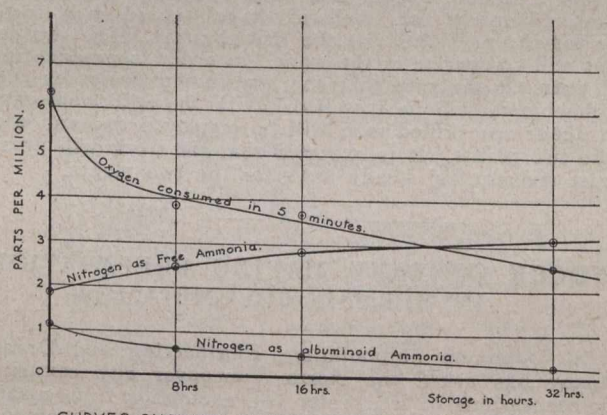
These results show that the improvement in the sewage is much greater in the first 6 inches than in the second, and greater in the second 6 inches than in the third, and greater in the first foot and a half than in the ensuing four feet. Would there be any advantage in exceeding the 5½ feet depth?

Effluents from sprinkling filters contain suspended matter at all times. The amount of suspended matter in one bed reached a proportion as high as 10 cubic yards per million gallons of sewage for a short period. This was exceptional; the average bed would probably not exceed more than a cubic yard per million gallons. Periodically, however, the beds slough off a large amount of humus-like material filled with worms and low forms of life. A cubic yard of this material is capable of taking all the dissolved oxygen from 50,000 gallons of water saturated with oxygen at 14 degrees C., or the amount of oxygen in over 4,000 cubic feet of air. This matter turned into a body of water would probably produce anaerobic conditions; this means the destruction of the original life in the water and the production of disagreeable odors.

To safeguard against a nuisance produced in this manner, it is necessary to treat the effluent from bacterial beds. Our experience shows that this material is easily sedimented. One hour's storage in an ordinary sedimentation bed removed practically all suspended matter; in twenty minutes the settlement of all the grosser matter had taken place, only very finely divided matter remaining in suspension. This would be readily retained in an Imhoff tank.



CURVES SHOWING EFFECT OF STORAGE IN SEPTIC TANKS.

Fig. 4.

The sludge collected in the sedimentation tanks, used in connection with the sprinkling filter effluent has some very objectionable features. It does not dry readily and has a most unpleasant odor, due probably to the large number of dead worms in it. On storage, under the conditions obtaining in the storage chamber of an Imhoff tank, it would become very similar to an ordinary Imhoff sludge, non-odorous and readily drying. Therefore, the best type of sedimentation tank would be the double chamber type, giving a length of storage of at least twenty minutes in the upper chamber and from one to three months in the lower chamber.

Analyses of Sludge in Effluent of Bacterial Beds.

Fertilizer Constituents.

Total nitrogen	6.8 %
Total phosphoric acid	0.8 %
Potash	0.16%
Grease	6.0 %
Ash	41.7 %

Further results obtained are given in a number of tables forming a part of the report. These tables record in detail all operating data respecting samples taken in the various stages of sewage purification under the different conditions considered. The first table relates to 52 samples examined between June 2nd, 1911, and September 25th of the same year. The free ammonia, albuminoid ammonia and amount of oxygen consumed are recorded in parts per million for the four stages of septic action, viz., (1) untreated raw sewage, (2) sewage after 16 hours septic action, (3) sewage further treated by aeration, (4) sewage 16 hours later, being a total of 32 hours septic action. A summary of the table is as follows:—

Stage.	Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
Untreated sewage	22.1	11.9	62.5
16-hour septic	30.6	4.0	35.7
Aeration of same	28.7	4.2	27.5
32-hour septic	32.9	2.6	25.0

Table II. relates to septic action No. 2 and gives in parts per million the corresponding amounts of free ammonia, albuminoid ammonia and oxygen consumed for 33 samples of sewage investigated between June 2nd and August 16, 1911. The stages being: (1) untreated raw sewage, (2) sewage after 8 hours septic action, (3) sewage further treated by aeration, and (4) sewage 8 hours later, having a total of 16 hours septic action. A summary of this table is a follows:—

Stage.	Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
Untreated sewage	19.2	11.5	62.8
8-hour septic	24.7	6.4	36.8
Aeration	23.7	5.4	34.7
16-hour septic	29.4	3.6	27.8

Table III. gives the results in parts per million for biologic treatment of 46 samples treated between June 2nd and August 22nd, 1912. The results relating to five stages, viz., raw sewage and state after treatment on two contact beds, sprinkling filter and intermittent sand bed respectively. A summary is as follows:—

Stage.	Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
Raw sewage	24.7	14.3	64.3
Contact bed A	18.8	8.5	34.7
Contact bed B	21.8	8.2	37.1
Sprinkler filter	8.7	2.5	20.2
Intermittent sand filter.	2.2	1.2	14.5

Table IV. relates to sprinkler filter operating data, giving results for (1) raw sewage, (2) sewage showing effect of first 7 inches of media, (3) same 13 inches of media, (4) same 18 inches of media, (5) same 5½ ft. of media. The tests cover 40 samples taken between January 16th and July 24th, 1912, and 12 samples taken between July 25th, 1914, and September 19th, 1914. A summary of the table is given as follows:—

Stage.	Free amm.	Alb. amm.	Oxygen consumed.	Nitrites.	Nitrates.
Raw sewage ...	23.0	9.7	50.6	...	...
7 in. of media.	21.0	8.5	43.7	0.4	0.8
13 in. of media.	17.3	5.4	33.8	1.7	2.6
18 in. of media.	13.2	3.8	27.0	3.1	4.5
5½ ft. of media	6.1	2.0	13.2	1.4	7.3

The first part of Table V. relates to chemical change due to filtration only and treats of samples from Imhoff