accurate knowledge of the educated engineer.

In considering the subject of the water supply of Philadelphia, I must remark that it seems to me to be one in which chemical (in which term I will in this paper always include bacteriological) examinations are of but limited value. If we assume, as we certainly may, for the purpose of this paper, that the supply for the city will come from some body of surface water, river or lake, we will find that there is no department of water analysis in which there is less opportunity for standards of comparison than with regard to surface waters. It is difficult to fix upon a limit of impurity with reference to those ingredients which are either regarded as dangerous or as indicative of past pollution. With the waters of wells or springs, or artesian waters, we have tolerably precise standards and principles, and, knowing the average character of a subsoil water of a district, we can with confidence approve or condemn a given well or spring. River waters, however, are subject to much variation. They may at times be perfectly clear, and the dissolved matters, both mineral and organic, be found decidedly below the limits assigned as standards

of impurity. A storm may alter the condition within a few hours and the water become so turbid as to be repulsive. Intermediate conditions of turbidity, often so slight as to scarcely attract attention, are frequently associated with the presence of dangerous materials. It must not be supposed, however, that in discussing the question of a water supply of a large city, the chemist can lend no aid. All such supplies involve the question of supervision and treatment, and, in determining the daily condition of samples, in detecting deterioration before it becomes evident to the senses, and in comparison of the effects of storage, aëration, filtration, etc., chemical analysis is of great service. With the knowledge that has been acquired within the last ten years concerning the propagation of the diseases arising from polluted water, we find that the inspection of a watershed may serve more satisfactorily to detect possible dangers, than even an elaborate study of the dissolved and suspended matters at the point of intake. The question of self-purification of water has been discussed at some length in sanitary literature. The conflicting utterances of some of the more eminent authorities may depend, partly, upon personal feeling: but it must be admitted that the power of any stream to destroy in its course dangerous pollution, will be so largely modified by conditions of weather and temperature that nothing but an almost continuous examination of samples could keep us informed as to the presence or absence of specific germs.

At this point, while avoiding too much laboratory science, I deem it proper to say that great caution must be exercised in accepting the results of the bacteriological examination of water samples. Mere microbe counting—*i. e.*, the determination of the actual number of living organisms present in a given volume of water—can be carried out with considerable accuracy, and when the object is to attain comparative results, as in studying a sample before and after filtration, before and after prolonged storage, or in determining the effect of sterilizing methods, the results are trustworthy even in not very expert hands. When, however, it becomes necessary to recognize and identify specific forms, especially such as are believed to cause typhoid fever, associated with many other similar organisms, the problem is

one of great difficulty, requiring special laboratory facilities and much biological knowledge. I am inclined, therefore, to doubt a certain proportion of the statements in which the detection of some specific microbe is noted, and I am not aware that competent bacteriologists have ever claimed to be able to recognize the germ of typhoid fever by microscopic examination alone. Certainly the authorities in this field are unanimous in saying that only by careful culture by special methods can we differentiate this organism. I make this assertion because I have seen reports of water analyses in which reference is apparently made to the detection of typhoid germs by microscopic examination. I have also seen photographs purporting to be taken directly from specimens, but I am compelled to say that I do not regard s uch meth ods as acceptable.

The improvement of the water supply in Philadelphia has been a subject of discussion in the newspapers and in department reports for a long period. It seems that no sooner does this question arise for discussion, than it is complicated by some proposition which is either justly or unjustly suspected of being of pecuniary benefit to some person or persons. It would be ungracious to impute improper motives too freely, but I think that it cannot be denied that, within the past twenty years, several propositions entirely selfish in motive and disadvantageous to the Philadelphia public, have been put forward and an effort made to secure a hasty acceptance under an alarm brought about by mortality statistics and chemical analyses. The plans proposed for the improvement in the Philadelphia supply usually involve the selection of a new source, and contemplate the entire abandonment of the Schuylkill, it being asserted, or assumed, that the Schuylkill water is absolutely unsuitable both as to quality and quantity.

