

NEW JERSEY

Court of Errors and Appeals

BETWEEN

THE STATE ON THE RELATION OF
THE BOARD OF HEALTH OF THE
STATE OF NEW JERSEY,

Complainant and Appellant,

and

THE BOROUGH OF VINELAND,
Defendant and Appellee.

} On Appeal from
Chancery.

Brief for the Appellant.

This is an appeal from a decree of the Court of Chancery dismissing the bill of complaint of the State filed for the purpose of securing an injunction to restrain the borough of Vineland from permitting the effluent from its filtration beds to flow into the waters of Tar Kiln brook, a tributary of Maurice river, from which a supply of water for potable purposes is taken.

The action was brought under the provisions of Chapter 41 of the Session Laws of 1899 (*P. L. 1899, p. 73*), commonly known as the "Potable Water Act." Sec-

tion one of this act contains a prohibition against the pollution of potable waters in this State, in the following language:

"No sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever, which, either by itself or in connection with other matter, will corrupt or impair or tend to corrupt or impair, the quality of the water of any river, brook, stream or any tributary or branch thereof, or of any lake, pond, well, spring or other reservoir from which is taken, or may be taken, any public supply of water for domestic use in any city, town, borough, township or other municipality of this State, or which will render, or tend to render, such water injurious to health, shall be placed in, or discharged into, the waters, or placed or deposited upon the ice, of any such river, brook, stream or any tributary or branch thereof, or of any lake, pond, well, spring or other reservoir above the point from which any city, town, borough, township or other municipality shall or may obtain its supply of water for domestic use, nor shall any such sewage, drainage, domestic or factory refuse, excremental or other polluting matter be placed or suffered to remain upon the banks of any such river, brook, stream or of any tributary or branch thereof, or of any lake, pond, well, spring or other reservoir above the point from which any city, town, borough, township or other municipality shall or may obtain its supply of water for domestic use as aforesaid."

The act further provides for the imposition of penalties upon any person or corporation which shall violate its provisions, and in section four gives the State Board of Health power, instead of proceeding for the recovery of a penalty, to file a bill in the Court of Chancery, in

the name of the State, on the relation of such board, for an injunction to prohibit the further violation of the said act.

A proviso in the act excludes from its operation any municipality which, at the date of the passage of the act, had a public sewer system, legally constructed, discharging its drainage. It is admitted that this case does not come within that proviso. There is no dispute in this case that the Tar Kiln brook, into which the effluent is being deposited, is a tributary of the Maurice river, and that the city of Millville is taking from the said Maurice river a public supply of water for domestic use in said city. If, therefore, the effluent now being deposited in the said Tar Kiln brook comes within the wording of the act, *i. e.*, is sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever which corrupts or impairs, or tends to corrupt or impair, the quality of the water of the said Tar Kiln brook, then the act in question applies, and the complainant is entitled to the relief sought.

This act has been the subject of judicial construction, with the result that its provisions are now clearly defined. The case to which we refer is that of the *State Board of Health vs. The Diamond Mills Paper Company*, 18 Dick. p. 111. This was a similar action brought by the State Board of Health to restrain the pollution of the Rahway river by the defendant, the Diamond Mills Paper Company. Vice-Chancellor Stevens, in a very elaborate and carefully considered opinion, construed the act as follows:

"The prohibition is against placing in the water of the river *anywhere* above the point from which the city obtains its supply any factory refuse which will either impair or tend to

impair its quality. If, at the place of discharge, the factory refuse put into the river impairs it, or even tends to impair it, the prohibited act is done."

In support of this position the Vice-Chancellor cited the earlier case of *State vs. Wheeler*, 15 Vr. 88, and then continues:

"I do not understand that there is any question made by defendant that the purity and potability of the waters of the river are impaired at the point of discharge. It is contended that the solids held in suspension in the water, as it passes out of the raceway into the river, soon sink to the bottom, leaving the water as pure as it was when it entered the mill; but it is not seriously pretended that the waste water, at the point of discharge, is either *pure or potable*. The bottled samples demonstrate that it is not.

"It would seem plain, then, that an injunction should issue. The city of Rahway is not shown to have been injured, but this is a bill filed, not by the city of Rahway, which is not a party, but by the State Board of Health."

The Vice-Chancellor then quotes from Sir George Jessel in the case of *Attorney-General vs. Cockermouth Local Board*, L. R. 18 Eq. Cas. 173, approving, among other things, the following language:

"I think the meaning is pretty plain and it means this: 'You shall not send your sewage into a natural stream until you have made it wholesome water—until you have got rid of all the noxious matter in it.' That, I think, is the effect of the clause, and, if that is the meaning, the next point is, what water is it that is not to be affected or deteriorated? You are not to affect or deteriorate the water in the river; what portion of the water? I cannot accede to the

argument of the defendants that it merely means that you must not poison the whole river. For a river may be hundreds of miles long. I think it must mean that you are not to affect or deteriorate the water in the river at the point where the outfall is; and that if you, at that point, pollute the water, you shall not enjoy the privilege given you by the act of parliament of making an outfall outside of your district.' ”

An injunction was granted and an appeal taken from the decision of the Court of Chancery to the Court of Errors and Appeals, which Court, upon the opinion of Vice-Chancellor Stevens, affirmed the judgment of the Court of Chancery, the opinion of the Court being reported in *19 Dick.*, p. 793.

The question, therefore, now under consideration is limited to whether the substance now being deposited from the Vineland Sewage Works is one of the substances prohibited by this act. The question as to whether it has any effect whatever upon that part of the stream from the Millville Water Company takes it water supply is barred by this decision; nor need consideration be given to the question as to whether it in fact harms the stream at any point below the point of deposit. The sole question is whether it is in fact a substance which the statute has prohibited from being placed in this stream. It therefore becomes important to consider what this substance is in order to determine whether it is or is not prohibited by the statute from being placed in the brook.

The Vineland Sewage Works are described by a witness produced on the part of the defendant, a Mr. Garrison, Superintendent of Public Works of the Borough of Vineland, as follows: There are eleven sewer beds in the Vineland sewer system, as shown by map, *Exhibit D 3*. Their operation is as

follows: "The raw sewage comes from up in the town, right on the first series of three beds, called settling beds. We use two of these beds at a time—these settling beds—and the sewage is allowed to flow into one bed for twelve hours; then the bed is closed and the sewage is allowed to flow into it for twelve hours. The entering sewage is then shut off and diverted into other settling beds, and while it is flowing into one it is flowing out of the other at the rate of twelve hours."

"Q. Where does it flow out of this settling bed?"

"A. Into a pipe leading into the filter bed, and at present as it passes through this pipe through the filter bed, sulphate of copper is introduced into the water, as the water goes on the filter bed and filters through this bed into the under-drain, and from there into Tar Kiln branch." (Book, p. 56, lines 19 to 33.)

Sewage is being deposited upon these beds at the rate of 250,000 to 280,000 gallons per day (p. 57), and the substance now flowing into Tar Kiln brook is the watery residue from such sewage as percolated through the so-called settling beds, and thereby reaching the drain, and from thence going into the brook.

The testimony of the witnesses for the State shows that this substance was of a foul odor, Dr. Hunt saying that it was apparently the odor of sewage (p. 16); Dr. FitzRandolph saying that it has an odor very decided and very offensive; that it had the odor which always occurs with stale sewage, and is quite a characteristic odor (p. 23); the odor being present in the samples which had been taken from the effluent at the time of the hearing still having this characteristic sewage odor (p. 24); and that this odor existed forty or fifty feet down the stream. Mr. Franklin, a witness of the complainant, also described the odor as being offensive and

strong (p. 48); and Mr. Wallace says that he smelled it, and drew samples, and "it was very obnoxious in the odor; in fact, the water in the bottles was of a cloudy, milky appearance," which gave him the opinion that there was no attempted purification of the sewage further than the abstraction of the solid matter, and that it was the clear effluent from the sewage, and the odor of the water confirmed him in that opinion (p. 51).

Dr. FitzRandolph, the chemist and bacteriologist of the Board of Health, has analyzed this substance and characterises it as "stale, rather dilute sewage" (p. 19). That there was an indication of the presence of the colon bacillus in one-thousandth of a cubic centimeter, *i. e.*, that there would be one thousand in a cubic centimeter (pp. 27 to 29); that he should consider such effluent unsafe to be placed in water if it contained more than one colon bacillus per cubic centimeter.

This testimony on the part of the complainant would seem to establish that the substance in question was within the prohibition of the statute in that it was either sewage, drainage, or excremental or other polluting matter which would corrupt or impair, or tend so to do, the quality of the water.

Considering the fact that this is the residue of the sewage of a large and populous town of the size of Vineland, it would seem almost unnecessary to argue that it was a substance of the character which the Legislature sought to prohibit by the enactment of the Potable Water Act.

The defense in this case, however, is somewhat novel. It is contended on the part of the defendant that this substance is not sewage, is not drainage, and is not polluting matter because of the fact that it is treated with a solution of copper sulphate, which, in the opinion

of certain experts called by the defendant, changes its characteristics by destroying the coli bacilli, and thereby, in the opinion of one of the defendant's witnesses, the substance ceases to be sewage, and becomes some nameless substance, which is not, however, sewage.

Before taking up the consideration of this defense we would call the attention of the Court to the fact that if valid at all, it is only valid upon the assumption, first, that the copper sulphate does, in fact, destroy the coli bacilli; and, secondly, that the system operates perfectly. Of course, if the coli bacilli and the other organisms remain in the substance which is deposited in Tar Kiln brook, even under the definition of the defendant's witnesses, the substance is sewage. It is likewise polluting matter, and is, therefore, prohibited by the act. Even if on the proper application by a system of filtration and treatment these substances are destroyed, if that system of treatment should not operate, so that it becomes inefficacious, the substance at once becomes sewage, and the complainant is entitled to the relief sought.

The evidence discloses, from the testimony of Mr. Garrison, that this condition complained of is an old complaint (p. 58). He further says that if there is a break in the Sewage Disposal Works, the sewage goes through in an unpurified condition, and that on one occasion there has been a break where the sewage had gone through in that condition (p. 59). Mr. Kellerman, one of the witnesses called by the defendant, says: "The cost of complete purification of sewage is very high, and, in general, complete purification is not aimed at." Asked by Vice-Chancellor Grey whether it is ever attained, he says, "In very rare cases complete purification of sewage may be attained" (p. 122), and that there should be very careful and expert supervision of any

such plant, and that so long as untoward conditions are liable to arise, if they should arise the coli bacilli would not be absent from this substance (p. 125).

Must the complainant in this case have no relief where such conditions are shown to exist; and where the slightest accident may bring the defendant's violation of the statute beyond controversy, upon the assumption that no accident will happen, and that no injury will therefore be done?

But let us examine a little more carefully just what it is that it is proposed to be done in this case. It is not denied that the substance in question is the direct residue of the sewage of the borough of Vineland. It is subjected, as we have said, to what is termed by the defendant's experts, a septic and chemical treatment. The septic treatment consists of filtration by means of which the solid substances are removed, leaving the watery residue to, by degrees, filter into the drain, and from thence into the brook. The substance reaching the brook, it is contended, is not sewage, because at one point in the process copper sulphate has been mixed therewith, which, it is assumed, will destroy all the coli bacilli or other organisms. The learned Vice-Chancellor seemingly saw the fallacy of this argument by the question which he directed to one of the defendant's experts, Professor Kellerman, where he says (p. 121): "In ordinary parlance or ordinary conversation, as between the very large majority of mankind, is there any doubt about the meaning of the word 'sewage'?" and the learned expert was forced to reply, "I think as I gave it when I first spoke of it, anything that goes through a sewer.."
Q. Is not that what is understood in ordinary conversation?" *A.* I suppose so."

The only expert who attempts to contend that the substance in question is not sewage is a young man by the name of Newcomb, who holds the high-sounding title of Assistant Professor of Botany and Pharmacognosy at the Philadelphia College of Pharmacy. This gentleman, it seems, however, only graduated from the institution in 1905, although he had held the chair above referred to during two years of his course as student. He admits that up until he commenced experiments, previous to his college work, upon a thesis on the subject of purification, on the introduction of copper sulphate, it had not been successfully done by any one else. He says, however, that sewage "is not true sewage if it has not got coli bacilli in it" (p. 87); that when he says that the effluent which goes through the pipes into Tar Kiln brook contains no sewage, he means simply that it contains no coli bacilli (p. 89). He, however, admits that the substance contains a slight odor, and that he would have suspected sewage had he not made a bacteriological examination of the substance in question. He is willing to go so far as to swear not only that this effluent is not sewage, and that it does not pollute the waters of Tar Kiln brook, but says that it is in fact "a potable water, and a safe water, just as it flows from the sewage beds," and that it would not contaminate potable water, but would make it better nine times out of ten." We refer particularly to his cross-examination on pages 96, 97 and 98. We think it doubtful whether this Court will take the same liberal views that this young gentleman takes with regard to a substance which may be properly placed in a drinking water. He goes so far as to state that if there be separated from raw sewage the coli bacilli, the residue may be safely placed in any drinking water (p. 99); and

that he does not consider such a substance injurious even though he admits that it contains decomposed animal matter (p. 102). The limits to which this witness is willing to go are shown by his reckless statements on pages 106 to 108, where, after declaring that raw sewage may be eaten with impunity, "in moderate amounts," but thinks that if you eat anything in large quantities it will hurt you, expresses a willingness to himself drink this effluent, showing how much weight is to be attached to the impetuous statements of the youthful expert who is desirous of demonstrating an experimental theory which he has himself evolved. (See especially p. 108).

The defendant sought to confirm the opinions of Mr. Newcomb by three witnesses, Messrs. Kellerman, Cochran and Cramer, but they soon abandoned any attempt to maintain that the substance in question is not at the point of deposit injurious to potable water.

Referring to Mr. Kellerman's cross-examination (p. 118), he is very careful to say that a mixture of sewage water, of rotten milk or soapsuds, which he admitted would not be removed by the copper sulphate treatment, would not be a proper substance to place in drinking water; that urine would be a polluting substance; that he knows of no case in which the effluent going directly from the sewage beds has been rendered free from coli bacilli by the application of copper except in the case of Vineland; that he has done no work himself on it; that bacteriologically he has made no determination, and that he is interested in it from an experimental standpoint (p. 127).

Mr. Cochran, the second witness, confirms the examination of Dr. Fitz Randolph (pp. 129 to 132).

Mr. Cramer, the most verbose witness sworn in the

case, was the instructor of Mr. Newcomb, and claims with him the joint credit of the so-called copper treatment. Upon his direct examination he claims that by tests which he has made, coli are absolutely eliminated from this substance, and that, therefore, the substance in question is not sewage. He is asked on cross-examination (p. 148) what his definition of sewage is. A careful examination of his testimony from that point to the conclusion discloses an unwillingness on his part to define this substance. He admits, however, that, for example, urine, which contains no *B. coli*, was transmitted into a water-supply, it would tend to pollute it unquestionably (p. 149). That is what occurs at Vine-land. He, however, in a desire to uphold the theory that the substance going into Tar Kiln brook is a potable water in itself, seems to think that taking raw sewage and eliminating therefrom the infinitesimal bacilli, the substance which remained would not tend to corrupt or impair the potable water, although he admits, on the following page (152), that he knows of no place where effluent is discharged into a stream from which potable water is taken. Dr. Cramer, however, seemingly breaks down the defendant's whole case by the admissions which he makes (p. 160), that there are other substances besides bacilli which tend to corrupt or impair a water-supply, and frankly says that he would not recommend the effluent water from a sewage bed to go directly "into my water pitcher," and that the treatment with copper sulphate is largely in an experimental stage. We would call the attention of the Court to his views as expressed on cross-examination to show that, notwithstanding the strenuous efforts which he is making to uphold this copper sulphate treatment as being a curative for all ills, nevertheless admits that this sub-

stance is, in fact, injurious to potable water. His only criticism of the complainant's whole case is based upon the criticism that having arrived at a conclusion, namely, that the copper sulphate treatment was destroying the coli bacilli, any tests which disclosed its presence were presumably erroneous (pp. 162, 163). Without commenting further on the testimony of this witness, we will only call the attention of the Court to the fact that he admits frankly that the entire success of the treatment depends entirely upon the continued flow of the copper sulphate, and that if anything should stop that flow it would permit raw sewage in an injurious form to flow into Tar Kiln brook. Further, being asked whether or not decomposed organic matter would tend to impair the water, he says emphatically, "It would decidedly" (p. 167), forgetting that his colleague, Professor Newcomb, had declared the substance shown in the sample of the effluent necessarily contained decomposed animal matter (p. 102), and finally states that "the water, *i. e.*, the effluent, as it is under those circumstances, the effluent from the pipe, it would tend to impair a water-supply at that point" (p. 168). Conceding this testimony to be true, complainant's case is established.

The whole difficulty of the experts for the defendant and the inconsistency of their position is most glaringly shown in the further cross-examination of Mr. Newcomb, when recalled, his testimony being found on pages 181 to 184 of the book.

The question, therefore, resolves itself into whether it is an adequate defence to this action to juggle with terms; to declare that that which was sewage is no longer sewage when it has had copper sulphate applied to it; ignoring the common acceptance of the word "sewage"; holding that substances which are so revolt-

ing as to be unthinkable are proper substances to place into potable drinking water; to prevent the operation of a most beneficial statute by accepting the experiments of two scientific men, who are as reckless in their statements as the defendant's experts are in this case; by accepting as a proven fact a system which is so far in its experimental stages as to render its results still problematical. Surely such a position as this cannot be taken with safety and with a due regard to the interests of the other citizens of the State, whose health is threatened by these disposal plants. The experts of the defendant have been forced to admit that the so-called purification treatment is in its experimental stage. While the experiments have satisfied them as to the efficacy of the treatment, it is interesting to know that their conclusions are not in harmony with those of other experts of certainly equal standing.

The most recent scientific discussion of this subject is that found in the *Infectious Diseases*, No. 2, published February, 1906, pages 175 to 204, in which the results of a careful test, made by the State Board of Health of the State of Massachusetts, are given by Messrs. Clark and Gage. After numerous and careful experiments made by them for the determination of the efficiency of this method of sewage treatment, they have come to the following conclusions:

"In conclusion, the writers believe that the treatment of water with copper sulphate, or by storing it in copper vessels, has little practical value, for the following reasons:

"I. The use of any method of sterilization which is not absolutely effective is dangerous in the hands of the general user, tending to induce a feeling of false security and leading to the neglect of ordinary precautions which would otherwise be employed.

"II. The removal of bacteria, *B. coli* and *B. typhosus*, by allowing a water to stand in copper vessels for short periods, while occasionally effective, is not sure, and the time necessary to accomplish complete sterilization is so long that the method would be of no practical value to the ordinary user. Furthermore, metallic copper seems to have little more germicidal power than iron, tin, zinc, or aluminum.

"III. Although the removal of *B. coli* and *B. typhosus* is occasionally accomplished by dilute solutions of copper sulphate, these organisms may both live for many weeks in water containing copper sulphate in greater dilutions than 1:100,000; and in order to be safe dilutions of 1:1,000 must be used, in which case the water becomes repugnant to the user because of its strongly astringent taste.

"IV. In some instances very dilute solutions of copper sulphate, or colloidal copper absorbed from contact with clean metallic copper, appear to have a decidedly invigorating effect on bacterial activity, causing rapid multiplication, when the reverse would have been true had the water been allowed to stand the same length of time without any treatment."

At page 174 of the same magazine the same professors summarize their experiments in the use of copper sulphate in water filtration, as follows:

"Summarizing, it can be said that poorer results in water filtration were obtained when using copper sulphate than when operating the same filter without the use of the copper sulphate; a poorer effluent, organically, was obtained, and there was an accumulation of copper upon the sand in the filter that would eventually—if copper, in the form in which it remains upon the sand, has any strength at all as a bactericide—

reduce the efficiency of the filter very greatly; that is, the biological actions upon which good results with slow sand filters depend would be badly impaired."

Life and health ought not to be the subject of experiments, and a statute such as this, when enacted by the Legislature for the purpose of protecting and guarding the health and welfare of the citizens, should not be trifled with, or its provisions not enforced, because, in the opinion of two gentlemen, neither of whom are experts in water analyses, no serious effects will result therefrom.

But if it be conceded, for the sake of argument, that the treatment is efficacious, and that the bacilli are eliminated from the substance deposited in Tar Kiln Brook, nevertheless the law has been violated and the complainant is entitled to the relief sought. Even the experts of the defendant, with the exception of Mr. Newcomb, admit that the definition given by Webster of sewage, namely, "the contents of a sewer or drain; refuse liquids or matter carried off by sewers," is substantially correct, and this is the word taken in its ordinary and accepted form. This is the substance which the Legislature intended to prohibit. It cannot be that the Legislature intended the technical and narrow definition given by Professor Newcomb. That words are to be construed in their ordinary and accepted meaning is so axiomatic as not to require authority, and if there were ever a case where this maxim was applicable, surely it is the present. It is almost unthinkable that a definition which has not the support of a single scientific writer, which has not the sanction of a single scientific expert outside of a boy who has recently graduated from a College of Pharmacy, should have been the meaning

which the Legislature intended should be given to the word "sewage." Disregard, if you will, the removal or non-removal of injurious bacilli from the substance which is flowing into Tar Kiln Brook; concede that it is not injurious; nevertheless, it is sewage within the meaning of the act; it is domestic refuse within the meaning of the act; it is excremental polluting matter within the meaning of the act; it corrupts and impairs the quality of the water of the brook, and is prohibited by the act from being placed therein.

The defendant further introduced evidence to show that the sewage beds in question had been located in the particular spot chosen with the consent of the State Sewerage Commission, a commission provided for by an act passed subsequently at the same session of the Legislature at which the Potable Water Act was passed (P. L. 1899, Chap. 210, p. 530). This act was subsequently amended by Chapter 72, Laws of 1900 (P. L. 1900, p. 113). These latter acts, which we shall refer to as the "State Sewage Act," provided for the creation of the State Sewerage Commission, and conferred upon that commission certain powers in the regulation and control of the disposal of sewage throughout the State. Section seven of this act, as amended, reads as follows:

"It shall be unlawful for any person, corporation or municipality to build, or cause to be built, or operate, any plant for the treatment of sewage or other polluting substance, from which the effluent is to flow into any of the waters of this State, except under such conditions as shall be approved by the State Sewerage Commission, to whom any new plans shall be submitted before building."

As we have said, the borough of Vineland, prior to the erection of the disposal works plant, submitted the

plans for such work to the State Sewerage Commission, and secured its approval. It is contended, on behalf of the defendant, that this permission renders the borough immune from the provisions of the Potable Water Act, and that having secured the permission of the Sewerage Commission, the State Board of Health cannot now prevent the contamination of Tar Kiln brook by calling into operation the Potable Water Act. In considering this argument it should be noted, first, that the act in question does not confer any privilege on any one. It is a restriction of the right to deposit the effluent of sewage or other polluting substances in *any of the waters of this State, without the consent of the State Sewerage Commission*. The Potable Water Act imposed a penalty for the deposit of polluting substances in potable waters. This act prohibited the deposit in any waters. Both of these acts are a limitation upon a right which previously existed, to deposit sewage either in potable or other waters without interference. The argument is seemingly fallacious therefore that the consent of the State Sewerage Commission conferred any new rights, privileges or powers upon the borough of Vineland, or removed it from the operation of the Potable Water Act.

Treating the contention, however, somewhat more at length, it should be noted that the argument involves the assumption that the Legislature of 1899, after enacting Chapter 41 of the Laws of that year, which, by its title, was an act to secure the purity of the public supplies of potable water in this State, and specifically prohibited the doing of various things which would tend to pollute them, at the same session, in Chapter 210, conferred upon the State Sewerage Commission the right to grant consent to a municipality to violate the earlier act, and having conferred upon the State Board of Health the

power to guard the purity of the potable waters, at once conferred upon the Sewerage Commission the power to grant permission to pollute these waters.

The acts in question received the executive approval almost at the same time, one having been approved on the seventeenth of March, 1899, and the other upon the twenty-fourth of March. Every presumption under the circumstances of the passage and approval of these two acts should be in favor, therefore, of the view that they were intended to be harmonious, and to accomplish the same end, namely, the preservation and protection in its original purity of our potable waters. Under these circumstances it is clear that the provisions of each act were intended to have full force and effect, and neither was to be modified or controlled by the other. Both, as we say, had a common purpose, and both were intended to accomplish a common end. Neither the sewerage act of 1899, nor the later amended act of 1900 contains any express repealer, so that if the potable water act was repealed or modified, it was done by implication and not by express action of the Legislature.

The amended act is really a re-enactment of the Act of 1899, with some slight additions.

Sections one and two of the new act are identical with the old.

Section three contains but a slight change, increasing the salaries of the commission from one thousand to fifteen hundred dollars.

Section four is the same.

Section five has been changed by adding to it a proviso for a notice and a proviso authorizing an appeal to the Court of Chancery.

Section six is practically the same, except that the

proviso has an addition to it that the persons controlling existing sewers must cease to pollute after notice.

Section seven is the same.

Sections eight and nine are new.

Section ten is identical, and section eleven simply fixes upon the sum of five thousand dollars which may be expended by the board.

Section twelve is identical with section eleven of the old act.

Section nine of the old act defines the words "waters of this State" to mean and include any and all waters of any pond, lake, creek, inlet, bay, estuary, river or stream of this State. In the amended law this section has been incorporated as section forty-two, and the words "waters of this State" are declared not to include the ocean or any waters separating this State from any other unless such waters are used for potable purposes.

In the case of *State v. Anderson*, 11 Vr. 224, the Supreme Court, speaking through Chief Justice Beasley, said:

"It has often been adjudged that the ordinary law relating to the repeal by implication of statutory provisions does not apply to acts which are re-enacted because they have been re-arranged or consolidated. When the body of statutory law is revised and re-enacted, the general purpose is obvious, and such purpose is not to change the existing system, except in cases where the intention to do so is clearly specified; and, hence, it is that the order of time in which such a series of consolidated acts receive the official sanction is of little, if any, moment in a question of implied repeal."

If, therefore, the Amended Sewerage Act of 1900 was nothing more than a re-enactment or continuation

of the Act of 1899, as seems to be conceded by the Vice-Chancellor, then the same construction should be put upon the re-enacted statute as would have been given to the original statute, and the intent of the Legislature in passing the original statute ascertained.

Lewis' Sutherland Stat. Con., Vol. 1, Sec. 273.

Ruckman vs. Ranson, 6 Vr. 566.

Clement vs. Kaign, 2 McCarter 56.

Wetherby vs. Wetherby, 34 Vr. 445.

Smith vs. Regan, 25 Vr. 167.

Carter vs. Mayor of Rahway, 28 Vr. 196.

Knight vs. Freeholders of Ocean, 20 Vr. 485.

Smith vs. Colloty, 40 Vr. 370, and cases there cited.

It is not to be assumed that the Legislature, in passing the State Sewerage Act in 1890, had not in mind the provisions of the previous act passed ten days before, known as the Potable Water Act, because both acts were before both branches of the Legislature practically at the same time. The Potable Water Act was known as Senate No. 49, while the State Sewerage Act was known as Senate Bill 152.

As judicial notice apparently is taken of the journals (*Lewis' Sutherland Stat. Con., Vol. 2, Sec. Ed., p. 100; In Re Murphy, 3 Zab. 194*), the record of the passage of these two bills in the Senate and House follows:

SENATE.

On January 31, 1899, W. M. Johnson introduced Senate Bill 49, entitled "An act to secure the purity of the public supplies of potable waters in this state," which was read for the first time by its title, ordered to have a second reading and referred to the Committee on Public Health. (Senate Journal 1899, p. 59.)

On February 21, 1899, Mr. Hand, chairman of the Committee on Public Health, reported Senate Bill 49, entitled "An act to secure the purity of the public supplies of the potable waters in this State, with amendment, which was read and adopted, and the bill ordered to be reprinted. (Journal, p. 90.)

February 27, 1899, Senate Bill 49, entitled, &c., was taken up, read a second time, considered by sections, agreed to, ordered to be engrossed and to have a third reading. (Journal, p. 112.)

March 7, 1899, Senate Bill 49 was taken up and read a third time and passed by a vote of 13 to 7, and the Secretary was directed to carry said bill before the House and inform that body that the Senate had passed the same and requested its concurrence therein. (Minutes, p. 187).

HOUSE.

March 8, 1899, a message was received in the House from the Senate, informing that body that Senate Bill 49 had been passed by the Senate, and requested the concurrence of the House of Assembly. (Minutes 1889, p. 221.)

March 8, 1899, Senate Bill 49 was taken up, read for the first time by its title, ordered to have a second reading and referred to the Committee on Revision of Laws. (Minutes, p. 223.)

March 9, 1899, Mr. Bell, chairman of the Committee on Revision of Laws, reported Senate Bill 49 favorable, with amendment, which amendment was adopted. (Minutes, p. 256.)

March 9, 1899, Senate Bill 49 agreed to and ordered to have a third reading. (Minutes, p. 260.)

March 13, 1899, Mr. Guenther, chairman of the Committee of Gross Bills, reported Senate Bill 49 correctly engrossed. (Minutes, p. 263.)

March 14, 1899, Senate Bill 49 was taken up and passed by a vote of 46 to 0; ordered that the speaker sign the bill and the clerk carried it to the Senate and informed the Senate that the House had passed the same. (Minutes, p. 278.)

SENATE JOURNAL.

March 15, 1899, message from the House that Senate Bill 49 had been passed with House amendment. (Journal, 264.)

March 15, 1899, the amendments made in the House of Assembly to Bill 49 were taken up severally, read three times and concurred in by a vote of 13 to 0. (Journal, 265.)

March 16, 1899, Senate Bill 49 delivered to the Governor.

SENATE JOURNAL, 1899.

March 1, 1899, W. M. Johnson, on leave, introduced Senate Bill 152, entitled "An Act to prevent the pollution of the waters of this state by the establishment of a State Sewerage Commission and authorizing a creation of Sewerage Districts and District Sewerage Boards and prescribing, defining and regulating the powers and duties of such commissions and such boards," which was read for the first time by its title, ordered to have a second reading and referred to the Committee on the Judiciary. (Journal, p. 147).

March 23, 1899, Mr. Johnson, chairman of the Committee on Judiciary, reported committee substitute for Senate Bill 152. (Journal, p. 389.)

March 23, 1899, Senate Bill 152 was taken up, read a second time, considered by sections, agreed to, ordered to be engrossed and to have a third reading. (Journal, p. 391.)

March 23, 1899, Senate Bill 152 was taken up and read a third time, and was passed by a vote of 16 to 0. (Journal, p. 442.)

HOUSE MINUTES.

March 23, 1899, message from the Senate to the House, informing the House that Senate Bill 152 had been passed by the Senate and requesting the concurrence of the House. (Minutes, p. 500.)

March 23, 1899, Senate Bill 152 read for the first time by its title, ordered to have a second reading and referred to Committee on Judiciary. (Minutes, p. 503.)

March 24, 1899, Mr. McKee, chairman of the Judiciary Committee, reported Senate Bill 152 without recommendation. (Minutes, p. 521.)

March 24, 1899, Committee Substitute for Senate Bill 152 was agreed to and ordered to have a third reading. (Minutes, p. 543.)

March 24, 1899, Senate Bill 152, under suspension of rules, was taken up, read a third time and passed by vote of 42 to 7, ordered Speaker to sign the bill and the clerk to carry it to the Senate. (Minutes, p. 544.)

SENATE JOURNAL.

March 24, 1899, message from the House to the Senate that Senate Bill 152 had been passed without amendment. (Journal, p. 474.)

March 24, 1899, bill delivered to Governor.

In *Lewis' Sutherland Statutory Construction, Volume 1, Section 268*, it is said:

"The presumption is stronger against implied repeals where provisions supposed to conflict are in the same act or were passed at nearly the same time. In the first place it would manifestly be an inadvertance, for it is not supposable that the Legislature would deliberately pass an act with conflicting intentions; in the other case, the presumption rests on the improbability of a change of intention, or, if such change had occurred, that the Legislature would express it in a different act without an express repeal of the first. 'Statutes enacted at the same session of the Legislature should receive a construction, if possible, which will give effect to each. They are within the reason of the rule governing the construction of statutes *in pari materia*. Each is supposed to speak the mind of the same Legislature, and the words used in each should be qualified and restricted, if necessary, in their construction and effect, so as to give validity and effect to every other act passed at the same session. The presumption is that different acts, passed at the same session of the Legislature are imbued by the same spirit and actuated by the same policy, and that one was not intended to repeal or destroy another."

In *Banks vs. Yolo County, 104 California*, the Court had under consideration two acts—one passed March 15, 1899, and the other on the following day. There was no clause in the latter act repealing any part of the former. The Court says:

"If, therefore, it repeals the former act, it must do so by implication. But "repeals by implication are not favored; and the repugnancy between two statutes should be very clear to war-

rant a court holding that the later in time repeals the other, when it does not, in terms, purport to do so. This rule has peculiar force in the case of laws of special and local application, which are never deemed repealed by general legislation except upon the most unequivocal manifestation of intent to that effect." (*Cooley's Constitutional Limitations*, 6th ed., 182.) In the case at bar the two acts, passed so near each other in point of time, must be so construed, if possible, as to give effect to both."

In *State vs. Archibald* 43 Minn. 330, the Court said:

"Of course, repeal by implication can be effected by inconsistent enactments at the same session of the Legislature; but it has been said that statutes enacted at the same session are to be construed to a certain extent as one act, and therefore, in such a case, there is a much stronger presumption against an intention to repeal which is not expressed than in case of statutes passed at different sessions; and in such cases, there should be such an exposition as will give effect to what appears to be the main intent of the law."

In *Houston R. R. Co. vs. Ford*, 53 Texas 364, the Court said:

"We are not advised why the Legislature at the same session passed two acts so similar in their provisions. * * * As they were passed at the same session of the Legislature, a more liberal rule of construction should be allowed against the repeal by implication of the first by the passage of the second." * * *

See also *Smith vs. People*, 47 N. Y. 330, 339; *White vs. City of Meadville*, 35 Atl. Rep. 695, 697; *Am. & Eng. Ency. Law*, Vol. 26, p. 736, par. ee.

In regard to implied repealer the rule is well settled that the courts will not favor implied repealers, but will

give to each statute its force and effect, notwithstanding the enactment of the law on the same general subject, unless the two laws are so inconsistent as to render this impossible.

The cases in this State are uniform: One of the earliest cases in which this question of implied repealer has secured a judicial expression is found in that of the *Industrial School District vs. Whitehead*, 2 *Beasley*, p. 290. In it Chancellor Green said, at page 291, "the repeal of the statute by implication is not favored. Unless the whole statute is manifestly inconsistent with and repugnant to the former, both remain in force. Courts are bound to uphold the prior law if the two may subsist together. The matter must be so clearly repugnant that it necessarily implies a negative."

Chief Justice Beasley, in delivering the opinion of the Court of Errors and Appeals in the case of *Ruckman vs. Ransom*, 6 *Vr.* p. 565.

Page 566: "There are no expressed words of repealer in the re-enacted law, and it is the familiar legal doctrine that an inferential repeal of a statute is a pure question of intention, and that every reasonable intentment will be made against such result. Such destroying effect will be deemed to reside in the more recent statute only when it is absolutely irreconcilable with the prior one. Mr. Sedgwick thus states the doctrine of the judicial decisions: 'It is, therefore, but reasonable to conclude, that the Legislature, in passing a statute, did not intend to interfere with, or abrogate any prior law relating to the same matter, unless the repugnancy between the two is irreconcilable; and hence a repeal by implication is not favored; on the contrary, the courts are bound to uphold the prior law,

if the two acts may well subsist together.' *Sedg. Stat. and Con. L. 127.*"

The most recent expression of this rule is found in the case of *Hotel Registry Corporation vs. Stafford*, 41 *Vr.* 522. Justice Pitney, in delivering the opinion of the Supreme Court, says, page 536, "Implied repealers are not favored in the law. The question is one of legislative intent in each case. Where the later statute is not necessarily repugnant to the former, but on a fair construction may be treated as cumulative or supplementary, so that both acts may stand together, the intent to repeal is not implied from the fact that the later legislative provision differs from the earlier."

We respectfully submit that there has been no repeal of the earlier statute, for an examination discloses that its sole object is to secure the purity of the public supply of potable water for domestic use, while the later act, as re-enacted indicates by its title that it is an "Act to prevent the pollution of the waters of this State by the establishment of a State Sewerage Commission, and authorizing the creation of sewage districts and district sewage boards, and prescribing, defining and regulating the powers and duties of such commission and such boards."

Section five of this last-named act authorizes the commission to investigate the various methods of sewage disposal, in order to make proper recommendations in regard thereto, and provides for the giving of notice to any person, corporation or municipality found to be polluting waters, and that, prior to a time to be fixed by the commission, which shall not be more than five years from the date of said notice, the person, corporation or municipality must cease to pollute said waters and make such disposition of their sewage or other polluting mat-

ter as shall be approved by the State Sewerage Commission.

Section six makes it unlawful for any person, corporation or municipality to "build any sewer, drain or sewerage system from which it is designed that any sewage, or any other article or deleterious matter, solid or liquid, shall flow into any of the waters of this state, so as to pollute or render impure said waters, except under such conditions as shall be approved by the State Sewerage Commission." A proviso to this section excepts existing sewers, unless the person or municipality controlling said sewers shall be served with a notice to cease pollution.

Section seven contains a prohibition against any person, corporation or municipality building, or causing to be built or operated, any plant for the treatment of sewage, or other polluting substance, except under such conditions as shall be approved by the State Sewerage Commission, to whom plans must first be submitted.

Section eight provides that it shall be unlawful for any person, corporation or municipality, after the date specified in the notice specified in section five, "to permit or allow any sewage or other polluting matter to flow into said waters from any sewer, drain, or sewerage system, except under such conditions as shall be approved by the State Sewerage Commission."

Section nine authorizes an application to the Court of Chancery for an injunction "to prevent the violation of the provisions of this act."

It is to be noted that section six prohibits the building of any sewer, drain or sewage system from which sewage is to flow into the waters of this State, except under such conditions as shall be prescribed by the commission; section seven to the building or operation of a

plant for the treatment of sewage, and not to sewers themselves, except under certain conditions, and section eight to existing sewers, the flow from which, after notice as prescribed in section five, may be entirely prohibited, if the conditions approved by the commission under which the sewage may be discharged in the waters be not complied with.

The whole purport and design of this so-called amendatory Act of 1900, as even a cursory examination will show, is to prevent the pollution of the waters of this State by any substance which flows from a sewer, drain or system of sewers or sewerage plants. Nowhere in the act, apparently, is there any power to prevent the pollution in any other manner of the waters of this State. While it is true that this Act of 1900 does confer upon the Sewerage Commission power to apply to the Court of Chancery for an injunction to restrain any person, corporation or municipality from violating any of the provisions of said act, still the violations to be restrained would be such only as occurred by sewage, or other polluting matter, flowing into waters from a sewer, drain, sewerage system or sewerage plant, and not to polluting matter which could get into a stream of potable water in any other manner. If, therefore, this latter act is limited to such matters as may flow through a sewer, drain, system of sewers, or sewerage plant, how are polluting matters, such as chemicals and dyes, which are discharged from factories and the like into potable water, to be restrained? Certainly not by the Act of 1900, for that act has its limitations, as has been indicated.

