by the starch and iodide reaction, in the water delivered to the mains at the high-lift pumping station. This has resulted in a comparative absence of complaints regarding the cold water; but there is no doubt that, after heating, the water possesses a peculiar odor, due to chlorine compounds. This odor is not the sharp, acid odor of chlorine, but a fishy one which is possibly caused by such compounds as chloramines.

Complaints regarding the effect on animals have been made, and a number of these have been investigated. It is undoubtedly true that when the amount of free chlorine in water reaches 0.5 part per million, both small and large animals refuse to drink such water entirely or absorb only small quantities. This possibly has had an adverse physiological effect. When the water is capable of absorbing as much as 1.5 parts per million of chlorine without showing free chlorine, naturalists who deal in small animals and fishes state that no effect is observed. Continuous physiological tests on minnows and gold fish confirm this. The Dominion Department of Fisheries has informed the author that free chlorine in the water had a markedly adverse effect on the hatching of the eggs of Atlantic salmon, Great Lake trout, pickerel, and whitefish, but no effect was noticed when free chlorine was absent. The Department has, however, decided to remove all the hatcheries to places where water free from chlorine can be obtained.

The effect of the treated water upon seeds, plants, and flowers has been investigated by the Dominion Department of Agriculture, and Dr. Gussow (Dominion Botanist) and Dr. Shutt (Agricultural Chemist), who were in charge of this work, have reported that water treated with hypochlorite caused no apparent injury to carnations and hybrid roses. Six varieties of wheat seed after soaking in freshly prepared hypochlorite solutions (0.05 to 10 parts per million available chlorine) were all sown on the same day. Germination was found to be uniform throughout and no influence could be detected either as regards the rate of germination or the development of the young plants. Experiments on barley and oats produced similar results. Radishes, turnips, cucumbers, and beans also showed no retardation in development after treatment with the water.

All these experiments were conducted with solutions of bleach in distilled water, but the same results were obtained in a later series when the treated city supply was used. These results prove conclusively that statements alleging damage to plants, flowers, and seeds by the hypochlorite treatment of water are absolutely unfounded and do not merit the slightest consideration.

The author has had, on several occasions during the past year, to investigate cases of alleged corrosion of piping due to the hypochlorite treatment of water, but before discussing these it will be advisable to review briefly the latest work on the corrosion of iron piping by water. The Committee on Water Supplies of the American Public Health Association have reported that, in general, hard waters have given little or no trouble in corroding metal pipes, and that this is apparently due in considerable measure to the formation of protective coatings upon the metal by the water itself. Soft waters do not seem to form such coatings naturally, and allow the carbonic acid in the water to dissolve such metals as iron and to retain the iron in solution. This process is maintained until the whole of the dissolved oxygen has been absorbed.

Jackson and Hale (New York Water Department Report, 1912) found that the first reaction is the solution of iron as bicarbonate by carbonic acid, with the formation of hydrogen. In experiments carried out in the cold, about 20% of the hydrogen formed was oxidized to water by the dissolved oxygen near the surface of the iron. The dissolved oxygen at the same time oxidizes the soluble iron bicarbonate to insoluble red oxide, setting free again carbonic acid. The carbonic acid liberated again dissolves more iron and is again set free until all the dissolved oxygen is exhausted.

These reactions are in accordance with the facts which have been observed in connection with corrosion of piping systems, and account for the rapid corrosion of both domestic and heating hot water systems. Methods which reduce the oxygen content will reduce the corrosion, but it is much more economical to eliminate the catalytic agent which enables the oxygen to produce its deleterious effect.

In view of the alleged corrosion of hot water systems in Ottawa, the author made routine determinations of the amount of free carbonic acid in the raw and treated waters: the average results for the year 1914 are as follows: raw water, 0.8 part free carbonic acid per million; treated water, 1.6 parts. During the early part of the year, when a bleach of high chlorine content was being used, the free carbonic acid in treated water was invariably higher than in the raw water, but the reverse was found later in the year, when the bleach invariably contained free lime. As the total amount found (maximum 2.7 parts per million) is insignificant compared with the 10 to 12 parts per million of half-bound carbonic acid which would be set free during heating, it is inconceivable that the treatment of water with hypochlorite has any effect on the corrosion or erosion of piping systems.

One example of the complaints received is worthy of mention. A large company alleged that hot water pipes had been damaged by the hypochlorite treatment to the extent of $40,000. On investigation it was found that the system had been supplied by the treated city water after passage through a mechanical filtration plant, and finally sterilized by heat. In this plant aluminum sulphate and soda ash were employed, and it was found that a large excess of soda ash was being used. At one time the water passing to the filter showed an alkalinity to phenolphthalein equivalent to 65 parts of sodium carbonate per million. The New York experiments have shown that an excess of lime or soda ash beyond what is sufficient for the neutralization of the free carbonic acid is not only unnecessary but positively injurious, inasmuch as it rapidly attacks the galvanizing coat of pipes. These facts were pointed out to the company, and the suggestion made that a small amount of lime should be substituted for the excess of soda ash. Since then no further complaint has been received.

During 1914 laboratory studies were made as to the effect of water which had been treated with hypochlorite upon galvanized iron pipes, and in these, both hot and cold water were used. Stated shortly, the results show that the effect of the treated Ottawa River water upon galvanized iron pipe of good quality is not appreciable unless the available chlorine exceeds 3 parts per million. The quantity used during 1914 has been invariably less than this amount and averages 40% less. A number of short lengths of pipe, procured for these tests from a firm which is supplied by makers manufacturing most of this class of pipe used in this section of the country, was found to be of very inferior quality. The galvanizing coat was evenly and thoroughly distributed on the outside, but on the inside large patches of bare iron were found in some