The pollution of the Schuylkill cannot be doubted, although analytical examinations made upon the perfectly clear water often give favorable results. One of the most severe of the critics of the Schuylkill has admitted in his report that the water is at times unexceptionable in quality, yet a journey along the banks of the river will demonstrate beyond all question the many sources of contamination and danger that must constantly im-

pend from a water supply receiving the discharges from so many populated points. The pollution is especially notable when the river is turbid. In the year 1888, from September 17th until October 11th, I made, in association with Dr. William Beam, a test, every week-day, of the water as supplied at my laboratory, No. 715 Walnut Street, and I append here a table showing the condition—total solids, the so-called albuminoid ammonia, and free ammonia—expressed in terms of the nitrogen they contained, which will serve to show the great variation in suspended and dissolved matters within this limited period. Undoubtedly, analagous results would be obtained by a consecutive study of the water at the present time, though, so far as the particular locality is concerned, the extension of reservoir capacity seems to have enabled a clear water to be supplied more continuously.

1888.	CONDITION.	TOTAL SOLIDS.	NITROGEN BY $K M_n O_4$	NITROGEN a $N H_4$
Sept. 17	Turbid.	160	.06	.048
" 18	Muddy.	160	09	.020
" 19	Turbid.	140	.108	.004
" 20	"	150	.124	None
" 21	Less turbid.	150	.132	None
" 22	Very muddy.	180	.180	None
" 24	Turbid.	140	.100	None
" 25	Slightly turbid.	130	.092	None
" 26	" "	120	.068	.01
" 27	Very slightly turbid.	110	.056	None
" 28	" " "	105	.052	None
" 29	Nearly clear.	125	.052	.008
Oct. 1	" "	140	.052	.012
" 2	" "	125	.044	None
" 3	" "	120	.080	.016
" 4	Clear.	120	.084	.008
" 5	"	120	.092	.012
" 6	"	120	.060	.012
" 8	Turbid.	150	.108	.008
" 9	Slightly turbid.	130	.088	.008
" 10	Almost clear.	125	.056	.010
" 11	Clear.	115	.044	.010

Two tests were made lately with following results:

1892.	CONDITION.	TOTAL SOLIDS.	NITROGEN BY $K M_n O_4$	NITROGEN a $N H_4$
Oct. 28	Clear.		Trace	None
Nov. 4	Slightly turbid.		0.08	None

The influence of turbidity is here indicated.

The typhoid death-rate in this city has been a subject of much sanitary interest for a considerable time. This cosmopolitan disease, seeming to accompany humanity under almost every condition, occurring in crowded cities, attacking crews and passengers in the open sea, and afflicting isolated residences apparently in perfect sanitary condition, may, when the significance of large numbers of cases is concerned, be taken as a fair index of the sanitary condition of the community. We may, however, overrate the value of such statistics. If we accept the view that the fever is caused by a specific germ, absolutely distinct, we must, of course, assume further that it can never originate from particular coincidences, but must be transmitted from some previous case. While it is not appropriate to discuss here a question so medical as the causation of typhoid fever, it is well to note that a prominent American authority, Dr. Vaughan of Ann Arbor, inclines, as the result of much personal investigation, to the view that the so-called typhoid bacillus is but a modified form of some of the harmless water bacteria, a position which, if even rendered probable, must disturb seriously our notions as to the relations of this disease to general sanitation. In Philadelphia there has existed for some years a comparatively high typhoid death-rate, exceeding that of most of the large cities of the world. The existence of the disease has unhesitatingly been ascribed to the Schuylkill River, and while it may be safely agreed that a marked improvement in this respect would follow the introduction of an absolutely pure water, yet the fact is that a considerable percentage of the excess over the death-rate of other cities occurred in a district of the city not entirely supplied by Schuylkill water. Some years ago I made a study as to the location of every death occurring in the city during a year, collecting information in regard to most of the cases by direct communication with the physician reporting the deaths. These results were presented in a paper read before the Philadelphia County Medical Society, and indicated that in the district of the city north of Poplar Street and east of Sixth Street, embracing about one-fifth the entire population of the built-up portion of the city, there occurred about one-half of the total number of deaths

from typhoid fever. The unsuitability of the Delaware supply was well shown by this fact, and has been further demonstrated by the marked lowering of the death-rate in this section since the supply from Otis Street was abandoned. I append here some figures showing the typhoid death-rate in certain sections of the city for a period of some years before the abandonment of the Kensington supply and extending up to the latest available statistics.