It is needless to attempt to indicate the many ways in which the waters of a stream used for potable purposes may be polluted, other than from a sewer, drain, sewer-

age system or sewerage plant. But one or two illustrations will suffice. For instance, if a person should locate a pig-pen on the banks of a stream of potable water, the use of such a pig-pen could not be restrained under the Act of 1900, but could be under the Potable Water Act. So, also, if a person should allow the waste liquids from the sink in his dwelling to flow into a stream of potable water, that apparently could only be restrained under the Potable Water Act, and so with overflowing vaults and the like, all of which could be restrained under the Potable Water Act.

Further than this, the Potable Water Act prohibits the placing or depositing upon the *ice* of any river, brook, &c., any sewage, drainage, domestic refuse, excremental or other polluting matter of any kind whatsoever, and also the placing of any such polluting matter upon the *banks* of any river, brook, &c. Certainly, violations of this kind could not be prevented by the Sewerage Act.

These various methods of pollution which cannot be restrained by the Sewerage Act are merely indicated because of the view taken by the Vice-Chancellor that the entire Potable Water Act had been swept away.

As has been seen, the Potable Water Act is limited in its operations to "*potable waters*," and to such potable waters alone as are used by a municipality for the domestic water-supply, while the sewerage act refers generally to all "*waters*," excluding, however, the waters of the ocean or stream separating this State from any other, unless used for potable purposes.

In *Rodgers v. United States*, 185 U. S. 83, 89, the following excerpt from the case of *Crane v. Reeder*, 22 Mich. 322, 334, is quoted approvingly:

"Where there are two acts or provisions one of which is special and particular, and certainly includes the matter in question, and the other general, which, if standing alone, would include the same matter, and thus conflict with the special act or provision, the special must be taken as intended to constitute an exception to the general act or provision, especially when such general and special acts or provisions are contemporaneous, as the Legislature is not to be presumed to have intended a conflict."

See also *Kellogg v. Treasurer*, 41 Mo. 17, 24; *In Re Rouse, Hazard & Co.*, 91 Fed. Rep. 96, 101; *Lewis' Sutherland Stat. Cons.*, Vol. 1, Sec. 274.

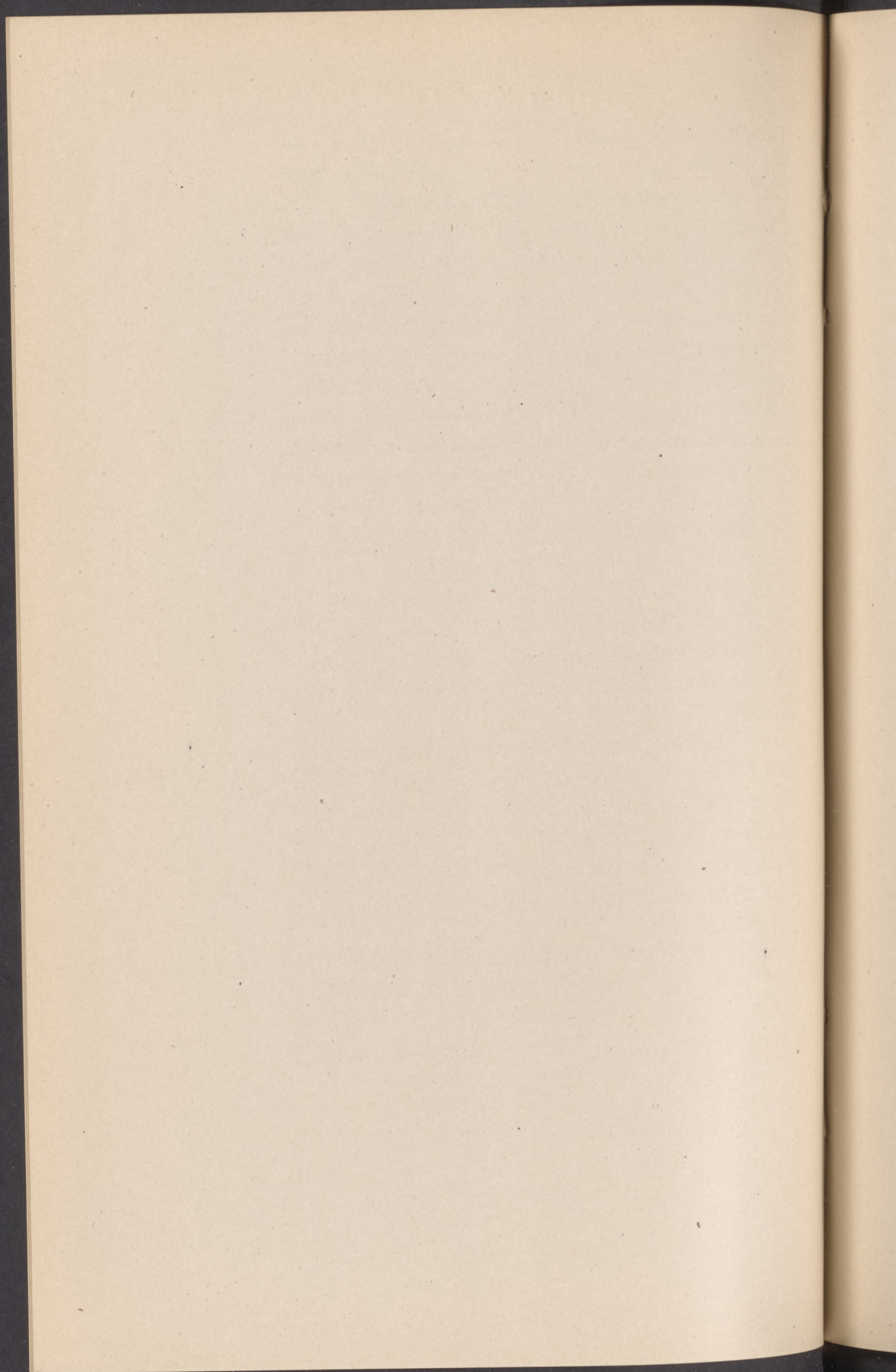
Surely it cannot be argued from the fact that a prohibition against pollution of any of the waters, without the consent of the State Sewerage Commission, would confer the right upon the State Sewerage Commission to give a consent to the pollution of the potable waters. The clear intent of the Legislature was to confer upon the State Board of Health the exclusive jurisdiction in case of pollution of potable water supplies, and in the broader act to require the consent of the State Sewerage Commission before sewage should be placed in any waters. It should, furthermore, be noted that it is not all effluent which is prohibited by the Potable Water Act. While it is true that practically, at the present time, no effluent coming from a sewage bed is safe to be placed in potable water, still the time may come when by scientific treatment an effluent from a disposal works will not come within the prohibition of the Potable Water Act. If by scientific treatment an effluent from a disposal works will not, by itself, or in connection with other matter, corrupt or impair potable waters, then it will not come within the prohibition of the Potable Water Act, but

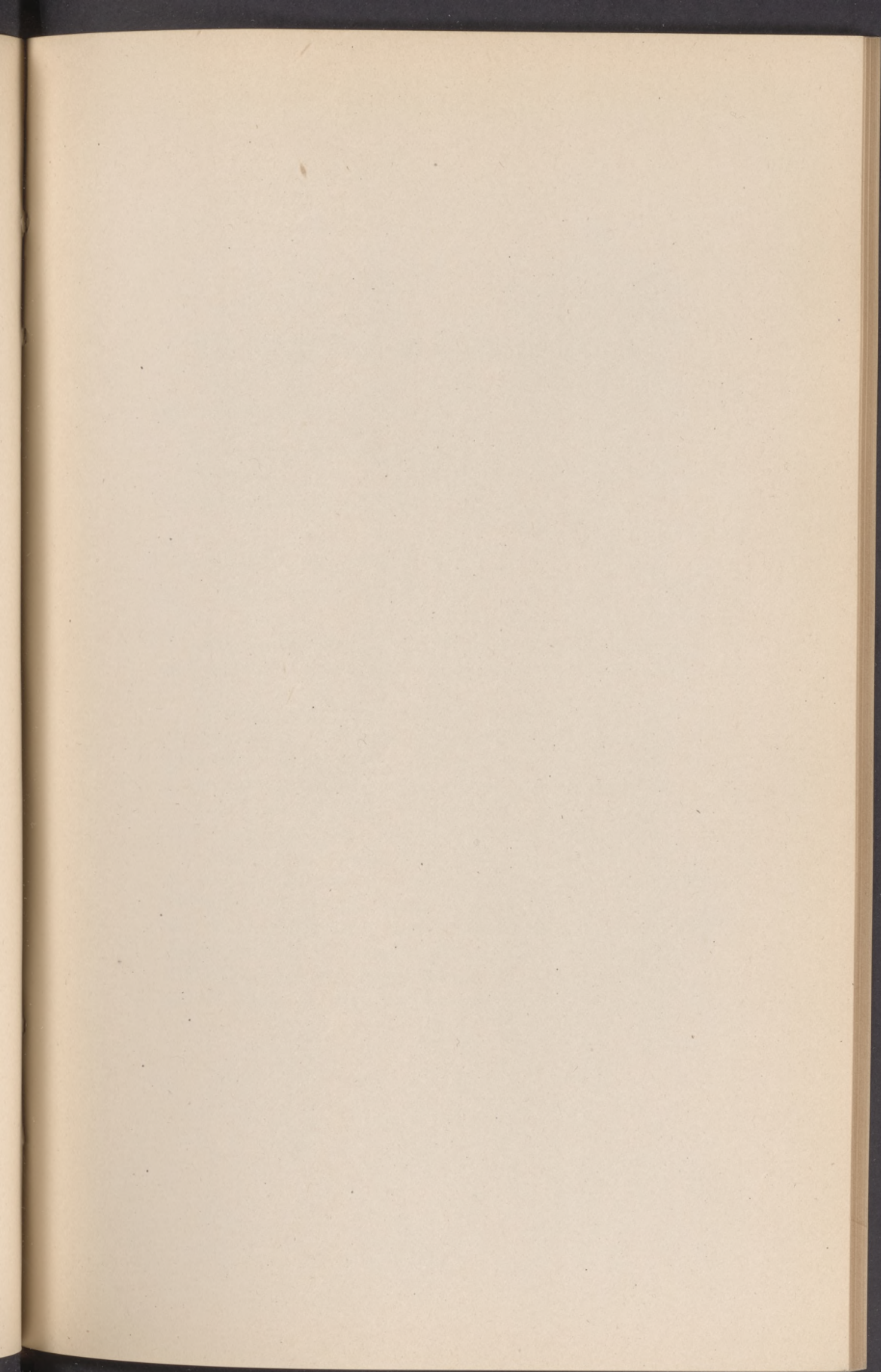
even in such a case before such effluent may be placed in any of the waters of the State the consent of the State Sewerage Commission must be first obtained.

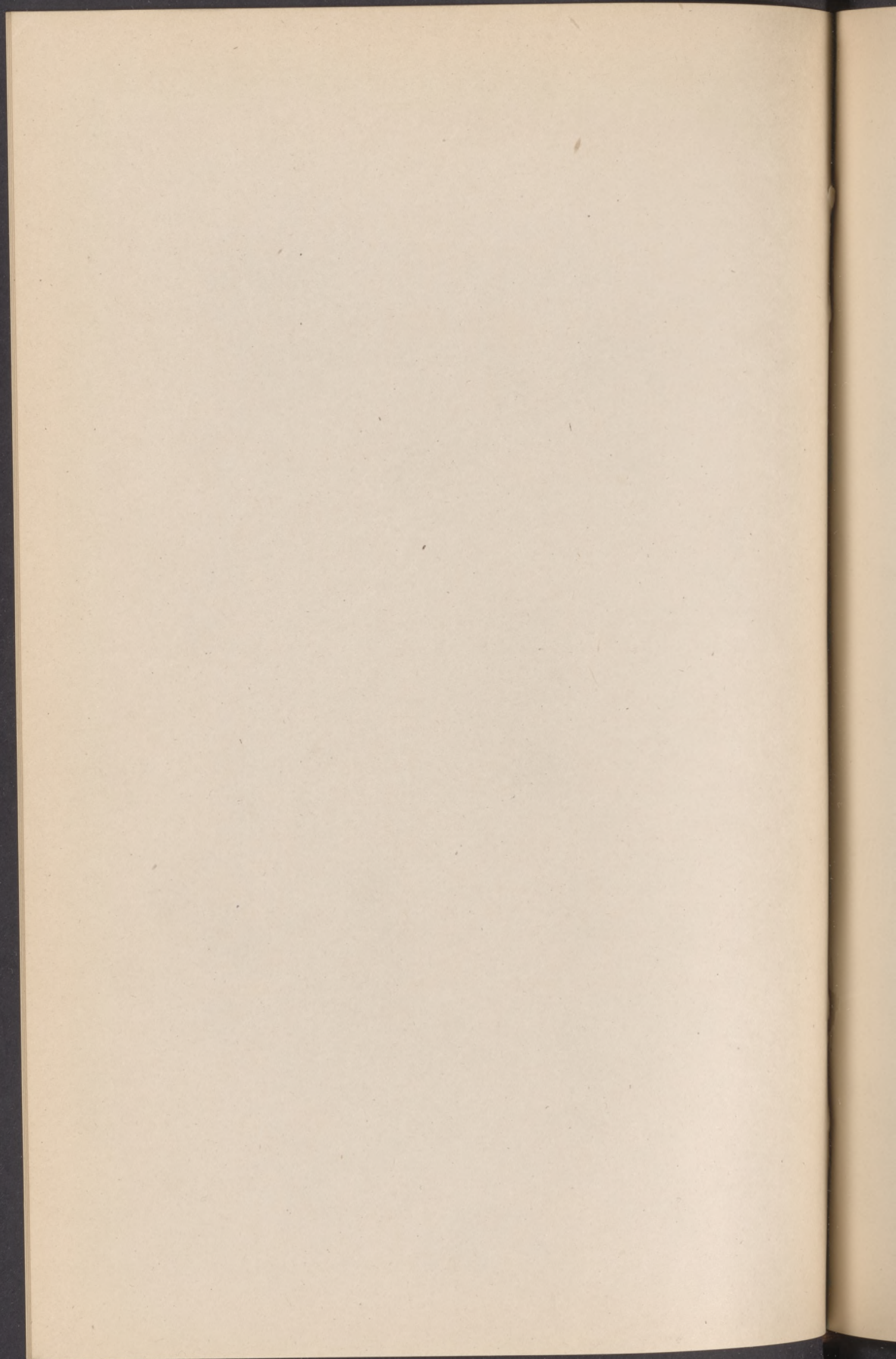
Section seven of the Sewerage Commission Act only applies to the question of the approval of plans. Supposing that the *plan* will theoretically produce an effluent which will not tend to corrupt the potable waters, but in the operation the effluent becomes polluting, can it then be said that the Legislature intended that such a substance might be placed in the potable water because the plan of the disposal works, from which such effluent came, had been approved? Clearly the intent was to prevent the erection of improper plants and not to grant permission to the disposition of corrupting substances flowing from the works erected in accordance with such plans. Giving to this act the broadest possible meaning, it cannot go beyond the permission for the erection of a plant and leave to the Board of Health the right to prevent the effluent from such plant polluting the potable waters.

It is, therefore, respectfully submitted that the Potable Water Act has not been repealed; that the effluent which is permitted to flow into Tar Kiln brook does pollute or impair, or tend so to do, the quality of the water of that brook, and that the decree of the Court of Chancery should be reversed and an injunction issue as prayed for.

THEODORE BACKES,
EDWARD D. DUFFIELD,
ROBERT H. McCARTER,
Attorney-General.







New Jersey Court of Errors and Appeals

Between The State, at the Re-
lation of the Board of
Health of the State of New
Jersey,

Complainant and Appellant

AND

The Borough of Vineland
Defendant and Appellee

On Bill For Injunction

B R I E F

Brief of Herbert C. Bartlett and Royal P. Tuller,
of Counsel with the defendant, The Borough of Vineland.

The Bill of Injunction filed in this case is to enjoin the Borough of Vineland from permitting the effluent from filtration beds maintained by it in connection with a Sewage Disposal Plant to escape into the waters of Parvins Creek (amended by consent to waters of Tar Kiln Creek) and from further polluting the waters of Tar Kiln Creek, Parvins Brook and Maurice River, by the use, maintenance and operation of its system of sew- 10
ers and sewage disposal plant filtration beds, in viola-
tion of the provisions of an act of the Legislature of New
Jersey, entitled, "An Act to Secure the Purity of the
Public Supplies of Potable Waters in this State, ap-
proved March 17, 1899," by reason of which the supply

of water taken by the Millville Water Company (from Union Lake into which Maurice River empties) at a distance of 15 miles from Parvins Brook is polluted.

Defendant, by its answer, denies that the effluent from its filtration beds in any way tends to or in fact does corrupt, impair or pollute the quality of water of Maurice River, either at the intake of the Millville Water Company or at any other point or place in said river, or in any way injures the public water supply to the
 10 city of Millville, and shows by the evidence produced at the hearing of this cause, that it does not corrupt, impair or pollute, or tend to corrupt, impair or pollute the waters of Tar Kiln Creek.

FACTS AND REVIEW OF EVIDENCE.

The filtration beds connected with the Sewer System of the Borough of Vineland are Intermittent Sand Filter Beds, eleven in number, covering $5\frac{3}{4}$ acres, located on the banks of a stream of water called Tar Kiln Creek, which stream flows into Parvins Brook; Parvins
 20 Brook flows into Maurice River, and Maurice River flows into Union Lake, at the lower end of which the city of Millville gets part of its water supply, 15 miles from said filtration beds.

The Filtration Beds were located at this point under the direction and approval of the State Sewerage Commission of New Jersey; plans for the same were submitted on June 25th, 1900, to the Commission and the Commission on July 13th, 1900, visited Vineland, and approved the location of the beds and the plans for the
 30 same. See pages 185-186 of State of the Case.

In April, 1904 (See testimony M. Fry, page 53 of

Case) the beds were remodelled, the under drains changed by removing the terra cotta pipes, substituting fired pipes.

This change was made and the beds fixed in accordance with suggestions of the State Sewerage Commission (See Testimony of Garrison, pages 58-59, State of Case).

The beds were built by excavating a field of five acres, then by banking the same and dividing into eleven beds. The bottom of the beds are filled with sand, the first thickness being about three feet through, then follows coarse sand, then a layer of cinders around the drain pipes, the first three beds being used as settling beds, and the remainder as filtering beds. 10

The amount of the sewerage received on the beds is about 250,000 gallons per day, being the sewerage of the Borough of Vineland, which has a population of 4500.

The treatment of the sewerage as received on the beds is as follows,—See Testimony of Garrison, page 20 56; Newcomb, pages 70-71, and page 109, line 30 and 110, line 10, State of the Case.

The raw sewerage runs into settling beds, A. B. and C. (See Blue Print—Exhibit D 3)

The raw sewage runs into settling bed A for twelve hours, the next twelve hours into settling bed B; while running into settling bed B, it is being drained out of settling bed A. From settling bed A the clarified settled sewage which has received a septic action passes to the filter beds. Copper sulphate is applied to this effluent (all the solid matter remains in the settling beds) as it passes from the settling bed to the filter beds. This 30

effluent has been greatly purified before it reaches the filter bed. The water or effluent from the settling after it passes on to the filter beds slowly filters through first a layer of sandy loam which is on the surface, next it strikes a layer of fine cinders, and third a layer of coarse cinders, which surround the under drains, and runs out from under drains into Tar Kiln Creek, having had all pathogenic organisms removed and about all solid matter, only 150 parts in a million being left. The
 10 chemical purification has also been nearly completed to such an extent the water is fit to drink. (See Testimony Newcomb, pages 109-110, State of the Case.

The defendant produces six witness to show the construction of the plant, its methods of operation and efficiency, and four witnesses, Professors Newcomb, Cramer, Cochran, and Mr. Kelleman, who testified as to safeness and potability of the effluent passing from the filtration beds into Tar Kiln Creek.

FIRST—Testimony of E. Leigh Newcomb, Assis-
 20 tant Professor of Botany and Pharmacognsy in the Philadelphia College of Pharmacy, under which subjects are embraced a course in Bacteriology, chemistry and water examinations (Pages 67-68-69 of Case). Prof. Newcomb was hired by the Borough of Vineland in April, 1905, to overlook its sewage disposal plant and filtration beds to get a better purification of sewage. (See pages 67-68, State of the Case).

He at once consulted with Professors Moore and Kellerman of the Bureau of Plant Industry, Department
 30 of Agriculture at Washington (this department of the United States Government being concerned with the

purification of public water supplies throughout the country. Pages 113 and 121 State of the Case), also with Professor Kramer, Professor of Botany and Pharmacognosy in the Philadelphia College of Pharmacy, which department comprises a course in bacteriology and water purification, as well as in chemical examination of the same. As a result of this meeting the use of copper sulphate in connection with the action produced by the beds themselves was determined on. The Bureau of Plant Industry having conducted successful experiments both 10
in the purification of public water supplies throughout the country (See pages 114 and 123 State of the Case) and also in the treatment of sewage and sewage effluent (Pages 114 and 115 State of the Case).

Professor Newcomb, who is both a chemist and bacteriologist (page 69, State of the Case) proceeded to make examinations of the raw sewage, sewage in the settling beds, effluent from the settling beds to the filter beds and from the filter beds to Tar Kiln Creek, as well as the waters of Tar Kiln Creek, Parvins Branch and 20
Maurice River.

We will confine his results to the beds themselves and from the effluent passing from the beds into Tar Kiln Creek, as the Vice Chancellor confined us to this position. He made reports from time to time of his examinations in triplicate, one being filed with the Superintendent of Public Works, Vineland; one with the State Sewerage Commission and one with the Bureau of Plant Industry at Washington, D. C. (Page 71, State of the Case. 30

The indications of dangerous organisms in water and sewage effluents are termed Coli or B Coli or the

Colin Bacilli.

It will be noticed that Professor Newcomb made over 100 examinations of water from the Vineland sewer beds from April 1905 to January 17th, 1906 (page 91) and as he states on 89 of State of the Case, before he began to use copper he found coli, after that none. These examinations from October 1905 to January 1906 were bacteriological, from January 1st, 1906, to January 30th, both bacteriological and chemical (pages 76-77 of Case), and with the constant examinations going on from October 1905 to January 1906, with one or two exceptions, no coli was shown; and from January 1st, 1906, to January 30th, the date of the hearing, *no coli were shown in either the chemical or bacteriological examinations*, this during the same month that Dr. Fitz. Randolph claimed he found coli (Page 77 State of the Case), on page 80, line 30 is shown his care in gathering samples, and on page 81 it appears he examined same with Professor Kramer, and as he states on page 20 89, after he began to use copper, no coli. On page 93 of Case will be found his tests and how he got his results.

On pages 96 and 97 of Case he is asked: Using the word sewage in a broad sense, not in a narrow sense, the substance which is passing into Tar Kiln Creek is sewage?

A. No, sir.

Q. I am not using your narrow definition; I am asking you whether the effluent is not a portion of the 30 sewage matter which is deposited on the beds?

A. *It is not.*

Q. What is the liquid—where does it come from?

A. That is filtered from the sewage which has been treated with copper, which has been settled, treated to copper and a septic tank action. (Page 97, State of the Case.)

Page 97, State of the Case:

Q. Is that material proper for a drinking water?

A. *It is a potable water.*

Q. Is it a safe water?

A. *Yes.*

Q. No you can't contaminate a stream of potable 10
water by pouring that in.

A. No, you can't contaminate any stream.

Page 98, line 10 of State of the Case:

The question is whether in your opinion that effluent is of such a character that it would contaminate potable water if poured into it?

A. It would not contaminate potable water; it would make it better nine times out of ten.

The reason of this is plain—most potable waters are surface waters, they are not as pure as water that 20
has been treated, distilled or filtered. The effluent which is water from these beds has been subjected to three treatments: *a*, Settling or septic tank action; *b*, Copper sulphate; *c*, Filtration, while surface drinking waters contain much drainage and have been subjected to no treatment, so that that effluent passing into Tar Kiln Creek from the Vineland Sewer Beds is *more pure than the waters from Tar Kiln Creek itself.*

See page 158, line 20, top of page 159, also page 30

141, for destruction of bacteria in drinking water, also page 74 of State of Case for elimination of coli and organisms by the filter beds themselves and with the use of copper sulphate combined.

Page 99 State of the Case: Do you consider it injurious?

A. *Not at all.*

Page 101 of Case: What do the Nitrates indicate?

A. Breaking down of ammonia compounds.

10 Q. Is that beneficial?

A. Beneficial.

Page 102, is asked as to odor.

A. It comes from the secondary growth.

Page 103, defines potable water as one safe to drink

Page 103, Is asked what are the harmful substances in water.

A. Bacteria.

Page 104, How much suspended matter is allowed in potable water?

20 A. 600 parts in a million.

Q. How do you get your standard?

A. Set by the Sanitarians of the country Trimble & Sadler.

Q How much do you find in effluent at Vineland?

A. *Only One 151 parts in a million.*

On pages 104, 105, and 106 of Case, Prof. Newcomb describes the chemical and bacterial changes taking place in the sewage as it is received on the beds.

30 (1) The septic tank action—the breaking down of the organic matter of sewage that is the crude solid matter in sewage which is broken down in the septic tank (settling beds) into soluble constituents which go

through from the settling bed to the filter beds.

(2) In passing from the settling bed to the filter beds it is treated with copper sulphate.

(*Asked by Vice-Chancellor page 106 of Case, if this process is not going on all the time in Nature, the answer is, Yes,—to a greater or less extent you get nitrification everywhere.*)

(3) After all dangerous pathogenic organisms are removed by the copper it is then filtered on the filter beds and it is then clear and potable.

10

All these processes go on before water passes from the beds through its pipes to Tar Kiln Creek.

We want to call the Court's particular attention to the action of these filter beds in purifying sewage and its effluent. The complainant would have you believe that raw sewage runs on to the beds and then right out again into Tar Kiln Creek (that is the case when a city or municipality runs its raw sewage into a stream or river), but here at Vineland you have a scientific plant, constructed for the very purpose of treating sewage, removing dangerous organisms, so that its effluent may pass with safety into the streams and rivers of this State without polluting them; and the Vineland beds have the double safeguard of copper sulphate.

20

The question was repeatedly put by Mr. Duffield as to if what passes through *after the coli was removed was not still sewage, and the answer was repeatedly made. NO.* The Complainant overlooks entirely the action of the filter beds in purifying the sewage, and intimates that raw urine, soap suds, etc., passes from the beds into Tar Kiln Creek. No urine or soap suds or material of this nature passes even from the settling bed to the filter

30

bed, let alone the subsequent treatment of copper and filtration of same of 3 or 4 days duration.

On page 106, line 20, State of the Case, Prof. Newcomb is asked if that is not the intention of the intermittent sand filtration beds used in sewage plants. Answer, Yes. And on page 08 he offers to drink the water. On page 112 of Case is an explanation of *odors* in connection with waters prevalent throughout the West and along the Mississippi Valley. Also see Prof. Kramer's testimony as to odor, page 168, and Kellerman on page 120, line 10 of Case.

PROF. KARL KELLERMAN,

Physiologist in charge of soil bacteria and water purification connected with Bureau of Plant Industry, Department of Agriculture was produced on part of defendant. (Page 113 of State of Case.)

He came to Vineland in April 1905 to look over Vineland sewer beds, and recommended the use of copper sulphate in treatment of sewage (Page 113, State of the Case). It had been used successfully in eliminating pathogenic organisms at Jamaica, Long Island, Columbus, Ohio, and Albuquerque, New Mexico. He was present at Anderson, Indiana, at a three months test, and at Marietta, Ohio, at a ten days test (State of the Case, page 114) as to drinking water.

As to Sewage.

The Columbus, Ohio, experimenting sewage testing station had been experimenting with copper and have eliminated coli by their treatment (Page 114-115, State of the Case). At Columbus they added copper to the

raw sewage, *no such disposal plant as at Vineland to treat it.*

He is asked, page 115, line 30, if from what he saw at Vineland if he thought they would have a total reduction of coli.

Answer. *I should think that they should have a total reduction.*

The experiments at Columbus in which I have been in pretty close touch and have treated and added copper directly to raw sewage, it takes more copper under these conditions to eliminate the coli bacilli, where they have no septic action before adding the copper—where a certain amount of septic action may precede as a preliminary treatment, a less quantity of copper would be necessary. In the case of the Vineland plant, the sewage effluent after the *preliminary treatment going on on top of the filtration bed is almost clear.* 10

That being the case, the quantity of copper should be entirely sufficient to cause complete elimination of coli within a few hours. 20

On page 116, State of the Case, of his testimony, he accounts for cloudiness of effluent by reason of the clay soil; and states, page 117, You cannot get murkiness of that kind in water containing sewage.

On page 120 of Case he speaks of the odor which he says is that of sewage effluent, not raw sewage.

On page 123 of case, states that copper sulphate kills the coli bacilli, and on page 124 describes use of copper sulphate in *purifying lakes and water reservoirs.*

On page 126, line 30, of Case, is asked if he considers these beds (the Vineland beds) are now managed so they will *insure a continued absence of coli.* 30

A *It does seem to me that would be the case, barring accidents.*

On pages 126-127 of Case, he tells of the success of Anderson, Indiana, where without the use of copper it had never been possible to get water for drinking purposes that was free from bacilli coli. By using copper it had been possible to get a filtered water constantly free of bacilli coli, over a very extended period.

- 10 On page 127 of Case, states that he is interested at Vineland, as a scientific man. And on page 128, that a small amount of sewage does not corrupt streams into which it is poured.

He is asked on page 122 in reference to building a sewage plant on a stream of water above a water supply.

Answer: If sufficient purification could be obtained it is perfectly proper, and if cheaper, I think it would be advisable.

Question, page 122 of Case: Have you ever recommended it?

- 20 Answer: I have never recommended it, and I think I would not recommend it; the cost of complete purification of sewage is very high, and in general complete purification is not arrived at.

By the Vice-Chancellor: Is it attained?

Answer, page 122 of Case: In very rare cases complete purification of sewage may be obtained. On page 127 of Case, states he considers Vineland Plant is getting that result.

- 30 The Court's attention is called to page 122 of State of Case, as to how complete purification of sewage may be obtained, also page 123 as to supervision of plants, and a description of the admixture of copper sulphate

with water to be treated on pages 123 and 124. And on page 127 of State of the Case, he shows how near the Vineland plant is to a complete purification:—

Question: Do you know of any case where an effluent coming direct from sewage beds has been rendered free from coli bacilli by application of copper. Page 127

Answer: Practically free, not exactly free, *except in the case of Vineland.*

The complainant attempted to claim that Prof. Kellerman showed no results of purification of sewage, 10 but only of water supplies—this is clearly shown on page 114 and 115, State of the Case, to be erroneous in the Columbus experiment sewage testing station; and the whole question hinges on the purification of the water supply, for it is the danger to that that is in question.

The complainant has raised the question frequently as to the freezing of the beds and the danger to the flow of copper sulphate in freezing weather.

It is shown by the defendant, in the testimony of 20 Prof. Newcomb pages , Professor Kramer, 165-168, and Prof. Kelleman pages 123, State of the Case, that there is no danger of the copper sulphate being interfered with by freezing weather.

Prof. Carlos B. Cochran, a witness produced on part of defendant, states on page 129 of State of Case, that he is a teacher of chemistry at State Normal School, West Chester, Pa., Chemist to State Dairy and Food Department of Pennsylvania since 1884. Has examined waters at Altoona, Downingtown, &c. 30

On page 131 he sets forth his chemical analysis, and on page 131 of State of the Case, that the total sol-

ids were 151 parts per million; and in answer to the question, page 132 of case, Is that a safe effluent, referring to effluent from Vineland sewer beds, answered, *Chemically speaking, Y.E.S.*

See TESTIMONY OF E. LEIGH NEWCOMB, as to amount of solid matter allowed in potable water, page 104. State of Case.

10 Prof. Henry Kramer, Professor of Pharmacognosy and Director of the Microscopical Laboratory, and Editor of the American Journal of Pharmacy, a witness on behalf of the defendant, testified, pages 133-134, that he came to Vineland in connection with the sewage disposal plant in May 1905, to look the situation over, and on January 10th and 17th, 1906, came to Vineland and took samples of the (1) raw sewage, (2) sewage after it was in the settling bed, (3) from the effluent into Tar Kiln Creek, (4) from Tar Kiln Creek and other waters. Qualifies both as a Bacteriologist, page 133, and as a Chemist, page 133, State of the Case.

20 On pages 134-135, State of the Case, he shows the results of his examinations and the purification of the Vineland Sewage Disposal Plant and Filter Beds as follows:

Examination of raw sewage showed, 380,000 organisms
18,000 coli

Examination of settling bed showed 126,000 organisms
1,066 coli

Examination from filler beds, 1,473 organisms
2.4-7 coli

The percentage of the reduction is as follows:

(1) From Septic or Settling

Beds, an elimination of 66 $\frac{2}{3}$ per ct total organisms
91 per ct coli.

On the Filtration Beds,

an elimination of 99 $\frac{1}{3}$ per ct total organisms
99.9-10 coli removed.

On page 136 State of Case, he explains how tests are made, and on page 143, the care in gathering his samples. 10

On pages 137-138 of Case, the similarity of coli colonies to other colonies is shown and the danger of confusing them.

On page 138, Case the tests made by him are used by Dr. Roben at Wilmington, Delaware, Belmont Water Works Association, American Public Health Association, Prescott & Winslow. Elements of Water Bacteriology.

On page 138, State of Case, he is asked if it is the number of coli that make the danger. A. Yes. 20

Page 139. Q. Have you ever known water purified by filtration to contain coli? A. Yes, sir.

Q. Would that be considered good water?

A. YES.

On page 139 of Case:

Q. How many coli did it contain?

A. In the case referred to, an analysis which showed purification of coli by 96.16, or as calculated.

one-half of a coli per c. c. That was water which was considered good.

Q. Was that water considered good?

A. That water was considered good.

Q. Can you refer to any one of standing who would pronounce such water pure?

On page 139, State of Case, answers, Yes, Dr. Darlington, of the Board of Health of New York, considers a water which has a purification of the total organisms
10 of 99 per cent *and of coli 90.6 as good as could be obtained.*

Page 139. Question, That is a good potable water?

A. YES.

On page 140 of Case is asked: I understand you to say plant at Vineland destroys .9999 per cent of B Coli and practically all of pathogenic organisms?

A. Yes

Q. Is this an unusual purification of water?

A. Yes.

Page 140, Question, To what do you attribute it?

20 A. *It is due to copper.*

On page 141 of State of the Case, Prof. Kramer describes the use of a piece of copper foil in drinking water at his home, which removed anywhere from 85 per cent to 97 per cent of total organisms—also see page 158-159, State of Case as to the action of copper.

On pages 141-142 of Testimony, states he has published papers on the subject, and that Winslow in the Technology Quarterly (Mass. Institute Technology) recommends it, also shows that the effluent contains no
30 copper or traces of it as it passes into Tar Kiln Creek from Vineland sewer beds.

On page 147, line 10, State of the Case, he says Vineland sewer plant is doing good work, and on pages 147-148, with the copper treatment we get a greater degree of purification than Dr. Darlington shows.

On page 152, State of the Case, Raw sewage, he testifies with pathogenic germs removed would not corrupt a water supply.

On pages 155-156 of case he defines potable water and drinkable water.

The Court's attention is called to page 156 as to 10
what constitutes a potable water.

On page 161 of Case, at Vineland by use of copper, septic tank action and chemical purification, you get a *water which can be considered a potable wate.*

On page 164, line 20, State of Case, before condemning any water he makes a *test of 25 samples.*

On pages 165-166 of Case explains about the barrel of copper always a continuous flow and no danger of freezing. See also testimony of Prof. Kelleman, as to freezing of copper, page 125. 20

On page 167 of Case he is asked on re-direct examination as follows:

Q. Taking that question right there under the conditions we have at Vineland, there would be no tendency to impair or corrupt the water, would there?

A. *There would not*, because the chemical examination shows that the effluent has no constituent which would tend to impair the water; *and bacteriologically it is purer than the potable waters in most communities.*

The odor is due to harmless gases—see page 167— 30
and growth in the pipes—page 168 State of Case. On page 172, State of Case, he is asked on what authority

you would say nitrates and nitrites and ammonia compounds which exist in waters are in themselves harmless. Answer, Leffman. In the American Journal of Pharmacy, of which I am editor, I am now publishing a paper by Dr. Leffman, in which he discusses potable waters from the point of view that it might be used in making medicine, and he distinctly states that the nitrites, nitrates and ammonia which are present are in themselves harmless, but merely indicate a previous condition of

10 pollution.

On page 169 is asked if soap suds would be eliminated by this process of chemical purification.

It would certainly.

On pages 169-170, State of Case, the chemical action of the sewer beds is explained, as to amounts of dangerous elements passing off in gases

On page 170 State of Case the chemical action in the rotting down and combustion that goes on all the time in sewage, is explained also on pages 171-172 of

20 State of the Case.

The Court's attention is called to this, and the Vice Chancellor's question relating to same, on page 171.

On page 173 Case, the danger in water is from bacteria.

On page 174 Case, Prof. Kramer sums up the efficiency of the Vineland Sewerage Disposal, as follows:

EFFICIENCY AT VINELAND PLANT IS—

- Practically an elimination of 85 percent solid matter, (2) an elimination of organic matter 95 percent,
- 30 (3) an elimination of total organisms of 99⅓ percent, and (4) an elimination of coli of 99 9-10 percent.

And on page 174 State of Case: Then taking all these facts into consideration would you consider that a safe effluent to pass into water which was furnished as a household supply.

A. *It should be.*

Question. Do you know of any analysis that will show a chemical or bacteriological purification greater than Vineland.

Answer. I don't.

Page 174. Question. What does Winslow say of 10
purification of sewage?

Answer. He discusses it in a recent paper which I have just referred to, and states it is likely that in the next few years it will be obligatory to make an effluent, *which is bacterially free, or certainly one that is free from pathogenic germs.*

Question. Do you think you are accomplishing that in Vineland.

A. *As far as I can see you are.*

Is asked on page 175 of Case,—

20

If he would condemn water on Fitz Randolph's statement.

Answer. NO.

And on page 176 of Case. No danger of Vineland beds becoming clogged and flowing into Tar Kiln Creek and that he considers the Vineland Plant an efficient one.

