of water no longer holds in the original form, but that the important factor in the whole matter is that of time, more or less regardless of distance, attempts have been made to put this new information into practice by holding the water for as long as possible before distribution. Houston of London, England, has found a very marked disappearance of the sewage organisms in 48 hours, and recommends the process. The efficiency of the reduction depends notably on the quality of the water and he notes that for an absolute safety factor, a month would be necessary. This of course would necessitate a reservoir area of prohibitive size, where as much water is used as is the habit in our American towns. On the other hand where the supply comes from a great distance this factor will materially help in disposing of a good deal of pollution.

It appears then that unless the source of the water is very distant or is above suspicion, some form of treatment must be used. The most frequent of these is filtration, in some form or other, either the slow sand type or the rapid mechanical with use of chemical precipitants. While with waters fairly grossly polluted careful management will give a nearly bacteria free effluent, it is admitted that either type of filter needs constant and conscientious supervision, or e'se there will be leakage of sewage forms from time to time. The London data may be quoted as there are a number of plants there of various sizes, corresponding to supplies to individual municipalities and handling different types of water. In the year 1908-9, summary of the results in the daily tests showed that 5 to 50 per cent. of the filtered waters contained colon in 100 cc. or less, and that in the next year 3.8 to 31.3 per cent. showed the same results. Sometimes the appearance of the colon is very sudden and rapid changes in the weather conditions may bring about so gross a change in the bacterial content of the water that the filtered water will be polluted before any change can be made. The results at other places are similar. At Hamburg where the conditions of weather approach more nearly those of Northern Ohio than do those at London, the formation of ice on the filter beds or presence of floods in the river leads to the appearance of colon in the water. It is true that where colon is found only in so large amounts of water as 100 cc. there is very possibly no typhoid or dysentery, but in the absence of accurate knowledge as to the actual number of bacteria necessary to set up disease, we cannot take any chances. In summary then one may say that in the presence of a polluted water supply, filtration will remove the suspended matters, and will remove the greater part of the bacteria, but that sudden variations in weather conditions or in technic may allow pollutions to pass the filter, when the belief in its efficiency will cause continued free use of a dangerous water.

For safety then it would appear necessary to sterilize waters for domestic use even after filtration. In the present paper it is unnecessary to refer to the various household methods, though it is the duty of all health officers in case of uncontrollable pollution of the city supply to warn the inhabitants to boil the water.

There have been many plans for sterilizing the water for drinking purposes, and for all conditions, such as armies in the field, institutions, and municipalities. Only those which may be applied to central supplies with comparative simplicity will here be considered.

The main general methods at present in use by municipalities are three in number :- They will here be discussed in inverse order to their practicability.

Ultra-violet Rays .- It has been known for some time that the rays at the ultra-violet end of the spectrum have marked bactericidal powers, but it is only recently that the Volume 21.

success are in the first place a white light, containing a large proportion of ultra-violet rays, next a water free from any opacity or turbidity, and in the third place an apparatus so arranged that the water will pass under the arc in a thin film and be thoroughly exposed. There has been recently established at Marseilles an apparatus of this sort, where the water passes into a constant level reservoir from which it issues over a central weir, passing at this point under the light from an arc formed between two carbons with cores containing alumina, giving a white light with many ultraviolet rays. The plant has been recently established and the results' in the line of efficiency and economy will be watched for with interest. The objections at present to the method are that it has not yet been sufficiently tried out on a commercial scale, that it is not standardized, and that it requires expert care for its proper control. Moreover the absolute necessity for a transparent water makes a preliminary filtration necessary in most cases of polluted waters.

Ozone .- Here the destruction of the bacteria depends on the presence of nascent oxygen in the water. This is obtained by passing an arc through a current of dry air, which is then, with its new content of ozone, passed onto a r.sing column of water which is thereby sterilized. Some failures in the process which have occurred in municipal plants have been found to be due to the insufficient drying of the air, so that special measures must be taken to avoid this trouble. There is no question of the actual efficiency of the method, and plants have been adopted by St. Petersburg, in Paris and elsewhere for the treatment of the city water supplies in whole or in part. The advantages lie in that the main expense after the rather expensive first instal.ation is the electric current, and that there are no waste products to be disposed of. Also from the point of view of the laity there is less objection to the introduction of oxygen than of any other chemical. On the other hand the primary expense is large, the constant services of an expert electrician are required, and the method is not as yet standardized. The best apparatus at present is probably that of the Siemens-Halske Company at Berlin, which firm has the contracts for Paris and St. Petersburg. The necessity of dry air makes further complications in the apparatus.

Chlorine .- It is probable that the essential principle involved is the same as in the ozone method, though more roundabout, the available chlorine so acting on the chemicals in the water as to free nascent oxygen which acts on the organic matter and the bacteria. For this reason the method by which the so-called available chlorine is obtained is more or less indifferent and a commercial rather than a laboratory proposition. The three usual methods used are ch'orine gas in liquid form, chlorine as given off from the electrolysis of salt water, and chlorine in the form of the commercial bleaching powder. The first method is the most expensive, and is said by some to be less efficient than the others. Where supplies of bleaching powder are not available except under prohibitive freight conditions it may be profitable to establish local electrolytic plants, but under ordinary circumstances the use of bleaching powder has been found equally efficient with the other methods, and a good deal cheaper. The form in which it is usually sold contains about 35 per cent. of available chlorine, which goes readily into solution in water, and can be fed into the reservoir, the mains, or at any other place desirable, in measured quantities. The cheapness of the material, usually less than \$25 a ton, the small amount necessary per million gallons, and the simplicity of the methods used, are all in favor of this plan. The disadvantage of the use of bleaching powder lies in the necessity of constant purchase of new supplies and in the large amount of residual sludge