Table No. 4—Comparative Data—Tanks 10 ft. and 15 ft. Deep

Depth of Tank in feet	Date	Cu. ft. of air Per Gal.	Av. No. of Gals. of Sewage treated per day	No. of mill. gals treated per acre per day	BACTERIA No. per c. c. in the effl. grow. at (20° c.)	BACTERIA Per cent. Removed	SUSPENDED MATTER P.P.M. in the effl.	SUSPENDED MATTER Per cent. Removed	ORGANIC MATTER Organic Nitrogen P.P.M. in the effl.	ORGANIC MATTER Organic Nitrogen Per cent. Removed	ORGANIC MATTER Oxygen Consumed P.P.M. in the effl.	ORGANIC MATTER Oxygen Consumed Per cent. Removed
	1915											
10	Oct.	1.46	59,100	8.8	56,000	96	16	94	4	77	19	85
10	Nov.	1.70	62,900	9.4	119,000	91	16	96	8	58	27	92
	1917											
15	July	1.03	110,000	16.9	68,000	95	16	92	10	42	36	71
15	Aug.	1.25	110,900	17.0	515,000	86	27	87	7	37	53	57
15	Sept.	1.14	117,900	18.1	280,000	87	20	86	7	37	40	66
15	Oct.	1.25	111,900	17.2	321,000	91	18	92	6	48	44	61
15	Nov.	1.19	105,000	16.1	216,000	90	33	86	4	41	50	62
Average		1.17	111,000	17.1	280,000	90	23	89	6	41	45	63
15 feet Standard		1.5	101,000	15.0	.....	90	..	95	..	..	..	..

choked up the exposed air ducts. Therefore, all compressed air pipes must be covered in cold weather.

All questions in regard to character of diffuser, size of bubbles, etc., sink into insignificance when compared with the importance of furnishing clean air to the filtros plates. Dirty air will run the cost of aeration up higher than economies introduced by fine bubbles can overcome.

The only practical remedy for such a condition is to take the plates out and replace them. This is an expensive and time-consuming operation during which the portion of the plant in service must carry an extra load thrown upon it by the tanks cut out for cleaning.

Depth of Aeration Tanks

There are certain structural reasons why 15-ft. tanks would be cheaper than 10-ft. tanks.

To determine whether 15-ft. tanks would be as efficient as 10-ft. tanks, we built a 15-ft. aeration chamber with three 15-ft. settling basins. The chamber holds 15 ft. of liquor above the filtros plates, has a surface area of 284 sq. ft.; a liquid capacity of 31,500 gallons, and contains 64 filtros plates set across the flow of the sewage.

The 15-ft. tank was put into operation on July 15th and ran through to November 12th.

The sewage fed to the tank was delivered by a centrifugal pump over the surface of a ½-in. bar screen, but received very little, if any, preliminary sedimentation. Therefore, it contained more grit and rough suspended matter than the aeration tanks in the future municipal plant, which is to be protected by grit chambers and fine screens, will receive.

Comparative Data from 10-ft. and 15-ft. Tanks

We did not have a 10-ft. tank in operation during 1917 that ran under normal conditions.

Therefore, in order to obtain data for comparison with the 15-ft. tank, records have been taken from the operation of the continuous flow, south tank in 1915, and are given in Table No. 4, together with those from the 15-ft. tank in 1917.

The data found in the preceding table show that the 15-ft. tank handled more sewage and used less air than the 10-ft. tank, and less than our standard provides. The purification obtained by the 15-ft. tank was not up to the standard set by the Commission. The efficiency would have been improved by reducing the volume of sewage treated and by increasing the air as called for in the standard. The period of contact between sewage and air was less than four hours. Therefore, the sludge became watery and would not settle well in the settling basins. For that reason abnormally large volumes of sludge were returned to the aeration chamber, cutting down the period of contact and decreasing the efficiency of aeration.

Sedimentation

Before the treated sewage can be discharged into the lake it must be separated from the sludge with which it is mixed at the outlet of the aeration tanks.

Experiments conducted at the sewage testing station during the last three years have shown:

1st—That when the sludge is well activated it settles readily.

2nd—That the settled sludge must be removed as fast as it collects.

3rd—That clarification depends upon area rather than upon depth.

4th—That in order to secure complete removal of sludge the flow of liquor through the tank must not be allowed to exceed three linear feet per minute.

Sludge that has been underaerated contains a large percentage of flocculent material that will not settle well. This fact makes it necessary to provide larger tanks for underaerated sludge than would be required to handle sludge which has been treated for six hours. Samples of the latter placed in cylinders on a laboratory table, show after 10 minutes, a clearly defined layer of sediment in the bottom of the glass, with the supernatant liquor practically free from coarse suspended matter and turbidity.

In order to take advantage of this rapid separation of solids from liquids, settling basins at the station have been provided with adjustable baffles, at the inlet end. These were raised or lowered to accommodate fluctuating conditions of the liquors entering the tanks.

Baffles submerged from 30 ins. to 36 ins. gave the best efficiency on the average. Wherever such baffles are set, clear liquor appears behind them as long as the capacity of the tank is not overtaxed. If the settled sludge is removed as fast as it accumulates, comparatively few particles rise into this clear zone. But when the rate of sludge removed is decreased, by choking the discharge pipe with rags or heavy sludge or when the volume of sludge is increased radically, by increased flows, due to peak loads, or when the sludge in the aeration chambers picks up to more than 20 per cent. of the liquid volume of the chambers, a blanket of sludge will rise behind the

(Concluded on page 317)