On page 156 of Case, on cross examination, Prof. Kramer is asked,—

You would not consider, for example, that if soap 30
suds were placed in a water supply that that was a potable supply for public purpose?

Answer. No.

Right here again let us call attention of the court that no such thing as soap suds passes out of the Vineland Sewer Plant; the very first process in the settling beds would end the soap suds, and the effluent therefrom is still *to be treated to copper and FILTERED before passing out into Tar Kiln Creek.*

As against Professors Kramer and Newcomb, who made both bacteriological and chemical examinations and Professor Cochran, who made chemical examinations, the State produces four witnesses: two only are chemists, Shippen Wallace and Dr. Fitz Randolph, Dr. Fitz Randolph who is also a bacteriologist. And only one of these made any examination, Dr. Fitz Randolph. As will be noticed from the testimony of Shippen Wallace, page 50 of case, he visited Vineland only once, made no chemical or bacteriological examinations, and on page 52 of Case,—

Question. You understand the system of Filtration beds there?

Answer. Only from what I am told.

And on page 52 State of Case shows his lack of knowledge of the construction of the beds. Sir John Franklin, a witness produced on the part of the complainant, had not examined water within six months from time of hearing, and Dr. Hunt on page 15 of Case, testifies as to discoloration which Kelleman on page 116 says is the clay soil.

This leaves only one witness produced on the part of the State who has made any examinations to determine the potability of the water, Dr. Fitz Randolph, and the defendant criticises his tests as follows,—

- (1) His few tests.
- (2) His method of gathering samples.
- (3) His method of making his tests.

Samples were collected for him only four times, the first two collected by a man not a chemist or bacteriologist, and personally he has only visited the place twice. It will be noticed on page 19 of State of Case how indefinite his testimony is, he shows on page 21 his lack of knowledge of the workings of the bed by speaking of the matter on the surface as sewage which is supposed to pass through—this matter is solid matter and is not supposed to pass through and does not, but is held in this basin and the water underneath it passes through, keeping all the solid matter in the first basin. 10

On page 26, line 20 of Case says, stream above the sewer beds has no coli and yet on page 31, line 30 says all waters have some. This stream, Tar Kiln Creek, receives the surface drainage of Vineland.

A cubic centemeter of water contains 15 drops. Professor Randolph has made his tests by taking 1-1000 of a cubic centemeter and 1-100 of a cubic centemeter, and because he has found one coli in this fractional part, that in one cubic centemeter there would be 1000 coli. There might not be another one in 50 cubic centemeters. Organisms are not equally distributed. It only indicated coli present in his immediate sample and not in the rest of the water. He should have taken larger quantities. 20

Again he only examined 1-1000—1-100 1-10 less than 2 cubic centimeters or 30 drops of water, on which examinations he proposes to condemn the Sewage Disposal System of Vineland. 30

Newcomb and Kramer examined 550 cubic centimeters of water on two visits and got no re-action for coli.

(2) HIS METHOD OF GATHERING HIS SAMPLES.

His samples were gathered at eleven o'clock, A. M. and his bacteriological test was not commenced until 5 P. M. at Trenton, page 35 of Case. On page 143 of Case, Prof. Kramer states I never make a water analysis unless I make an examination immediately, almost
10 immediately on the spot. The American Public Health Association requires that a sample made as late as four hours after collection must be placed on ice. See a full description on this page, 143-144, State of Case, as to the reason of this.

(3) HIS METHOD OF MAKING HIS TESTS.

Prof. Fitz Randolph made no count of the total number of organisms in his examinations, and as Prof. Kramer says on page 146, State of Case in answer to the question—

20 Is it not customary in examinations of this kind to determine the total number of organisms as well as B. Coli?

Answer. *I never knew of a case where it was not done.*

Question. Where is that method used?

Answer. Every place that I know anything about—as I first stated, the Wilmington Water Company use that continually. At the Belmont Water Station they use this test all the time.

30 Prof. Fitz Randolph also failed to make any analysis of the effluent on the settling beds or filter beds—yet attempted to say the plant is not working properly.

He was asked on page 194, State of Case, as follows:—

Question. You stated the filtration bed of the Vineland Sewer Plant in your opinion are not working properly, did not you?

Answer. I did.

Question. Did you make any analysis of the raw sewage as it comes to the bed?

Answer. I did not.

Question. Did you make any analysis of the sewage in the settling bed?

Answer. No.

Question. Did you make any analysis of samples after the copper was put there?

Answer. No.

Question. Or from the filter bed?

Answer. No. I made the analysis only from the effluent pipes.

Yet Prof. Fitz Randolph without any tests chemical or bacteriological attempted to show that the beds are not purifying the sewage to a proper degree.

In Professor Kramer's testimony, page 135 of State of Case, he shows the percentage of reduction and elimination of bacteria step by step from one part of the sewer beds to the other.

To return to the failure of Fitz Randolph to make a count of the total organisms on page 144 of Case, Professor Kramer is asked:—

Question. What do you think of Dr. Fitz Randolph's conclusion that the effluent from the Vineland Beds contained as many as 1000 coli to the C. C., when your results show that there were not more than 2000 total organisms to the C. C.?

Answer. I can only say this, that I don't know of any one who would make or venture to *make an examination of water, and on two tests as Dr. Fitz Randolph made of this delution* say that that water contains 1000 coli. When Theobald Smith proposed that method, he supposed one would take at least ten tubes. Dr. Fitz Randolph used only 2 and they would use 1-100 of a C. C.

- 10 And on the bottom of page 145, State of Case, Professor Kramer states I would have made 25 tests before pronouncing such an opinion as this.

On the bottom of page 195 and 196 of Case, Prof. Fitz Randolph was asked:—

Question. But to determine that they were 1-1000, how many tubes?

Answer. I don't understand what you mean.

Question. How many tubes did you use, 1 in a thousand?

Answer. Two.

- 20 Question. And this says ten? (Quoting from Prescott & Winslow, Elements of Bacteriology, page 60.)

Answer. Let me see, I think it does, yes 10 tubes. And further down the page.

Question. Then yours will be an incomplete analysis as you didn't do this?

Answer. *It was incomplete with reference to this.* It was perfectly satisfactory to determine the point I was anxious to determine.

- 30  It seems to the defendant that no water supply or sewerage system should be condemned on the testimony of one witness, like Dr. Fitz Randolph, who made but four examinations of the effluent from these beds,

whose method prescribes the use of ten tubes, and he used only two; who made no count of the total organisms to determine the relative quantity of coli; who made no tests as to organisms of coli in the raw sewage, then after its treatment by settling and filtration—yet attempts to maintain the beds are not working satisfactorily.

While the defendant has produced two bacteriologists who are both chemists, and one of whom has made over 100 tests of the effluent, together with the 10
chemist from the State Board of Agriculture of Pennsylvania, who all pronounce the effluent a safe one to go into potable waters, both Professors Newcomb and Kramer testifying that it is potable, together with Prof. Kellerman, of Washington, who says the Vineland plant, pages 126-127, of Case, is rendering an effluent free entirely from coli and all state that it *will not corrupt or impair or tend to corrupt or impair any potable waters*; that the State has failed to make out a case for injunction, the burden was on the State in a subject of 20
vast importance as this to have proven its case beyond any shadow of doubt which they have failed to do.

The defendant quotes from the work of Charles V. Chapin on Municipal Sanitation to show operation and results obtained from sewerage disposal plants.

MUNICIPAL SANITATION.

Chapin P. 264.

N. Y. State provides that State Board of Health shall pass on location, plans, etc., of water and sewerage systems. 30

Formerly chemical, now bacteriological examinations.

The most essential thing to get rid of is pathogenic bacteria.

It has in recent years been learned that storage and sedimentation is a most excellent method of getting rid of disease germs, and indeed all kinds of bacteria. The pathogenic bacteria which are feared in drinking water, do not thrive in that medium, but rapidly die out.

- 10 These as well as other pathogenic bacteria are largely carried to the bottom by their own weight or by precipitation of other material.

Chapin P. 275.

River water stored in reservoirs lose from 90 to 95 per cent. of their bacterial contents in a week.

P. 276 describes thickness of filters 4 to 6 feet. In Cincinnati experiments according to Fuller report over 99 per cent. bacteria removed.

Chapin P. 285.

- 20 East Providence, 6 weeks' test, 99 20-100 per cent. removal.

That the removal of 97 to 99 per cent. of bacteria from polluted water is sufficient to remove danger due to presence of disease germs is amply proved by well known examples.

Chapin P. 287.

One acre for every 1000 inhabitants is estimated in sewage plants.

Chapin P. 301.

MUNICIPAL SANITATION IN U. S.

By Chas. V. Chapin, Providence, R. I.

This shows the action of filter beds such as we have at Vineland and in addition thereunto we have copper sulphate.

LAW POINTS.

Defendant maintains that the provisions of Chapter 41 of the Laws of 1899 (P. L. 1899, page 73) entitled "An Act to secure the purity of the public supplies of potable waters in this State", under which act the bill of complaint is filed in this cause, to restrain the Borough of Vineland from discharging the effluent of its municipal filtration beds into Tar Kiln, branch, a tributary of Maurice River, does not apply to the municipalities of this State, who either at the time of the passage or since the passage of this act, maintain a public system of sewers or drains, discharging sewerage or drainage into the rivers, brooks, streams, lakes, &c., of this State. 10 20

(1) It will be noticed by the provision in the first section of this act, that it states specifically—that this act shall not apply to any city, borough or township, which at the date of the passage of the act had a public sewer or system of drains, constructed under municipal or township authority, discharging its drainage or sewerage into any such river, stream, lake or pond, well spring, or other reservoir.

(2) If this act was intended to apply to municipalities that should thereafter construct sewerage systems, it was repealed by a later act in the year 1899, on 30

page 536 of the Laws of 1899, entitled "An Act to prevent the pollution of the waters of this State by the establishment of a State Sewerage Commission and authorizing the creation of sewerage districts and district Sewerage Boards, and prescribing, defining and regulating the powers and duties of Such Commissions and such Boards." Approved March 25th, 1899—"As amended by an act bearing the same title passed March 21st, 1900. (See P. L. 1900 p. 113.)

- 10 The main question for adjudication is, Does the act entitled "An Act to prevent the pollution of the waters of the State" &c., approved March 24th, 1899 (P. L. 1899—536), as amended by the act approved March 21st, 1900 (P. L. 1900 p. 113), repeal the act entitled "An Act to secure the purity of the public supplies of potable waters in this State", approved March 17, 1899 (P. L. 1899—73)?

A short review of the provisions of each act may not be amiss in the discussion of this matter.

- 20 The titles of the acts, when compared, show that the objects for which they were passed are identical, being to "secure the purity of the public supplies of potable" &c., by the act approved March 17, 1899, and "to prevent the pollution of the waters of this State" &c., by the act approved March 24, 1899, and the amended act approved March 21, 1900.

- 30 The first section of the former act provides "no sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever, which either by itself or in connection with other matter, will corrupt or impair or tend to corrupt or impair, the quality of the waters of any brook, stream or any tributary

or branch thereof, from which any public supply of water is or may be taken for the use of any municipality, which will render it injurious to the public health", shall be placed in or discharged into the waters, or placed or deposited upon the ice, of any such river, &c., above the point from which any city, &c., shall or may obtain its supply of water, and providing that this section shall not be held to apply to any city, &c., which at the date of the passage of the act has a public sewer, or system of sewers, &c., constructed under municipal authority. 10

The second section provides a method of enforcing the penalty incurred in the violation of the provisions of the first section, and the fourth section provides for the enforcement of the provisions of the act by an application to the Court of Chancery for an injunction, the proceeding taken in the case before the Court.

By the third section of the act, the general supervision as regards the purity of the water supply of the State, is lodged in the State Board of Health, as follows: 20

"The State Board of Health shall have general supervision, with reference to their purity, of all rivers, brooks, streams, lakes, ponds, wells, springs, or other reservoirs in this State. the waters of which are, or may be, used as the source or sources of public water supplies for domestic use, together with the waters feeding the same, and shall have the authority as they deem necessary or proper, to examine the same and to inquire what, if any, pollutions exist, and their causes."

The act of 1900 amending the act of 1899, P. L. 30 1900, p. 113, by its first section creates a State Sewerage Commission, directs how it shall be composed, and

by subsequent sections provides for the duties of the various officers. The general duties of the Commission are provided for by section five, as follows:

- “It shall be the duty of the said Commission to investigate the various methods of sewerage disposal, in order that it may be able to make proper recommendations in regard thereto; it shall investigate all complaints of pollution of the waters of this State, which shall be brought to its notice, and if the said Commission finds that any of the waters of this State are being polluted to the injury of the inhabitants of this State, either in their health, comfort or property, it shall be the duty of the said Commission to notify, in writing, any person, corporation or municipality found to be polluting the said waters; that prior to a time to be fixed by said Commission from the date of said notice, said person corporation or municipality must cease to pollute said waters and make such disposition of their sewerage or other polluting matter as shall be approved by the State Sewerage Commission.”

- The sixth section makes it unlawful to build any sewer from which it is designed, sewerage etc., shall flow into any of the waters of this State so as to pollute or render impure said waters, except under such conditions as shall be approved by the State Sewerage Commission; and by the seventh and eighth sections it is provided that no sewerage system or sewerage disposal plant shall be built, or discharge its effluent into any stream, except under such conditions as shall be approved by the State Sewerage Commission, and to whom any new plans shall be submitted before building.

It is admitted by Counsel for Complainant, page

186 of Case, in this case that on June 25th, 1900, plans were submitted for approval providing for a sewer system and intermittant filtration beds for the Borough of Vineland; that on July 12th, 1900, the Commission visited Vineland and Millville, examined the territory lying between these municipalities and at a meeting held on that day, the following resolution was adopted:

"Resolved: That the plans for a sewer system and the disposal of sewage for the Borough of Vineland, submitted to the Commission be approved, subject to such conditions of operation as the Commission shall, from time to time, require." 10

Defendant maintains that the act of 1899 (P. L. 1899 page 536) as amended by the act of 1900, page 113, herein termed the State Sewage Act, is a repealer of the Potable Water Act. P. L. 1899 page 73, under which the bill is filed in this case, as far as the same relates to the disposal of sewage by the municipalities of this State.

A. The provisions of the Act of 1899, as amended, creating the State Sewerage Commission, are in conflict with and repugnant to the Potable Water Act of 1899, P. L. 1899 page 73. 20

A comparison of the provisions of the Act creating the State Sewerage Commission, and the Act of 1899, by which the State Board of Health is given general supervision, will show that the provisions of the former act are clearly repugnant to those of the latter, in all essential particulars, affecting the defendant municipality. For instance, by the third section of the Act of 1899, P. L. 1899 page 73, "The State Board of Health shall have the general supervision, with reference to their purity," of all the waters of the State; and by the 30

fifth section of the amended State Sewerage Commission Act, it is provided that it shall be the duty of the Commission to "investigate all complaints of pollution of the waters of this State," and providing for the cessation of such pollution and the future "disposition of their sewage or other polluting matter as shall be approved by the State Sewerage Commission."

The powers conferred by these sections of the acts cannot consistently be exercised by both because there
 10 would at once arise a conflict of authority, such as has now arisen in the case before the Court. It is not easily seen how the State Board of Health can be invested with the exercise of general supervision of the purity of the waters of this State without coming into conflict with the State Sewerage Commission, which derives its authority to provide for the creation of sewerage systems and disposal plants under such conditions only as shall be approved by it, by virtue of the sections 5, 6, 7 and 8 of the later act of 1901, P. L. 1900, pages 115-116.

20 How may a "person, corporation or municipality" be certain under whose direction and authority they are to proceed in the erection of a sewerage disposal plant or system of sewage drainage, if each of these Boards is clothed with the full and complete supervision and control of the subject?

Will not the greatest confusion result from such an investiture of authority, as well as the most financial difficulties overtake the municipalities acting under the direction of either in the erection of their systems.

30 It seems to us that the proposition is self-evident and is clearly within that familiar rule stated by the Court of Chancery in *Mersereau vs. Mersereau*:

"When two statutes on the same subject are repugnant in any of their provisions, the later without words of repeal operates to the extent of the repugnancy as a repeal of the earlier."

6 Dick. page 383.

"Every statute is, by implication a repeal of all prior statutes, so far as it is repugnant thereto."

Industrial School District vs. Whitehead,
2 Beasley 200.

The State Golding V. Col. of Chambers- 10
burg. 8 Vroom 258.

B. And even though the two acts be not repugnant in all provisions, yet if the later one, as in the case at hand, the passage of the State Sewerage Act was to create the only rule or law relating to the disposition of sewerage by municipalities, this repeals the former, the Potable Water Act.

"If a subsequent statute be not repugnant in all its provisions to a prior one, yet if it was clearly intended to prescribe the only rule that should govern in the case 20 provided for, it repeals the original act."

Industrial School vs. Whitehead,
2 Beas. 290.

Bowyer vs. Camden, 21 Vroom 87-80

"Where the legislative intent is clearly manifested to establish the only rule that should govern it, operates by necessary implication as a repeal of all prior statutes in which a different rule was adopted. Both statutes being incapable of being executed, the earlier must yield

- to the later (Sedgwick on Statutes, 124-125). The legislative intent is to include all railroads within a scheme of taxation proposed in the first section of the act of 1873 is so clearly expressed as to admit of no doubt and the mode of taxation therein established is so plainly repugnant to the special provisions for taxing the prosecutor under the supplement of the charter of 1865, that the power of taxation under both statutes cannot be exercised consistently with a legislative intent as declared in the later statute, under such circumstances the earlier statute is necessarily repealed by the later."

State Morris & Essex R. R. Co. vs. Commissioners of R. R. Taxation.
8 Vroom 228-232.

The Court of Errors and Appeals in affirming the case, 9 Vroom page 472, at page 476, quotes from McGarisk vs. State, 5 Vroom, page 511, approving the same as follows:

- "Two methods of taxation for the same purpose must certainly be repugnant, both cannot be used without confusion, oppression and double taxation; nor can the option to use either be left at the discretion of any public officer, such extraordinary power could only be conferred by express terms most clearly stated. No such construction can be given to this law by implication, either the one or the other must prescribe the only rule for the assessment of taxes against this Company; and because of the manifest repugnancy, the later special law must prevail."

- State Morris & Essex R. R. Co., vs. Comors. of R. R. Taxation, 9 Vroom page 476.*

The Court can see the confusion that would result to the municipalities of the State with two independent State Boards each prescribing what should pass into the rivers, streams, etc., as sewage.

"Every statute must be considered according to what appears to have been the intention of the Legislature, and even though two statutes be not in terms repugnant or inconsistent, if the later statute is clearly intended to prescribe the only rule which should govern the case it will be construed as repealing the earlier statute." 10

Roche vs. Jersey City, 11 Vroom, p. 257.

C. The Act of 1899 Pamph. Laws 1899, page 536, creating the State Sewerage Commission was designed as a complete, new and sufficient scheme embracing the whole subject of municipal sewerage, and placing the same in the hands of the State Sewerage Commission, the same being re-enacted in its entirety in 1900 P. L. 1900, page 113, which new scheme operated as a repealer of the Potable Water Act as far as the same applies if it was ever intended to affect the municipalities of this State. 20

As evidence of the truth of this proposition, it is necessary to refer the Court only to the general scope of the two acts. It will be noticed that the act of 1899 from which the Board of Health derives its authority, restricts that authority to the sewage systems constructed after the passage of the act; or to use the language of the act, "provided however, that this section shall

not be held to apply to any city, town, borough, township or other municipality of this State, which at the time of the passage of this act, has a public sewer or a system of sewers, drain or system of drains, legally constructed under municipal or township authority"; while the act of 1900 creating the State Sewerage Commission confers on that Commission the control of the whole system of sewage disposal and the prevention of the pollution of any of the waters of this State, without restrictions as to time or place, and compelling all persons, corporations or municipalities to conform to the regulations of such Commission and obtain their approval in the erection of any system and the disposal of the effluent.

10 "Every statute must be considered according to what appears to have been the intention of the legislature. and even though two statutes relating to the same subject matter, be not, in terms repugnant or inconsistent, if the later act is clearly intended to prescribe the only rule which should govern the case provided for, it will be construed as repealing the earlier act. The rule does not rest strictly upon the ground of repeal by implication, but upon the principle that when the legislature makes a revision of a particular statute and frames a new statute upon the subject matter, and from the framework it is apparent that the Legislature designed a complete scheme for this matter, it is a legislative declaration that whatever is embraced in the new law shall prevail, and whatever is excluded is discarded.

20 It is decisive evidence of an intention to prescribe the provisions contained in the later act as the only ones on that subject which shall be obligatory.

Roche vs. Jersey City, 11 Vroom 257.

Citing United States vs. Tynan, 11 Wallace 88.

Murdock vs City of Memphis, 20 Wallace 617.

Quoting also from *Bartlet vs. King*, 12 Mass , P. 637 on page 261 as follows:

"To have the rescinding effect it is not necessary that the subsequent act should have every provision of the former one; it is sufficient if it revised the whole subject matter and an intention is manifest to make it substituted for the earlier act." 10

DeGinther vs. New Jersey Home 29 Vroom P. 354, at page 357, quoting from Vice Chancellor Van Fleet in *Bracken vs. Smith*, 12 Stew. Eq. 169, "the rule is to give effect to both if possible, but if the two are repugnant or any of their provisions, the later act, without any repealing clause operates, to the extent of the repugnancy as a repeal of the first; and even where two acts are not in express terms repugnant, yet if the later covers the whole subject of the first and embraces new provisions, plainly showing that it was intended as a substitute for the first act, it will operate to repeal that act. 20

DeGinther vs New Jersey Home 29 Vroom P. 357.

Bracken vs. Smith 12 Stew 169.

"But further it is a settled rule of statutory construction, that when a later law deals generally with the subject matter of earlier statutes, not simply as a 30

revision but as a new and independent enactment, that affords decisive evidence of an intent to abrogate and repeal the older legislation."

Haynes vs. City of Cape May, 23 *Vroom* 180.

Mersebau vs. Mersau, 6 *Dick.* 382-385

Varney vs. Camden, 34 *Vroom* 325-329.

Mulligan vs. Cavanagh, 17 *Vroom* 45 at p. 49.

- 10 "Implied repealers are not favored in law. Ordinarily an intent to repeal a former statute will not be implied unless the subsequent enactment is either clearly repugnant to the former, or is manifestly intended to cover the same subject matter by way of revision, and thereby furnish a complete substitute for the former."

The Hotel Registry Realty Cor. vs. Stafford 41 *Vr.* p. 529.

- 20 In this case on page 537 are collected many of the cases bearing on this subject in New Jersey and we would refer to the following in addition thereto.

District of Columbia vs. Hutton 143 U. S. 18; *Henderson Tobacco Co.*, 78 U. S. 235; *Norris vs. Crook*, 51 U. S. 429; *People vs. Burt*, 43 Cal. 561; *Forgueron vs. Donnelly*, 7 W. Va. 124; *Covington vs. East St. Louis*, 78 Ill. 518.

- 30 Quoting from Opinion of V. C. Leaming, page 202 of State of Case, it will be seen that the purpose of the later Act, as stated in its title is to prevent the pollution of the waters of this State by the establishment of a State Sewerage Commission, and authorizing the creat-

ing of Sewerage Districts and District Sewerage Boards. With the primary aim to prevent the pollution of the waters of this State, the act appears to have adopted or undertaken the adoption of a complete and self-sufficient scheme to the accomplishment of that end. In the purposed accomplishment of that end, the provisions of the Act seem to cover the entire scope and operation of the earlier act, etc., etc. And on page 204; "Any conception that the legislature intended to preserve to the State Board of Health, the powers con- 10
tended for (to enjoin the operation of works constructed and operated pursuant to the consent and directions of the Sewerage Commission) includes the assumption that the State Sewerage Commission would fail in the performance of the duties imposed upon it, is not to be entertained. It necessarily follows that the provisions of the earlier act, in so far as they seem to authorize the State Board of Health to maintain an action of the nature of the present one against a municipality operating a sewage disposal plant which has been construct- 20
ed and is being operated pursuant to the consent and directions of the State Sewage Commission, are repugnant to the provisions of the earlier act, and in consequence repealed to that extent at least."

The case of the State Board of Health vs. The Diamond Mills Paper Co, 18 Dick. III, relied upon by the complainant, does not appear to us to touch upon the question raised by the defendant in this case. In that case the power of the Court to issue an injunction when the same is conferred upon the Court by the statute, was upheld and the sufficiency and constitutionality of the act are also decided, but the Court does not 30

consider either the conflict or the repugnancy of the act therein under consideration to the later act now brought before the Court for the first time, and it appears that the case referred to does not uphold the contention of the complainant, except so far as it refers to the power vested in the Court of Chancery in the matter of injunctions in such cases.

10 This was the case of an individual infringing the act of 1899 relating to the purity of waters, not a municipality. The defendant in that case was not sanctioned by any act such as creates the State Sewerage Commission as to what he might discharge into the river as the cities and towns are by the act creating the State Sewerage Commission.

Lastly the bill of complaint was filed to protect the consumers of water in Millville, or the Millville Water Company in securing a pure supply of water.

20 The complainant has long since given up the claim that any danger or the likelihood of any danger will come to the citizens of Millville from the effluent discharged into Tar Kiln Creek from the Vineland Sewer Beds, after it has passed through the operation of the settling beds, filter beds and treatment of copper sulphate, so that in granting an injunction in this case no benefit results to the complainant, the State Board of Health or the City of Millville, but great injury will result to the inhabitants of the Borough of Vineland, in that its whole sewerage disposal system would be affected; as this is the sewerage system of a municipality of
30 nearly 5000 people, and an injunction affecting its operations would be serious.

"The granting or refusing of an injunction is a

matter resting in the sound discretion of the Court, when it would cause great injury to the defendant, and might be a serious detriment to the public, without corresponding advantage to the complainants it will not be granted."

Simmons vs. Paterson. 15 Dick p. 393.

In the case in hand no benefit would result to Millville and great injury would result to the Borough of Vineland.

SUMMARY.

The burden of maintaining this Bill is on the Complainant; they have produced four witnesses, one only who had made an examination of the effluent scientifically, his methods are criticized and shown to be incomplete. He has made only four examinations of the water. The defendant has produced six witnesses; four who have passed on the sewage disposal plant, and the effluent passing from the same in a scientific manner, showing 50 examinations clear of any corrupting material, both chemical and bacteriological.

Is this whole system to be condemned on four incomplete examinations in questions of such tremendous importance to the Municipalities of this State. The State's case has been overturned by the defendant; *by the strength and preponderance of evidence produce by them*, and the effluent from the Vineland Sewer beds is one that does not corrupt, impair or tend to corrupt or impair in the *least degree* any of the potable water supplies of this State.

And lastly,

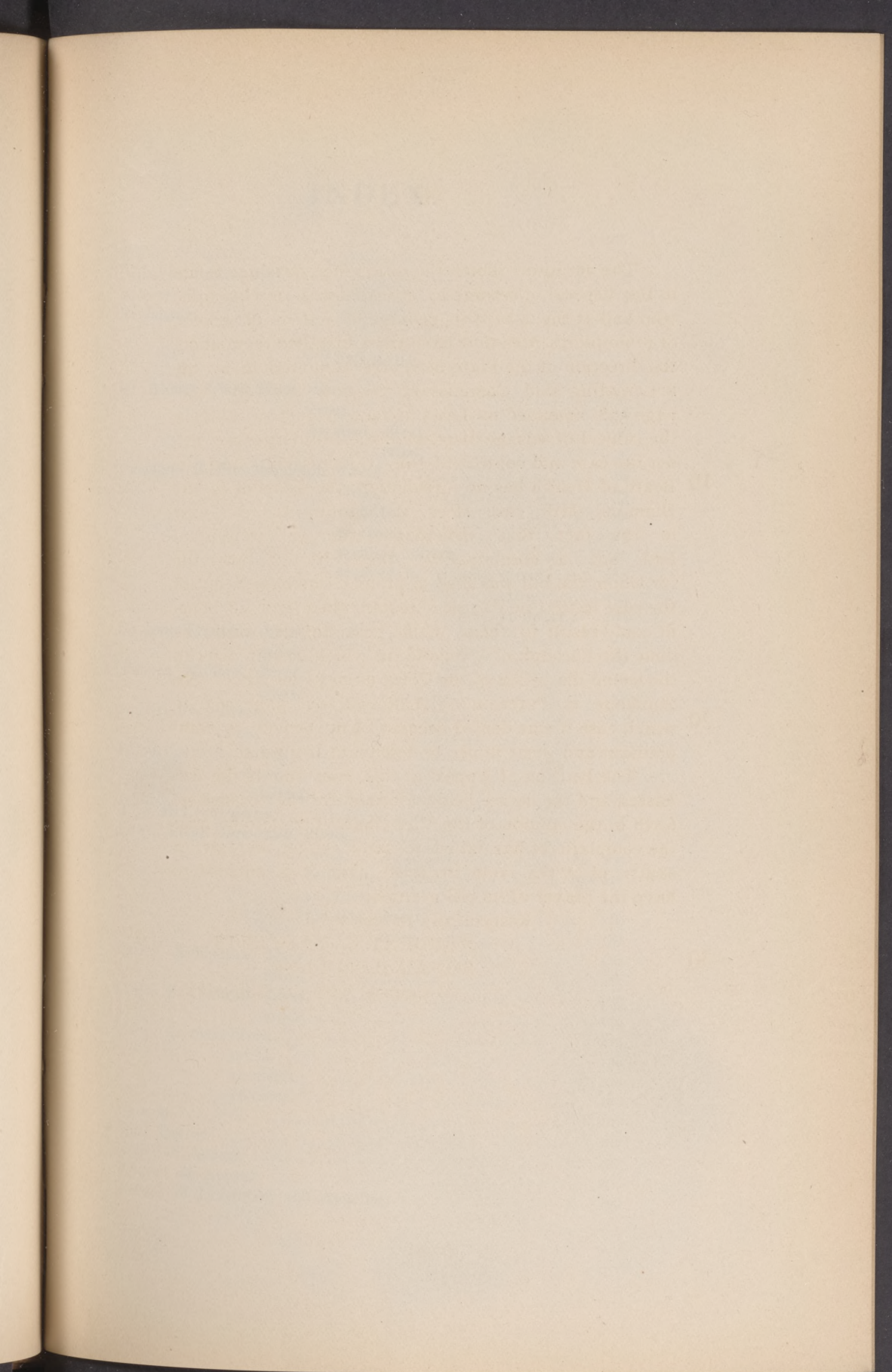
The act under which the bill is filed does not relate to the disposal of sewage by cities, towns or boroughs, who had at the date of its passage a system of sewers, or to municipalities that have since installed them under the direction of the State Sewerage Commission by the act creating said Commission, Session Laws of 1899, page 538, amended by Laws of 1900, page 113, placing the subject of sewage disposal of the municipalities under the care and control of this Commission, and the Board of Health has no jurisdiction; the decision in the Diamond Mill case does not apply to this case in the fact that defendant was an individual and not a municipality: the city of Millville for whom the bill was filed to protect, has passed out of the case in that no danger threatens them and no benefit could result to them, while great injury would be done the Borough of Vineland; in which case it rests in the sound discretion of the Court as to its issuance. See Simmons vs. Paterson, 15 Dickinson on page 393, in which case it was denied because of no benefit to complainant and great injury to defendant if granted.

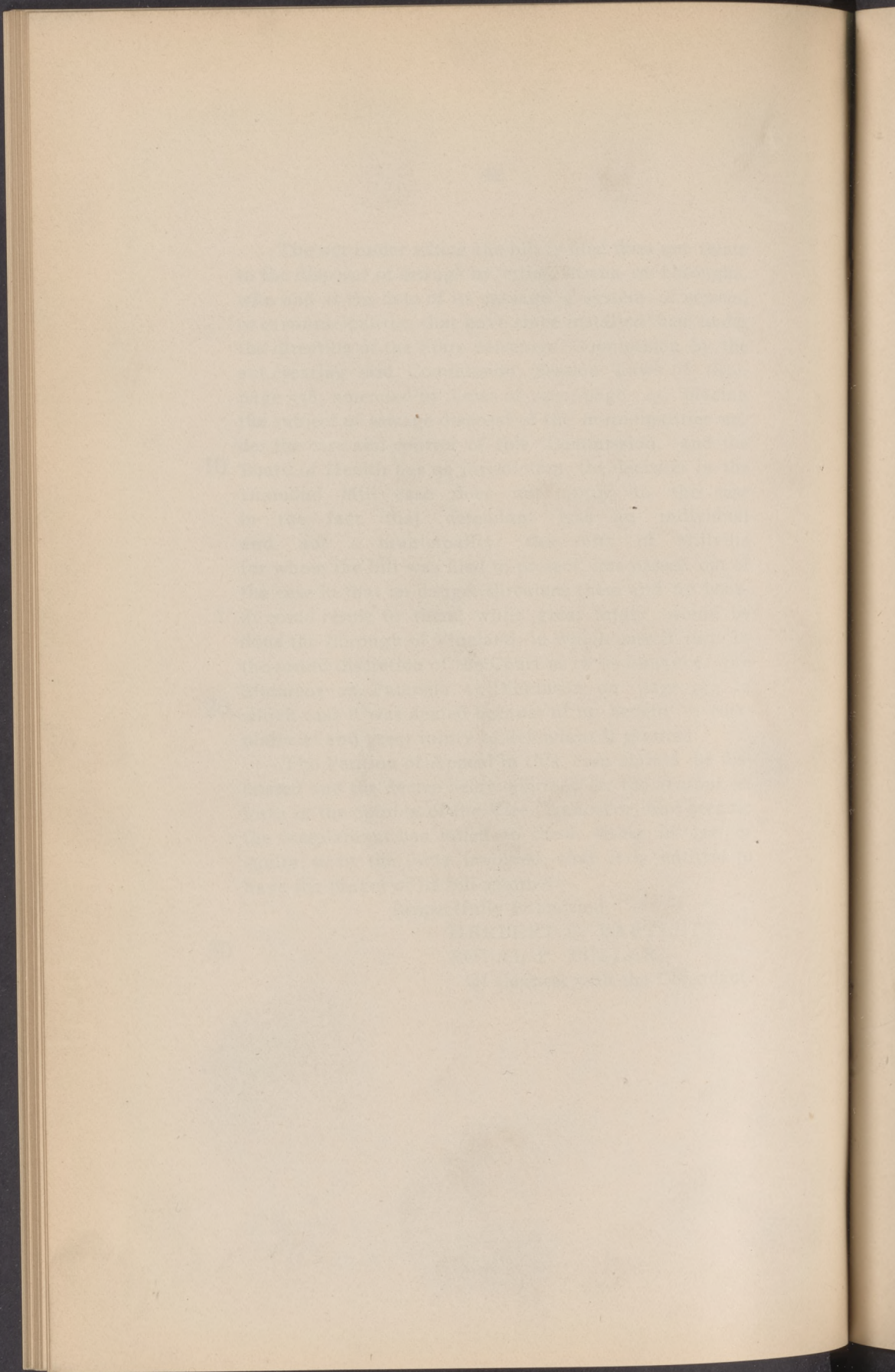
The Petition of Appeal in this case should be dismissed and the decree below affirmed for the reasons set forth in the opinion of the Vice Chancellor, and because the complainant has failed to show either in law or equity, or by the facts involved, that it is entitled to have the prayer of its bill granted.

Respectfully Submitted,

HERBERT C. BARTLETT,
ROYAL P. TULLER,

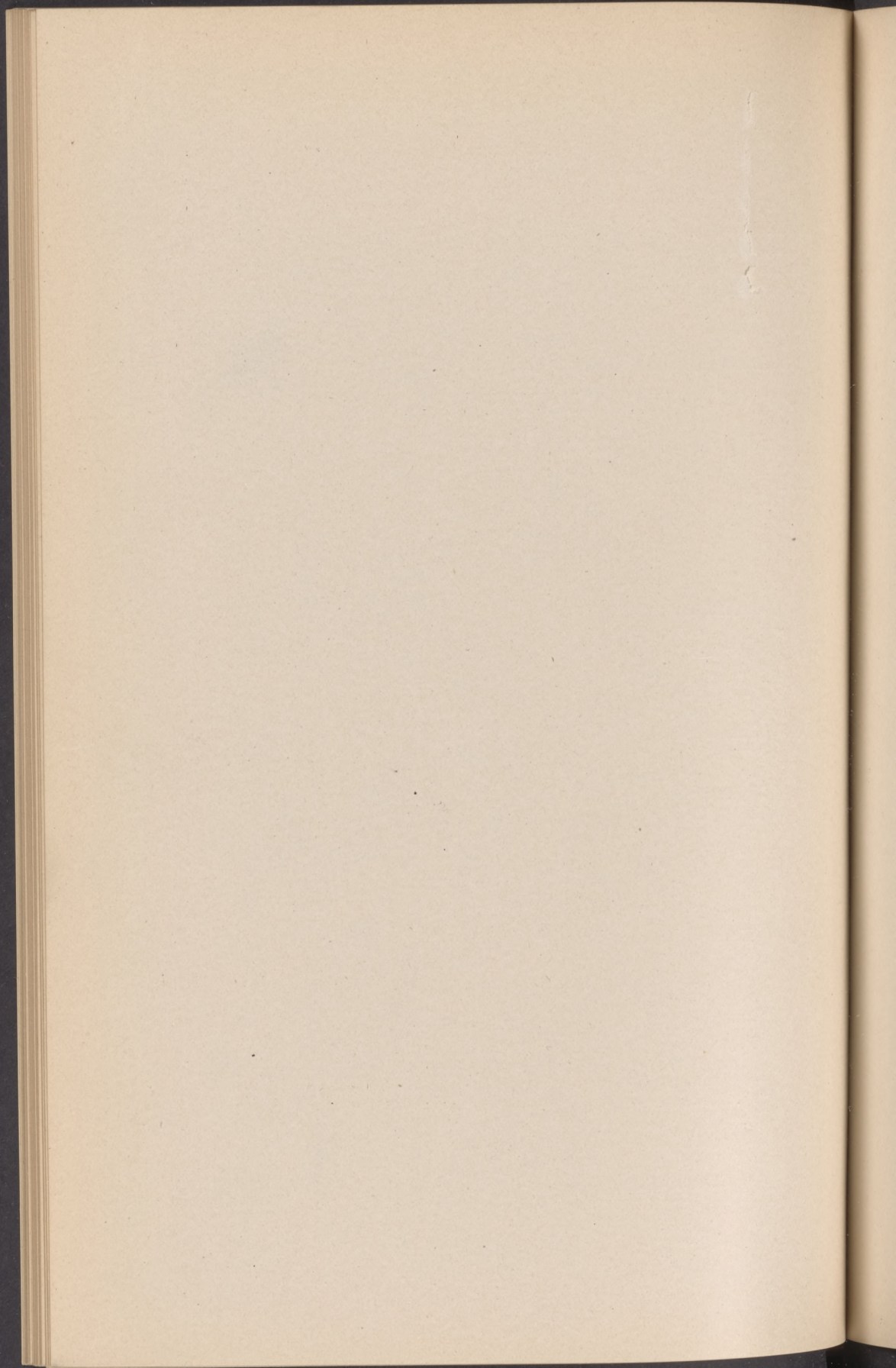
Of Counsel with the Defendant.





