

are likely to disintegrate. The strength of the hypo decreases rapidly upon exposure to the air. There is considerable loss to the material by being weighed out and being made up into a solution, and there is a great deal of undesirable nuisance connected with this operation. Accurate readings must be made of the amount of solution being applied. Orifices and solution feed lines clog up with undissolved material in the solution.

Advantages of Liquid Chlorine

Liquid chlorine, or compressed chlorine gas, is shipped in steel cylinders holding 100 or 150 lbs. each. These are similar in appearance and construction to ammonia, oxygen and carbonic acid cylinders. At room temperature the pressure on a full cylinder of chlorine is about 90 lbs. Being under pressure, there is no loss in the strength of the substance. In order to liquefy the gas, it is necessary to rid it of its impurities and so it will average over 99.8% pure chlorine as used from the cylinders. In the use of liquid chlorine for the disinfection of water and sewage it has been found that the ratio between the amount of hypo to the amount of chlorine to accomplish similar results is about 6:1, with a minimum of 3:1 and a maximum of 10:1.

These ratios depend upon the strength of the hypochlorite in the solid form, upon the care with which a solution is made of the hypo in the water and upon the care with which the solution is applied to the water. The ease of operation, especially the direct reading of the amount of sterilizing agent being used, lends itself to more accurate control and more consistent results than could be obtained by the use of hypochlorite. Tastes and odors are seldom met with in supplies treated with liquid chlorine. Milwaukee, Wis., effected a saving of \$2,200 in one year on labor alone by the use of liquid chlorine instead of hypochlorite. An appreciable saving was effected also in the chemicals used in favor of liquid chlorine. Minneapolis, Minn., saved \$1,800 the first year of operation with liquid chlorine instead of hypochlorite, all of which saving was in the cost of the chemicals. In addition to this there was a saving in labor. The average cost of disinfection with liquid chlorine during 1917 was 37 cents per million gallons. In more than two years, there have been no complaints of tastes and odors resulting from this treatment.

At the present time there are probably 1,200 cities in this country using chlorine compounds for the disinfection of water and sewage. Of these, possibly 300 are still using hypo and the others are using liquid chlorine.

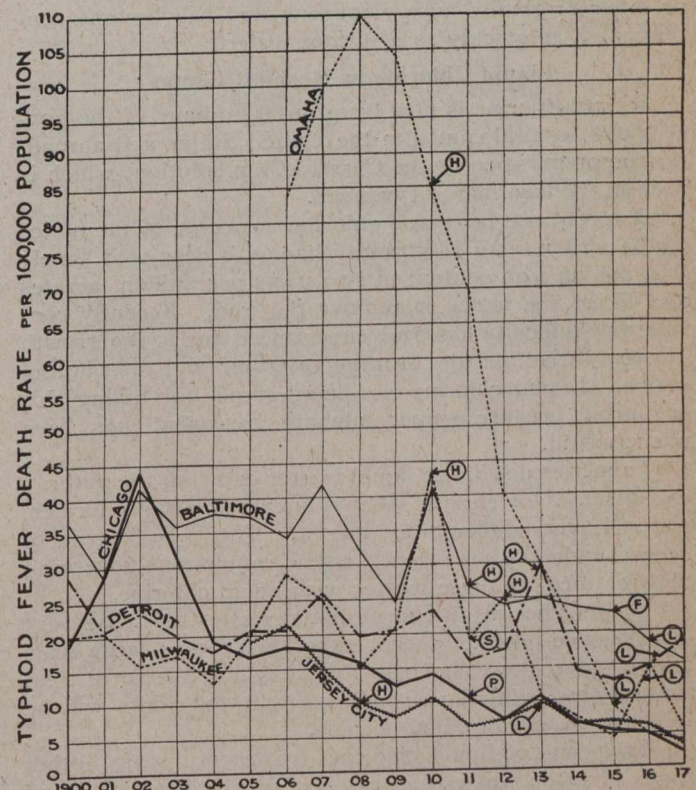
Prejudice Has Almost Disappeared

The former prejudice against "doping the water supply" with a "foul-smelling chemical," has almost died out. This has come about through the successful treatment of water supplies, in most instances, without any production of odors or tastes, through the wonderful reduction in the typhoid fever death rates, and through the winning over of the health officers and other members of the medical profession to an understanding of what this treatment could and would accomplish.

There was a time, not so long ago, when as a result of a report submitted by a committee composed mostly of Washington members of the medical profession, the United States Congress decreed that no coagulating or other chemicals could be used in the purification of the water supply of Washington, D.C. To-day, the water supplies of most of the government cantonments, construction camps, ship-building yards, etc., are treated with liquid chlorine in addition to the fact that the soldiers and

sailors are all vaccinated against typhoid fever; and in most of the camps, the water is obtained from underground sources. Practically half of the state boards of health of this country are supplied with a portable emergency chlorine control apparatus, weighing about 40 lbs., mounted in a carrying case, which is shipped out to municipalities in the event of a sudden typhoid fever epidemic or scare. Such measures make for expedition, increase the confidence of cities in the aims and assistance of state health departments, and help lower the typhoid fever death rates of cities by giving prompt and efficient control of emergency conditions.

Liquid chlorine is used in the disinfection of all types of water supplies; viz., water obtained from rivers, lakes, impounded supplies, shallow and deep wells, filter galleries, filtration systems, etc. Mountain streams, impounded supplies and well water are no longer considered



H, Hypo Treatment Started; F, Filtration Started; S, Hypo Stopped; P, Partial Disinfection Started; L, Liquid Chlorine Treatment Started

safe because they are obtained from the mountains, storage reservoirs and the ground. There are too many contaminating influences to be considered. The Chicago Bureau of Public Efficiency, in its report on the waterworks of Chicago, states that "a water supply contaminated on four or five days in a year, may result in serious epidemics."

Many cities have learned that liquid chlorine is a safe, cheap and reliable form of health insurance. The manager or superintendent of a water plant who uses liquid chlorine treatment does not have to lie awake at night fearful of the quality of his water supply.

The city of South Bend, Indiana, obtains its water from deep wells. The U.S. Public Health Service analyzed the water during the summer of 1917 and found *B. coli* present. Disinfection was ordered to be installed at once. This was done. It was found that the water coming from the wells was pure. The water being pumped from the storage reservoir was polluted. The chlorine was applied to the suction of the high-duty