Deaths from typhoid fever in the district east of Sixth Street and north of Poplar, in the city of Philadelphia, comprising the Sixteenth, Seventeenth, Eighteenth, Nineteenth and Thirty-first Wards, from 1884 to 1891, both inclusive, together with the deaths from the same disease over the entire city and in the Fifteenth Ward:

	ENTIRE CITY.	FIFTEENTH WARD.	KENSINGTON DISTRICT.
1884	662	25	160
1885	610	19	161
1886	618	19	153
1887	621	20	181
1888	785	31	211
1889	736	42	126
1890	666	45	53
1891	683	52	57

The figures for the entire city and for the Fifteenth Ward, which latter is selected because it is a large ward, mostly in good sanitary state, show that the marked decrease in the Kensington district is not due to any general abatement of the disease. The increase in the Fifteenth Ward is doubtless due in great part to the increase in population.

Table showing total deaths per month from typhoid fever in Philadelphia in 1889, with pumpage at Kensington Water Works in millions of gallons, and deaths from the fever in Kensington district (Sixteenth, Seventeenth, Eighteenth, Nineteenth and Thirty-first Wards):

MONTH.	TOTAL DEATHS.	MILLIONS PUMPED.	DEATHS IN KENSINGTON DISTRICT.
January	62	0	6
February	55	0	3
March	61	10	3
April	41	173	5
May	64	149	19
June	50	131	21
July	68	196	19
August	53	171	15
September	70	101	9
October	63	49	12
November	33	0	6
December	66	0	6

It must be understood that in speaking of the Delaware supply I refer to that taken at the foot of Otis Street, and not to that pumped from Lardner's Point, which has generally been found satisfactory.

All will admit, I think, that whatever view be held as to the relation of water supply to general health, or as to the special question of the suitability of the Schuylkill or Delaware rivers as sources of supply to this city, the improvement should be of such a character as to be substantial and permanent. In view of the difficulty with which large communities are aroused to liberal assistance in public works, it will be better to introduce such changes as will enable the city to furnish, from the present sources, an abundant supply of water of as high degree of purity as is attainable by natural and artificial means. In short, I haye to suggest, as the principal point in this paper, the temporary setting aside of the discussion and investigation of new sources of supply and the limitation of immediate action to the construction of storage and purification facilities. Much as we may suspect the Schuylkill water, it has been noted above that it is sometimes of fair quality. Evils which have resulted from its use in this city have certainly been due in part to the direct pumpage of it from the river to the houses without any opportunity for subsidence. It has been frequently delivered in a condition actually repulsive.

By the employment of small amounts of precipitants, or by boiling, even polluted water may be rendered safe; but few citizens will resort to such methods, and a public water department

is a useless burden on the community if it does not furnish a water in condition to be employed freely without treatment. In addition to the complaints as to the quality of the water supply to the various parts of the city, there is much complaint in some localities as to the deficient amount. I consider that a very great step toward relief both as to the quality and quantity of the supply would be secured upon the introduction of abundant storage capacities. This is no new observation. It has been frequently noted in connection with the suggestion for the improvement of our condition, but it needs to be pointed out, I think, that such storage capacity would be beneficial from several points of view.

In the first place, if the storage capacity were of such a character as to give us, when charged to its fullest capacity, twenty-five or thirty days' supply under moderate demands, it would enable the pumping to be discontinued at times when the river was in an unsatisfactory condition. In this way a much smaller quantity of subsiding material would be introduced into the basins and danger from drought would be diminished.

Secondly. There is a good deal of experimental evidence to show that a material improvement in the wholesomeness of water results from its storage in suitable reservoirs, this improvement being the result partly of subsidence, but largely of the changes that take place in the organic life present. Even noxious organisms may be destroyed by such methods.