INDEX.

	PAGE.
Bill of Complaint,	1
Order to Amend Bill,	6
Answer,	7
Replication,	12
<i>Testimony.</i>	
Dr. Alonzo Clark Hunt, direct,	13
cross,	16
recalled, direct,	46
cross,	46
Raymond B. Fitz-Randolph, direct,	18
cross,	25
re-direct,	44
re-cross,	45
recalled, direct,	100
recalled in rebuttal, direct,....	186
cross,	194
re-direct,.	196
Sir John Franklin, direct,	47
cross,	49
Shippen Wallace, direct,	50
cross,	51
Marcus Fry, direct,	53
cross,	54
Ralph Garrison, direct,	55
cross,	57
re-direct,	64
Boyd McLean, direct,	65
Edwin Leigh Newcomb, direct,	67
cross,	84, 100
re-direct,	103, 112
re-cross,	106
recalled, direct,	179
cross,	181
Carl F. Kellerman, direct,	112
cross,	116
Carlos B. Cochran, direct,	129
cross,	132
Henry Cramer, direct,	133
cross,	148
re-direct,	167, 177
re-cross,	176
Opinion,	197
• Final Decree,	206
Notice of Appeal,	207
Petition of Appeal,	208
Answer of Defendant and Appellee,	209



NEW JERSEY

Court of Errors and Appeals

THE STATE, AT THE RELATION OF
THE BOARD OF HEALTH OF THE
STATE OF NEW JERSEY,

Complainant and Appellant,
and

THE BOROUGH OF VINELAND,
Defendant and Appellee.

} On Appeal
from Decree
of the Court
of Chancery.

BILL OF COMPLAINT.

IN CHANCERY OF NEW JERSEY.

To His Honor, William J. Magie, Chancellor of the 10
State of New Jersey:

Humbly complaining, shows unto your Honor, the
State of New Jersey, at and by the relation of the Board
of Health of the State of New Jersey.

1. That the city of Millville, in the county of Cum-
berland, is a city of this State existing under the laws
thereof.

2. That the Borough of Vineland, in said county of
Cumberland, is a body corporate, in fact and law, and
exists as such by virtue of an act of the Legislature of 20

this State, entitled "A General Act relating to boroughs (Revision 1897)," approved April 24th, 1897.

3. That the Millville Water Company is a corporation created by and existing under the provisions of an act of the Legislature of this State, entitled "An act for the construction, maintenance and operation of water works for the purpose of supplying cities, towns and villages of this State with water," approved April 21st, 1876, and the acts amendatory thereof and supplementary thereto, and has lawful authority to supply the inhabitants of said city of Millville with water, as by reference to the certificate of incorporation of said company, now on file in the office of the Secretary of State of this State, will appear.

4. That said Millville Water Company now is, and for sometime past has been, supplying the inhabitants of said city of Millville with potable water for domestic use.

5. That said Borough of Vineland now owns, uses and operates, and for sometime past has owned, used and operated, a system of sewers and a sewage disposal plant and filtration beds.

6. That said filtration beds of said Borough of Vineland are located near said borough and on or very near the banks of a stream of water known as Tarkiln branch; that said filtration beds are now, and for sometime past have been, constantly filled with sewage received through the system of sewers of said borough of Vineland; that the effluent from said sewage is allowed and permitted to escape into the waters of Tarkiln branch, a tributary of Parvin's brook; that said Parvin's brook is a tributary to Maurice river, one of the waters of this State, and at a point near said borough of Vineland empties into the waters of said Maurice river.

7. That from the waters of said Maurice river, and at a distance of about fifteen miles from said Tarkiln branch and said filtration beds, the said Millville Water Company obtains its supply of water for the domestic

use of the inhabitants of the said city of Millville; that by reason of the effluent from said filtration beds being permitted to escape into the waters of said Tarkiln branch, and thence into the waters of said Parvin's brook, and from thence into the waters of said Maurice river, the waters of said river are greatly polluted; that the place where the effluent from said filtration beds is permitted to escape into the waters of said Tarkiln branch of Parvin's brook, one of the tributaries of said Maurice river, is above the point where said Millville Water Company obtains its supply of water for the domestic use of the inhabitants of the city of Millville; that said effluent from said filtration beds tends to corrupt and impair, and in fact does corrupt and impair, the quality of the water of said Maurice river at the place of intake of said Millville Water Company, and tends to render, and in fact does render, such water injurious to health, and tends to pollute, and in fact does pollute, the domestic water-supply of said city of Millville. 10 20

8. That on the thirty-first day of May, in the year nineteen hundred and four, the secretary of the State Board of Health of the State of New Jersey addressed a letter to the Mayor and Council of the borough of Vineland, New Jersey, of which the following is a true copy:

"May 31, 1904.

*To the Mayor and Council of the Borough of Vineland,
N. J.:*

GENTLEMEN—A reinspection was made May 27, 1904, of the sewage disposal beds of Vineland, and the report of this inspection shows that the purification of the sewage is still unsatisfactory, and that the stream into which the effluent discharges (one of the tributaries of the Maurice river) is polluted thereby. 30

At a meeting of the Board of Health of the State of New Jersey, held April 19, 1904, it was ordered that unless the purification of the sewage of Vineland shall be effective, and unless the discharges from the sewage-

disposal beds, situated in that borough, shall be freed from organic matter and rendered safe and suitable to be discharged into the waters of a stream used for potable purposes, that the facts relating to the pollution of said stream shall be placed in the hands of the Attorney-General for such action as the law provides.

Very respectfully,

HENRY MITCHELL,

Secretary."

10

That on the twelfth day of July, nineteen hundred and four, the Secretary of the State Board of Health of the State of New Jersey addressed a letter to the Mayor and Council of the Borough of Vineland, New Jersey, of which the following is a true copy:

"July 12, 1904.

*To the Mayor and Council of the Borough of Vineland,
N. J.:*

20 GENTLEMEN—At a meeting of the Board of Health of the State of New Jersey, held July 8, 1904, a report of an inspection made July 7 of the outfall of the sewage of Vineland into a tributary of Maurice river was presented, and it was shown by said report that the waters of said tributary are still polluted by the effluent from the sewer beds of Vineland. On motion it was voted that the facts in relation to the pollution of said tributary be referred to the Attorney-General for such action as the law provides for the prevention of the pollution of the Maurice river.

30

Very respectfully,

HENRY MITCHELL,

Secretary."

That notwithstanding said letters, the said borough of Vineland continues to permit the effluent from its said filtration beds to escape into the waters of said Tarkiln branch of Parvin's brook, a tributary of said Maurice river, and has utterly failed and neglected to refrain from

said acts or to adopt such measures or plans whereby the waters of said Maurice river shall cease to be corrupted, impaired or rendered injurious to health.

9. That the matters and things hereinabove alleged bring the borough of Vineland, which controls, operates and maintains said sewage disposal plant and filtration beds directly within and subject to the provisions of an act of the Legislature of the State of New Jersey, entitled "An Act to secure the purity of the public supplies of 10 potable waters in this State," approved March seventeen, eighteen hundred and ninety-nine, and the borough of Vineland, in owning, using, operating and maintaining said sewage disposal plant and filtration beds, directly violates the provisions of said act; that at the time of passage of said act the said borough of Vineland had no system of sewers discharging into the waters of said Tarkiln branch, Parvin's brook, or Maurice river, but has erected the same since the passage of said act.

All which acts and doings of said borough of Vine- 20 land are contrary to equity and good conscience.

In consideration whereof, and forasmuch as adequate relief in the premises cannot be had at and by the strict rules of the common law, and can only be obtained in this honorable court, where matters of this nature are properly cognizable and relievable.

To the end therefore, that the said borough of Vineland may, without oath, oath being hereby expressly waived, full, true and perfect answer make to all and singular the matters aforesaid as fully and particularly 30 as if the same were here again repeated and the said defendant distinctly interrogated thereto, and that the said defendant may be enjoined, by the State's writ of injunction, from permitting the effluent from its filtration beds to escape into the waters of Tarkiln branch of Parvin's brook, and from further polluting the waters of said Tarkiln branch, Parvin's brook, or Maurice river by its use, maintenance and operation of said system of sewers, sewage disposal plant and filtration beds, and

from further violating the provisions of said act of the Legislature, entitled "An Act to secure the purity of the public supplies of potable waters in this State," approved March seventeenth, eighteen hundred and ninety-nine, and that such further relief may be had in the premises as the nature of the case may require and as shall be agreeable to equity and good conscience.

May it please your Honor, the premises considered,
 10 to grant unto your orator not only the State's writ of injunction as aforesaid, but also the State's writ of sub-pœna, issuing out of and under the seal of this honorable court, to be directed to said Borough of Vineland, commanding said borough, at a certain day and under a certain penalty therein to be expressed, to be and appear before Your Honor in this honorable court, then and there to answer the premises and to stand to, abide by and perform such decree as to your Honor shall seem meet, and as shall be agreeable to equity and good con-
 20 science.

ROBERT H. McCARTER,
*Attorney-General of the State of New
 Jersey, Solicitor and Counsel for the
 Relator, the Board of Health of the
 State of New Jersey.*

ORDER TO AMEND BILL.

30 It appearing that by inadvertence the name of the defendant in the above-entitled matter was incorrectly styled as "The Borough of Vineland," instead of "The Mayor and Council of the Borough of Vineland," and notice having been given of an application to amend the bill by striking out wherever they the words "The Borough of Vineland" and substituting in lieu thereof the words "The Mayor and Council of the Borough of Vineland," and Herbert C. Bartlett, Esq., appearing in response to said notice.

It is thereupon, on this first day of August, nineteen hundred and five, on motion of Robert H. McCarter, Attorney-General, ordered that the bill of complaint in the above-entitled cause be amended as above described, and that the defendant have thirty days in which to answer said bill.

By the statute.

J. J. BERGEN,
Master. 10

ANSWER.

The answer of the Mayor and Council of the borough of Vineland, defendant to the amended bill of complaint of the State, at the relation of the Board of Health of the State of New Jersey.

1. This defendant answering admits that it is a body corporate in fact and in law existing under and by virtue of an act of the Legislature of the State of New Jersey entitled "A General Act relating to Boroughs" (revision 1897), approved April 24th, 1897. 20

2. This defendant answering says that as to the Millville Water Company being a corporation created and existing under an act of the Legislature of New Jersey as set forth in paragraph three of complainant's bill, and as to the fact of its supplying potable water for domestic use to the inhabitants of the city of Millville as set forth in paragraph four of complainant's bill, it has no knowledge and neither admits or denies the same. 30

3. This defendant answering says that it now uses, owns and operates and for some time past has owned, used and operated a system of sewers and a sewage disposal plant and filtration beds.

4. That said filtration beds of defendant are located near the borough of Vineland, and near the banks of a small stream of water known as Tarkiln branch, a tributary of Parvin's brook or stream, but deny that the said

filtration beds are now or have been for some time past constantly filled with sewage received through the system of sewers of the borough of Vineland, and further show that said filtration beds are now and have been in first-class sanitary condition, free and clear of sewage; and that said beds are eleven in number, and sewage is only allowed to flow upon one bed for twelve hours at one time, giving each bed a rest of one week; and that
10 whatever effluent passes from the said beds into Tarkiln branch is only after the same has been thoroughly filtered and cleared of all sewage organisms so that the effluent passing from said filtration beds into Tarkiln branch is in fact clear water.

5. This defendant further answering denies that by reason of any effluent passing from said filtration beds into the waters of Tarkiln branch, thence into Parvin's brook, and thence into Maurice river, that the waters of Maurice river are polluted either at the point where the
20 city of Millville receives its water supply as alleged by complainant, which is some twelve miles from said filtration beds of this defendant, or at any other point or place in said river; and further deny that the effluent from said filtration beds of this defendant either tend or in fact does corrupt or impair the quality of the water of Maurice river either at the place of the intake of the Millville Water Company or at any other point or place in said river; and further deny that it tends to render
30 or in fact does render the waters of Maurice river either at the intake of said Millville Water Company or at any other point or place in said river injurious to health, and deny that it pollutes or tends to pollute in any way or manner whatever the domestic water supply of the city of Millville.

6. This defendant further answering admits that it received a letter bearing date the thirty-first day of May, nineteen hundred and four, and one of the twelfth day of July, nineteen hundred and four from Henry Mitchell, Secretary of the State Board of Health, copies of

which letters are set forth in paragraph eight of complainant's bill; that an immediate reply was made to the letter of May thirty-first, and also to the letter of July twelfth, no copy being kept of the letter of this defendant in answer to letter of May thirty-first, but the following is a copy of the letter sent by this defendant to Henry Mitchell, Secretary of the State Board of Health, in answer to said letter of July twelfth, nineteen hundred and four to this defendant.

10

VINELAND, N. J., July 14th, 1904.
The Board of Health of the State of New Jersey,
Mr. Henry Mitchell, M. D., Secy.,
Trenton, N. J.

Dear Sir:

Your letter of the 12th inst. received and contents carefully noted. We regret very much to learn that our beds are not working in a degree satisfactory to your Board. We have spent a great deal of money fixing these beds up in accordance with the suggestions given us by the State Sewerage Commission and others, and we confidently expected that the beds were purifying the sewerage to a proper degree. 20

As I told your representative the bed from which the sample was taken was being worked for the first time and of course would not purify the sewerage to the extent that it will after it is worked a few times.

We would be glad to receive a report of the analysis, as we can work more intelligently if we know what objectionable matter remains in this affluent. 30

Yours respy.,

R. H. GARRISON,
Supt. of Public Works.

And this defendant shows that no attention was ever paid to the request of this defendant for an analysis of

the water as contained in its letter to said Henry Mitchell, Secretary of State Board of Health of July fourteenth, nineteen hundred and four and no analysis ever sent to this defendant by said State Board of Health or any one for it, showing the condition of said effluent from the sewer beds of this defendant and although requested by this defendant for the results of any analysis made by said State Board of Health at any
10 time, this defendant has never yet received the result of any such analysis from said State Board of Health.

This defendant, further answering, says that after the receipt of said letters of May thirty-first and July twelfth, nineteen hundred and four, from the State Board of Health, set forth in paragraph eight of complainant's bill, extra precautionary methods were taken in the care and management of the sewage disposal plant and filtration beds of this defendant, and now are taken in the care and management of the same as to the treatment of
20 the sewage received thereon, and the care and conduct of the disposal fields and filtration beds; that this defendant has kept constantly in touch with the State Sewerage Commission of this State, who approved the plans for the location and construction of said disposal fields and filtration beds of this defendant, as well as the plans for its sewer system; that it follows carefully such rules or directions as the State Sewerage Commission has prescribed or given to it in the care and management of the same, as well as such suggestions as said commission has
30 given to it, and has from time to time not only followed the directions and rules of said commission as to the care and conduct of said disposal fields and filtration beds, but has written to said commission for instructions and advice as to the care and management of the same.

And this defendant shows that it not only follows the directions and suggestions given to it by the said State Sewerage Commission as to the care and management of its sewerage system, filtration beds and disposal field, but this defendant has secured the opinion of different

experts as to the care and treatment of sewage, and the care and treatment of its disposal field and filtration beds, and since March, nineteen hundred and five, has worked under the direction and suggestion of the Bureau of Plant Industry of the Department of Agriculture, of Washington, District of Columbia, both as to the care and treatment of the sewage on said disposal fields and filtration beds, as well as to the care and management of said filtration beds and disposal field; that examinations 10 have been made by experts at the request of this defendant, of the water of Maurice river just above the point where the city of Millville, as alleged by complainant, received its water supply, within the past four months, and no sewage organisms found therein to pollute or corrupt the waters of said river in any manner; that examinations have been made by experts, at the request of this defendant, of the water in Tarkiln branch within the said time, and repeated examinations at short intervals made since the first day of March, nineteen 20 hundred and five up to the present time, of the effluent as it passes directly from said filtration beds into Tarkiln branch, and no sewage organisms, pollution or corruption found therein passing from the disposal field or filtration beds of this defendant into Tarkiln branch aforesaid.

And this defendant, answering, says, that the sewage disposal field and filtration beds connected with its sewer system aforesaid are now in every manner and respect 30 in a first-class sanitary condition; that great care is taken in the care and treatment of the sewage of said disposal field and filtration beds, as well as care and conduct of said fields and beds, and that no sewage organisms or pollutions are escaping from its said disposal plant into Tarkiln branch, Parvin's brook, or Maurice river, and that the waters of neither of these streams or the waters of Maurice river are corrupted or polluted from the effluent passing from said filtration beds and disposal field, and that the water supply of the city of Millville, as

taken from the waters of said Maurice river, is not now, or has it been, corrupted, impaired or rendered injurious to health by reason of any effluent passing from the said filtration beds and disposal fields of the sewer system of this defendant.

This defendant denies that in the maintenance or operation of its sewage disposal plant and filtration beds that it in any way violates an act of the Legislature of New Jersey, entitled "An Act to secure the purity of the
10 public supplies of potable waters in this State," approved March seventeenth, eighteen hundred and ninety-nine.

All which matters and things this defendant is ready to maintain and prove, when and where this honorable Court may direct, and pray to be hence dismissed with its reasonable costs and charges in this behalf most wrongfully sustained.

HERBERT C. BARTLETT,
Solicitor for and of Counsel with Defendant.

REPLICATION.

20 The complainant joins issue on the answer of the defendant.

ROBERT H. McCARTER,
Attorney-General,
Solicitor of Complainant.

IN CHANCERY OF NEW JERSEY.

BETWEEN

THE STATE AT THE RELATION OF THE
STATE BOARD OF HEALTH OF THE
STATE OF NEW JERSEY,*Complainant,**and*

THE BOROUGH OF VINELAND,

Defendant.

} On Bill, &c.

TESTIMONY.

10

CAMDEN, N. J., January 29th, 1906.

Transcript of shorthand notes taken at the final hearing
of the above cause, before His Honor Martin P.
Grey, one of the Vice-Chancellors of this State,
at the Chancery Chambers in the city of Camden.

Messrs. Edward D. Duffield, Assistant Attorney-Gen-
eral, and Theodore Backes appeared for the Complain-
ant.

Mr. Herbert C. Bartlett appeared for the defendant. 20

Counsel for complainnt offered in evidence a certified
copy of the certificate of incorporation of the Millville
Water Company, incorporated November 8th, 1878,
certificate filed in the office of the Secretary of State
November 11th, 1878, being a certified copy under the
seal of the Secretary of State. Marked *Exhibit C 1*.

Counsel for complainant also offered in evidence the
map of the Geological State Survey of New Jersey, No.
14, under title of "Atlas Sheet, No. 14, Delaware Bay,
survey made 1890." The map was not marked, but is 30
known as *Exhibit C 2*.

Dr. Alonzo Clark Hunt, sworn for the complainant.

Direct examination, by Mr. Duffield:

Q. You live where?

A. Metuchen.

Q. You are a practicing physician?

A. I am not a practicing physician; I formerly was a practicing physician.

Q. You are connected with the State Board of Health?

A. I am.

Q. In what capacity?

A. Assistant Secretary and Medical Inspector of that
10 Board.

Q. You have particularly the duty of inspecting the water supplies in various parts of the State?

A. That is one of my duties, inspecting of public water supplies.

Q. In the discharge of this duty, have you had occasion to inspect the water supply of the city of Millville?

A. I have.

Q. Where is that water supply procured from?

A. There are two sources of supply, one called the
20 Consumer's Company, and the other the Millville Water Company.

Q. Is the Millville Water Company one of the companies engaged in the public supply of water there?

A. It is as I understand it.

Q. Where does their supply come from?

A. Maurice river.

Q. You have gone over the ground between Millville and Vineland, have you?

A. Not all of the ground between Millville and Vine-
30 land.

Q. Have you inspected the sewage disposal works of Vineland?

A. I have.

Q. Tell generally what this work consists of?

A. There are a number of filter beds which are placed near a stream known as the Tarkiln branch, I think of Parvin's branch, which is a tributary of Maurice river, and the sewage is placed upon these artificially made filtration beds, and the effluent from the bed is discharged into the stream.

Q. Will you describe what you mean by effluent, what that term is?

A. Whatever comes from a sewage filtration bed is known technically as the effluent.

Q. Containing sewage matter?

A. Supposed to contain in a great many instances sewage matter.

Q. Have you yourself from time to time inspected the disposal works of Vineland to determine whether or not the effluent was coming from there into Tarkiln branch? 10

A. I have seen the flow from the filtration beds discharge into the creek.

Q. How often?

A. I could not say definitely without reference to my note book, but probably eight or ten times.

Q. Did you at those times take any sample for analysis?

A. Yes, in two or three instances, and forwarded it to the laboratory at Trenton. 20

Q. And they are delivered to whom?

A. To Doctor Fitz-Randolph, I think, in each instance. Doctor Fitz-Randolph was present with me when two of the samples were taken.

Q. Did you ever inspect this creek or branch below the point where this filtration is deposited, to determine whether the water was in any way corrupted or injured by it?

A. I have merely followed when there was evidence from the outflow of the pipe of discoloration—I followed the discoloration simply until it disappeared from the water. 30

Q. How far down did you follow it?

A. That is but a short distance; it disappears very soon.

Q. At the time you inspected it, was there any perceptible odor arising from the water of the creek at the point where the effluent was discharged?

A. There was a milky discoloration and an odor that was apparently the odor of sewage.

Q. That is all.

Cross-examination, by Mr. Bartlett:

Q. When did you make your last inspection?

A. I haven't the notes in reference to that. I made four inspections, four inspections in 1903 and three in
10 1904, and I have been there three or four times this year, 1905, at least.

Q. When was the last time in 1905?

A. Quite recently, I think, within two months; if I remember, Dr. Fitz-Randolph was with me at that time, and I think he has the date of that.

Q. How far down the stream, known as Tarkiln creek, did you go?

A. I have been down the stream to the first road, the first bridge which crosses the stream below.

20 *Q.* About how far?

A. I judge 300 or 400 yards.

Q. From what?

A. From the sewer beds, from the point where the sewer beds are located.

Q. You say this disappears, this coloring matter?

A. The discoloration disappears, or rather did not appear after a distance of maybe 50 or 100 feet.

Q. The odor disappeared?

30 *A.* The odor is not perceptible as you get down the stream.

Q. Where does the Millville Water Company get its supply; you said Maurice river; is it Maurice river or Union lake?

A. As I understand, it is Union lake, but Union lake is merely Maurice river, which is dammed at that point.

Q. (By the Vice-Chancellor.) And the river flows through it?

A. Yes, Union lake is supplied by Maurice river.

Q. Then the overflow goes down and constitutes the river?

A. The overflow over the dam.

Q. (Further cross.) Is the water supply taken from the lower end of the lake?

A. I think it is.

Q. Do you know the size of that lake?

A. I am not acquainted with the size of the lake; I could not state definitely.

Q. What is the color of that effluent as it leaves the sewer beds? 10

A. It varies; in each inspection it has been different; sometimes it has been more milky than others; other times it is very clear. I have generally noticed there is some discoloration.

Q. How was the last inspection?

A. There was less discoloration at the time of the last inspection than any other time before.

Q. (By the Vice-Chancellor.) Was that since this suit was brought?

A. It was since the suit was brought. 20

Q. (Further cross.) Nearly clear?

A. Nearly clear.

Q. (By the Vice-Chancellor.) I am speaking of the discoloration that you are referring to at the time of the examination made three or four hundred yards from the escape from the sewer beds?

A. No examination made at the point where this discharges into the stream.

Q. How long has the overflow been flowing into the stream before you reach the point of your examination? 30

A. It is just flowing into the stream, I mean at the outlet pipe.

Q. Then the thing you examined was the outflow from the sewer beds, and not the stream?

A. I followed the stream down a ways to see how long the discoloration lasted.

Q. Tell me the difference between the two; of course, it is quite important whether or not the thing you examined was the outcome from the sewer beds, or whether

it was the stream after it had been intermixed with the outcome of the sewer beds?

A. Both.

Q. How far distant from the incoming of the outcome from the sewer beds was it that you examined the stream after there had been an intermixture?

A. As I said, I followed the stream down some 300 or 400 yards below.

10 *Q.* Was that the extent of your examination?

A. That was the extent of my examination.

Q. (Further cross.) You made no chemical or bacteriological examination or analysis?

A. I simply took the samples, and they were taken by me to the State Laboratory of Hygiene for chemical examination by the chemists employed by the State Board of Health.

Q. That is all.

20 *Raymond B. Fitz-Randolph*, sworn for complainant.
Direct examination, by Mr. Duffield.

Q. Where do you live?

A. Trenton, N. J.

Q. Do you hold any official position with the State Board of Health?

A. I am director of the State Laboratory of Hygiene.

Q. How long have you held that position?

A. Since February, 1903.

Q. Where did you obtain your education as a chemist?

30 *A.* Lehigh University.

Q. When was that?

A. I graduated in 1893.

Q. Since that time have you been engaged in chemical work?

A. I have, continuously.

Q. In what capacity, or in what position?

A. Assistant in the laboratory of the Brooklyn Health Department for some years, and for three or four years after that I had a Fellowship in the Hoagland laboratory, in Brooklyn.

Q. Have you had occasions to make examinations of water in order to determine the presence of sewage matter or contamination?

A. I have.

Q. How frequently have you done that in a general way?

A. I can't say how many I have made with any degree of definiteness. I was engaged pretty constantly at that work for two or three years in Brooklyn, and since 10 coming to Trenton I have been engaged in the analysis of water, public and private supplies.

Q. Did you receive at the laboratory in Trenton various specimens of water from Dr. Hunt which were alleged to have been taken from the Tarkiln creek, near the Vineland sewage beds?

A. Yes, I received two samples from him taken at different times, and Dr. Hunt and I visited the plant together and took samples.

Q. You took samples yourself?

20

A. Yes, sir.

Q. Did you analyze those samples?

A. Yes.

Q. Both the ones that Dr. Hunt gave you, as well as the ones you took yourself?

A. Yes.

Q. When was the occasion you went there yourself, do you recall?

A. (Referring to a memorandum) Dr. Hunt and I visited the plant November 1st, 1905.

30

Q. How long prior to that did Dr. Hunt give you these samples to which you referred?

A. The first sample was February 20th, 1905.

Q. Did you analyze that?

A. I did.

Q. What was the result of your analysis, so far as disclosing contamination?

A. The sample was rather diluted and somewhat stale sewage.

Q. When was the second sample taken?

A. April 24th, 1905.

Q. Was that one of the samples taken by Dr. Hunt?

A. Yes.

Q. Did you analyze that?

A. Yes.

Q. With what result?

Mr. Bartlett—Is that your chart you refer to?

10 *A.* I am referring to a memorandum of the analysis.

Q. Prepared by you, this memorandum to which you refer?

A. Yes.

Q. What was the result of the analysis of April, I think you said?

A. April 24th. The analytical figures were the same general character and the material was about the same; it has the composition of rather dilute, stale sewage.

20 *Q.* When was the first occasion on which you were present when samples were taken?

A. November 1st, 1905.

Q. Tell us where these samples were taken from?

A. There were two samples taken, one from one of the pipes through which the effluent flows into the brook and another from one of the others—there are five of those pipes altogether, and the samples were taken from the material that was flowing from those pipes into the brook.

30 *Q.* The samples were taken, as I understand it, before the effluent had reached the brook?

A. Those were.

Q. Did you analyze them?

A. Yes, sir.

Q. What was the result of that?

A. The material was in a general way similar to the other samples; it was stale, rather dilute sewage.

Q. Was the effluent at the time you were there running into the brook?

A. It was.

Q. In how steady a stream?

A. It was running steadily from each of the pipes.

Q. The five pipes in there?

A. Five pipes; I am not sure it was running from all the pipes; it was running from four.

Q. From four of those pipes this substance which you took was discharged directly into the brook?

A. Yes; some of the pipes had more of the material running through it than others, and they were running directly into the brook. 10

Q. Have you made a more recent trip to Vineland?

A. Yes; I visited the plant on January 21st, 1906.

Q. That is about a week ago?

A. Yes, a little more.

Q. Did you make photographs of the situation at that time?

A. Yes, I made some photographs.

Q. I show you four photographs, and ask you if these photographs were taken by you? 20

A. They were.

Q. Do they disclose the situation as to location and in other respects as to the disposal works?

A. As nearly as can be done in photographs, I think.

Photographs offered in evidence and marked *Exhibits C 3, C 4, C 5 and C 6.*

Q. Will you just look at those, and referring to them by numbers which they have been marked, tell us what they show?

A. C 3, this is the Tarkiln brook; I am informed that is the name of it, and those are three of the effluent pipes in the near foreground with the material running from them into the brook. 30

Q. Taking C 4, what does that disclose?

A. That is a corner of one of the filtration beds filled with sewage. This matter on the surface is sewage which is supposed to pass through it.

Q. What is C 5?

A. This is one of the sedimentation basins; the sewage comes in at this point and is distributed on to this basin,

and on to the next one, and I am informed that it runs from this sedimentation basin to the filtration bed proper.

Q. I show you *Exhibit C 6*?

A. That shows on the right a portion of the sedimentation basin; on the left one of the filtration beds, which is dry, and up here on this bank is a barrel from which solution of copper sulphate was trickling into the sewage as it flowed onto the bed.

10 Q. Won't you, doctor, in a general way, describe to us just what the process of this sewage is, what is the method of purification, or attempted purification?

A. As I understand it, the raw sewage is brought into the sedimentation basins, of which there are two in use, and there the bulky material and large pieces of stuff, which are always in sewage, settles out for the most part in the sedimentation basins, which, the man at the works informed me, were not underdrained. The sewage runs through a ditch on to the filtration beds proper.

20 Before it gets to this bed a certain amount of copper sulphate solution is added from the barrel which stands there. The sewage percolates through the soil and goes out through the underdrain into the brook.

Q. Upon the occasion on which you were last there, a week ago, did you take specimens then?

A. I did.

Q. Where did you take those specimens?

A. I took one specimen from the brook, about 200 feet above the upper basins of the beds.

30 Q. What did you find there as to contamination?

A. There was practically no evidence of sewage in that.

Q. That was above the beds?

A. Yes, there is a factory some ways above, a rug factory, which discharges more or less waste dye stuff into the brook; the brook at that point was colored pink from the dye stuff, but there was no, or at least very doubtful, evidence of sewage at that point.

Q. Where else did you take samples?

A. From one of the pipes out of which the effluent was flowing into the brook, and another one from the brook itself, at a little bridge about 33 feet below the lowest outlet pipe.

Q. What did those disclose?

A. The one from the effluent was of a character similar to the other sample which I had had; it was rather a dilute stale sewage, and the sample from the brook evidently consisted quite largely of that material. 10

Q. (By the Vice-Chancellor.) Did it have any odor?

A. It was very decided and offensive.

Q. The one from the brook?

A. The one from the brook as well as the—

Q. What is the nature of the odor?

A. It is very difficult to describe it, it is the odor that always occurs with stale sewage. It is quite a characteristic odor, and differs very little in different places.

Q. (Further direct.) Has it somewhat the odor of wash water? 20

A. Possibly a little like that, not exactly.

Q. Have you one sample with you that you took that day?

A. Yes, I have it in my overcoat pocket.

Q. The bottle now produced contains what?

A. This contains material collected from one of the effluent pipes on January 21st.

Bottle produced by witness has a printed label marked "Board of Health of the State of New Jersey, No. E. 1089," and is marked *Exhibit C 7* 30 on the margin of that label.

Mr. Duffield—I don't know whether it is advisable to open that bottle to indicate the character of the odor.

The Vice-Chancellor—That is for you to settle. A smell may be evidence.

Q. Will you open that bottle and tell us whether there is any odor that arises therefrom. Has that bottle been opened since you took it?

A. I opened the bottle for an instant this morning in order to see that the stopper was securely placed in it.

Q. No additions have been made to it?

A. No, nor has any material been removed.

Q. So it is substantially in the same condition as when you took it?

A. Yes.

Q. Not only substantially but actually?

10 *A.* Yes, except for decomposition.

Q. (By the Vice-Chancellor) When did you take this sample from the brook?

A. About 2 o'clock in the afternoon of January 21st of this year. That is a little over a week old.

Q. What kind of a stopper have you?

A. A ground glass stopper.

Q. (Re-direct) You said two o'clock?

A. No, I am mistaken; it was in the morning.

Q. Who was with you?

20 *A.* Mr. Backes of the Attorney-General's office and Shippen Wallace of the Laboratory of Hygiene.

Q. What was the condition of the filtration beds when you saw them that morning?

A. What do you mean?

Q. As to odor?

A. That was marked.

Q. Decidedly so?

A. Yes, it was decided; it was perceptible quite a distance from the beds.

30 *Q.* (By the Vice-Chancellor) That is during this month of January, the examination?

A. Yes, it was perceptible quite a distance, about a quarter of a mile.

Q. (Further direct) Is the odor still there?

A. Yes; it is there still, the character of the odor is about the same.

Mr. Duffield—The bottle is offered in evidence including the odor.

The Vice-Chancellor—It is marked as above stated.

Q. What does that odor disclose to you as a chemist?

A. That is the odor which is commonly associated with sewage.

Q. Did you follow down below the last pipe on the stream?

A. Yes, we went down in short ways; I should say forty to fifty feet.

Q. Was there any odor?

A. Yes, a very decided odor; I took the sample down 10 there.

Q. And that disclosed the presence of sewage matter?

A. Yes, the odor was practically the same as this, perhaps not quite as intense.

Q. That is all.

Cross-examination, by Mr. Bartlett:

Q. What analysis did you make of the water of the samples taken January 21st?

A. I determined the free and albumenoid ammonia, 20 the nitrates and nitrites, the chlorine and made a bacteriological test for the presence of bacillus coli communis.

Q. The first three you mention are chemical tests?

A. Yes.

Q. What is the last?

A. I think I mentioned five. I determined the nitrogen as free ammonia, the nitrogen as albumenoid ammonia, as nitrates, nitrites and determined the chlorine, and made bacteriological tests for the bacillus coli com- 30 munis.

Q. What test determines the dangerous organism in water, chemical or bacteriological?

A. I don't quite understand your question.

Q. (Last question read)?

A. The bacteriological tests are rather more conclusive when it is a test of actual pollution of the supply.

Q. That is the up-to-date test?

A. There are certain bacteriological tests which are indicative of pollution.

Q. Did you make a bacteriological test of the sample of January 21st?

A. I did of the bacillus coli communis.

Q. What samples did you test?

A. Three of them.

Q. Where were they taken from?

10 *A.* One taken above the filtration bed, one from the effluent from one of the pipes that comes from the bed, and one from the stream below the beds.

Q. From a bacteriological test, what are the dangerous organisms in water called, what is the term they are known as?

A. You mean pathogenic?

Q. What are the other names?

A. A variety of names may be applied.

Q. The common name known to bacteriologists?

20 *A.* I can't imagine what you are referring to.

Q. Are they called coli?

A. That is what I have been talking about some time, bacillus coli communis.

Q. What percentage of coli or sewage organism did the samples show taken above the bed?

A. The largest quantity of water that I tested of any of these samples was one cubic centimeter, the bacillus coli communis was not present in one cubic centimeter in the water taken above the beds.

30 *Q.* (By the Vice-Chancellor) Let me understand what you mean by taken above the beds, in what stream did you take the water?

A. Tarkiln creek.

Q. You took a sample from Tarkiln stream before the overflow from the sewage bed was poured into it?

A. Yes, sir; about 200 feet above.

Q. That stream flows into Maurice river?

A. Yes, sir.

Q. It is not a tidal stream in any sense?

A. No.

Q. And the sample that you took then, as I understand you, above the bed was the one which you took before the overflow of the sewage bed came into the stream?

A. Yes, about 200 feet up the stream from the pipes.

Q. (Further cross) Where was the second sample taken from?

A. That second sample was the effluent from one of 10 those pipes which came from the bed.

Q. Which pipe?

A. It was the last pipe of the three.

Q. The down-stream pipe?

A. Yes, sir; the last pipe. (Witness looking at *Exhibit C 3.*) It was this last pipe.

Q. Indicating the down-stream pipe of the three emptying into it?

A. Yes, sir.

Q. What percentage of coli or sewage organism did 20 that sample show to you bacteriologically?

A. That indicated the presence of the colon bacillus in one one-thousandth of a cubic centimeter.

Q. How many did you get of the coli in that sample?

A. I didn't test it in that way.

Q. Didn't you test the number of coli or sewage organism?

A. Approximately.

Q. What was the approximation?

A. The result was that there was approximately one 30 in every thousandth of a cubic centimeter; that would be one thousand in a cubic centimeter.

Q. What was the total number of your colony?

A. I didn't get a colony at this particular stage, as I didn't make the test in the way you are referring to.

Q. What sort of a test did you make bacteriologically?

A. By adding a measured portion of the effluent to a fermentation tube containing lactose broth and neutral

red, in this instance amounting to one cubic centimeter, one-tenth of a centimeter, one one-hundredth of a cubic centimeter and one one-thousandth of a cubic centimeter were added in duplicate to different fermentation tubes; the small amounts were obtained by appropriate dilution in sterile water.

Q. What evidence did you get from that examination that there was coli in the water?

A. That is just the first step. After twenty-four
10 hours' growth in the incubator this tube showed decoloration of the neutral red and presence of gas in the closed arm of the fermentation tube. Transfers were made from this fermentation tube into the broth containing Parietti mixture and incubated for twenty-four hours; from there further transfers were made into a second fermentation tube and incubated forty-eight hours. From the second fermentation tube lactose litmus argar plates were made and on those plates developed the typical red colonies. Some of those colonies
20 were examined for motility and morphology, and transfers were made from them to Dunham's solution, in which a test for indol was made and to a broth containing nitrate to determine whether or not the organisms would produce nitrite.

Q. What was the result?

A. The result indicated the coli bacillus was present, the bacillus coli communis was present in that sample in the smallest amount that was taken for examination, that is one one-thousandth of a cubic centimeter.

30 *Q.* How many plates did you make in the first test?

A. I used eight fermentation tubes, two for each dilution.

Q. You say you found coli, that is one in one-thousandth centimetre?

A. One in one-thousandth of a cubic centimetre.

Q. How many total organisms were there in that effluent?

A. I didn't make any count.

Q. Did you examine the gas?

A. I did—you mean the gas in the fermentation tube?

Q. Yes.

A. Yes, I examined the gas in the second fermentation tube.

Q. And in the first?

A. No, simply noted the presence there.

Q. What was your result in the second tube?

A. The gas ratios were approximately correct. You are speaking now of the sample from the effluent? 10

Q. Yes.

A. In the one one-thousandth tube the ratio in one three to two, and in the other two to one.

Q. Did you take the sample from the beds, doctor?

A. From the beds themselves?

Q. Yes.

A. No, I took no sample from the beds.

Q. Then you can't tell the reduction in the amount of coli as the sewage comes on the beds?

A. No, I have no means of finding out. 20

Q. What would you say was a safe elimination of sewage organisms from water?

A. What is my opinion on that point?

Q. Yes.

A. I should regard an effluent as unsafe if it contained more than one colon bacillus per cubic centimeter. Of course that depends somewhat on circumstances.

