APPLICATION OF COAGULANT INTERMITTENTLY IN EXCESS AMOUNTS.

IN a paper read before the New England Waterworks Association, Mr. E. E. Lochridge, chief engineer of waterworks at Springfield, Mass., deals with a problem that has given concern to those in charge of waterworks plants. Following is an abstract of Mr. Lochridge's paper:—

Coagulation by sulphate of alumina prior to slow sand filtration has been the practice at the West Parish Filter Plant of Springfield, Mass., since its construction. Records are now available covering six full years. During the last four years of this time the method of application has been so altered that materially reduced amounts of coagulant are necessary, although at all times it has been possible to produce satisfactory water. This method has been the application of over-doses of sulphate of alumina to the water intermittently. The filters, six in number, are of the slow sand type and of ½ acre area each. The water of Little River as it comes to the filters is that of a mountain stream usually clear, of low alkalinity, but with a varying color, which with the rise of the stream may increase several fold within a few hours. This color in the river water may be low enough for use without any reduction for a long period of time, when suddenly a rise in the stream will cause a large increase of color which makes the water objectionable for use.

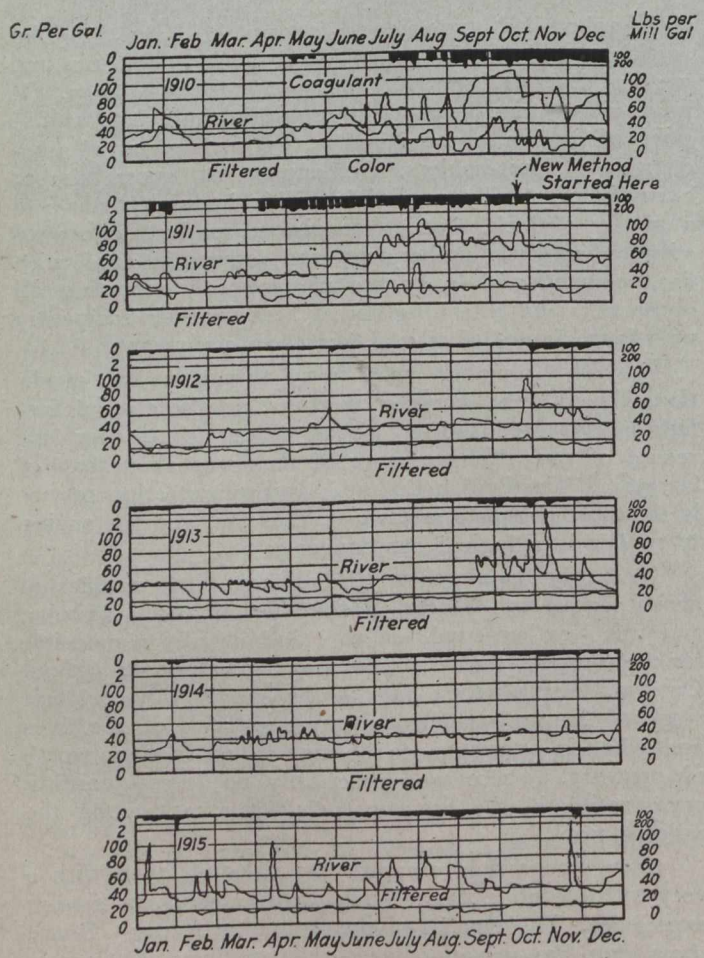

Fig. 1.—Coagulant—Grams per Gallon—Pounds per Million Gallons—Color—River and Filtered Water.

In the chart (Fig. 1) the upper line represents the color of the river water by day, and the lower the color of the filtered water at the same time. These are plottings of daily results. The amount of sulphate of alumina in terms of both grains per gallon and pounds per million gallons is plotted above the color lines in such manner that the amount applied each day may be readily seen. This chart gives the comparison of the two-year period of 1910 and 1911, during which time coagulant was applied in the usual manner, with the years 1912, 1913, 1914 and 1915, in which the method to be described was used. The records for the six years are plotted in such manner that seasonal comparisons are also possible.

The Little River at the point of diversion has a catchment area of 48 square miles. Its elevation at this point is 496 ft. above sea level, and with steep slopes the ground rises to an elevation of from 1,500 to 1,700 ft. at the highest points of the watershed. The surface of the storage reservoir on Borden Brook is 1,070 ft. above sea level, and 1,000 ft. above Main Street in Springfield. The water is diverted from the stream in a deep and narrow gorge, and sent through a mile of tunnel to a sedimentation basin 8 acres in area with a capacity of 40,000,000 gallons, or between three and four days' supply. From this small reservoir the water is drawn to the filters. The water from the tunnel is carried by a concrete conduit to an arm at the greatest distance from the outlet. There are no baffles or other artificial obstructions in this reservoir. The coagulant is applied in solution to the water in transit in the concrete conduit at a point which causes it to travel with the current 540 ft., permitting some mixing before its submerged delivery into the basin. Water is constantly flowing from the river to this basin through the conduit and is drawn uniformly from this basin to the filters.

The determination of the amount of aluminum sulphate necessary for complete reaction is made in a series of 2-gallon bottles, from 15 to 20 in number, which are filled each day with the river water. To these are added, in uniformly varying increments, definite amounts of sulphate of alumina. For example, to the first bottle enough is added to give the effect of the rate of 50 lbs. per million gallons; to the next, 60 lbs.; to the next, 70 lbs., and so on by 10 lbs. per million-gallon increments to 270 lbs. Within a few hours all of the bottles with amounts of coagulant in excess of the "reaction point" will indicate complete color removal, and the precipitation of foreign matter will be complete, while all bottles containing less coagulant than this amount will be in a cloudy or murky condition, indicating incomplete reaction. The determination is made in this manner each day, permitting a study of the effects of the rise and fall of the stream, the effect of storms, melting snows, etc. This information is also of great value at times of sudden changes, when there is insufficient time to make the determination. The amount necessary is dependent on a number of different conditions. With waters of the same alkalinity there may be quite a marked difference in the amount necessary for reaction, varying with river conditions. It is not entirely dependent on the amount of color, as with the same color to be reduced it varies on different days. The amount of coagulant actually applied to the water is always a little in excess of the reaction point determined and during the period of application this is kept as nearly constant as possible.

With the amount or rate of coagulant application per hour thus known, it is still necessary to determine the