Thirdly. An advantage of these reservoirs would be that under any method which may hereafter be adopted, it would be advisable and even necessary for the city to be able to maintain within its bounds a supply of water for a considerable number of days. Even should we go to the Upper Delaware or Lake Erie for our water, it seems to me it would be a grave engineering mistake to depend from day to day upon the supply through the conduit that might be constructed. Accidents to the aqueduct, the presence of a hostile force, or even of an excited mob in the immediate territory, might serve to deprive the city of this water. It would be far better able to meet such emergencies which may at any time occur, if it had within its bounds a total reservoir capacity of, say three thousand million gallons. Under great stress

and careful supervision such an amount may be made to last double the time that it would otherwise, and thus afford opportunity for the construction of supplemental methods of supply. It is objected occasionally that the storage of water in large masses for a considerable time results in the development of vegetable growths which give a disagreeable odor and taste. This condition does not appear to be associated with any real sanitary defect, nor to occur appreciably when the water is stored in a fairly pure condition and the basins kept free from mud and decomposable organic matter. Dr. Thomas M. Drown, in an article upon the effect of aëration on water (Report, State Board of Health, Mass., 1891), states that "while in the case of Jamaica Pond, Boston, Mass., the water became foul from stagnation, yet in basin No. 4 of the Boston Water Works, which was carefully prepared for the reception of the water by the removal of all soil and vegetable matter, and is supplied with a brown swampy water from a water-shed almost entirely free from pollution, the water is good at a depth of forty feet, because the water contasnvery little organic matter with a tendency to decompose." Even with waters not of the best quality, as far as organic impurities are concerned, a material improvement may be secured by agitation of the water, such as is brought about by continuous aëration, and it may be worth noting, in passing, that from the numerous experiments recorded by Dr. Drown in the same pamphlet, it appears that no appreciable influence on the amount of nitroi genous organic matter is produced by even long-continued aëration under strong pressure. Samples of water, both of good and bad quality, have been treated for periods varying from forty-two hours to thirty days without material diminution in the proportion of organic matter, as shown by the albuminoid ammonia yielded, or by the quantity of oxygen required for complete oxidation. Nor was there a material increase in the proportion of nitrates, or diminution in the amount of nitrites. The view, therefore, that aëration of water will render it more wholesome, seems to have no foundation. In fact, since we now know very clearly that the transformation of the organic matters of water into nitrates and nitrites takes place under the influence of living organisms, we are not surprised to learn that

these organisms cannot be forced by an additional supply of oxygen to do more oxidizing work than they would do under normal conditions. Dr. Drown inclines to the view that the prevention of the growth of algæ, which is noted as one of the beneficial effects of aëration of water, is due to the agitation, and not to the additional supply of oxygen. Further, it must be noted that the removal of odors from water can be accomplished by a current of carbonic oxide as well as by a current of air. This is dependent upon the well-known physical law that constant exposure of a fluid to the atmosphere of any particular gas will withdraw from solution in it another gas.

In addition to the construction of large storage reservoirs, the introduction of some purifying system would be appropriate. There is no reason to doubt that a material benefit can be brought about by the employment of methods now available. Of these the simplest is probably sand filtration, which method is in operation on an extensive scale in many places. As a summary of the results that have been obtained on a practical scale, I present the following notes on the efficiency of sand filtration in use at the Zürich Public Water Works (J. S. C. I., December, 1889). In this system both covered and uncovered filters are employed. The former require cleaning once in seven days, the latter once in forty-eight days. Under normal conditions the filter is free from microbes, although a few are taken up again in the latter stages of filtration. After cleaning the filter, the water which passes through is not in a normal condition, an efficient layer or scum not having had time to collect on the sand, though the chemical purity of the water is satisfactory. When the filters have not been used for some time the water which first passes through them contains more bacteria than usual, owing to their rapid multiplication in stagnant water, but its chemical purity is not materially different from the normal filtered water. In the absence of facilities for the establishment of sand filters of the class above noted, several forms of pressure filters employing a coagulant, such as alum, are available. With proper supervision as to the quantity of coagulant used, and especially with abundant storage capacity which will enable the filtering system to be worked as a mere accessory to the supply, it seems to be pos-

sible to furnish the citizens of Philadelphia at all times with an abundant amount of perfectly clear water, suitable for all purposes, even when taken from the Schuylkill or Delaware within the city limits. Other filtering systems depending upon less understood chemical principles have been shown to be efficient, and several of these more modern methods have been demonstrated at meetings of this Club. Some attention has lately been drawn to the employment of electrical currents through iron electrodes immersed in the water, and experiments show that a material improvement results in this manner, as far as the dissolved organic matter is concerned.