Q. (By the Vice-Chancellor.) In what way is it unsafe?

A. It is an indication that other and more dangerous 30 organisms may go through the filter in the same manner as the colon bacillus which has become an organism—

Q. Dangerous to what?

A. To health, to people who drink the water. And when the colon bacillus itself is not dangerous, it is simply an indication that other organisms which are commonly associated with it, such as typhoid bacilli, would also go through the filtration beds in the same way.

Q. (Further cross.) Why is it you didn't make a plate of litmus argar?

A. My experience is that that is by no means as reliable as the other.

Q. Is not that the customary way by the litmus argar to make a plate?

A. Some people do and some do it by the other. In fact, I am inclined to think that the majority of persons
10 do it the other way.

Q. (By the Vice-Chancellor.) That is by your process?

A. A process more reliable, the process I use, than by direct plating; both methods are in common use, yes.

Q. (Further cross.) Will you state who uses your process, what authority?

A. The process I used was originally devised by Stone, of Vermont, and a similar process is used in various laboratories. They use a similar method in the
20 Lawrence station.

Q. (By the Vice-Chancellor.) Is the process which you observed one which you in your own experience have found to be successful in the discovery of the presence of this harmful bacteria?

A. I have found it to be more reliable than other methods. All these methods are only roughly approximate. They haven't the same degree of exactness that the chemical analysis, for example, has.

Q. (Further cross.) Is the other test the one used by
30 the majority of bacteriologists?

A. I can't say that definitely one way or the other.

Q. What per cent. would you say was a safe elimination of sewage organism in water, out of 100?

A. I hardly think it is possible to law down a hard and fast rule.

The Vice-Chancellor—I do not understand what you mean, what is safe to take out.

Q. What percentage of organism removed would be safe for water?

A. I can't answer a question like that.

The Vice-Chancellor—Is it not dependent rather upon what remains than what is taken out?

Q. If five per cent. remain, is it dangerous?

A. It all depends upon what the nature of the raw sewage is. If five per cent. remain and the raw sewage is dangerous, the effluent is dangerous whether it is one per cent. or one-tenth per cent.

Q. State what you mean?

10

A. If the raw sewage contains sewage which is dangerous sewage, as typhoid bacilli, then effluent where the bacteriological purification was ninety-five per cent. would be dangerous.

Q. Would water be safe at five per cent. of coli or sewage organism remaining in it?

A. What do you mean by five per cent.

Q. Would it be safe, water having five per cent. of coli or sewage organism remaining in it?

A. That is impossible to understand, five per cent. 20

Q. Is all water clear of sewage organism?

A. No.

Q. There is some in all water?

A. No, not at least that we have been able to discover.

Q. The great majority of water contains some?

A. I should say not, unless very large quantities are taken for examination; probably the majority of surface water contains more or less, what might be called sewage contamination.

Q. The majority of surface water.

30

A. In small numbers.

Q. What numbers?

A. That depends altogether on the water anyway; any water which would be regarded as under ordinary circumstances safe for use, probably one bacilli coli in 10 cubic centimeters up; it is impossible to fix a definite number.

Q. Does not that range from 1 to 5 per cent.?

A. I don't understand what you mean.

Q. You figure them in one one-hundredths centimeters?

A. I never heard of water or sewage that contained anything near 5 per cent. of sewage bacteria; the actual amount of sewage organism per cent. is extremely small.

Q. But there is some in nearly all surface water?

A. Very likely.

Q. What organisms behave much like the bacilli coli?

10 *A.* There are a group of organisms which in some of their reactions behave somewhat like the coli bacilli, many of them.

Q. Name some?

A. The bacillus cloacal, the bacillus, lactis aerogenes, the typhoid bacillus resembles it quite remarkably.

Q. Did you detect any of those organisms in the examination you made?

A. I didn't look for them.

Q. Did they closely resemble the B-coli?

20 *A.* In some respects each of them do.

Q. It is sometimes hard to determine which the B-coli are?

A. These other organisms—not having a sufficient number of tests made. When you say B-coli, or when I say it, I am referring to the group of organisms which differ in some minor points, but which correspond to several general tests which are used, and which are commonly found in human or mammal intestines.

Q. How do they differ?

30 *A.* How or which?

Q. You say they differ from other organisms?

A. They differ in certain of their biological reactions.

Q. What are they?

A. Each one differs from the other.

Q. In what particular way do they differ?

A. Some of them—if you can be a little more specific.

Q. I don't know that I can be any more specific.

The Vice-Chancellor—He wants to know how the group or the species can be differentiated. You

are dealing with a subject which is so occult and hidden that it is very difficult to give an explanation unless you do particularize the answer to the single thing you are describing.

Q. The question I am asking is to show how they differ from these other organisms which resemble them, so as to determine how you tell that they were B-coli as distinguished from the other?

A. The bacillus coli ferments the commoner sugars 10 with a production of gas that is lactose, dextrose, saccharose and mannite and some of the other sugars, with a production of from 20 to 60 per cent. of gas. The actual amount of gas formed is very variable and that gas consists principally of a hydrogen mixture, hydrogen and carbon dioxide, in a proportion of two parts of hydrogen, approximately and one part of carbon di-oxide. The bacillus coli coagulates milk in from twenty-four to forty-eight hours, with the produc- 20 tion of a certain amount of acid and a hard formed curd. If litmus be added to the milk it becomes red- dened and ultimately decolorized. The colon bacillus is motile, usually has from three to eight cilia, although the exact number is somewhat difficult to determine. It is not as motile as the typhoid bacilli usually, but it differs from some of those organisms which are not motile at all; it will grow in the presence of a consider- able amount of carbolic acid; that differentiates it from any of the others, any water organisms, which are in- 30 hibited by carbolic acid. It produces indol in liquid cultures, usually, not always. It reduces nitrate to nitrite quite vigorously. I might also say that most of these cultures which I obtained were tested against serum that was obtained from the mammal, immunized against the colon bacillus. I don't regard that as very reliable for the reason that different strains of the un- doubted bacilli coli will not react except to serum pre- pared from the particular strain tested under high dilu- tion.

Q. (By the Vice-Chancellor) Are you relying only upon the tests which you here adopted?

A. No, I am saying in addition to what I did I made that test, but I don't place a great deal reliance upon it because of the different behavior of the different strain of what are undoubtedly coli bacilli.

Q. (Further cross) Then I understand you didn't make the gas test in the two examinations?

10 *A.* I didn't determine the ratio between the hydrogen and the carbon di-oxide in the first fermentation tube. I did in the second. In the first fermentation tube the amount of gas is very variable, probably because of the presence of the other organisms growing in the tube, and it throws practically no light upon the test. When most of the water organism are eliminated by the Parietti solution the amount of gas and gas ratios are much more constant.

Q. Why didn't you use the Parietti solution first?

20 *A.* Because as a rule the bacillus coli in water or sewage is in an inenfeebled condition, and the Parietti solution, after the raw sewage is planted into it, will kill off many of the colon bacilli.

Q. Why didn't you use a little bouillon with it as is usually done?

A. There is always bouillon in the Parietti solution as I understand it.

Q. Didn't you add some in addition to that in the Parietti solution?

30 *A.* I don't quite understand.

Q. Didn't you add some bouillon to the Parietti solution in making that test?

A. Yes, I used bouillon containing carbolic acid and hydro-chloric acid with bouillon solution.

Q. Did you use any other bouillon in addition to that?

A. Only a very small amount, which was transferred by the loop in planting from the first fermentation tube into the tube containing Parietti solution.

Q. Did you make a chart or analysis on paper bacteriologically as a result of this sample?

A. I recorded my results on paper.

Q. Have you them with you?

A. Yes, I have.

Q. Do I understand they will be offered in evidence?

A. That is simply a table showing the analytical figures.

Q. Can you make an analysis of that bottle C 7 at the present time?

A. Now?

10

Q. Yes.

A. It could be done; of course, this has changed in composition since the sample was taken, but it is undoubtedly still sewage.

Q. How long did you keep that sample before you made the test?

A. Some of these tests, bacteriological tests, were started the same day, and the test for nitrite was made the same day; the rest of the analysis was made the day after.

20

Q. What time was the sample taken in the morning?

A. Along about 11 o'clock, I should say.

Q. What time was the bacteriological test made?

A. Starting about half-past 5 in the afternoon.

Q. Where?

A. At the laboratory at Trenton.

Q. That is, the water was placed in the fermentation tubes?

A. Yes, the dilution was made and planted at that time; about half-past five I should say.

30

Q. What day was that?

A. That was the 21st.

Q. Of January last?

A. Yes, Saturday.

Q. (By the Vice-Chancellor) January instant?

A. Yes, this January.

Q. (Further cross) Have you ever placed in a bottle similar to Exhibit C 7 pure water and then let it stand for a week and then noticed the odor?

A. What do you mean by pure water?

Q. Drinking water, pure water?

A. I don't recall that I have definitely made such an experiment; I have often observed samples of water which have been in bottles for some time.

Q. There is an odor to water after it has stood for a week, which was supposed to be drinking water?

A. That all depends upon the water; some waters will develop an odor in that time and some will not.

10 *Q.* Will the majority of drinking water develop an odor?

A. The majority of surface water would develop an odor in that time.

Q. What day of the week did you get this sample?

A. Saturday.

Q. That is the 21st?

A. I think it is the 21st.

Q. (By the Vice-Chancellor) Are you sure Saturday was the 21st?

20 *A.* No, that is wrong; here is the date I put on the bottle, January 20th.

Q. That was the date in fact?

A. Yes, sir.

Q. (By Mr. Duffield.) When you have been referring to the 21st, all through, you meant the 20th?

A. The sample was collected on the 20th, the memorandum was made on the 21st.

Q. When was it as to time, a week ago Saturday?

A. Yes.

30 *Q.* (Further cross.) He took the sample on the 20th and the test was made on the 21st, the next day. It is marked here the 21st.

A. The date on my memorandum was put down when I was making a portion of the chemical analysis; that was Sunday morning, the day after the 21st.

Q. (By the Vice-Chancellor.) When was the date when you started your test on the sample?

A. Saturday, the 20th, about half-past five.

Q. The date when you made that memorandum, which was now shown to counsel?

A. Yes, that is a typewritten copy of the original memorandum made for the purpose of collecting the data in one place.

Q. Then you began your bacteriological culture by doing it on the same day on which you took it from the stream?

A. Yes, the sample was taken in the morning.

Q. You are referring to this analysis you made, bacteriological examination, that was the sample which you took from the stream below the intake or overflow of the sewage bed?

A. I made three analyses.

Q. Did you make an analysis of the contents of the overflow themselves?

A. Yes, one sample was material just as it came from the pipes, and another one was a sample taken at a little distance.

Q. Now, taking the sample, limiting yourself to the material just as it came from the pipe, irrespective of the condition after it had been intermixed with the stream, from which pipe did you take it?

A. The last pipe.

Q. That is indicated on *Exhibit C 3* as the down stream that poured into the brook?

A. Yes, sir.

Q. What did you find to be the chemical and bacteriological condition of that?

A. The chemical analysis was that of a moderately diluted and somewhat stale sewage; the bacteriological examination showed much fewer bacillus coli than would be present in raw sewage, where the number runs up from one hundred thousand to several millions sometimes.

Q. What was that material, was it of a kind to be deleterious to health?

A. I should say that it was of the kind that might become deleterious to health when conditions were

proper. It is difficult to say that ordinary sewage, unless it contains germs of an infectious disease is deleterious, its danger lies in the fact that it may at any time contain them.

Q. Do I understand you to say that the material which you examined as it came from the pipe indicated, in your judgment, with your experience and observation, that the effect of the filtration of the sewage was not such as to
 10 take from it, in case there were passing through the sewage dangerous, say typhoidal germs; was it such as would not take from it dangerous bacteria?

A. I can only express an opinion.

Q. What is it?

A. I should not regard that as safe.

Q. That is, you would not regard the condition, the material delivered into the stream as safe?

A. I would not.

Q. Why not?

20 *A.* Because of the imperfect action of the filtering plant. The beds there are evidently not worked properly. If this matter of filtration is properly done it is rather a satisfactory way of handling that type of sewage, and it results in considerable—

Q. (Further cross.) Do you understand the subject of filtration in regard to sewage?

A. I have some knowledge of it, I don't say that I understand it all.

Q. (By the Vice-Chancellor.) I want to limit my in-
 30 quiry from you to what you took from the third pipe, and to the information which, in your experience, you might fairly draw from your examination of what you took from that third pipe. I would like to know from you whether that material which you took was of such a character as might be within the description of the matter which contained the bacteria or impaired the quality of the water into which it was poured?

A. I should say it was.

Q. (Further cross.) On what do you base that, doctor?

A. On its composition.

Q. Chemical or bacteriological?

A. Both.

Q. Does your examination, bacteriological examination indicate that, that it was unsafe?

A. To my mind it does.

Q. How many coli are there to a cubic centimetre of this effluent?

A. Approximately, of course this figure is only approximately, one thousand. Of course, that is a rough approximation. We have no method of determining accurately the number.

Q. Why do you base it on that?

A. Why do I base what on that?

Q. The number of the coli?

A. I don't understand your question.

Q. Just strike it out. How do you base the number as being 1,000?

A. From the fact that in a test of one one-thousandths of a cubic centimetre of the effluent, the coli bacilli was found, of course, there may have been more than that there.

Q. How many tests did you make of that character?

A. On this particular sample?

Q. Yes.

A. The tests were made in duplicate, two.

Q. Did you make any tests of the water below the beds in Tarkiln creek?

A. Yes.

Q. How far below?

A. I should say about 33 to 35 feet.

Q. What does your bacteriological examination show in regard to that sample?

A. You have my memorandum there.

Q. (Handing it to counsel.)

A. The bacilli coli was present there in one-tenth of a cubic centimeter.

Q. What decrease is that from the sample in the pipe to the place where this was taken?

A. A decrease from one-thousandths to one-tenth, approximately.

Q. Ninety per cent.?

A. No, it would be a reduction of a hundred times, a hundred times reduction.

Q. In 35 feet?

A. About that, I should think.

Q. Did you take any sample further down Tarkiln
10 creek?

A. I did not.

Q. You took no sample from the bed direct as the sewage was received?

A. No, I did not.

Q. Then, you can't tell the per cent. of elimination of sewage organism as they come on to the beds and pass out?

A. No.

Q. Would a single examination be a sufficient cri-
20 terion of the quality of the water?

A. I should hardly regard it so.

Q. Might it show one day coli and another day none?

A. I suppose there is a possibility of that; I should hardly think it probable in this case.

Q. What other days did you make bacteriological examinations?

A. On all of them; the sample collected February 20th, 1905, April 24th, two samples November 21st, one sample November 1st and one sample January 20th;
30 that is five altogether.

Q. What did the tests show on those days, of the previous examinations?

A. February 20th, 1905, present in one-one-thousandths.

Q. Next?

A. April 24th, present in one-one-hundredths.

Q. What sample?

A. Collected April 24th, 1905?

Q. From the same pipe?

A. I don't know; Dr. Hunt collected that.

Q. From where was it?

A. From one of those pipes; which one I don't know.

Q. Not from the stream?

A. Not from the stream.

Q. These other examinations were made from samples brought to you by Dr. Hunt?

A. Yes.

Q. The only samples you gathered were January 10 20th?

A. No, Dr. Hunt and I gathered the samples November 1st.

Q. What did they show on November 1st?

A. The bacilli coli was present in one one-hundredths?

Q. Your examination previous to that was when?

A. April 24th.

Q. What did they show on that day?

A. One one-hundredth.

20

Q. The examination previous to that?

A. February 20th.

Q. What did they show on that date?

A. One one-thousandth.

Q. How were those samples brought to you?

A. Those collected by Dr. Hunt?

Q. Yes.

A. He brought them to me in person.

Q. What day did you receive them, the day that they were taken?

30

A. I suppose so.

Q. In what form did you receive them?

A. Bottles.

Q. How large bottles?

A. They were two-quart bottles.

Q. How many?

A. One in each case.

Q. Just one sample in each case?

A. Yes.

Q. Just brought to you in a bottle without any preparation; had they been prepared in any way?

A. Prepared?

Q. Were they brought on ice, or were they brought simply in the bottles?

A. They were brought to me, if I remember correctly, simply in the bottles. They were collected in bottles which had previously been prepared and sterilized in the
10 laboratory?

Q. What confirmatory tests did you make in addition to the tests you have spoken of?

A. Of what?

Q. Of your bacteriological examinations; did you make any further confirmatory tests?

A. The test for bacilli coli was the only one I made—bacteriological test.

Q. On all your examinations that you made bacteriologically?

20 *A.* Yes.

Q. Without going over them, how many were these?

A. Seven altogether.

Q. (By the Vice-Chancellor) Did you find indications of the presence of the bacteria mentioned in all of them?

A. In all of those taken from the effluent pipe.

Q. (Further cross) Have you your chemical analysis with you?

A. Here on the sheet.

30 *Q.* That is the bacteriological?

A. Both results are here.

Q. Did you make a bacteriological and chemical test each time?

A. Yes, sir.

Q. Will you give the analysis that your chemical examination shows of the 21st, of the effluent from pipe, *Exhibit 3*?

A. The last pipe?

A. Yes.

A. Free ammonia—this is free ammonia including the nitrogen—13.5 per million; albuminoid of ammonia, two parts per million; nitrates, .160 parts per million; nitrates, four parts per million; chlorine, thirty-eight parts per million.

Q. That is the full analysis that you have there?

A. I noted the odor, the turpidity and color.

Q. Now, give us the chemical analysis of the sample taken above the beds.

10

A. Free ammonia, .14; albuminoid ammonia, .14; nitrites, .01; nitrates, none; chlorine, 11.6.

Q. Were there any coli in that?

A. Not in the one cubic centimeter, which was the largest amount that I tested.

Q. Where was your other sample taken that day?

A. In the stream about thirty-three to thirty-five feet below this pipe.

Q. Give us the chemical analysis of that.

A. Free ammonia, .94; albuminoid ammonia, .27; ni- 20
trites, .110; nitrates, .32; chlorine, .30.

Q. Were there any coli in that sample?

A. Yes.

Q. How many?

A. The coli bacilli was present in one-tenth of a cubic centimer.

Q. Were there any present in one C. C. sample, in the water below the beds?

A. In the brook?

Q. Yes.

30

A. This is the sample thirty-three feet below.

Q. Yes.

A. Yes, coli bacilli came up in the one cubic centimeter, and one-tenth of a cubic centimeter, and not in the one one-hundredths and one one-thousandths test.

Q. How did you make your determination of the amount of ammonia and nitrites in the albuminoids, in the samples below the bed and in the sample taken from the pipe?

A. It was done the same way.

Q. Just state how.

A. The free ammonia was determined by diluting ten cubic centimeters of the effluent with ammonia through water to 500 distilling, receiving the distillate in the ordinary 50 cubic centimeters Nessler jars, and Nesslerizing in the usual way. The colored comparisons were made with permanent standards.

10 *Q.* How was the albuminoid done?

A. That was done by adding, after the free ammonia had been distilled off, by adding to the residue fifty cubic centimeters of alkine potassium permanganate distilled again and Nesslerizing in the usual way.

Q. You took no water samples down the stream?

A. No; only that one.

Q. That is all.

Re-direct:

20 *Q.* What is the colon bacillus?

A. What is a bacillus which is found in large numbers in the intestines of men and mammals, and probably birds, although I am not sure of that point, and does not occur to any extent in liquids which are exempt from feocal bouillon.

Q. Something was said by counsel on th eother side about a safe effluent, do you consider an effluent coming directly from sewage as safe to be placed in water supply?

30 *A.* I should say on general principles, no. It is, I suppose, theoretically possible to so purify sewage that it would be safe to use it, but such a complete purification would be exceedingly difficult, probably not possible in practice.

Q. Assuming that an epidemic of typhoid took place in Vineland, that the excreta from the patients was deposited in the sewage bed, and from there carried to the filtration plant, judging from the number of bacilli which you found in the effluent, would it be possible for the typhoid bacilli to pass through equally with them?

A. I should think it might be possible.

Q. Would it be probable?

A. I can't say about that, that is a question, to answer that properly would require experimentations on those particular beds.

Q. That is all.

Re-cross.

Q. I think you gave an answer showing a decrease in 10 the coli in the sample taken from the lower pipe in the sewer beds, to the sample taken in the stream below the beds?

A. Yes.

Q. What was the decrease, percentage?

A. A decrease of one one-hundredth, one hundred times decrease.

Q. A decrease of a hundred times in thirty feet?

A. Yes, in that particular place and time.

Q. What would that decrease be in a stream four miles 20 long?

Objected to.

A. I can't say.

The Vice-Chancellor—The whole question of a defense based upon the decrease or purification of the pollution at the lower point down stream, and before reaching the point where the water is used for town supply, was raised in the case of the *State Board of Health vs. Diamond Mills*, 18 Dick. 111, affirmed on appeal, 19 Dick. 793. The statute of 1899 (*L. L. 1899, page 73*), with respect to that 30 defense was in that case interpreted, and it was there held that it was inadmissible. That the statute applied to prohibit the discharge into the stream of any matter which tended to corrupt it for drinking purposes. That the prohibited act is done when such matter is put into the stream, whether its foulness continued until it reached the intake or using point or not. I do not think it is worth while to

open any defense which is based upon an attempt to show that at the point where the Millville Company used the water, it had become pure. The decision in the cited case, and the affirmation of it by the Court of Appeals upon the opinion of Vice-Chancellor Stevens, is, in my view, conclusive on that point.

Mr. Bartlett—We will take an exception.

10 Q. In case of an epidemic of typhoid, it is the practice, is it not, to sterilize the faecal matter?

A. No, it is not always the practice.

Mr. Duffield—Objected to as immaterial.

The Vice-Chancellor—None of the issues being tried make this testimony pertinent or material.

Q. That is all.

Dr. Alonzo Clark Hunt, recalled for complainant.

Direct examination, by Mr. Duffield:

20 Q. You have heard the testimony of Dr. Randolph, as to the results of the analysis which he has made; assuming that coli bacilli were present in the effluent to the extent which he has indicated, would you consider it safe to permit such effluent to be deposited in water to be used as water supply?

A. I don't consider that any effluent which shows evidence of containing sewage is safe to place in a public water supply, or any other impure liquid.

30 Cross-examination, by Mr. Bartlett:

Q. Would you say that was a dangerous amount?

A. I know nothing about the amount, I am not a chemist or bacteriologist.

Q. You could not testify to that?

A. No, but I believe in sustaining the absolute purity of the drinking water.

Q. (By the Vice-Chancellor.) You heard the testimony of Dr. Fitz-Randolph?

A. I did.

Q. From your observation and experience, you believe that the effluent in the Vineland sewage bed into Tarkiln stream tends to corrupt and impair the quality of the water of that stream?

A. I believe it does.

Q. (Further cross.) On what do you base that?

A. I base it upon testimony—from the testimony I have heard given here, he testifies that there is evidence that sewage is discharged into the stream at that point. 10
From my own knowledge of such sewage, aside from bacteriological and chemical knowledge, and from my own observation, I believe that some sewage in a diluted state enters the stream, and I therefore say that an effluent of that character should not be placed into the potable water supply, or an effluent of any other character, which tends to corrupt its purity.

Q. That is all.

Adjourned until January 30th, 1906, when it was continued as follows:

20

Sir John Franklin sworn for complainant.

Direct examination, by Mr. Duffield:

Q. Where do you reside?

A. Millville, N. J.

Q. You are engaged in what business?

A. I am superintendent of the Millville Water Company, among other companies.

Q. You are familiar with the workings of the Millville Water Company?

30

A. Yes, sir.

Q. From where do they get their water?

A. Union lake.

Q. That is part of Maurice river?

A. Yes, sir.

Q. Have you followed the Maurice river from there up to Vineland yourself?

A. Well, as far as a man can follow it. There is a swamp through there that you can't get through.

Q. Does Tarkiln branch—are you familiar with that?

A. Yes.

Q. What is that, a small creek?

A. A little bit of a stream; a small creek.

Q. Where does that empty into?

A. That empties into Parvin brook.

Q. Where does Parvin brook empty into?

A. Maurice river.

10 *Q.* That in turn goes through Union lake?

A. Yes, sir; of course, I told you I hadn't followed it clear through.

The Vice-Chancellor—There is no dispute about that.

Q. Have you seen the Vineland Sewage Disposal Works?

A. Yes, sir.

Q. Have you seen the effluent running off there?

A. Yes.

20 *Q.* Exhibit C 3 shown witness; is that a fair representation of Tarkiln branch, with the effluent from the Vineland water bed, as shown by the three pipes in the foreground?

A. Yes, sir.

Q. When you have examined the sewage disposal plant, have there been effluents deposited in this creek?

A. There have.

Q. From how many of those pipes?

A. Two or three that I know of.

30 *Q.* What was the odor of those?

A. That would be hard to describe; there is an odor to it, however.

Q. Is it offensive, or otherwise?

A. Yes, offensive.

Q. Strong or not?

A. Oh, yes, strong, if you get your nose right to it.

Q. (By the Vice-Chancellor) At what point do you say that this is offensive?

A. Right over this effluent.

Q. And at the venting of the pipe?

A. Yes.

Q. How close down did you get to it?

A. Within a foot of it.

Q. Within a foot of the vent?

A. Yes, sir.

Q. With relation to the odor, did your nose receive it at that point that you say it was offensive?

A. Yes, further away than that.

10

Cross-examination, by Mr. Bartlett.

Q. What was the date of your examination?

A. I don't know as I can give you the exact date; the first time was sometime in the winter of 1904; that is, the early 1903-4.

Q. When was the last examination?

A. I haven't been there within six months.

Q. You get your water supply from the lower end of Union Lake?

20

A. Yes, sir.

Q. What is the size of that lake?

Objected to as immaterial.

The Vice-Chancellor—I cannot see that the size of the lake at Millville has any relation to the questions here being tried, unless to show the precipitation of the polluted matter, between the discharge of the Vineland plant and the intake from Union Lake at Millville. That is the defence which has been excluded. If there is any other purpose and 30 counsel will open it, I will hear it.

Mr. Barlett—No, that is all.

The Vice-Chancellor—Any defence based upon the idea that the complainant must show that there was pollution at the intake at Union lake at Millville will be overruled, under the Diamond Mills case. The question under the statute is whether the material discharged from the Vineland filtra-

tion beds tended at the place where it was poured into the stream to corrupt it.

Mr. Barlett—You rule out all testimony as to the character of the water below the Vineland intake?

The Vice-Chancellor—The complainant is obligated under the ruling of the Court in the previously cited Diamond Mills case, to show a pollution, or a tending to corrupt or impair the quality of the water of any river, brook or stream, from which is subsequently taken or may be taken, any public supply used in any city, &c. That whole question was gone over in that case and it was attempted to be shown that by precipitation between the point of venting of the corrupting matter into the stream and the point of intake from the stream, the water had become pure, and that was ruled out.

I am bound by that ruling of the Court of Appeals.

Q. Do you still get your water supply from Union lake?

A. Yes, sir.

Q. And the last examination you made was five or six months ago?

A. Yes, in January, in the fall, September, 1905.

Q. That is all.

Shippen Wallace, sworn for complainant.

Direct examination, by Mr. Duffield:

Q. Where do you reside?

A. Burlington.

Q. Are you a chemist?

A. I am.

Q. Are you familiar with sewage?

A. I am.

Q. Did you visit the Vineland disposal beds?

A. I did; I visited there last Saturday week with Dr. Randolph.

Q. You went with Dr. Randolph, who testified in this case; did you notice the fluid coming from the pipes and emptying into Tarkiln creek?

A. I saw the pipe enter into the ditch which I was told led to the river.

Q. What was the substance which was flowing down the pipes into the creek?

A. It was clear water, free of any suspended matters, solid matters.

Q. Visible to the eye?

A. Not visible to the eye, no solid matter.

Q. What was there in that water; did you smell of it? 10

A. We drew samples of the water; I smelled it and drew samples, and it was very obnoxious in the odor; in fact, the water in the bottles were of a cloudy, milky appearance.

Q. Did that disclose anything to you as to the constituents of that water?

A. That gave me the opinion that there was no attempted purification of the sewage further than the abstraction of the solid matter, and that was the clear effluent from the sewage, and the odor of the water confirmed me in that opinion. 20

Q. What was this date?

A. Saturday, the 20th of January.

Cross-examination, by Mr. Bartlett:

Q. What examinations did you make?

A. The only examination I made was what you might term an optical examination and the smelling of the water after it got into the bottles.

Q. You made no chemical examination? 30

A. No.

Q. Are you a chemist?

A. Yes, chemist to the Board of health.

Q. It is in your line to make examinations of water?

A. I have

Q. Chemical examinations?

A. Yes.

Q. Yet you made none of these samples?

A. In this instance I made no chemical examination.

Q. Can you also make bacteriological examinations?

A. I do not, but I am a bacteriologist.

Q. Did you examine the system of filtration there of sewage, on the beds themselves?

A. At Vineland?

Q. Yes.

A. I saw the filter beds; some were more or less full, and some other beds that were not full. I mean by that, they were dry.

Q. You understand the system of filtration there of
10 sewage?

A. Only from what I was told. I gather that the system simply consists of sediment beds, and the water soaks through and beneath the beds there was an under tiling, and when the water reached the under tiles themselves it runs into the pipes which lead to the ditch.

Q. Did you notice any other process there of purification?

A. I did not.

Q. That is all.

20 *A.* I might correct that. If you term that purification, I did in one of the beds; they had a barrel of sulphate of copper dripping on the bed.

Q. What was that dripping into?

A. Into the sewage that was running into the beds, into the large pipe that was passing into the bed.

Q. As the sewage came from the first two beds through the pipe into the other bed, copper sulphate was dripping on it?

30 *A.* I could not tell which bed they came from. I only saw this pipe running; I didn't make any examination to see from which bed it came.

Q. (By the Vice-Chancellor.) Was this pipe which was running or dripping with sulphate of copper—

A. Just dripping, dripping, dripping.

Q. I understand; was it dripping into the waste water which passed from the filtration system into Tarkiln creek?

A. No, sir; I judge it was passing into the beds.

Q. (Further cross.) That is from one bed into another bed, as it passed from one filtration into another filtration bed the sulphate dripped?

A. Yes.

Q. That is all.

Complainant rests.

Marcus Fry, sworn for the defendant.

Direct examination, by Mr. Bartlett:

Q. Where do you reside?

10

A. Vineland.

Q. What is your occupation?

A. Civil engineer.

Q. How many years have you been civil engineer?

A. Forty years.

Q. Did you make a map of the Maurice river watershed and the country surrounding the river and pond?

A. Yes, sir.

Q. And showing the location of the sewage beds?

A. Yes, sir.

20

Q. Is this the map?

A. Yes, sir.

Q. Does this map show the elevation of the country?

A. Yes, sir; they were taken from the State reports, the elevations; the map was made from survey.

Q. And this is the map you made?

A. It is

Map in question is offered and marked *Exhibit D 1*.

Q. What further connection have you had with the 30 Vineland sewage beds?

A. In April, 1904, I made a re-survey for laying underdrains on the beds.

Q. Is that the survey?

A. Yes, sir; that is where I laid it out for the men who put the stakes up.

Defendants offer in evidence the map showing the diagram of the sewage beds, marked *Exhibit D 2*.

Q. When did you say that was made?

A. April, 1904.

Q. What was being done at that time?

A. The men were on hand to lay the pipes.

Q. What pipes?

A. As laid out, so many feet apart, as the map shows.

Q. (By the Vice-Chancellor.) Upon whose employment did you make the map here produced?

10 *A.* The borough of Vineland.

Q. (Further direct.) They were changing the under-drain?

A. Yes, sir; putting the regular field drain pipes under.

Q. What had previously been done there?

A. Terra-cotta pipes three feet in length; this was about eighteen inches long, porous drain pipes, as it is called.

Q. As shown by that map?

20 *A.* Yes, sir.

Q. How many acres do the sewage beds of the borough of Vineland cover?

A. About six acres, five and three-quarters acres.

Q. And the number of beds were how many?

A. Eleven.

Cross-examination, by Mr. Duffield:

Q. How did you come to make this re-survey?

A. At the instructions of the Borough Council.

30 *Q.* The old system was not working very well, was it?

A. No, sir; the pipes were defective.

Q. And the purpose of this new system was to provide a better method of filtration than the old?

A. Yes, sir.

Q. Is it not a fact that even since this new system has gone in, that the matter has not worked entirely satisfactory?

A. Not to my knowledge.

Q. (By the Vice-Chancellor) That is, you haven't known that it was not satisfactory?

A. No; I have not known.

Q. (Further cross) Is it not a fact that occasionally there will be made a hole in this filtration bed so that the sewage will go through without any percolation?

A. Not that I saw.

Q. Don't you know that such condition existed quite recently to your knowledge?

10

A. No.

Q. That is all.

Ralph Garrison, sworn for defendant.

Direct examination, by Mr. Bartlett:

Q. What position do you occupy in the borough of Vineland?

A. Superintendent of Public Works.

Q. Do the sewer beds come under your department?

A. Yes, sir.

20

Q. How many beds are there in the Vineland sewer system?

A. Eleven.

Q. Have you made a map of them?

A. Yes, sir.

Q. Have you it with you?

A. Yes, here it is.

Q. Is that a map made by you of the beds?

A. Yes, sir.

Q. Showing them as at present?

30

A. Yes, sir.

Blue print may entitled "Sewer Beds, Borough of Vineland," offered and marked *Exhibit D 3*.

Q. What was the date of the making of that map?

A. I think it was dated the 18th of March, 1905.

Q. That is the bed as it is presently?

A. Yes, sir.

Q. How many beds are there?

A. Eleven.

Q. Will you explain briefly the operation of the beds?

The Vice-Chancellor—Will you not, before the witness enters upon the details, have him state what his functions are?

Q. What is included in your functions as Superintendent of Public Works?

A. The operation and management of the electric light plant, the water works and sewage system.

10 *Q.* What does your work consist of in that connection?

A. I have charge of all new work done and charge of the management, full charge of the operation of all these plants, any change, etc., made.

Q. Have you any oversight over the sewage beds?

A. Yes, sir.

Q. Now, if you will state briefly the method of the operations of the beds?

A. The raw sewage comes from up in the town right
20 on the first series of three beds, called settling beds. We use two of these beds at a time, these settling beds, and the sewage is allowed to flow into one bed for twelve hours; then the bed is closed and the sewage is allowed to flow into it for twelve hours. The entering sewer is then shut off and diverted into other settling beds, and while it is flowing into one it is flowing out of the other at the rate of twelve hours.

Q. Where does it flow out of this settling bed?

A. Into a pipe leading into the filter bed, and at pres-
30 ent as it passes through this pipe through the filter bed, sulphate of copper is introduced into the water, as the water goes on the filter bed and filters through this bed into the under drain and from there into Tarkiln branch.

Q. How long does it stay on the filter bed?

A. That is according to the time of the year, sometimes it filters quicker than others.

Q. Until it is thoroughly filtered out?

A. Yes.

Q. And then it passes from the filter bed where?

A. To the under-drain.

Q. And from there where?

A. To the Tarkiln branch.

Q. (By the Vice-Chancellor.) The Tarkiln branch?

A. They call it many different names, Fisher's branch.

Q. (Further direct.) How many gallons of sewage are received on these beds?

A. We estimated last summer that we first received about 280,000 gallons a day, at present 250,000 gallons. 10

Q. What assistance have you had in the care of the bed?

A. Mr. Newton had charge of the beds this summer.

Q. (By the Vice-Chancellor.) What is his full name?

A. E. Lee Newton.

Q. How long has he had charge of the beds?

A. Since last April.

Cross-examination, by Mr. Duffield:

Q. Then you are speaking of conditions that existed 20 prior to last April, are you Mr. Garrison?

A. What do you mean?

Q. Your own knowledge of the situation out there is received from what?

A. Since September, 1903, I have had charge.

Q. Until last April?

A. I have had charge, but I turned over the immediate supervision to Mr. Newton.

Q. How much sewage was deposited daily?

A. We estimate about 250,000 gallons. 30

Q. Has it run as high as 350,000 gallons a day?

A. No, sir.

Q. Have you always used that settling bed?

A. No, sir.

Q. What was your purpose in putting it in?

A. Previous to my working there during the winter the beds became clogged from the paper, etc., the filtering beds, and during the winter they would get flooded and

the filtering was not very good; they clogged up, so I introduced the settling beds to obviate that difficulty.

Q. (By the Vice-Chancellor.) When did you do that?

A. It was—I don't know the exact date—it was in the fall of 1904 we started them.

Q. (Further cross.) The State Board of Health had already complained of the condition existing, had they not?

10 *A.* They complained right along, ever since I had anything to do with it.

Q. Had they already complained then?

A. I think they had.

Q. And was it not for the purpose of obviating their cause of complaint that you made the change to which you refer?

A. No, I don't know as I directly heard of any complaint of the Board of Health about that.

Q. Do you remember writing to the State Board of
20 Health under date of July 14th, 1904?

A. I wrote several times asking for information about tests, etc., that they had made of the effluent; I don't remember the date.

Q. Do you remember saying to them in a letter under date of July 14th, 1904—

Mr. Bartlett—Why don't you show him the letter?

Mr. Duffield—I don't happen to have the original.

30 The Vice-Chancellor—Go on, you may do that.

Q. —in which you said, "I told your representative the bed from which the sample was taken was being worked for the first time, and, of course, would not purify the sewage to the same extent that it will after it has worked a few times."

A. I remember that.

Q. Do you remember saying that you had been fixing up the beds in accordance with the suggestion given by the Sewage Commission?

A. Yes, sir.

Q. Now, the purpose therefore was to correct the flow of sewage which was going into this creek?

A. Not primarily; the simple matter was, the beds were not working efficiently, and it was to improve the work.

Q. If the beds were not working, what was the result?

A. Part of the time the beds had to be worked harder than ordinarily we had to use them, and now we don't 10 have to work them.

Q. What would happen if they didn't work properly?

A. A flood.

Q. And this substance would go through without purification?

A. Where, through the filter?

Q. Through the under-drain.

A. No, would not go there, that's the trouble.

Q. Then it would overflow right into the creek?

A. Overflow the land. 20

Q. This is located right on the bank?

A. It overflowed the creek, it did previous to that time.

Q. As I understand this system, the sewage is deposited on the beds, and from there is percolates, and the liquid is taken off, and that goes into the under-drain and into the creek, is that right?

A. Yes, sir.

Q. So if there is a break in the disposal works the sewage goes through in an unpurified condition? 30

A. Yes, sir.

Q. Have you not known a great many occasions during the last year in which breaks have occurred, and the sewage gone in an unpurified condition into the under-drain?

A. There has not been any the last year.

Q. How about prior to that time; since you have been there, you say there was no occasion?

A. Only one.

Q. Only one occasion has there been a break where the sewage has gone through without purification?

A. To my knowledge.

Q. You are familiar with this under-draining?

A. Yes, sir; most of it.

Q. You have taken them all up?

A. I have taken most up, not all.

Q. Have you ever noticed any discoloration in the
10 pipes?

A. No, not to any extent that I can remember.

Q. And this substance which goes through and out into Tarkiln Creek, is the residue, as I understand it, after 250,000 gallons of sewage have been deposited on the beds?

A. Yes, sir.

Q. The liquid residue?

A. Yes, sir.

Q. Have you ever been down on that and taken
20 occasion to smell the fluid which comes through those pipes?

A. Yes, sir; I have.

Q. What kind of odor has it got?

A. I am like the fellow yesterday; I can't describe it.

Q. Did it have an odor?

A. A slight odor.

Q. It has an odor of sewage?

A. Somewhat the sewage odor; a slight odor.

Q. You haven't any doubt that that effluent that
30 comes through contains sewage?

A. I don't think it contains sewage.

Q. I don't mean solid sewage, but I mean that there is in that effluent sewage?

A. No, I don't think there is any sewage.

Q. What do you think created the smell?

A. There is water and stuff that comes out of those pipes, and we were fixing, we have a vent pipe to the underdrain, and there is a circulation of air, and then you would smell it, I think you could smell the underdrain.

Q. Then you think the smell is occasioned by the filthy condition of the underdrain?

A. I didn't say that.

Q. You think it is occasioned by the condition of the water passing through the underdrain?

A. I don't know what causes the smell.

Q. Nevertheless, there is a decided odor?

A. There is a slight smell.

Q. A decided odor?

10

A. I don't know what you call a decided; I have got so used to it that I could not smell good.

Q. When this effluent goes into the creek is there any discoloration?

A. Very little.

Q. There is, however, some?

A. A slight discoloration.

Q. You can follow the effluent as it drops or runs into the creek for some little distance?

A. No, it is pretty clear, that which goes into the creek. 20

Q. (By the Vice-Chancellor) But would you say, Mr. Garrison, that the effluent from the pipes to the point where it pours into the creek is potable?

A. I have seen persons drink it.

Q. I ask you whether you say it is potable?

A. I think so.

Q. Fit to be put into a vessel and be served up for food?

A. I think it is potable, yes, sir.

30

Q. (Further cross.) Do you know of anyone in Vineland that is accustomed to drink this water?

A. I have seen people drink it.

Q. Right at the pipe?

A. Yes, sir.

Q. Who?

A. Alexander Potter.

Q. He is a civil engineer?

A. Yes, sir.

Q. And he constructed the bed?

A. Yes, sir.

Q. And this was to prove that his work was O. K.?

A. Yes, sir; he must have faith in it.

Q. Have you ever drank it?

A. No.

Q. Would you drink it?

A. If I was very thirsty.

10 *Q.* And there was no water around?

A. Yes, sir.

Q. (By the Vice-Chancellor) You mean you would choose that last of any water around?

A. I would not say that the I thought there was sewage in, but very naturally anyone would think they would not like to drink water found around there, but I would drink that water.

Q. (Further cross) Which would you prefer to drink, the Tarkiln branch or the effluent?

20 *A.* I would rather drink the effluent that comes out of there.

Q. How often do you clean these sewer beds?

A. How do you mean?

Q. Take the excreta off?

A. Since we used this settling bed, they don't need cleaning as often as we used to. We usually rake them, but there is very little left after we use the settling beds.

Q. How long is it since you cleaned the first bed?

A. What is the first bed?

30 *Q.* The settling bed.

A. About last July, somewhere along there.

Q. That is where the sewage is first deposited?

A. Yes, sir.

Q. And you haven't cleaned those settling beds since last July?

A. I have not.

Q. Is it not a fact that in a system of purification such as you have with these beds, by degrees the sewage matter is carried through?

A. No, not in a settling bed. The settling bed has a crude septic tank, and I heard of septic tanks that haven't been cleaned for five years.

The Vice-Chancellor—Your examination speaks generally of "sewage." When you speak of "sewage," do you mean fluid as distinct from solid matter?

Mr. Duffield—I was speaking generally of sewage, both solid matter and fluid. 10

The Vice-Chancellor—As I understand it, one portion of the filtration bed retains the solid matter, and the fluid matter only passes away through the overflows into the stream.

Mr. Duffield—I want to know whether the solid matter, if left for a considerable period didn't percolate through the ground, so that the fluid carried with it particles of solid matter.

Q. Assuming that your beds are not cleaned as often as they should be, is it not a fact that under the system 20 of sewage purification that you have, the solid sewage will, by being intermingled with the water, and the water drifting through this purified substance, carry large particles of the solid sewage with it?

A. No, sir; it does not.

Q. Then, taking up this fluid substance, from your settling beds the fluid flows on to the filter beds?

A. Yes, sir.

Q. And then trickles down through the pipes; is there any other water on the beds? 30

A. No.

Q. Than the substance which comes out into the pipes as liquid sewage?

Mr. Bartlett—What pipes do you mean?

The Vice-Chancellor—The pipes which vent in Tarkiln creek.

Q. The fluid that goes in there is the fluid residue of the substance which is deposited?

A. It is the fluid residue, it is not sewage.

Q. Is is the fluid substance of sewage?

A. It is the remains of the water that is introduced in the sewage bed.

Q. But the water introduced on the sewage bed was part of the sewage?

A. It was sewage, but it is filtered water now. It is not the sewage that is in the under-drain?

Q. It was sewage when it started in?

10 *A.* It was sewage on the filter bed.

Q. And the solids were retained on the beds?

A. Practically any solids, the solids were left on the settling beds.

Q. And the fluids are released from the solids, and the fluid residue which is deposited upon your beds goes into the Tarkiln creek by means—

A. Of the filter.

Q. Of the filter, that is a fact?

A. Yes, sir; that is the fluid residue.

20 *Q.* That affluent which is deposited in Tarkiln is the fluid residue of the sewage which is deposited on your beds at the rate of 250,000 gallons a day?

A. Yes, sir; part of it.

Re-direct.

Q. After it has gone through what?

A. After it has gone through filter purification.

Q. After it has been received on the settling bed, filtered and gone through how many processes?

30 *A.* Through a settling process and a filtering process.

Q. What other process have you?

A. Copper sulphate is introduced.

Q. What is the color of this effluent as it comes through?

A. Pretty clear.

Q. It is discolored to some extent?

A. Not to any extent, if you take it in your hands it is practically as clear as water generally is.

Q. Have you seen it discolored at times?

A. I have seen is discolored, but not recently.

Q. What is the material that you made your filter out of?

A. Sand.

Q. Where did you obtain the sand?

A. I don't know, it was before my time.

Q. That is all.

Boyd McLean, sworn for defendant.

10

Direct examination, by Mr. Bartlett:

Q. Where do you reside?

A. Jersey City.

Q. What official position do you hold in the State of New Jersey?

A. I am Secretary of the State Sewage Commission.

Q. How long have you been secretary of that body?

A. Since May, 1899.

Q. Were you secretary in 1900?

A. I was.

20

Q. What is customary in locating sewage beds and disposal plants in this State, for a municipality that desires these beds to do?

Objected to as immaterial and irrelevant.

Mr. Bartlett—I want to show that they applied to the State Sewage Commission, who granted permission to locate the beds and passed upon the situation.

Mr. Duffield—It does not seem material.

The Vice-Chancellor—I consider that I am governed in the trial of this case by the above cited decision of Vice-Chancellor Stevens in the case of the State Board of Health *vs.* The Diamond Mills Company, which was appealed to the Court of Appeals and there affirmed upon the opinion of Vice-Chancellor Stevens.

30

Mr. Bartlett's question seems to indicate that he conceives the defendant's case may be justified by the approval of the location of the sewer vents by

the the State Sewer Board, and the conducting of the sewage filtration in accordance with their orders.

10 Mr. Bartlett—No, I don't take it that way. I understand we are confined to the effluent, but it seems to me part of our case to show that the beds were located there under the authority of the commission, and then passed directly to this question at issue.

The Vice-Chancellor—If you will state what you mean to show in justification, I will pass on the question. The Board of Health Statute of 1899, page 73, does not seem to recognize an approval by the Sewer Commission as a justification. If you did the thing which resulted in the deliverance of corrupting matter into Tarkiln creek, under that statute it appears to be prohibited, no matter how you did it.

20 Mr. Bartlett—The question is whether we did it. The Vice-Chancellor—That is it.

Mr. Bartlett—I want to show that these are the formal parts of my case.

The Vice-Chancellor—No, they are not necessary.

Mr. Bartlett—Their pleadings, allege contamination of the Millville—

30 The Vice-Chancellor—I will hear Mr. Bartlett's argument upon the assumption that the complainants have failed to prove that the intake at Millville is in any way polluted or affected by what is done by the effluent at the Vineland filtration beds.

Mr. Bartlett—Very well, that will narrow it right down, if you will just allow an exception.

The Vice-Chancellor—You do not need any.

Mr. Bartlett—Then I will withdraw this witness and call Leigh Newcomb. How late do you want this examination confined?

The Vice-Chancellor—Either late or early, or any time you please.

Edwin Leigh Newcomb, sworn for defendant.

Direct examination, by Mr. Bartlett:

Q. Where do you reside?

A. Vineland, N. J.

Q. What position do you occupy at the present time?

A. Assistant professor of botany and pharmacognosy at the Philadelphia College of Pharmacy.

Q. How long have you occupied that position?

A. Two years.

10

Q. Were you formerly a student there?

A. Yes, sir.

Q. How long?

A. Three years.

Q. What is embraced in the subject that you teach, that is, in connection with water examinations?

A. The water examinations and work on water examinations is connected with an optional course and bacteriology, in which I am also assistant professor.

Q. How long a course did you take in bacteriology? 20

A. Two years.

Q. You taught it two years?

A. Yes, sir.

Q. How long did you study the subject previously?

A. I had studied it more or less for three years before I began to teach.

Q. And that course consists in what, the course in bacteriology?

A. Do you want a complete outline of the course?

Q. No, a general statement.

30

A. Bacteriological work consists of, first, study of known pathogenic organisms, such as are found in air, water, and in various drugs, and after the students are grounded in that we take up pathogenic organisms, typhoid, tuberculosis, diphtheria, gonococcus.

Q. You are in the habit of making examinations of water, are you not?

Q. When were you first called in in connection with the borough of Vineland and the sewer beds?

A. April, 1905, I think it was April.

Q. What did you do then?

A. At that time I began some experiments in connection with the Department of Agriculture at Washington, D. C., to determine the value of utilizing copper sulphate in connection with sewage purification.

Q. Then what steps did you take in regard to the beds at Vineland?

A. The first steps taken were to determine the nature
10 of the sewage which was to be purified. A chemical examination was made of raw sewage. That was the first work we did. This was made in order to determine how to use the copper sulphate.

Q. (By the Vice-Chancellor.) You are speaking now of your studies and examination of the use of copper sulphate, and not particularly of the Vineland filtration beds yet?

A. Yes, this is in connection with the Vineland sewer beds. That is, this sewage which was analyzed was
20 Vineland sewage, which was to be purified, and it is necessary, in order to know how to use the copper sulphate, to know the exact nature of the sewage to be treated.

Q. (Further direct.) Upon whose advice did you use the copper sulphate?

A. Dr. Moore, of Washington, and Carl Kellerman.

Q. What department are they connected with?

A. The department of plant industry, Washington, D. C. Dr. Moore had charge at that time of the labora-
30 tory of plant industry and physiology.

Q. (By the Vice-Chancellor.) What did you say was the exact function which you expected from the use of copper sulphate upon fluid sewage?

A. The idea in the use of copper sulphate in sewage was based upon the fact that laboratory experiments and practical field work had shown that coli and typhoid could be eliminated from these waters, such as surface waters, and reservoirs, by the use of copper sulphate,

that is, they could be purified by the use of copper sulphate.

Q. You mean purified in the sense that those two elements of bacteria could be removed?

A. Yes, they are purified with the operation because the coli or typhoid is removed.

Q. Are those two the only elements which make water properly definable as sewage?

A. Sewage water is one which contains coli.

Q. Do I understand you to say that if water be analyzed and found to contain no coli or bacteria of that nature, that it is not sewage?

A. Not in the strict translation of the word.

Q. And upon that basis your testimony is to be understood?

A. That is, liberating the coli from this sewage.

Q. And that is the extent to which you testify, is it?

A. No.

Q. I understood you to say that?

A. I said also, I testified to the chemical nature of the effluent, and to the nature of the sewage, or to the nature of the Tarkiln creek above where the sewage enters, and below where it enters.

Mr. Duffield—I don't think the witness has qualified as a chemical expert.

The Vice-Chancellor—You may challenge him when the questions are asked.

Q. (Further direct.) In your connection with the Philadelphia College of Pharmacy, have you taken a course in chemistry?

A. Yes, sir.

Q. You also have taught chemistry?

A. I have taken a course in chemistry and have taken special work in chemical analysis in connection with thesis work, having taught chemical examinations of water.

Q. Also bacteriological as well?

A. Yes, sir.

Q. Both chemical and bacteriological?

A. Yes, sir.

Q. When did you commence to use copper sulphate at Vineland?

A. Began to use copper sulphate at Vineland on the 20th day of April, 1905.

Q. Just state briefly how it is used there in connection with the purification of sewage?

10 *A.* At the present time or at that time?

Q. At that time and on along up?

A. When we began using copper sulphate in Vineland, the sewage was partially settled or clarified. That is, we were using three beds on the west side of the field as settling beds. The sewage ran into these beds, where it had a chance to settle, and then the clear portion was drained off to the filter beds. The copper was added from the point where it left the settling beds, in between where it left the settling beds and where it went
20 into the filter beds, and we proceeded—

Q. (By the Vice-Chancellor.) As I understand you, then, copper was added after the solid matter in the sewage had been eliminated so far as precipitation could eliminate it?

A. Yes.

Q. That was solely by gravity?

A. Yes, mostly, of course a portion—a difference in gravity because those portions of sewage which are light float on top and the heavy portions go down.

30 *Q.* The first bed is not operated solely by gravity?

A. Yes, has no copper.

Q. Nor has it any filtration when first delivered?

A. No filtration, it is simply a tank.

Q. Whilst in this tank, so to speak, the solid matter is precipitated by gravity, that is the only mode in which it is separated from the fluid portion, is that so?

A. Yes, the heavy particles go to the bottom and the lighter portions float on top.

Q. And in that there is no filtration?

A. No, they drain off, simply separated by mechanical means.

Q. (Further direct.) Any other action in connection with them?

A. In these beds we find we get a remarkable septic action.

Q. What do you mean by septic action?

A. We mean a breaking down of complex organic compounds into more simple compounds.

10

Q. Those settling beds have that action?

A. They do.

Q. Did you make an examination from time to time?

A. Yes.

Q. Of what did you examination consist?

A. The first examination I made consisted—that is the first examinations for the first two or three months—consisted of making litmus lactose agar plates.

Q. Where were the samples taken that you made the examinations from?

20

A. At various points from the effluent, from the stream above the beds and from the stream below the beds.

Q. What did you do in connection with the making of this examination, how did you embody them?

A. How did I carry them out?

Q. One moment; the question is, did you embrace them in a report or in what way?

A. Most of my examinations, that is the results of all my examination were embraced in reports which were 30 handed to the Superintendent of Public Works.

A. I believe the superintendent sent them to the State Sewage Commission, some of them at least; I don't know whether he did all. They were also sent to the Department of Agriculture.

Q. Did any of the members of the Department of Agriculture visit Vineland in connection with this work?

A. Mr. Kellerman, who was at that time connected, or was assistant physiologist in the laboratory of plant

physiology, came to Vineland and looked over the plant with me before we began to use the copper sulphate.

Q. What is the first report you have?

A. The first report that I handed in?

Q. Yes?

A. That was a report of the chemical analysis of the sewage which was to be treated.

Q. Does that show the amount of the sewage?

10 *A.* The chemical analysis shows the condition of the raw sewage. It shows the amount of organic matter which we had disposed of, or had to dispose of, which is a big factor in the treating of sewage with copper.

Q. How much did it show, your analysis; have you the analysis?

A. Yes.

Mr. Bartlett—Then we will offer it in evidence.

Mr. Duffield—I presume this is all preliminary to the report of the constituents of the effluent?

20 Mr. Bartlett—That is it.

The Vice-Chancellor—It is pertinent, because if it should turn out that the water was as pure as Poland water it would necessarily follow that the sewage delivered was just as good.

Marked *Exhibit D 4*.

Q. What was your next examination and report?

A. The next examination was made of the effluent from the filter beds.

Q. What was the date of that?

30 *A.* The 12th of April.

Q. What year?

A. 1905.

Q. What does that show?

A. That shows that at that time there were passing coli from these beds, and that the total number of organisms was quite high; that is I might give you in round numbers, the total number ran from thirty-two to 270,000.

Q. Per what?

A. Per cubic centimeters.

Q. Is that 32,000?

A. From 32,000 to 270,000 per cubic centimeter. That is the total organism. The number of colonies which developed red on these plates ran at that time from six to 32,000.

Q. What are these red colonies?

A. Red colonies may be characteristic of sewage.

Q. Is there anything further in that report?

10

A. Yes. On the 18th. I made an examination.

Q. The 18th of what month?

A. Of the same month, April, 1905, and this one didn't show as many red colonies, from one to 8,000, showing there is a difference in the action of the bed.

Q. What made that difference in the action of the bed at that time?

A. Probably some beds filter better than others.

Q. Any other examination in that report?

A. At that time that was an examination made of 20 Tarkiln creek, on the 18th, the same date, of Tarkiln creek where it enters Parvin's branch.

Mr. Duffield—Objected to as immaterial.

Mr. Bartlett—I understand that is so too.

Q. How far below is this?

A. Three miles.

The Vice-Chancellor—It makes no difference in my opinion, as I have previously told counsel, if Tarkiln creek, by percipitation or otherwise becomes free from corrupt matter put into it from the Vineland sewer beds at some point further 30 down the stream. The essential question is whether the effluent from the filter beds tends to corrupt the stream. That it afterwards becomes pure is no defence.

I think counsel ought not to require me to repeat this so often when there is a leading case which lays down the principle which must govern the application of this statute.

Q. When was your second report made?

A. The second examination of the effluent was made on the 20th of April, 1905.

Q. What examination did you make of that, chemical or bacteriological?

A. Bacteriological.

Q. That shows what?

A. It showed considerable coli amounting to 31,000
10 to 51,000.

Q. That is the effluent?

A. Yes.

Q. Any other examination made within those few days?

A. On the 21st. I examined it again and there was no marked effect as yet from the copper because the solution, or rather the water which is treated with copper required about twenty-four hours to go through the bed, and the first water which we treated had not come
20 through at the time the first examination was made, after we began to use copper.

Q. When was the next examination?

A. On the 21st, twenty-four hours after we began to treat that copper and this showed coli also to the extent of 14 to 72,000.

Q. How much of a decrease?

A. The decrease was not at all noted.

Q. When was the next examination made?

A. The next examination was made—I beg pardon;
30 that examination I gave you 4-21-'05 was not litmus lactose agar; that is this number, 14 to 72 are the total number of organisms found in the effluent on the 21st of April, 1905.

Q. Get down to some of your later examinations, Mr. Newcomb, in the field?

A. The examination which I made that day on the litmus lactose agar plates showed a reduction of coli from four to 13,000 against—

Mr. Duffield—When are you reading from now?

A. 4-21-'05.

Mr. Duffield—I thought you said that didn't show any change?

A. April 21st showed no change in the total number of organisms, but a change in the coli or red colonies.

Q. What did April 21st show?

A. That is on litmus lactose agar, which showed a noticeable effect, there being only from four to 13,000 red colonies per cubic centimeter.

Q. There is a decrease?

10

A. I haven't figured out the percentage, but in those made on the 20th I found—the examination was not made on the 20th—to show red colonies on litmus lactose agar plates, but the previous one showed from six to 33,000 down to four to thirteen, after twenty-four hours' treatment.

Q. Did you continue to make examinations from time to time?

A. Yes, sir.

Q. How many examinations have you made from 20 that date up to this date?

A. Well, I don't know exactly; I haven't counted them up; I suppose maybe a hundred.

Q. When was your next examination after the one you have just stated?

A. On the 27th of April it showed coli or red colonies from one to 8,000 per cubic centimeter.

Q. You continued to make examinations from time to time up to this day?

A. Yes.

30

Q. Now, taking the examinations you made from April, 1905, up to October, 1905, how many did you make in that time?

A. From April to October.

Q. Yes?

A. That is this last October?

Q. Yes?

A. Practically all of them.

Q. How many altogether?

A. As I said before I suppose about 100.

Q. What was the average coli found in that effluent from this examination made from April, 1905, to October?

A. After we had determined exactly how to use the copper, that is the different factors which influences copper; we have been able to render an effluent which will not give any reaction for coli.

10 *Q.* That is no coli was shown?

A. In my reports no coli is shown.

Q. (By the Vice-Chancellor) That does not answer the question.

A. The average number—there have been coli that runs through—there have been organisms developed which were more or less of the characteristics of coli. That is they produced acid and red on this plate. I didn't prove that they were, I simply admit that they probably were and when I treated that copper in sufficient quantities, I didn't get those reactions; I got no
20 acid producing organisms, no reddening of the litmus lactose agar plates, even after I plated or made plates with one cubic centimeter with the water of the effluent direct without any dilutions showing that if there was coli there, they were in very few numbers.

Q. (Further direct) What kind of examinations did you make, bacteriological or chemical, from April, 1905, to October?

A. Bacteriological.

30 *Q.* Now, taking from October, 1905, to January 1st, 1906, how many examinations have you made?

A. I should say I made on an average one a week.

Q. What kind of examinations?

A. What was the last date you stated?

Q. From October 1st, 1905, to January 1st, 1906?

A. Bacteriological.

Q. Were you using copper then at the bed?

A. Yes.

Q. How long had you been using copper at the beds?

A. Since April, 1905.

Q. Steadily?

A. Yes, sir.

Q. What did your examinations show from October, 1905, to January 1st, 1906?

A. It showed, with one or two exceptions, that there was practically no coli in the effluent.

Q. Showed practically no coli in the effluent?

A. Yes, sir; that is right.

10

Q. What examination did you make from January 1st, 1906, up to date, how many have you made?

A. I have carried out one chemical examination of the effluent, I have examined Tarkiln creek above—do you want that?

Q. State what you did?

A. And Tarkiln creek below. I have examined the Maurice river water; I have examined Parvin's branch before it runs into Maurice river; I have examined the water in Millville—all of this chemically.

20

Q. What other examinations?

A. I have examined the water in Parvin's branch before it enters Tarkiln creek, and I have carried out a number of chemical examinations—I mean bacteriological examinations.

Q. Has Professor Cramer, of the Philadelphia College of Pharmacy, been with you in this examination?

A. Yes, sir.

Q. Has he been to Vineland?

A. Yes, sir.

30

Q. When were the first samples taken by you and him after January 1st, 1906?

A. January 10th, I think.

Q. Did you take samples of the effluent?

A. Yes, sir.

Q. From what pipes?

A. On the 10th we took from pipe, I think it is marked No. 4 on the blue print.

Mr. Duffield—Won't you see if you can tell it from that photograph?

A. That only gives three of them.

Q. (By the Vice-Chancellor.) Is that one of the ones from which it was taken?

A. No, sir.

Q. Witness is shown *Exhibit C 3*, photograph, and looking at the picture of the third pipe, he is asked, was the pipe from which the effluent you have testified to was taken one of those shown on the picture?

10 A. No, sir; not one of those; it is up the stream; you can't see it here.

Q. It is a single pipe and not one of the group?

A. Yes.

Q. (Further direct.) How many pipes are there entering?

A. Five pipes in all.

Q. A group of three shown on *Exhibit C 3*, and what others are there?

A. There are two above, as shown by this blue print.

20 Q. (By the Vice-Chancellor.) You say there are five effluent pipes on the Vineland filtration beds; you are shown *Exhibit C 3*, do you recognize that as an illustration of the three pipes grouped together which pour into the creek, or Tarkiln branch?

A. Yes, sir.

Q. Was the effluent about which you are about to testify, coming from one of those three pipes?

A. It was not.

Q. (Further direct.) Was it a pipe leading from the
30 beds?

A. Yes, sir; above the three pipes, the first one above.

Q. How many samples did you take from the effluent pipe?

A. On that day we took one.

Q. What day?

A. January 10th, 1906.

Q. You took one sample?

A. Yes, sir.

Q. How did you examine that sample?

A. Professor Cramer examined it, I worked with him.

Q. What sort of an examination did you make, chemical or bacteriological?

A. He made a bacteriological examination.

Q. Did you assist on that?

A. Why, partially.

Q. Where was the examination made?

A. The examination, the plating was done on the ground. 10

Q. What was the result of your bacteriological examination of the effluent from that pipe, the discharge pipe from the sewer?

A. On the 10th?

Q. Yes, on the 10th.

A. It showed an effluent which was entirely free from coli.

Q. When were your next samples taken from the effluent pipes of the Vineland sewer?

A. On the 17th. 20

Q. Of what month?

A. On the 17th of January, 1906.

Q. Who was with you at that time?

A. Dr. Cramer.

Q. What effluent pipes were those samples taken from?

A. One, two, three and four.

Q. They were taken from pipe No. 1?

A. Right.

Q. And pipe No. 2? 30

A. Yes, and 3 and 4.

Q. Are either of those three pipes that enter into Tar-kiln creek?

A. The 1, 2 and 3 are the ones shown in this photograph, *Exhibit C 3*.

Q. You took the sample of the effluent on January 17th?

A. Yes, sir.

Q. On what pipe did you take the sample from?

A. No. 4, the first one above the group of three as shown in *Exhibit C 3*.

Q. What sort of an examination did you make of the effluent on that date?

A. Bacteriological.

Q. What did your bacteriological examination show from the three pipes in *Exhibit C 3*?

A. Showed absolutely no coli.

10 Q. What did your bacteriological examination show of the pipe above those three pipes?

A. Showed the same thing, absolutely no coli.

Q. When was your next sample taken from the effluent pipes leading from the sewer bed at Vineland?

A. The Tuesday following; it was on Wednesday, I think the 23d.

Q. Where did you take your samples on that day?

A. From effluent pipe No. four.

Q. What is effluent pipe No. four, one of the group of
20 three?

A. No, sir; the first one above the group of three.

Q. And lays single?

A. Yes, sir.

Q. It is the effluent pipe leading from the beds?

A. Yes, sir.

Q. What sort of an examination did you make at that time?

30 A. I plated the water, the sample of the water right on the ground took characteristic colonies, which developed; there were a few colonies which developed red; I studied those colonies, incubated fermentation tubes, got the production of gas, I found they reduced neutral red to a yellow color. I examined the gas produced and found it was not carbon dioxide and hydrogen in the proportion of two to one.

Q. Who examined these samples with you?

A. Dr. Cramer.

Q. Have you taken any samples since then?

A. No; I have not.

Q. Have you taken any samples of the water as the sewage comes first on the beds?

A. In connection with Professor Cramer, I have.

Q. When did you take those samples?

A. On the 10th of January.

Q. Did you make an analysis of those samples?

A. I worked with Professor Cramer on that.

Q. What sort of an examination did you make?

A. We determined the total number of organisms and the number of acid formers for red colonies. 10

Q. What place on the sewer beds was that sample taken from?

A. That of the raw sewage was taken at gate chamber No. 1, where the raw sewerage enters the filterer.

Q. What does your examination show in regard to that?

A. Showed that it contained, as would be expected, a large number of intestinal organisms.

Q. What other samples did you take of the water at that time? 20

A. We took samples as it left the septic tank.

Q. And going where?

A. Into the filter beds.

Q. Did you make an examination of that?

A. Yes.

Q. What did that show in the way of coli?

A. It showed a big reduction in the number of coli.

Q. Have you the figures there?

A. I have not.

Q. Did you take any further sample that day from 30 the effluent pipe?

A. Yes, we examined it.

Q. And that showed what?

A. No coli.

Q. Did you figure the percentage of the reduction of the coli from the time the raw sewage entered the bed until it leaves the effluent pipe; have you at any time?

A. During the various experiments I have made, do you mean?

Q. Yes.

A. When I got colonies which were characteristic of coli I did not, with but one exception, examine them to prove whether or not they were coli.

Q. You don't know the percentage of the reduction, then?

10 A. No, I don't; when I got colonies which were specific of coli, I simply admitted that perhaps they were and added more copper and eliminated them.

Q. Witness being shown a bottle of water marked *Sample T*, is asked, what that is, where was that sample taken from?

A. That is a sample of water selected from Tarkiln creek above where the effluent enters.

Q. That is above where the effluent from the Vine-land sewer beds enter Tarkiln creek?

20 A. Yes, sir; on the 28th of January, 1906.

Q. Witness being shown *Sample D*, is asked what that is?

A. *Sample D* is effluent from the exit pipe No. 5, 1-28-06. I might state in connection with that that the exit pipe No. 5 is partially under or below the level of the stream, so that this sample does not represent the exact nature of the effluent from pipe No. 5. That is, it may be contaminated by the water of the stream.

Q. What is the label on that?

30 A. *Sample D*, effluent from exit pipe No. 4 collected January 28th, 1906.

Q. Showing witness another bottle. This is a sample of what?

A. *Sample D*, effluent from exit pipe No. 2, January 28th, 1906. This is one of the group of three.

Q. Another bottle?

A. *Sample D* again, effluent from exit pipe 1, January 28th, 1906. That is another one from the group of three.

Q. Another bottle?

A. Sample D is an effluent from exit pipe No. 3, January 28th, 1906. This is another one of the group of three.

Q. (By the Vice-Chancellor.) Looking at these three samples, which you say were taken separately from the effluents Nos. 1, 2 and 3, and which, as I understand you, are indicated on the complainant's *Exhibit C 3*, state how those effluent pipes are numbered as relating to 10 your samples?

A. The blue print, the original ones were numbered and lettered. This one I see is not. We number these exit pipes beginning with the west side.

Q. Up or down stream?

A. Down stream beginning from 1.

Q. The down stream is numbered 1?

A. Yes, sir; and the middle one No. 2, and the up stream is numbered 3, and the one above is numbered 4, and the next one is numbered 5. 20

Mr. Bartlett—Your Honor don't care for any of these other specimens of the water below.

The Vice-Chancellor—I will not pass upon anything you do not offer. I will rule upon anything you offer.

Mr. Bartlett—I will simply make a formal offer of the samples.

Q. (Further direct.) Did you make an examination of the water at Tarkiln as it enters Parvin creek and take samples? 30

A. Yes, sir.

Q. Is that the sample marked T C?

A. Yes.

The Vice-Chancellor—That is below?

Mr. Bartlett—Three miles below.

The Vice-Chancellor—You offer that for the purpose of showing that at that point there is no contamination?

Mr. Bartlett—Yes, I offer that to show the quality of the water, or the clearness of the water.

Of course, the idea is to show no contamination at that point, or to show the clearness of the water as compared with the other, with the sample taken from the effluent pipe.

Mr. Duffield—If you offer it for that purpose I will not object.

Mr. Bartlett—Well, I offer that for the purpose of comparison with the samples taken from the effluent pipe.

10 Mr. Duffield—Then I withdraw my objection.
Q. That is all.

Cross-examination, by Mr. Duffield:

Q. I understand you to say that you were a graduate of the College of Pharmacy, Philadelphia?

A. Yes.

Q. What year did you graduate?

A. 1905.

Q. Last summer?

20 A. Last spring.

Q. Then you have only held your position as professor since the opening of the term this fall?

A. No, I have held it for the last two years.

Q. You were in the position of student and professor during that period?

A. Yes, sir.

Q. Then you held the position as professor practically from the time you entered?

A. No, I did not.

30 Q. I understood you to say you pursued your studies for about two years prior to graduation, tell us about that please?

A. I pursued my studies along bacteriological lines, you mean?

Q. I understood you to say you pursued your studies in the College of Pharmacy for about two years prior to graduation?

A. Three years; it is a three year's course

Q. Prior to entering the College of Pharmacy, did you engage in bacteriological work?

A. I was interested in it from the point of a reader; I hadn't done any practical work.

Q. Where did you obtain your preliminary education before going to the college of pharmacy?

A. At the Vineland high school.

Q. You went directly from the high school to the college of pharmacy?

A. Yes.

10

Q. The high school gives a general training in chemistry, but nothing special?

A. They don't specialize, general chemistry.

Q. At the end of the first year you secured the position of professor of the various courses you have outlined?

A. At the end of the second year.

Q. You have held that for how long?

A. Two years.

Q. You are on the second year now?

20

A. That is right.

Q. What is it you said you are professor of ?

A. Botany and pharmacognosy.

Q. What is Pharmacognosy?

A. The study of drug knowledge, the study of drugs.

Q. You say you also are a lecturer on bacteriology?

A. No, I didn't say that.

Q. What did you say?

A. I said I was assistant professor in bacteriology.

Q. Do you hold any other position in this institution? 30

A. That is all.

Q. What training did you have in bacteriological examinations; who was your preceptor?

A. That is who was I under?

Q. Yes, prior to assuming the position of assistant professor?

A. Under Mr. Watson and Professor Cramer.

Q. How much of your time did you devote to bac-

teriological work during the three years you were at the institution?

A. About every minute that I was not doing something else.

Q. How often were you doing something else?

A. Well, I was there nearly every morning from nine to twelve during the second year, and during the first year I was in the laboratory and not taking special
10 work in bacteriology, but doing microscopic work, and often overlooking others who were taking bacteriological work, overlooking their work, and during the third year I have devoted practically all my spare time, except what was taken up in the classes, in bacteriological work.

Q. And what writers did you have, what books?

A. That were used?

Q. Yes?

A. Nowry's Bacteria, Frederick B. Chester, of Wilmington, Delaware, we used Muir and Richey's, Abbott's; want any more?
20

Q. Ever have occasion to consult Sedgwick on the principles of sanitary science and public health?

A. I have read quotations from his books.

Q. He is recognized authority?

A. I believe he is getting—

Q. On sewage purification?

A. I believe he is of some authority.

Q. He is one of the recognized authorities in your institution?

30 *A.* As far as I know he is. I don't much of him or his work.

Q. I understood you to say you were called to Vineland in 1905; at this time you were a student in the school as well as a professor. You hadn't yet received your degree?

A. What is the date?

Q. April, 1905?

A. Yes.

Q. How did you happen to be called to Vineland?

A. I was employed previous to my college work with Dr. Conwell and in connection with a thesis I was working on, I was interested in water purification. I

Q. How did you happen to be called to Vineland? knew of the condition of the water at Vineland, and knew of the effect of copper sulphate upon these intestinal organisms, and my object was to write a thesis which would show how to purify sewage or water containing sewage organisms by the use of copper. 10

Q. Had that work been successfully done by anyone before you took it up?

A. Not in the line of sewage; that is, not as far as I know.

Q. I understood you to define sewage as a substance containing coli bacilli; am I right?

A. Any water which contains coli bacilli shows that it is contaminated with sewage.

Q. You don't want us to understand that there is not plenty of sewage that has no coli bacilli in it? 20

A. It is not true sewage if it has not got coli bacilli in.

Q. Is not the word sewage simply defined as drainage or the contents of drainage?

A. Not correctly so.

Q. You differ, then, from Mr. Sedgwick?

A. If he claims that any water being a drainage is a sewage whether or not it contains coli, I do.

Q. Even though it contains domestic drainage, but contains no coli?

A. Domestic drainage usually contains coli. 30

The Vice-Chancellor—That is not the question.

Q. The question I asked you is whether the substance containing domestic drainage, but containing no coli, is or is not in your opinion sewage?

A. It is not.

Q. Did you ever have occasion to examine a book on the purification of sewage by a man named Barwise?

A. No, sir.

Q. Do you know this work at all?

A. No.

Q. What is your definition of a sewer?

A. A sewer is usually a culvert or a line of pipes which contains or carries sewage.

Q. Then if a culvert or line of pipe contains a substance not containing coli bacilli in your opinion is not a sewer, is that so?

A. That is right. I think the way the term sewer is
10 usually used, it is often used to mean any culvert which carries refuse water, whether it contains sewage or not.

Q. Suppose you take sewage, such as is deposited on the sewer beds in Vineland, and eliminate from that sewage, by chemical process or otherwise, the coli bacilli, what have you got left?

A. You have water which don't contain sewage.

Q. I am not talking about the water, I am talking about the substance you have eliminated coli out of.

A. You have a liquid which don't contain coli.

20 *Q.* As soon as you have eliminated the coli, which is the excreta, it is not sewage?

A. It is not sewage.

Q. Then this effluent which is produced when you say it is not sewage, all you mean is that it does not contain, in your opinion, coli bacilli, is that so?

A. State that again.

Q. Is it so, that when you say that the effluent which comes from the pipes in the Tarkiln branch contains no sewage, do you mean simply that it contains no coli
30 bacilli?

A. So far as stating a fact that way, yes. That is the word sewage refers only to coli.

Q. Have you any other reason for stating that the effluent discharged into Tarkiln branch from the Vineland sewage bed, is not sewage, than the mere fact that it does not contain coli bacilli?

A. That is the best evidence.

Q. Have you any other?

A. We have other methods by which sewage is often indicated, but they are not positive.

Q. By sewage you mean the presence of the coli bacilli, don't you?

A. You always have coli bacilli in sewage.

Q. And you say if coli bacilli are not present it is not sewage?

A. It is not sewage.

Q. You do say that?

A. Yes, sir; that is right.

Q. Now, I ask you whether the statement that the substance which is being discharged into Tarkiln branch from the Vineland sewage beds, is not sewage is based upon the fact that there are no coli bacilli in it? 10

A. The reason why I say it is not sewage is because I know there is no coli bacilli in it.

Q. That is the sole reason for saying that?

A. Yes, sir; that it is not sewage.

Q. Suppose you were to find other bacteria in it beside coli bacilli, what would be your conclusion then?

A. You find bacteria in all water. 20

Q. Suppose you should find typhoid bacilli?

A. You would find coli if you found typhoid.

Q. Assuming the proposition that you did not?

A. There is no such proposition.

Q. That is impossible?

A. Yes, sir.

Q. (By the Vice Chancellor) Is the converse true that if you did find coli you might find typhoid bacilli?

A. Yes.

Q. (Further cross) I notice in your examinations from day to day you found a very varying number of coli bacilli when you found any? 30

A. Before I began to use copper I did.

Q. Is it or not so that on varying days coli bacilli will be in liquid effluent from sewage in larger or lesser quantities?