One of the most notable defects in the Philadelphia water supply is the want of systematic methods for the prevention of waste. Not only has the Department given insufficient attention—at least so far as practical results are concerned—toward securing economy in the employment of water, but there is abroad in the community a foolish spirit that restriction in this respect is disadvantageous. The *per capita* consumption of water in Philadelphia is very high, and from conversation with engineers familiar with the more economical systems of European cities, I believe that two-thirds of the present consumption could be made amply sufficient for the purpose. Among the steps that should be taken to secure this economy would be the introduction of measurement systems at all points, where either the water has a purely trade value (that is where it is not merely conducive to personal comfort, cleanliness or bodily needs), and also at all points at which water is used so irregularly that the average employment cannot be accurately estimated. Hydraulic engineers are, as I believe, not favorable to the introduction of water meters in private houses. A sufficiently close approximation to the daily use can be made in these cases, according to the size of the house, the neighborhood, and the appliances for the use of water, so that the expense of measurement apparatus may be avoided; but large establishments, even hotels, and, certainly, manufacturing places, should pay for the water in proportion as they use it. In estimating the water rate, even in private houses, the decisions should be based upon the type of apparatus in which the water is used. Certain forms of house-

hold appliances are apt to be very wasteful, and the use of these should be discouraged by the imposition of a higher rate wherever they are employed. The hopper water-closet, for instance, is frequently allowed to run continuously and cause much waste. Flushing systems should, therefore, be preferred. I have seen in sucessful operation at several points, a system of closets depending entirely on subjecting the fæcal matters to a continuous air-current, by which they became very soon sufficiently dry to be burned. This method does not involve the use of water, and its general use would result in much saving.

A reasonable amount of attention should be given to the condition of the supply in all establishments, that is, in regard to leakage, whether from pipes or from defective fittings. Much water, doubtless, runs to waste in Philadelphia in consequence of overflowing of storage tanks on the upper floors of the large residences. The overflowing pipes of these tanks, which by the careless or ignorant plumber are usually connected to the soil-pipes or ventilating shaft, and by the more careful plumber to the rainwater conduit, either directly or over a portion of the roof, may be almost continuously discharging without attracting the attention of the householder or the inspectors. The automatic control will, of course, when it works properly, prevent this waste; but in the loft of a building it is but rarely that such an apparatus will be kept under supervision, and when, as is always the case, the overflow pipe is provided as a protection against accident, it is simply human nature of the householder to rely exclusively upon that. In at least one of the European cities, the ingenious expedient is adopted of so arranging the overflow pipe that it empties directly from the eaves on to the pavement, thus giving public notice of any failure of the automatic control.

Probably there is no more objectionable form of waste than that which arises from the wash-paves. I believe the custom of deluging the sidewalks with water is carried to a greater extent in this city than in any other. Certainly it would be difficult to find a city in which the practice is more extensive. Much of this is unnecessary. Sufficient cleanliness could be obtained by sweeping the pavement, especially if good methods of paving are adopted. One has only to watch the method pursued to see

that the entire arrangement promotes waste without securing any particular sanitary or sentimental advantage. The curved discharge-pipe permits the water, generally at full head, to run into a bucket; the current is kept on continuously, and, though I have never made any measurement of the amount of water employed in the washing of an ordinary pavement, I feel satisfied that several times the amount is used that would be needed even when the pavement required washing. The simplest method, it seems to me, outside of actual prohibition, would be the imposition of a very heavy annual rental for the attachment of such pipes.

One source of waste in the supply of large cities is so purely a matter of hydraulic engineering, that I do not feel that I could more than indicate it, with the hope that some facts will be brought out in the discussion. It also belongs to most city supplies, that is, the waste from leakage from originally imperfect joints, settling of pipes, corrosion, etc. No doubt, that in a total area, in a large city like Philadelphia, this source of waste must be a considerable item.

Waste in a city water supply involves more than the objectionable feature of extra cost for furnishing the water. It involves greater wear and tear on all forms of apparatus, and by adding to the dilution of the sewage from the district, increases the expense and trouble of dealing with it. There is no more important problem in sanitary engineering than this question of sewage disposal. One step towards a practical solution of the problem in such a city as this will be, by diminishing the waste of water, to diminish the volume of offensive liquid produced. Did the limits of this paper permit, I should like to discuss at this point some system of disposal of offensive matters which avoid the employment of water and yet secure the prompt and safe treatment of the material. A wise administration of the water department will seek, by legislation and judicious levying of fixed charges, to encourage all methods which will secure economy without causing inconvenience or sacrificing safety.