A. Undoubtedly so.

Q. I suppose your purpose in making frequent examinations was to determine whether the coli bacilli

were present on other days, you didn't rely on one examination?

A. No.

Q. The frequency of your examinations was caused you thought that possibly a day or two before or after you made an examination disclosing no coli, that you would find coli, is it not?

A. Before I used copper the reason of my frequency
10 was because I knew that the climatic conditions, and the conditions of the sewer and of the water being different would influence the number of coli which you would find at different times.

Q. You made frequent examinations this month when you said you found no coli?

A. Yes, sir.

Q. What was the purpose of that?

A. This is experimental work with copper, never having been done before, and the variation in the weather,
20 the weather is fluctuating.

Q. (By the Vice-Chancellor) What difference does the fluctuation of the weather have to do with the result of your bacteriological examination?

A. The effect of copper upon bacilli coli and typhoid is very different in different temperatures.

Q. Then at one temperature the copper sulphate may be distributive and in some temperatures not so distributive?

A. That is it requires different quantities according to
30 the temperature to kill the coli and typhoid.

Q. Then do I understand that assuming that you are experimentally engaged in an effort by the use of copper sulphate mixed with the liquid flow from sewage, to destroy the coli bacilli in the overflow, that the success of the experiment depends upon the conditions of the weather, and they must be varied according to those conditions to be successful?

A. That is when it has been determined exactly how much copper is required for even the coldest winter day,

then we can use that much, and we are safe, there is no contamination from coli or typhoid, because we know that they are all killed.

Q. Were your efforts made this month for the purpose of ascertaining what quantity of copper sulphate was needed to be added to be successful?

A. That has been the constant aim.

Q. Were those experiments to which you testified as made this month, made for the purpose of ascertaining 10 what the quantity of copper sulphate was there needed to be added in order to successfully eliminate the coli bacilli?

A. Well, this month we have not obtained definite reaction for coli at any time.

Q. That is not quite the question which I understand I asked you. I asked you whether your experiments made this month were for the purpose of ascertaining what was the amount of copper sulphate needed?

A. Yes, because if we get coli with this weather it 20 shows we need more copper.

Q. Was that the object of your experiment?

A. That is one of the factors.

Q. (Further cross) I understood you to say when explaining the differences in April that some beds filter better than others; that is right?

A. Yes.

Q. That is true to-day, that some of your beds work better than others?

A. I haven't made any examination recently to deter- 30 mine whether or not that is strictly true, but it necessarily must be.

Q. I understand you to say that you made a hundred examinations of the water?

A. About 100.

Q. I don't mean to pin you down. The greater part of those examinations did show the presence of coli to a larger or lesser degree?

A. No, the greater amount of time that I have been experimenting I have been able to liberate the coli.

Q. That means that coli were present to be liberated?

A. Certainly; always have been.

Q. So that the hundred examinations disclosed the presence of sewage?

Mr. Bartlett—He means the sewage which comes on the beds; you are speaking of the effluent.

Q. That is a misunderstanding then. I understood you meant a hundred or more examinations of this effluent?

A. Perhaps so.

Q. And I ask you whether in that hundred examinations there were not some indications of the coli in almost all?

A. No, sir; not all.

Q. In what proportion?

A. Maybe half of them.

Q. After you had made tests and found no coli present you made some tests in which coli were disclosed?

20 *A.* How is that?

Q. After you had made tests in which no coli were present, you made subsequent tests in which they were?

A. After I began to treat the sewage, you mean, and got results which were negative as far as coli were concerned, I got results which were positive?

Q. Yes.

A. Why, certainly, those are all accountable for, however. That is, during experimental work you are always going to get negative results at certain times.

30 *Q.* So that this work that you are doing is to some extent experimental?

A. It has been; we are getting it reduced to a fine point.

Q. Now, turning to your experiments of January 17th, 1905, I understood you to say that there were absolutely no coli present?

A. That is right.

Q. January 23d, I understood you to say, there were a few disclosed?

A. No.

Q. Won't you take your examination of January 23d, and tell us the result of that?

A. I found a number of colonies which were somewhat characteristic, but when they were tested and examined, they didn't give the end reactions for coli.

Q. That means to a layman that your experiments first tended to indicate the presence of coli, but you got to the end of your determination, and there was some 10 point where the reaction was not as it would have been had they been present?

A. No, that means you may be misled by certain organisms, which you take for coli, which really are not.

Q. Won't you tell us what method you tried in order to determine the presence of coli on this specimen taken January 23d?

A. Samples of the water were taken and places were made on the beds right on the ground; the water was sampled and sterilized bottles, 100 CC. bottles, which 20 were sterilized in an autoclave, one CC was used in making these plates.

Q. One cubic centimetre?

A. Yes. The media was litmus lactose agar. These plates were taken and placed in an incubator, body temperature, about $37\frac{1}{2}$ centigrade, incubated for twenty-four hours. At the end of twenty-four hours there were no colonies developed which were entirely characteristic of coli. That is, I had ten plates, samples representing 10 cubic centimeters of water, and from those 10 cubic 30 centimeters there were no colonies which developed which were at all characteristic of coli. There was one or two, however, which I made culture from in order to be positive. I made culture from these. These cultures afterwards were incubated into neutral red lucose bouillon, fermentation tubes. In these tubes I got a production of gas about 30 millimeters, if I remember right, and a reduction in the red color.

Q. What per cent.?

A. I say about 30 millimeters.

Q. How large a tube?

A. The tube held about 25 cubic centimeters, and there were perhaps 30 to 35 millimeters of gas developed in the long arm of the tube. A yellow color was also produced.

Q. How long was the arm of the tube?

A. I don't know, I never measured it. They varied
10 somewhere from 100 to 150, or, if you get an extra size, they are larger.

Q. It may be a fact that I don't quite comprehend, but I still don't understand the per cent. of gas which was produced from this culture?

A. There were about 30 millimeters in the long tube, and the tube was perhaps 125 millimeters long. The gas was afterwards tested and found not to be typical as produced by coli organism.

Q. In what way?

20 *A.* By testing for C. O. tubes.

Q. What was the composition of this gas?

A. I didn't examine it carefully; that is, further than to determine that it was not carbon dioxide, but it was combustible gas, probably methane, or some other form of hydrogen, just the percentage I don't know. I didn't examine it; it was combustible gas.

Q. Is not hydrogen combustible?

A. Yes, when it is combined with methane.

Q. Is not hydrogen formed by coli?

30 *A.* Yes; you always get it in your reaction with coli, you get the gas, carbon dioxide, or—

Q. Is that accompanying or consequent?

A. Consequent.

Q. Whether the production of hydrogen is the result of the presence of coli, or whether wherever you find coli you always find hydrogen accompanying it; suppose you destroy the coli by the use of your sulphate of copper, and the destroyed body remains, does not that produce hydrogen?

A. What do you mean, the dead bacteria?

Q. Yes.

A. No.

Q. (Further cross.) How were you able to determine that the result was not a combination of hydrogen and carbon dioxide?

A. By treating the gas with caustic soda.

Q. What was the result?

A. Proved that it was not carbon dioxide.

10

Q. What was the result of your experiment?

A. There was no change, proved it was not carbon dioxide.

Q. That was the only test you made?

A. That was sufficient.

Q. That may be, but please answer the question.

A. Yes.

Q. What bacteria, in your opinion, were there that caused you to suspect the presence of coli?

A. That is, what were the organisms that produced that gas? 20

Q. Yes; or the organisms which produced the reddish colonies?

A. Didn't produce any red; it was red.

Q. What produced the colorization and the colonies, to which you refer?

A. I don't know, I didn't study those individual organisms; I know they were not coli, and that was sufficient.

Q. Your sole purpose in your work in Vineland has been to discover the presence of coli in the effluent which is discharged from the sewer beds? 30

A. No.

Q. What else have you been doing?

A. I have been also trying to render the effluent free from chemical material.

Q. Have you been successful in that line as yet?

A. The chemical purification, although not as great as you get in certain, that is, it is not what I think they

generally get in most filtration plants where they filter sewage, but at the same time it has been much better than it originally was. That is, we have increased the chemical purification by the careful operation of the bed.

Q. What is the percentage of increase?

A. I don't remember what the analysis was; it was stated earlier; but I know what it is at present.

Q. What is this effluent which is at present passing
10 out of the pipe into the Tarkiln creek?

A. That is water which contains dissolved, or in suspension in it, perhaps 150 parts per million, solid matter, and contains certain dissolved gases. It contains absolutely no coli.

Q. That solid matter which you speak of is what; what is its original constituent; where does it come from?

A. It probably comes, as is apparent, from a growth
20 in the pipes, the pipes are fouled more or less by a certain kind of growth, a secondary organism, which, during the use of the beds when the filtrate runs out the effluent pipes, which gradually breaks from the pipes and runs out.

Q. In all the samples which you took you found the presence of odors, didn't you?

A. Yes, sir.

Q. The characteristic odor of sewage?

A. A slight odor, somewhat sulphurous.

Q. So without a bacteriological examination you
30 would have suspected the presence of a sewer from the odor, would you not?

A. I would not have passed any conclusion.

Q. But you would have suspected it?

A. A person naturally would suspect it was contaminated if he didn't know?

Q. Using the word sewage in a broad sense, not in a narrow sense, the substance which is passing into Tarkiln branch at present is sewage?

A. No, sir.

Q. I am not using your narrow definition; I am asking you whether that effluent is not a portion of the sewage matter which is deposited on the beds?

A. It is not.

Q. (By the Vice-Chancellor) According to the popular vernacular?

A. No, it is not; that coming from the pipe.

Q. (Further cross) What is the liquid, where does that come from?

A. That is filtered from the sewage which has been treated with copper, which has settled, treated with copper, submitted to septic tank action, treated with copper and filtered.

Q. Tell us just what it is. I don't want it chemically, but it is part of the sewage which is deposited on there before it is treated?

A. It is the water which contains the sewage after the sewage is taken out.

Q. In your opinion, is that material proper for drinking purposes?

A. It is potable water.

Q. (By the Vice-Chancellor) You don't quite answer the question you were asked whether you considered that to be drinking water.

A. It is safe water, yes.

Q. (Further cross) Just as it flows right from the sewage beds?

A. Yes, sir.

Q. You consider that no possible contamination can be given to the water into which this sewage bed directly drains?

A. How is that?

Q. In your opinion, no contamination can be given to potable water into which this effluent directly drains?

A. I don't know what you mean; you mean you can't contaminate the effluent?

Q. No, you can't contaminate the stream of potable water by pouring that in?

A. No, you can contaminate any stream of water.

Q. (By the Vice-Chancellor) No, you were not asked that. There is such a thing as an effluent from these pipes?

A. Yes, sir, and that is not contaminated.

Q. The question is whether, in your opinion, that effluent is of such a character that it would contaminate potable water if poured into it?

10 *A.* It would not contaminate potable water, it would make it better nine times out of ten.

Q. (Further cross.) Do you want that answer to stand?

A. Certainly.

Q. Suppose you were credibly informed that between the time you made your examination, on the 17th of January, and the 23d of January, specimens had been taken of this effluent which did disclose coli, would you then consider it a proper substance to place in potable

20 water?

A. It is impossible to consider.

Q. (Question repeated.)

A. If it contained coli?

Q. Yes.

A. No.

Q. You mean it is not proper to place it in potable water?

A. If it contained coli.

30 *Q.* Then your whole assumption that this is proper to be placed in potable water is based upon the fact that there are no coli present?

A. Yes, of course, if there are no coli there, there will be no typhoid.

Q. I am not talking about typhoid, I am talking about a proper substance to be placed in drinking water, and I ask you whether the sole basis you have for making that statement is the fact that there is no coli present in the effluent?

The Vice-Chancellor—The statement you made was, that this effluent would not contaminate potable water?

A. It will not.

Q. (The last question repeated.)

A. Yes, that is a critical point of determination.

Q. Then as long as you can separate the colon bacillus from the sewage, the residue, which you say is not sewage, may be placed with impunity into any drinking water, is that so? 10

A. Yes, that is, with safety, if that is what you mean.

Q. Do you consider it injurious?

A. Not at all.

Q. The solid or liquid, as soon as you eliminate coli bacillus the sewage may be mixed with that water and the resultant safe to drink?

A. That is, a person would not get typhoid.

Q. I am not asking you about typhoid, I ask you whether that pollutes water? 20

A. It does not pollute it.

Q. Will you kindly examine Sample D, which I understand was taken from pipe No. 1, which is the pipe further down the stream, with regard to which Doctor Randolph testified—did you hear his testimony?

A. No.

Q. (By the Vice-Chancellor.) Were you not here this morning?

A. Yes.

Q. Didn't you hear Dr. ShippenWallace's testimony? 30

A. The chemical examination?

Q. No, he said he had examined by sight and smell the effluent from the pipes shown in Group No. 3.

A. Yes, I heard everything that was here this morning?

(The witness was then withdrawn for the purpose of recalling Dr. Fitz-Randolph.)

Raymond B. Fitz-Randolph, recalled.

Direct examination, by Mr. Duffield:

Q. I want to recall you to identify from which of the pipes shown on *Exhibit C 3*, the photograph, you took the specimens which you testified to?

A. This last pipe, down stream.

Q. Shown on *Exhibit 3*?

A. Yes, sir.

10 Q. That is all.

Edwin Leigh Newcomb.

Cross-examination continued, by Mr. Duffield:

Q. I show you a bottle marked "Sample D, effluent from exit pipe No. 1," and ask you if that was taken from the pipe indicated on *Exhibit C 3*, the further down stream, to which Dr. Fitz-Randolph has just testified?

A. It was.

20 Q. I also show you Sample T. C., marked Tarklin creek at point where it enters Parvin's branch. Do you see anything different in those two waters?

A. Yes, sir.

Q. The sample T. C. is very much clearer than Sample D-1?

A. Yes, sir.

Q. What, in your opinion, is the cause of that?

A. The sample D contains a larger amount of ammonia.

30 Q. Do you consider that beneficial in water?

A. It is not harmful.

Q. Is it beneficial?

A. I don't know.

Q. Go ahead; what else does it contain?

A. Contains nitrite—

Q. Sample D 1 contains a larger quantity of nitrite than found in sample T. C.?

A. Just one moment.

Q. All right.

A. Sample T. C. contains a larger amount of nitrate than does Sample D 1.

Q. You consider that the presence or absence of a larger quantity of nitrates is beneficial or prejudicial to the water?

A. What do you mean by a larger quantity?

Q. I mean is, in your opinion—

A. I don't know what you mean.

Q. In your opinion is Sample T. C. better for drinking purposes than Sample D 1? 10

A. As far as nitrites are concerned.

Q. It is better?

A. No difference, one is just as good as the other.

Q. But as far as chemical constituents are concerned, which is the best potable water, T. C. or D.?

A. One is just as safe as the other.

Q. I am not talking about safety; which is the best potable water?

A. One is just as potable as the other. 20

Q. In your opinion, there is no difference in drinking the excretion coming from a sewer, or in taking a sample of water?

A. These are not excretions.

Q. Taking a cloudy fluid containing a characteristic odor of sewage, that is just as good a potable water as a clear sample taken in the middle of a creek of flowing water?

A. Provided it is free from coli, it is just as safe.

Q. What do these nitrates indicate? 30

A. They indicate a breaking down probably of the ammonia compounds.

Q. Is that beneficial or otherwise to the water?

A. Beneficial.

Q. So that the presence of the larger quantity of nitrates is more beneficial than their absence?

A. To a certain extent.

Q. And the presence of a large amount of ammonia is more beneficial than its absence?

A. To a certain limit.

Q. What do you consider that the odor of the water found in Sample D 1 is due to?

A. The smell is rather sulphurous, perhaps hydrogen sulphide.

Q. Is it not probably due to the decomposition of organic matter?

A. The organic matter in sewage contains sulphur,
10 and you get sulphide by liberation.

Q. Is not this odor produced by the decomposition of organic matter, produced by that?

A. A portion of that probably comes from the purification of the sewage, another portion may come from the growth, secondary growth in the pipe.

Q. I don't think yet I have an answer to my question, which is, whether the characteristic odor produced by this effluent, is not due in your opinion to the decomposition of animal matter in the effluent itself?

20 *A.* Not altogether.

Q. Is it not partially?

A. Partially it is due to the decomposition of the sewage.

Q. Then this effluent does contain decomposed animal matter?

A. Necessarily must.

Q. In your opinion, is decomposed animal matter a proper substance to put in a potable water supply?

A. It depends upon the nature of it.

30 *Q.* Is it ever?

A. Sometimes.

Q. (By the Vice-Chancellor) Won't you state what is the nature of decomposed animal matter, which, when added to potable water, does not affect its usability for that purpose; just state any condition in which decomposed animal matter under those circumstances, does not affect in a polluting way the potability or usability for drinking purposes of water.

A. This decomposed organic matter which we have from this effluent does not at all pollute drinking water.

Q. (Further cross) What is your definition of potable water?

A. Drinkable.

Q. (By the Vice-Chancellor) In referring to drinkable water, do you mean water of such fluid condition that it can be swallowed?

A. Which is fit to drink, safe to drink.

Q. You mean safe to drink, water which when drunk by a healthy person will not produce disease?

A. Water which is not at all harmful.

Q. Suppose it is distasteful and disagreeable and offensive, without being actually contaminated, without originating disease, is it in your view potable?

A. It is safe to drink.

Q. I didn't ask you that.

A. A potable water is one which is safe to drink, it is potable.

Q. That is all.

Re-direct.

Q. What are the chemical constituents in water an index of?

A. The chemical constituents in water are simply an index of some former contamination, in certain cases; in other cases they are not an index of contamination, so far as sewage is concerned.

Q. Are they in themselves harmful?

A. They in themselves are not harmful, unless of course an excessive amount.

Q. What are the harmful substances in water?

A. The harmful substances in water are bacteria.

Q. Any other name except bacteria, what are they called?

A. The coli.

Q. What is the general name of the organism, the harmful ones?

A. Typhoid.

Q. What are they termed, under one general head?

A. The coli group.

Q. Are they known as pathogenic?

A. They are known as pathogenic organisms.

Q. Are those harmful?

A. They are the harmful substance in water.

Q. And the chemical solutions are not?

A. The chemical solutions are not.

Q. What test is there to determine if those pathogenic
10 or disease producing organisms are eliminated, what
are the tests?

A. Bacteriological tests are the only ones.

Q. Then the fact that there are chemical properties in
water does not make water harmful?

A. It does not.

Q. How much suspended matter is allowable in
potable water?

A. 600 parts per million.

Q. (By the Vice-Chancellor) How do you get your
20 standard?

A. The standard is that set by the sanitarians in this
country, as stated in Sadler's and Trimble's text-books.

Q. (Further direct) How much did you find in the
effluent of the Vineland filtration plant?

A. Only 151 in a million.

Q. There is a chemical action in the sewage as it is
received on the beds there, is there not?

A. Yes, sir.

Q. Does that go on continually?

30 *A.* What do you mean, on the beds?

Q. Yes, first on the settling bed.

A. Constantly, yes, sir.

Q. What produces that?

A. Bacteria.

Q. That is, the bacteria themselves?

A. Right.

Q. In that bed, producing a chemical change there?

A. Right.

Q. And is there a further chemical change on the bed,
passing from the settling bed to the filter bed?

A. Still having a bacterial action.

Q. A further one?

A. Yes, sir.

Q. That is by the organisms that are not destroyed by the copper; they in themselves are constantly destroying, are they not, the properties of this water, the harmful properties?

A. That is, the organisms that are not destroyed by the copper are constantly taking up and breaking down 10 and destroying this organic matter?

Q. Which is harmful matter?

A. Yes, sir.

Q. They are constantly working on that independently of your copper, are they not?

A. Right.

Q. Then in addition to that you have the copper?

A. Right.

Q. That is the object of the filtration bed, is it not?

Objected to as leading.

20

The Vice-Chancellor—I am disposed to be very liberal as to what is done with the water before the matter gets into the pipes.

Mr. Bartlett—I want to show that we have two factors, our copper and our natural process, that are going on all the time.

The Vice-Chancellor—So far as the witness is asked what is going on in the filter bed, I think it is clearly admissible.

Q. The filter beds are designed to make that potable 30 water in themselves?

A. Yes.

Q. And you have a constant change there going on chemically, which is producing potable water, have you not?

A. Right.

Q. And then in addition you have your copper?

A. Right.

Q. What actions have you there?

A. We have first the septic tank action.

Q. Define the septic tank action.

A. We have the breaking down of this organic matter of this sewage, that is the crude solid matter in sewage which is broken down by the bacteria in this septic tank into soluble constituents, which go through into the settling bed, into the filter bed, and going through it is treated with copper sulphate.

Q. (By the Vice-Chancellor) Is not that action which
10 you have here referred to, one that is going on in all nature at all times?

A. Yes, sir, to a greater or less extent, you get nitration everywhere. We treat it then with copper sulphate and we remove all dangerous pathogenic bacteria, and then we filter the water, which gives us a water which is clear and palatable.

Q. (Further direct) All these processes go on before the water goes through the pipes?

A. Yes, sir.

20 *Q.* Those beds are designed to produce these very effects?

A. Yes, sir.

Q. That is the intention of the intermittent sand filled filtration beds used in sewage plants?

A. Yes, sir.

Re-cross.

Q. I understood you to say in answer to some questions that the injurious elements or germs which you
30 were seeking to destroy were typhoid germs?

A. Not altogether, also pathogenic.

Q. Coli bacilli are not of themselves injurious?

A. They are considered differently by different authorities, some claim they are and some not.

Q. What is your opinion?

A. I have never expressed an opinion.

Q. They are not generally considered injurious, are they?

A. I don't think they are, generally, I don't know.

Q. The purpose of testing for coli is for the purpose of testing to see whether the typhoid bacilli may be present?

A. That is the principal thing.

Q. The idea being that if coli bacilli are in the water the typhoid bacilli may also be found?

A. If there is typhoid bacilli you will find it. If there is coli there and the water has been contaminated with typhoid, if the coli still remains you are apt to find the typhoid; that is, if any typhoid has been contaminated into the water.

Q. (By the Vice-Chancellor.) Define just what coli bacteria are; what is the colon bacillus, why is it called colon?

A. It is a characteristic organism of the intestinal tract.

Q. And is called coli bacilli because of what; where is its home?

A. The bowels.

Q. The colon of the human body?

A. Yes, sir; that is where it all comes from.

Q. And that gives it its characteristic name because it is indigenous there, grows and lives there?

A. Yes, sir.

Q. (Further cross.) In order to get the typhus bacilli you must have a case of typhoid?

A. Well, yes.

Q. So, unless there is excreta from a typhoid patient deposited on the sewage bed, there is no danger of typhoid being present?

A. No.

Q. Then, in your opinion, if this matter came through—under your definition of sewage—containing bacilli coli, there would be no harm to potable water?

A. For the reason, if there was no coli there would be no typhoid.

Q. I am assuming that the pathogenic organisms are

absent, but coli is present, and the substance is sewage under your definition; I ask you whether sewage under your definition, but not containing pathogenic organisms is or is not prejudicial to potable water?

A. There is nothing in it which is harmful.

Q. Then it is not prejudicial?

A. No.

Q. As far as your view goes, there is no injury done
10 to potable water by placing sewage therein, provided you eliminate therefrom the pathogenic organisms?

A. There is a difference between harmful and whether it would be, from an esthetic point of view, fit to drink?

Q. I ask you whether it would be harmful?

A. It would not produce any disease, it would not be harmful in moderate amounts; eat anything in large quantities, and it will hurt you.

Q. You think that would tend to corrupt a potable water stream?

20 *A.* Not if there were no pathogenic organisms in it.

Q. You consider, then, from an esthetic standpoint, sewage from which coli has been eliminated is a proper substance to place in potable water?

A. That is, sewage in which coli is present?

Q. (Question repeated.)

A. I don't think it would injure me, no, to take it.

Q. Do you consider it from an esthetic standpoint?

A. No.

Q. Would you care to drink this effluent yourself?

30 *A.* Yes, I am thirsty now. Give me a glass; I will drink it. It is all right; it is not harmful.

Q. It is beneficial I think you said?

A. Probably it would be.

Q. As a matter of fact, you have spoken of the condition of this sewer bed; is there any sand in those beds?

A. Yes, sir.

Q. Is it not really farm loam that you saw put there?

A. No, sir.

Q. Haven't you had a constant controversy with the Sewer Commission ever since they were put there?

A. I don't know about that.

Q. Will you point out this bed which you spoke of as a septic bed; witness is shown blue print marked *Exhibit D 3*, and entitled "Sewer Bed, Borough of Vineland, N. J.," point out to me the septic beds you have been referring to.

A. These three marked "settling beds."

Q. Those are where the sewage was first deposited?

A. Yes, sir.

10

Q. Why do you call those septic; you consider the raw sewage deposited there as septic?

A. Because we get septic action.

Q. You are tending to establish a septic condition, but you mean to say that those beds are septic?

A. They tend to produce a substance which is more septic than the one that goes in.

Q. They don't produce a septic substance, do they?

A. Not entirely septic.

Q. You would not consider that if the substance that went through those beds was introduced into the human system it would produce an antiseptic condition?

20

A. How is that?

Q. If the effluent which comes through your septic beds as you describe it, and gets into the human system, you don't mean to say that it would produce an antiseptic condition?

A. Certainly not.

Q. Describe just what those beds do; the whole process; how are they constructed?

30

A. The raw sewage runs into settling beds A, B and C, as has been indicated. (Witness is now speaking from *Exhibit D 3*, blue print). The raw sewage runs into A settling bed for twelve hours. The next twelve hours we run it into settling bed B. While it is running into settling bed B, it is being drained out of settling bed A. From settling Bed A, the clarified settled sewage which has had the septic action passes to the filter beds. Copper sulphate is applied between the set-

ting beds and the filter beds. The material which, the liquid portion which runs on to the filter beds has been purified to a large extent bacteriologically. The water on the filter beds filters through first a layer of sandy loam which is on the surface; next it strikes a layer of fine cinders, and, third, a layer of coarse cinders which surround the under-drains, and runs out the under-drain after having had all pathogenic organisms removed, and a large portion, in fact, about all of the solid matter, only 150 parts in a million being left. The chemical purification has also been nearly completed, to such an extent that the water is a fit water to drink.

Q. Now, having gotten back to the point where the effluent is fit to drink, would you mind telling me the thickness of this sandy loam and cinders, to act as filter agents?

A. It is all the way from three and a half to four feet thick, that is, clear down to the bottom of the under-drain.

Q. What is?

A. The filter you mean?

Q. You say the substance passes through the sandy loam and cinders?

A. Yes.

Q. The purpose of it is to purify the water; I want to know how thick that sandy loam and cinder is?

A. From three to three and a half feet.

Q. Three to three and a half feet of sandy loam and cinders?

A. That is the filter material. Three to three and a half feet, and the lower edge is four, I believe. I didn't put them in, but I have been told that is the condition.

Q. (By the Vice-Chancellor) I understood you a little while ago in defining what you consider to be the purity of potable water, to say the contamination of the purity of potable water must proceed from bacteria?

A. That is, the pollution of drinkable water.

Q. That the pollution of water in its purity must proceed from bacteria, is not that your testimony?

A. Not entirely, I don't think.

Q. I so understood you. What other elements of contamination of potable water are there than bacteria?

A. It depends upon what you call a pollution.

Q. I am asking you what you call pollution?

A. If you have a water, take a water and empty into it a pound of certain drugs, which will produce some toxic effect, that is not potable water.

Q. Then there are other elements which might interfere with potable water besides bacteria? 10

A. There are in certain cases, here there is not.

Q. Would you consider that an intermixture which was charged with sulphuretted hydrogen or other offensive gas, intermixed with water, would interfere with the purity and potability of water?

A. That would all depend upon the amount.

Q. Suppose the intermixture was so great that it was distinctly perceptible to anybody who wanted to drink the water, by the smell, would you think that interfered with the potability of the water? 20

A. If it was no greater than what we have here, I don't think it would.

A. Answer the question.

A. The factors are different, one person could smell a water which another cannot.

Q. You didn't understand that in referring to smell of water, I was speaking when tried by a person who could not smell?

A. No.

Q. I was naturally speaking with reference to a person who could smell, so you should have answered it that way. Now, I want to know if water that is so charged with offensive smell that it is perceptible to an ordinary user, you would consider that that interferes with the purity of water for potable purposes? 30

A. No, some water always smells.

Re-direct.

Q. Are any waters liable to have a sulphurous odor that do not contain sewage?

A. Indeed there are; some waters are very sulphurous and smell and taste worse than this effluent.

Q. Are they not health giving waters?

A. Yes, sir.

Q. (By the Vice-Chancellor) And are given for that
10 purpose?

A. Yes, sir.

Q. And taken medicinally?

A. Yes, sir.

Q. Did you ever know any such water taken from a spring which is sulphurically charged to a degree to be perceptible, and which is taken medicinally because of the presence of sulphur; did you ever know that to be used as a potable water, in the sense of water for general use?

20 *A.* Yes.

Q. For the general water purposes of a city or town, did you ever know such a thing?

A. Why, yes; there are waters through the West; this past summer several places where I went they had water which was strong enough so that you could get a very decided effect from the water, from the constituents which were present and which were used; that is, a person who was used to them would not be affected by it.

Q. Did the people of the town congratulate them-
30 selves upon the presence of the odor?

A. They simply used it. Along the Mississippi river, you go in a restaurant, and the water they give you was worse looking than this and smelled worse, and if you gave them clear water they would say it was not fit to drink.

Q. That is all.

Carl F. Kellerman, sworn for defendant.

Direct examination, by Mr. Bartlett:

Q. Where do you reside?

A. My legal residence is Columbus, and my actual residence is Washington, D. C.

Q. What position are you occupying at the present time?

A. At present I am physiologist, in charge of soil bacteria and water purification.

Q. In what department?

A. The Department of Agriculture, Washington.

Q. Have you made any visits to Vineland, N. J.? 10

A. I have.

Q. What did you come in connection with?

A. I came in connection with experiments conducted in co-operation with the borough of Vineland. In connection with the purification of sewage by the use of copper sulphate.

Q. When did you make your first visit there?

A. It was some time, I think, in April. The first correspondence we had on the subject was in the latter part of March. 20

Q. Did you look the field over?

A. I did.

Q. What did you recommend in connection with their plant there?

A. I recommended the copper sulphate at the rate of about one part of copper sulphate to one-hundred-thousandths part of sewage, to be applied to the sewage.

Q. What result has your department gotten from the use of copper in connection with drinking water?

A. There are two sub-heads in which the copper is 30 very valuable in connection with destroying growths of lower plants, algæ; the other is in connection with destroying a very low plant of bacteria, especially at certain times. The toxicity of copper in connection with bacteria is different for the different bacteria. That is, it has a selected action.

Q. Has copper sulphate been used extensively in water reservoirs throughout the country?

A. It has, very extensively for eliminating various

growth of algæ, to a less extent it has been used for eliminating pathogenic bacteria.

Q. What cases do you know where it has been used for the purpose of eliminating pathogenic bacteria?

A. It has been used at Jamaica, Long Island, Columbus, Ohio, Albuquerque, New Mexico.

Q. (By Mr. Duffield) You mean Jamaica, Long Island?

10 *A.* I am not absolutely positive there of the address, I believe it was Jamaica.

Q. (Further direct) Have you seen the results at any of those places?

A. I have visited some of the places, at Anderson, Indiana, and Marietta, Ohio; I was present in the first case during a three months' test, in the second during a ten days' test.

Q. Was this drinking water?

A. Yes.

20 *Q.* What success did they have in those cases?

A. The success seemed to be complete in the two cases in which I spent some time myself. I was convinced of the elimination of the coli bacilli, and from whatever indication we could get of all intestinal bacteria, it seemed to be complete.

Q. Have you seen any sewage plants where the copper has been used outside of Vineland?

A. The Columbus Experiment Sewage Testing Station has been experimenting with copper. I have been
30 in correspondence with them and have visited their plant.

Q. How do they discharge their sewage there; that is, I mean do they have a filtration system?

A. At present they have no filtration system, they discharge directly into the stream.

Q. What results have they had by the use of copper in the treatment of raw sewage?

A. The results there are favorable in the copper treatment, in using sufficient amount, but are rather expensive. That is, by favorable, I mean it has been possible for them to eliminate the coli bacilli.

Q. In the use of forty-five pounds of copper to 250,000 gallons of sewage, what would be the purification?

A. I am not sure exactly what dilution that would give; I think that would give a dilution of probably a little stronger than one to one hundred thousand. That should be sufficient unless the water is of a very peculiar character. The character of the water must be taken into consideration as well as the temperature in treating sewage. That quantity of copper would be insufficient 10 if the water was very hard and the temperature very low. It would be sufficient if the water was not very hard, and the temperature was not very much below about fifty or sixty degrees.

Q. In a hard water it would bring about nearly a total purification, would it not?

A. I think it would bring nearly total.

Q. How about in a soft water?

A. In a soft water it ought to be complete, total, except in case of a lower temperature. 20

Q. (By the Vice-Chancellor) The lower the temperature the greater amount of copper sulphate required?

A. That is right.

Q. From what you have seen at Vineland would you think they had a total reduction there, from what you saw of the situation?

A. I should think that they should have a total reduction. The experiments at Columbus, in which I have been in pretty close touch, and have treated and added copper directly to raw sewage, it takes more copper 30 under those conditions to eliminate the coli bacilli, where they have no septic action before adding the copper; where a certain amount of septic action may precede as a preliminary treatment, a less quantity of copper would be necessary. In the case of the Vineland plant, the sewage effluent, after the preliminary treatment going on on the top of the filtration bed, is almost clear. That being the case, the quantity of copper should be entirely sufficient to cause complete elimination of coli within a few hours.

(At this point a recess of one hour was taken, after which the direct examination of this witness was continued as follows) :

Q. I notice that Sample D, marked "Effluent No. 5," and Sample D from Exit Pipe No. 1, and also Sample D, effluent from Exit Pipe No. 2, and Sample D, effluent from Pipe No. 3 of the Vineland sewer bed, are
10 more cloudy in appearance than sample T. C., taken from Tarkiln creek at the point where it enters Parvin creek.

A. I see the difference you refer to.

Q. How would you account for that difference in the color?

A. On account, knowing the composition of the filter bed, I think the cloudiness of the four samples from the effluent pipes, is due to a certain amount of clay, or some such substance held in suspense. This has been washed
20 out from the lower layer of the sewage filter beds.

Q. That is all.

Cross-examination, by Mr. Duffield:

Q. That is purely a hypothesis of yours, I assume?

A. Scarcely a hypothesis, I think it deserves a little higher rank.

Q. You haven't made any test of this effluent to determine its chemical constituents?

A. I have not.

30 *Q.* Assuming that sewage matter was contained in this effluent, it would have a somewhat similar appearance, would it not, to this sample?

A. That is very highly improbable.

Q. Would it or not have that appearance—answer the question please—if it were sewage matter passing through, would it have this appearance indicated by this cloudy specimen?

A. I think not.

Q. How would it appear?

A. It would have material that was more readily capable of sedimentation.

Q. It would produce a cloudy appearance in the water, would it not?

A. It would produce a cloudy appearance differing from that cloudy appearance, in that the particles could be observed to a considerable degree.

Q. Assuming that sewage matter was placed into the creek in the quantity which this effluent discharges, and that creek empties into another creek four or five miles below, the dilution of the sewage matter would tend to clarify the water taken at the lower place? 10

A. This is entirely theoretical.

Q. This is entirely theoretical?

A. In that case on theoretical grounds, I would say you could not distinguish any sewage, cloudiness, or any other indication at that distance, with a small quantity of sewage. If the quantity was very great, and the speed of the water was slow, you would get no cloudi- 20
ness, you would get a clear water at that distance, but it would be susceptible to chemical examination; be capable of determining sewage constituents by chemical examination.

Q. There would be a great difference between the appearance of the effluent containing sewage matter?

A. The appearance would probably be as clear as crystal at that distance?

Q. There would be as great a difference as is shown between these two specimens in the case of the cloudiness 30
of the effluent showing sewage matter, as though it was the clayey substance to which you have referred?

A. I don't think you have understood my answer. If you take a water five or six miles away from the point at which the sewage enters a stream, given a slow flow, it would precipitate all large chunks that would cause any cloudiness in a sewage. You could not get a murkiness of that character in water containing sewage matter.

Q. (By the Vice-Chancellor) Would it not depend a little upon the quantity?

A. No, not appreciably, because of this, the matter in sewage is capable of agglutination to a certain extent.

Q. Suppose the sewage water consisted of rotten milk or soapsuds, are not both of those soluble substances which would pollute water?

A. Rotten milk, rotted so that it is a liquid.

10 *Q.* I am speaking of a mixture of sewage water of rotten milk, or soapsuds, I want to know whether either of those substances is not one which would pollute water?

A. (Witness paused).

Q. Are you doubtful about it?

A. I think that will depend upon the quantity of water into which it was injected, entirely.

Q. Suppose there was sufficient injected to be perceptible, and produce a murkiness, would you say that
20 was polluting the water?

A. Yes.

Q. If, after passing through the filter beds, sewage water indicated a murkiness, such as would be shown by a mixture of soapsuds or spoiled milk, would that respond to the bacteriological test which you referred to?

A. That would depend altogether on other circumstances.

Q. You would not test it for the presence of spoiled milk unless it was indicated by the bacteria, or of soap,
30 unless it was indicated by the bacteria, would you?

A. Yes, because bacteria would not indicate the presence of soap.

Q. So a bacteriological test would not indicate it at all?

A. No.

Q. Assuming that the sewage was mixed with spoiled milk or soapsuds, what tests would show the difference between the murkiness produced by spoiled milk or soapsuds, or the murkiness produced by clay?

A. I would not try to go at that sewage in that way; I would not try to test for spoiled milk or soapsuds, but I would go to the sewage above and see if that contained an apparently similar material.

Q. Have you any doubt that sewage from a city between three and four thousand inhabitants taken indiscriminately and from waste, contains waste milk and substances of that kind?

A. Waste milk, after some considerable length of 10 time—

Q. Have you any doubt of that proposition?

A. I can't answer absolutely; I have to limit it a little.

Q. Then say you can't answer it.

A. I can answer it with limitations.

Q. No, you say you have doubts; I don't care for any more.

Q. (Further cross) I show you *Exhibit C 7*; will you examine that; are you able to tell us whether that cloudi- 20 ness is produced from the clay substance to which you have referred?

A. It is apparently different from the clay substance in the other bottles.

Q. Is there any indication from the sedimentation there of sewage?

A. That looks as if it had been taken from a drain; I don't think I would be warranted in answering and saying it was sewage.

Q. What is your definition of sewage?

30

A. Sewage I should consider, strictly speaking, is anything that went through sewers.

Q. You then recognize that there is sewage which does not contain coli bacilli, do you not?

A. I think that might be theoretically possible. You could certainly take sewage and sterilize it and speak of it as sterilized sewage.