Concerning this matter of waste, I take the following data from the Annual Report of the Bureau of Water for 1891, pages 95–8:

Square from Broad to Thirteenth, Walnut to Spruce Streets,

containing no manufacturing establishments, 104 dwellings, 12 stables, 15 other establishments, with a total population of 794. There are 96 hydrants, 71 wash-paves, 384 kitchen spigots, 244 bath tubs, 255 wash-stands, 181 closets, of which 134 use flushing tanks, 18 urinals. The total water rent is $2,335.55. The consumption of water is 113 gallons *per capita*. The annual charge for a urinal is $2.00; the minimum water necessary for proper washing would cost by meter $33.58 per year; the amount used if the urinal runs at full capacity would cost $179.85. The total water consumption of the district was 89,000 gallons per 24 hours, 43,000 of which, or nearly half, was consumed by the urinals. As the report remarks: The only check that can be put upon them is a meter, which will either make payment for the water used or compel the shutting off of the water when the use of the appliance is not required.

Another experiment in the Twenty-eighth Ward showed that a manufacturing establishment was using $\frac{1}{17}$ of the water pumped to the district. This establishment was paying $1,792.00 water rent, while by meter the amount payable would be $17,520.00

The third experiment was made in a manufacturing district of the Thirty-first Ward, containing 200 dwellings, 13 manufacturing establishments, 7 dye-houses, a total resident population of 849, and a transient population of workmen of 1,733. The consumption equalled 1,522 gallons *per capita* of the resident population.

An essential point in the construction of reservoirs is almost entirely overlooked in American cities: this is the necessity for complete protection of their contents from accidental or intentional pollution. I believe that the common practice of making such reservoirs places of public resort, is an error. They should be kept entirely under official observation and the public should be excluded. No inconvenience would result from this plan, and the protection of the water supply would be promoted.

If a new source of supply is to be obtained for Philadelphia, its selection should be made with the greatest care. Unless a complete control of the whole area concerned in the furnishing of the water is secured by the municipality, the change of source

would be only of temporary advantage. If an expensive system is to be constructed, and in a few years the city is to be obliged to protect itself from some newly developed source of pollution by the slow and uncertain method of legal procedure, or the highly expensive remedy of purchase, under condemnation or bargaining, of the territory of the offending settlers, we will find that we have accomplished but little in the way of improvement.

From time to time the suggestion occurs to hydraulic engineers as to whether a double supply is feasible. In Philadelphia it might be possible to secure the use of the Delaware water, which is abundant and sometimes even better adapted for manufacturing use than Schuylkill, for supply over the same territory as that receiving better water. There are, however, grave difficulties in such an engineering enterprise. Not only do we have the question of the expense of installation, but if the water should be furnished more cheaply or even more abundantly, the temptation to use it for all purposes might lead to serious sanitary results. Some of this danger might be avoided by excluding residences from the benefits of the supply, but even if it were limited to large manufacturing establishments the liability of the workmen to use the water would be great, and epidemic dysentery or more serious results would certainly occur.

It is beyond the scope of this paper to discuss at length the relative advantages of public and private ownership of waterworks, yet I would like to express my opinion that under no circumstances should the citizens of Philadelphia part with any portion of the control of the water supply and distribution. However strongly we may feel on the question of the difficulty of securing economical, honest and judicious management of public works, the control of the water supply is certainly one thing that should be retained by the municipality. Water is an absolute necessity. When its quality and quantity are subject to the greed of a private corporation, the oppression may be most serious, because the citizen has practically no alternative. Substitutes may be found for many other of the requirements of civilized life. If a private company possessing the monopoly of supplying gas or electricity to a city neglects or refuses to furnish

a suitable service at reasonable cost, the citizen may at least find some substitute for the light. If a street car company fails to maintain a sufficient number of cars to carry the passengers, private conveyances are at least available, but if impure or insufficient water is furnished, the burden is most distressing. It is to be hoped, therefore, that, whatever may be done in developing the water supply of Philadelphia, a complete control of it will be maintained by the city authorities.