Q. Now, doctor, assuming that the sample which I have just shown you, C 7, contains sewage, would not

the cloudy condition, which is shown in that bottle, assuming that it traveled the distance from the point of intake of the effluent to the conjunction of Tarkiln creek with Parvin brook, produce a comparatively clear water in Parvin creek; in other words, would have no effect on the waters of Parvin brook?

A. I should be inclined to think it would not.

Q. I mean no visible effect?

10 *A.* I should not think it would, it would depend somewhat on the character of this. Now, for instance, in chemically examining the same in C 7, and smelling it, I think there is a possibility that the odor there is caused by other things than contamination by sewage.

Q. Will you just smell of that sample?

A. I just did.

Q. Does it smell like sewage?

A. Not like raw sewage.

Q. Does it smell as though it contained sewage?

20 *A.* No, it smells like sewage effluent.

Q. That is the liquid residue of sewage, if I may use that term?

A. That is too loose a definition, I can't answer that.

Q. I withdraw that. What is the difference in the smell of raw sewage from the smell of sewage effluent; is there a distinct difference?

A. Raw sewage has a very disagreeable odor, and depending upon the kind of bacteria that may be fermenting the sewage, may be exceedingly disagreeable,
30 or only moderately disagreeable, as might be the case with fresh sewage.

Q. Urine contains no coli bacilli?

A. No.

Q. Then if urine happened to go through this sewage disposal works, and come out without chemical change, that would, in your opinion be sewage, would it not?

A. Well, that is one of the constituents of sewage; sewage generally speaking, is such a broad and loosely defined term; it is certainly one of the constituents of

sewage. I think different people would define it differently.

Q. (By the Vice-Chancellor) In ordinary parlance or ordinary conversations, as between the very large majority of mankind, is there any doubt about the meaning of the word sewage?

A. I think as I gave it when I first spoke of it, anything that goes through a sewer.

Q. Is not that what is understood in ordinary conversation?

A. I suppose so.

Q. (Further cross) I understood you to say you were in charge of the experiment station in connection with the Agricultural Department; will you tell us just what that branch has to do, what that department does?

A. In soil bacteriology; I think that has no bearing here. In water purification, the points which my laboratory covers, are points in pollution of streams by odor-producing algæ.

20

Q. Those are minute plants, are they not?

A. Yes.

Q. They are vegetable rather than animal contamination?

A. Entirely vegetable, and similar work in bacteriology in water.

Q. In your examinations you have then brought to bear methods for removing contamination from water supplies, have you not?

A. Yes; I have.

30

Q. Is it not a fact that the attempt at water purification is to remove contamination—I will withdraw that question. Is it not a fact that any connection between sewage and water is considered injurious?

A. You mean introducing sewage into water?

Q. Yes.

A. If it is not properly purified, yes; if it is properly purified, no.

Q. Would you not prefer as an expert, in laying out

sewage works in connection with water works, to prevent any connection between the two; that is preferable is it not?

A. You mean would you have sewage water discharged into a stream above where your water intake is?

Q. Yes, would not that be considered bad construction in engineering circles?

A. I think my answer would have to be qualified very much.

10 *Q.* Qualify it.

A. If sufficient purification could be obtained, it is perfectly proper, and if it were cheaper I think it would be advisable.

Q. Have you ever recommended it?

A. I have never recommended it, and I think I would not recommend it, as in general, the cost of complete purification of sewage is very high, and in general, complete purification is not aimed at.

Q. (By the Vice-Chancellor) Is it attained?

20 *A.* In very rare cases complete purification of sewage may be attained.

Q. Is not that a laboratory result rather than an actual performance?

A. It is claimed for some sewage plants, and with the addition of a little bit more elaborate apparatus, or more processes than are usually followed, it could be practiced probably anywhere.

Q. Is it not entirely dependent upon the presence of the highest skill and the most constant and unremitting
30 attention, if there is to be a continuous performance?

A. A continuous performance does necessitate accuracy in management, not necessarily great skill; skill, great skill must be used in outlining the methods to be followed, and in selecting the sites that are most advantageous, and in determining what processes are fitted for particular places.

Q. And that must be done once and for all?

A. Yes.

A. Yes. And then there should be a very careful and expert supervision, but not necessarily expert management.

Q. Now, leaving that, is not the continuity of success entirely dependent upon the degree of attention and care which, in the usual and ordinary conduct of the business cannot be attained?

A. No, similar results are required of filtration in water and they are attained in water.

10

Q. In public business?

A. In public business. For instance, in a filtration of municipal water supply for a large city, there they have usually, not always, expert supervision, but that supervision is seldom constant and directed only to this one thing, the control of the work in the filtration of water, because it generally is in the hands of people who are not exceptionally fitted for maintaining the bacteriological or chemical purity of the water.

Q. Let me inquire a little on this line: take the process of eliminating the coli bacilli by using the copper sulphate, what is the actual operation of the elimination by the admixture, what does the copper sulphate do?

A. You mean does it kill the bacilli?

Q. Yes.

A. It kills the coli bacilli.

Q. Must it not, in order to kill them, come in contact with them?

A. Necessarily.

Q. Is it not necessary, therefore, that there must be in or at the place where the copper sulphate is admixed, some process of intermixture by which the copper sulphate should come in contact with all the bacilli?

30

A. A flowing stream or a waterfall through a narrow orifice, then providing the copper is allowed to flow into the water at this point, so that you have a large volume that is churned in this action and mixed in this manner, it is not necessary then to employ any mechanical aid.

Q. Nevertheless, it must be of such perfect intermix-

ture that there is contact between the copper sulphate and each of the bacilli?

A. Not strictly, because there is another point in copper treatment, the diffusion rate of copper in a solution is very high. For instance, we have treated lakes containing something like four billion gallons of water. It is absurd to think that we could stir up the copper, or stir up a lake of four billion gallons. We go over that
 10 lake in paths perhaps twenty or thirty yards apart, and the copper sulphate is drawn through the water in a bag. The solution made here at the surface of the water in this narrow area diffuses through that entire body of water with sufficient thoroughness to eliminate the organism thoroughly. This has not been done in a lake of four billion gallons for that, but it has been done for algæ, and the distribution of the copper must be the same for algæ as for bacteria. This elimination of bacteria has been done in lakes somewhat smaller than this
 20 where the same proceeding has been followed. But not only does this copper diffuse itself in this way, the action,—it has not been brought out—that the action of copper is a selected action. It will kill a certain algæ and not other algæ; it will kill certain fish and not other fish.

Q. Nevertheless, it has to reach the fish or the algæ before it kills it?

A. Yes, sir, and you can kill certain bacteria and not others. It will not kill the ordinary bacteria in diluted solution, but it will, in a diluted solution kill the organism causing Asiatic cholera, that causing typhoid, and
 30 also the coli bacilli.

Q. (Further cross) You are familiar with the Vineland disposal works?

A. I think so.

Q. In your opinion, will the placing of the amount of copper that has been testified to in this case, upon the Vineland disposal works, running them the way they are run, insure a complete absence of the coli bacilli in the effluent continuously?

A. If there are no untoward conditions.

Q. Are not untoward conditions liable to arise at any time?

A. As long as they are liable to arise at any plant they would here.

Q. Supposing we had a sudden lowering of temperature that froze the sulphate of copper so that it would not drop in there as it should, that would at once cause coli bacilli to go through?

10

A. It would, I think.

Q. (By the Vice-Chancellor) Then you would not have any copper solution at all?

A. No.

Q. (Further cross) What are you going to do that would remedy that?

A. That will require more attention.

Q. Suppose these filtration beds themselves froze solid, so that there could not be a diffusion of copper, would not the result of the freezing be a large increase in the bacilli coli?

20

A. If the bed froze, nothing could go through.

Q. I don't mean freeze solid, I mean a scum of ice freeze over the top, so that there is no diffusion of the copper, so that the water stands just above 32°?

A. If at the top of the sewage beds you have a little film of ice, then you have some water that is not frozen, and then your sewage beds would work.

Q. Won't the water that is not frozen carry through into the effluent?

30

A. Because you get in this water that is not frozen you can still get your copper diffusion.

Q. Still it would tend, the freezing of those beds, would tend to increase the danger?

Q. If the beds have only a film of ice on the top, it does not interfere with the action of the beds because of that ice. If the ice is on the top of the beds so that the water cannot get at the beds, then no water can go through.

Q. What happens to the fluid that is coming through the settling beds?

A. In what case?

Q. We are assuming that the beds are frozen, what would happen to the sewage which is coming through at the rate of 250,000 gallons?

A. It would have to back up.

Q. It would back right up into this stream?

10 *A.* It would back up into the settling beds.

Q. (By the Vice-Chancellor) Would it not depend upon how long the condition continued; if that continued for some time, they would overrun, and the beds would not hold it?

A. That would happen some time undoubtedly.

Q. (Further cross) Is not this whole question of treating sewage with copper sulphate in an experimental stage?

A. It is hardly so considered—

20 *The Vice-Chancellor—*In practical use?

A. It is not generally in practical use, but it is not considered chimerical by some of the best New York sanitary engineers.

Q. (By the Vice-Chancellor) I did not understand Mr. Duffield's question to cast any doubt upon the system.

A. Then I misunderstood it.

Q. He asked you if this effort to cleanse the sewage by the use of copper sulphate, whether in actual practice it was not yet in its experimental stage?

30 *A.* For general application, yes.

Q. (Further cross) You consider that these filtration beds at the present time in Vineland are managed in a way that will insure a continual absence of coli bacilli in the effluent discharged therefrom?

A. It does seem to me that would be the case, barring, of course, accidents.

Q. I notice you spoke of the success which had attained some experiments in Anderson, Indiana, and

Mariette, Ohio, and you stated the success seemed to be complete. Tell us why you qualified that statement in that way.

A. Well, "seeming success," I qualified it from a matter of habit. At Anderson, Indiana, without the use of copper it has never been possible to get the water for drinking purposes that was free of bacilli coli. By using copper it has been possible to get a filtered water constantly free of bacilli coli over a very extended period.

10

Q. That is a direct effluent from the sewage?

A. This is not sewage; this is water that contains a great deal of sewage.

Q. Do you know of any case where an effluent coming direct from sewage beds has been rendered free from coli bacilli by application of copper?

A. Practically free, not absolutely free, except in the case of Vineland.

Q. That is the only case you know of?

A. Yes, sir.

20

Q. (By the Vice-Chancellor) You say that has rendered it absolutely free?

A. I think it has, in a great many cases at least.

Q. Free in a great many cases?

A. I mean a great deal of the time. I am not sure just how far that may extend. I have done no work myself on it.

Q. (Further cross) Have you ever yourself tested the effluent from the Vineland sewage beds?

A. Bacteriologically I have made no determination.

30

Q. Is it not a fact that your interest in the Vineland sewage beds is because of the novelty of the process and your desire to ascertain the result in order to aid you in your work?

A. I don't quite understand your question.

Q. You are interested as a scientific man at seeing a novel process put into operation, to see that what is theoretically true is practically true?

A. Yes.

Q. Would you consider that the direct effluent from sewage from which coli bacilli had been removed, but all other ingredients remain, was a proper substance to put into a spring from which potable water was taken?

A. It would depend upon the stream.

Q. Would you consider that it corrupted the quality of water in that stream?

10 *A.* That would depend upon the stream.

Q. (By the Vice-Chancellor) No, would it?

A. Yes, if a small quantity of sewage is injected into a large stream, it does not in any way pollute or tend to pollute, because the supply of well-oxygenated water can immediately so destroy the sewage material that it no longer exists.

Q. It would take time?

A. No, instantly.

20 *Q.* But at the point of taking, when you add the filthy material to a running stream, even if it was not the best, don't you tend to increase the impurity of the water; never mind what happens after the combination takes place, but at the instant, is there not a point where you add impurity to impurity—does not two and two still make four?

A. To add black to gray don't make a still blacker substance.

30 *Q.* Your simile is not true; I don't think it needs to be demonstrated. It does seem to me that we ought not to try this case as if we hadn't any sense, and it is not a question for experts to make it clear that adding impurities to a stream, whether it is impure or not, does not add to it. I cannot believe that. It may be true that afterwards the chemical action may take place by which the added impurity results in improving the impure stream, but to tell me that adding impurity to an impure stream does not make it more impure, it is impossible; I cannot believe it. That is all.

Carlos B. Cochran sworn for defendant.

Direct examination, by Mr. Bartlett.

Q. Where do you reside?

A. West Chester, Pennsylvania.

Q. What position do you occupy at the present time?

A. I am teacher of chemistry in the State Normal School at West Chester, and chemist to the State Dairy and Food Department.

Q. Of what State?

10

A. Pennsylvania.

Q. How long have you been chemist of the State Food and Dairy Department?

A. I have been chemist of the State Department of Agriculture since 1884. In 1884 they organized the Bureau of Agriculture, with a Dairy and Food Department. In 1895, and since that time, I have been connected with that department.

Q. Does your work have any connection with the examination of water chemically?

20

A. Yes; I have done a great deal of water analysis, but it has chiefly been for individuals; not so largely in connection with my State work, but for outside parties mostly.

Q. What places have you examined?

A. I have examined waters from Altoona, Downingtown, Coatesville, Swarthmore College, Ridgeley—

Mr. Duffield—To save time I will admit that the expert is qualified.

Q. Did you examine water brought to you from the Vineland sewage beds?

30

A. I did.

Q. What date did you make that examination?

A. The sample was received by me one week ago, I think. I have the date here; if you want it I will get it.

Q. One week ago?

A. One week ago yesterday.

Q. Was the sample from the effluent of the sewer beds?

A. It was.

Q. How did you get the sample?

A. The sample was sent to me by a messenger from Mr. Newcomb.

Mr. Duffield—It seems to me we ought to have some proof as to where this sample was taken from.

Mr. Bartlett—I will have to recall Mr. Newcomb.

The Vice-Chancellor—Is the sample here?

10 Mr. Bartlett—No, it was an additional sample. I will have to bring Mr. Newcomb back.

Mr. Duffield—I don't know that that is necessary, if you can identify it. I don't want to urge my objection now; but, on the other hand, I don't want to waive my right to object. If I can be satisfied that this sample was fairly taken, I don't care for any sworn evidence. It seems to me that the mere production of the sample which this witness analyzed is not sufficient.

20 The Vice-Chancellor—There is no question about that.

Mr. Duffield—I will consent to this extent, that counsel may now proceed with the examination of this witness in regard to the analysis of the sample taken, reserving to myself the right, however, to demand the production of the person who delivered the sample to him, and to cross-examine upon the method in which the sample was taken—possibly it won't be necessary.

30 The Vice-Chancellor—Under those conditions the examination may proceed.

Q. What does your chemical analysis show?

A. The figures of my chemical analysis agree very closely with the figures given by Professor Fitz-Randolph yesterday, as I understood them from his report on the effluent.

Q. (By the Vice-Chancellor.) Were your samples in any way identified to you as the same which Professor Randolph examined?

A. They were not, they were totally different samples. The only way in which they agreed, they were sewer effluents, and I understood that he said he analyzed the sewer effluent, and I am led to believe that I analyzed the sewer effluent, and the two seem to agree in general results.

Q. What was your result?

A. I found in chlorine 32.2 parts, nitrogen as nitrites were not quantitatively determined, but were very abundant. Nitrogen as nitrates were 0.5 parts per million. 10

Q. What is the difference between nitrogen in the form of nitrates and nitrogen in the form of nitrites?

A. Nitrogen as nitrates is nitrogen combined with a certain number of atoms of oxygen, nitrogen as nitrites is nitrogen combined with a great number of atoms of oxygen.

Q. (Further direct.) Proceed.

A. Nitrogen as ammonia was 18.9 parts per million. This is higher than was obtained by Professor Randolph. My nitrogen by permanganese or albuminoid is 0.224. The total solids were 151 parts per million. The oxygen absorbed, or the required oxygen is 7.6 parts per million. The total unoxide nitrogen was 19.8 parts per million. 20

Q. Did you make an examination of samples of water taken above the Vineland sewer bed, from Tarkiln creek?

A. No, sir.

Q. It was an examination of below, your water was taken below? 30

A. I did receive a sample from below.

Q. How far below was that?

Mr. Duffield—Our same agreement holds as to this sample.

The Vice-Chancellor—I understand it holds good as to the total examination of this gentleman, subject to the identification of the samples.

A. I believe this was taken at a point near where Tarkiln creek joins with Parvin run.

Q. Would you consider that a safe effluent from your analysis of the effluent from the beds at Vineland?

A. Chemically speaking, yes.

Q. That is all.

Cross-examination, by Mr. Duffield:

Q. Is any effluent a safe effluent bacteriologically speaking?

10 *A.* I don't think I have qualified at all in this case as a bacteriologist.

Q. In your experience in water supply methods, do you consider it safe to have effluents directly running from sewage beds into water?

A. Such is very commonly, very frequently practiced, and it seems to be a question of degree of dilution.

Q. (By the Vice-Chancellor) Do you know of any effluents from sewage beds, whether filtered or not, which has been contrived to empty into a public water
20 supply?

A. Directly?

Q. Yes.

A. Or just above the intake?

Q. Yes.

A. I do not.

Q. (Further cross) Did this sample which you examined have any odor?

A. I don't know, and I will tell you why; I have been suffering severely from a cold during the past week to
30 such an extent that a smell would be impossible, therefore I can't say.

Q. You heard Dr. Randolph's testimony yesterday?

A. I did.

Q. Were the tests which he made recognized chemical tests for the purpose of determining the chemical constituents of water?

A. Yes, they were practically the same as mine, except in the determination of the ammonia, which I made in a different manner.

Q. That is all.

Henry Cramer, sworn for defendant.

Direct examination, by Mr. Bartlett:

Q. Where do you reside?

A. Philadelphia.

Q. What is your occupation?

A. I am a teacher.

Q. In what college do you teach?

A. The Philadelphia College of Pharmacy.

Q. How long have you been connected with that college?

A. About eight years.

Q. What are you professor of at that college?

A. Professor of Botany, pharmacology, and director of the microscopical laboratory.

Q. Have you studied chemistry?

A. Yes, I have a Bachelor degree in chemistry; I am a graduate of Columbia University in New York City.

The Vice-Chancellor—Do you challenge him?

Mr. Duffield—Not as a chemist; I don't know about his qualifications as a bacteriologist.

Q. Are you a bacteriologist?

A. The study of bacteriology is simply a province of botany, and I teach it.

Mr. Bartlett—Is that satisfactory?

Mr. Duffield—Yes.

Q. When did you visit Vineland?

A. In the latter part of May of last year.

Q. Did you make any examination of the effluent?

A. No.

Q. At that time?

A. No.

Q. Have you been in Vineland within the past month?

A. I have.

Q. What did you do at this time?

A. It was on January 10th and January 17th; I procured samples of raw sewage, sewage after it was in the settling beds, and from the effluent, and examined water above the effluent and in Tar Kiln creek and

various other places, Parvin Branch, Maurice river, and so on.

Q. How many visits did you make?

A. I made two visits.

Q. You examined the effluent from the sewage bed on the first visit?

A. Yes, sir.

Q. That is the sewage beds?

10 *A.* Yes, sir; the raw sewage.

Q. What did your examination of the raw sewage show?

A. I made a bacteriological examination, and that showed, using Hayden agar 380—that is approximately on three plates—380 thousand organisms to the cubic centimeter.

Q. (By Mr. Duffield) Was this raw sewage?

A. Yes; 380,000 total organisms to the cubic centimeter, and practically 18,000 coli to the cubic centimeter.

20 *Q.* (Further direct) Then did you examine the effluent from the settling beds?

A. I did.

Q. What did that show?

The Vice-Chancellor—That is before it reached the stream?

A. Yes, sir; we took it before it came into the settling beds, as it came in, and this figure is after it goes from the settling beds to the filter, this figure which I am going to give. There were 126,000 total organisms and

30 1066 coli.

Q. Then did you examine the effluent from the filter beds?

A. I did.

Q. What did that show?

A. 1473 total organisms and approximately $2\frac{4}{7}$ coli. That is making a certain number of plates and dividing them. That is, I made in that connection seven plates.

Q. (By Mr. Duffield) This was on the visit of January 10th, 1906?

A. Yes, sir; I might say that I examined other samples of water on the 17th, but I also examined the exit from pipes 1, 2, 3 and 4, which were different in that the total organisms were there and there were no coli.

Q. Where was the sample taken that you got the 2.4/7 coli?

A. It was taken from the effluent at the upper part of the stream; I have forgotten just now. 10

Q. (By the Vice-Chancellor) From that effluent which is furthest up the stream?

A. Yes; I don't think it is a matter of great moment, if you will pardon me to say that, because I think you are as desirable of getting information as we are.

Q. (Further direct) What purification is obtained from the settling or septic beds?

A. In the raw sewage you have 380,000 organisms, and 126,000 in the effluent, which would mean a purification of $66\frac{2}{3}$ per cent. of total organisms. 20

Q. That is, in the settling beds?

A. Yes, sir.

Q. (By the Vice-Chancellor) That is, the effluent from the settling beds?

A. No; $66\frac{2}{3}$ per cent. purification of total organisms in the effluent from the settling beds, and I would say 91 per cent. of the coli.

Q. (Further direct) What is the percentage in the filtration bed?

A. While it might seem strange, having 380,000 to 30 begin with, and considering that this effluent, making an average of all three of my examinations of 2,000, when that is computed it is found to be $99\frac{1}{3}$ per cent. purification of total organisms which is obtained in that effluent as it enters Tar Kiln creek.

Q. How much purification of coli?

A. It would be practically, allowing that these were coli, it would be 99.99 per cent.

Q. How do you carry on your tests?

A. The test which I employed was to take one cubic centimeter of the effluent, and in the case of the effluent entering into the stream, of the effluent of the sewage beds, 1/100, and raw sewage bouillon, one part in 1,000. The cubic centimeter was placed in a Petri dish, and about ten C. C. of litmus lactose agar was added to the plate; and in the case of those colonies which were red they were isolated and placed in bouillon, in a bouillon tube, and incubated for 24 hours, and 1 C. C. then
 10 of the bouillon was placed in a fermentation tube containing neutral red lactose bouillon, and in addition to that we took 50 C. C. of the water, added ten C. C. of bouillon, half a C. C. of Pariette solution, and they were allowed to incubate for 24 hours, after which one C. C. was taken and added to fermentation tubes containing neutral red lactose in bouillon.

The Vice-Chancellor—Gentlemen, do you expect to challenge the method in which he made the test?

20 Mr. Duffield—No; we don't challenge it.

Mr. Bartlett—I desire to go into it a little further.

Q. What further did you do?

A. The matter then was to determine whether there was a change in the coloring of the neutral red, whether there was gas produced, and a test was made then of that gas, and if we got no reaction we concluded there was no coli present. That is, that even colonies in all probability did not show coli, although as a matter of
 30 fact, those red colonies, although they were not strictly coli, were considered coli.

Q. Those plates were not made on that day?

A. Yes; I had the plates there. I have here some plates which were made which show the method. That is one cubic centimeter.

The Vice-Chancellor took the covering off of one of the plates.

A. That is spoiled now; it spoils as soon as the lid is taken off.

The Vice-Chancellor—Then you will have to pass it by; it was my fault.

Q. What plates have you there of the tests of January 10th?

A. Here are two plates.

Q. Those plates are called what?

Mr. Duffield—I understand in the test of January 10th, coli was discovered?

A. Yes.

Mr. Duffield—I don't care how he made it, if he 10 discovered coli.

Mr. Bartlett—In the beds he discovered them.

A. And in the effluent.

Mr. Duffield—What is the use of going into how he did it?

Q. One question more; what would be the coli shown on those plates if coli was present?

A. If coli was present there would be a reddening produced. That might be considered as coli, but subsequent tests would show that it was not. As a matter of 20 fact, subsequent tests would show that it was not coli. They are characterized by one fact that they retain their red colors for weeks or months, whereas the coli organisms soon lose that red color.

Q. You made a confirmatory test of that and found no coli?

A. No, but I reckoned it as coli, and usually in my work, when I have found red colonies of that kind, and found them in great abundance, I was inclined to believe that they were coli, but, strictly speaking, they are 30 not, but they usually accompany sewage, and I believe that the water should not have a large number of coli like organisms present.

Q. You confirmed those agar plate tests?

A. Yes, sir.

Q. You found that these were not coli?

A. No.

Q. Then there is no coli there in those tests?

A. As I say—

Q. (By Mr. Duffield.) You can't tell what is on those plates until you have made your tests?

A. I have isolated some of those colonies and made tests of them.

Q. You say they are similar to the colonies which are left on the plates?

A. Yes, sir.

Q. (Further direct.) But in making your confirmation test, it showed that they were not coli, didn't it?

A. That is right.

Q. Are those the usual tests which are employed in public health laboratories?

A. They are very largely employed.

Q. Where are they used?

A. Dr. Roben, of the Wilmington water supply, employs them; they are employed at the Belmont water works, in Philadelphia. A number of authors refer to them in the American Public Health Association proceedings, and I might say that Prescott and Winslow, in their little manual, consider it is a very efficient test.

Q. Have you used this method in the examination of potable water?

A. I have; it is the usual test I employ in determining whether the water is fit to drink.

Q. Have you ever examined any water using this method that you condemned?

A. I have.

Q. On what data did you condemn the water?

30 *A.* On the number of coli which were present. That is, or what resembled coli which I found in the course of this work as shown by the red colonies on these plates.

Q. Is it the number of coli that make the danger?

A. Yes, the number of coli. That is, we usually conclude that if there are no coli, that is, if there are a few, it is hardly likely that there are any pathogenic organisms present. But the best indication that we have of sewage is the presence or absence of coli, or some or-

ganism resembling it; therefore, it is important to know the number. If you have only one or two, you know you have eliminated all typhoid or pathogenic organism.

Q. Have you ever known water purified by filtration, still to contain coli?

A. Yes, sir.

Q. Would that be considered good water?

A. Yes, sir.

Q. How many coli did it contain?

A. In the case I referred to, an analysis which showed 10 purification of coli by 96.16, or as calculated one-half of a coli per C. C. That was water which was considered good.

Q. Can you refer to any one of standing who would pronounce such water pure?

A. Yes, I have seen not long ago the report published by Dr. Darlington of the Board of Health of New York; he considers that a water which had a purification of the total organisms, say about a ninety-nine per cent. elimination of coli, to 99.6 as being as good water as could be 20 obtained.

Q. That is good potable water?

A. Yes.

Q. Now, to come back to the neutral red test, is it not true that negative results in a case of neutral red would undoubtedly mean the absence of the B-coli?

A. Yes, I think that is a very important thing. I want to emphasize that if I may.

Q. Yes.

A. If you don't get the neutral red test, you can rest 30 assured that there are no coli. That is almost axiomatic in water work.

Q. Is there any authority that agrees with you on that?

A. Yes, Hollis in a paper published in the American Public Health Association.

Mr. Duffield—I will admit that as a fact, if you desire.

Q. Is it a fact or not that the change in the color, neutral red, might be due to other organisms than B-Coli?

A. Yes.

Q. Will you give some of the other tests of B-coli; I guess you have already given all the other tests for B-coli?

A. Yes.

Q. Any other tests you have in mind?

10 A. It is usual, not necessary, to proceed much farther than what I have indicated.

Q. When you stated you found one coli to the C. C., or two and four-sevenths to the C. C. in the effluent, how did you then distinguish these colonies from this organism resembling B-coli which you just testified to?

A. I did make the attempt by an analysis of the gas, but found instead of the proportion of gas as you find it for B-coli, that there was evidence that they were coli, but as I said before, it is safer to err on this side than to
20 consider they were not coli. They were the same relative organism as coli.

Q. Then I understood you to say that the plant for the disposal of sewage in Vineland practically destroys 99.99 per cent. of the B-coli, and practically all of the pathogenic organisms?

A. Yes.

Q. Is this not an unusual purification of sewage?

A. It is.

Q. Or water?

30 A. Yes.

Q. Either way?

A. Yes.

Q. It is an unusual purification of either sewage or water?

A. Yes.

Q. What do you attribute that to?

A. It is due to the copper.

Q. Have you carried on tests to prove that copper will destroy typhoid in coli bacilli?

A. I have; rather extended tests were carried on in my laboratory for probably six or nine months last year to verify this. Indeed, we got some unusual results, by not simply the use of copper sulphate as indicated here, but by simply allowing a small quantity of copper, as one would obtain from a piece of foil like this (producing a copper foil) and placing it in and allowing it to remain in water—

Mr. Duffield—It does not seem to me that this is material. 10

The Vice-Chancellor—Mr. Bartlett says he wants to show that great care was exercised under his test.

Mr. Duffield—I don't think it is material.

The Vice-Chancellor—He says coli were eliminated by the use of copper; now he is illustrating the method by which copper at a very low solution may have this effect. I think it is proper.

A. The point I wish to bring out—I am not going to take time—but it is important in the course of our work 20 to determine how small a quantity of copper would be toxic in typhoid, and we simply place a piece of foil like this?

Q. Like what?

A. A piece of foil which is probably fifteen millimeters by eight or nine centimeters long, allowing it to remain in water for five minutes. There was sufficient copper dissolved to destroy as many as 600,000 typhoid organisms in that water in the course of four hours. I might say that we also applied this, using a piece of foil 30 of the same character as described, in drinking water. We found an elimination of anywhere from eighty-five to ninety-seven per cent. of the total organisms, always.

Q. Have you published anything along this line?

A. Yes, sir; I have published papers on this subject.

Q. They have been circulated throughout the country?

A. Yes; very widely circulated and republished.

Q. Have you ever seen it proposed to utilize copper in the treatment and sterilization of sewage?

A. Yes.

Q. Where have you seen that?

A. The most recent statement was what I saw in the Technology Quarterly, which I received Saturday, where it is proposed to purify certain effluents which are more or less turbid, and which do not receive a high per cent. of purification by use of copper sulphate. I mean
10 to say that it has been suggested there as one of the possible other tests which can be used, and by no less an authority than Winslow, of the Massachusetts Institute of Technology.

Q. Have you made tests of the effluent at Vineland to see whether it contained copper?

A. I have.

Q. Does it?

A. I have evaporated a gallon of the water and made careful tests.

20 Q. Of what water?

A. Of the water from the effluent of the sewer beds at Vineland, a gallon of it, I say, I have evaporated a gallon of it and found no trace of copper.

Q. You heard the testimony of Dr. Randolph yesterday?

A. Yes, sir.

Q. How do you account for the fact that he found more B-coli than you did in his examination?

A. Well, his methods were very different, and I am
30 not quite clear as to how those samples were taken, and as to the fact that he followed the method which is usually prescribed in the preliminary precautions to be observed in making water analysis or sewage analysis.

Q. What are those precautions?

A. In the first place, I presume his bottles were sterilized, but it was very easy for a small amount of dust touching the finger of the man who made the examination, which would influence those results, and especially the temperature has an influence.

Mr. Duffield—It seems to me that this question has come down to the matter of methods. In order to have this testimony of any value, if there is any doubt of the method in which the samples were taken, I suggest, before this witness gives his testimony as to the reason for the different results, that we should have Dr. Fitz Randolph called and have it clearly stated how these samples were taken.

Mr. Bartlett—I asked Dr. Fitz Randolph how he gathered the samples, or whether he iced them, 10 or what he did.

The Vice-Chancellor—I do not understand this witness to say definitely that the particular method which Dr. Randolph took or the way in which he preserved the samples was not proper.

Mr. Bartlett—I will ask him how he gathered his samples, how they were cared for and examined, and then you can compare the method with Dr. Randolph's method.

Q. How were your samples gathered and cared for? 20

A. I never make a water analysis unless I make an examination immediately, almost immediately on the spot. It is well recognized; indeed, the American Public Health Association requires that if a sample is made as late as four hours after collection, that it must be placed on ice. There are many factors which enter into the change in the number of organisms; that is, those things which require light and air under natural conditions tend to be either starved or agglutinate, run together. I use that word because it is very commonly 30 seen that way. For instance, in order to determine whether a patient has typhoid they produce a toxin and take a little of the blood, and place a number of the typhoid organisms under the microscope, when that blood and these organisms tend to run together. That is the test for typhoid organisms, and it is a very common thing in any water to see things of that kind. I have for years examined medicinal waters, and where

they are stoppered and where they are kept under those abnormal conditions—

Q. How soon did you make the examination after the samples were gathered?

A. Immediately, within the hour; of this effluent I dare say within 30 minutes.

Q. Is that a correct way of determining the number of organisms?

A. The manner of determining the number of organisms is usually carried out by using either gelatine plates or Heyden agar.

Q. Is there a difference as to the result of the examination, depending upon how long the samples are kept?

A. Yes, there is.

Q. What is the difference?

A. As I started to say, in some cases there is an increase of organisms of a certain class and a decrease in others, and the result is the longer you keep them you have more or less discordant result in the examination. That is, no two cubic centimeters are exactly alike as you take them from the running stream in the first place.

Q. What do you think of Dr. Fitz Randolph's conclusion that the effluent from the Vineland beds contained as many as 1,000 coli to the C. C., when your results show that there was not more than 2,000 total organisms to the C. C.

A. I can only say this, that I don't know of any one who would make or venture to make an examination of a water, and on two tests, as Dr. Fitz Randolph made of this dilution, say that that water contains a thousand coli per C. C. When Theobald Smith proposed that method, he supposed that one would take at least 10 tubes, and that they would use probably one one-hundredth of a C. C. I would say that I don't think it is a good way of deriving or arriving at a quantitative knowledge of a water or sewage.

Q. (By the Vice-Chancellor) Your tests were not taken from the effluent on the same day as were Dr. Fitz-Randolph's?

A. They were about the same time.

Q. I ask you whether they were taken on the same day?

A. No.

Q. They were not taken from the same effluent, were they?

A. Mine were taken from 1, 2, 3 and 4. I don't 10 think that would influence the result.

Q. Answer the question, were they taken from the same effluent?

A. I can't say positively, if you want specific statements, but I made examinations of 1, 2, 3 as a mixture and No. 4.

Q. What was the day on which you made the examination?

A. January 10th and 17th.

Q. (Further direct) This testimony that you have 20 given relates to those two examinations, January 10th and January 17th?

A. Yes, sir.

Q. Do you think he made enough tests in the manner in which he testified yesterday?

A. I don't think anyone would pronounce a water containing 1,000 coli to the C. C. on the few tests which he made. My criticism would be this, that a man who would use all those extraordinary tests for confirmation of the presence of coli, which are wholly unnecessary, 30 would have made what would have been even simpler, ten tube tests, or if I had been him, I would have made twenty-five tests before pronouncing such an opinion as this. That is taking the waters which I examined and which I condemned, I would not want to do it on a basis of that kind.

Q. You would not want to condemn a water on the basis of his examination?

A. I should not; I don't think it would be the part of wisdom. There are very few waters which might not show some coli even with a very large number of tests. But I don't want to go into that matter, it might lead us to something which is not germane to the question.

Q. Is it not customary in examinations of this kind to determine the total number of organisms as well as B-coli?

A. I never knew of a case where it was not done.

10 *Q.* Where is that method used?

A. Every place that I know anything about. As I just stated the Wilmington Water Company, they use that continually. At the Belmont Water Station they use this test all the time.

Q. Where is that?

A. At Philadelphia they use the gelatine test. At Wilmington, Robens uses the Heyden test.

Q. What number do they get there of organisms?

Objected to.

20 The Vice-Chancellor—That is asking as to a report which somebody else makes. The only value would be as a comparison of this water with some other, which is not the question in this case. I do not understand the statute to contemplate a question of degrees.

Q. It would have been more conclusive if Dr. Randolph had stated the number of organisms as well as the coli?

30 *A.* It certainly would, because water containing 2,000 total organisms and 1,000 coli is hardly likely in nature. That is taking my total count, and I think we would have gotten the same total count, because he would have had to use either Hayden agar or gelatine, and I don't think the result would have been as various as that.

Q. If he had used the same test as you, there would not have been such a discrepancy?

A. There would not have been.

Q. Then you would question the conclusiveness of Dr. Fitz Randolph's examination, would you?

A. I would, yes.

Q. Can you state briefly the grounds?

Mr. Duffield—I think we have been over that.

The Vice-Chancellor—No, I will permit it as long as he asks questions which contradict the observations and tests made by Dr. Fitz Randolph, or the opinion which Dr. Fitz Randolph based on those observations and tests.

Question admitted.

A. I would on the ground that sufficient number of 10 tests were not made, and he didn't make at the same time a count of the total number of organisms. I think that might be sufficient; I think they are very important.

Q. Can you state briefly, you have examined the Vineland sewer plant, what you think of its efficiency?

A. I think it is doing very good work.

Q. And taking all the facts into consideration, are you satisfied that the effluent passing from there is a safe effluent to discharge into potable water?

A. It certainly is. There are a large number of 20 potable waters that are not as good as that from a bacteriological point of view.

Q. And you are satisfied that it is free from any pathogenic organisms?

A. It must be; that is basing it on the fact that I got so few, in many cases none, in two cases none, when I went down there, and other cases simply on maybe three out of seven plates, a few of those red coli-like organisms, which are really not coli, but which are all grouped 30 as coli.

Q. Your test of the effluent of the Vineland sewer beds January 17th shows a greater degree of purification than you stated there of the potability of water by the gentleman from New York—what was the name?

A. It was Darlington's work.

Q. They show a greater degree of removal, and a greater degree of purification than he claimed for potable water?

A. Yes, that is right, and with copper treatment that is what you expect.

Q. If there is an epidemic at Vineland, would there be any reason to fear any danger from the discharge of that bed through the effluent pipe?

A. Not if these beds were being taken care of as they are at the present time, and as I have seen them on the three occasions that I have visited Vineland.

Q. You would consider that, then, a safe effluent to
10 pass into potable water?

A. Unquestionably.

Cross-examination, by Mr. Duffield:

Q. What is your definition of sewage?

A. That is rather a difficult thing to make.

Q. Do you agree with your colleague of the faculty of the Philadelphia College of Pharmacy that all matter containing coli is sewage?

A. I would not put it that way probably, I would say
20 this, if I may explain: We recognized it all through; that is, taking it as we ordinarily see it in our city homes, that there is about one part of solid matter to a thousand of fluids. Now, that would mean, taking that it is perfectly pure water, that you would have there an effluent of water which would have a one-thousandth part of solid matter to a million. Now, an effluent which contains one-thousandth part of solid matter per million, and which contains—

Q. I didn't intend to wander off into such an exten-
30 sive answer.

A. This is my definition of sewage.

The Vice-Chancellor—You are giving it from the chemist's point of view?

A. This is a very general definition.

The Vice-Chancellor—If you allow me, I would like to hear the explanation?

A. It is very difficult. The whole matter of water purification and sewage is all in an experimental stage.

In most places no attempt is made, and as we progress with this work, it is natural that we should make definitions and come to conclusions as to what constitutes sewage; but I was basing it on this—you would then have a thousandth part of solid matter in sewage, granting that the water as it passed through that sewage was perfectly pure water in the house. Now one-thousandth part solid matter per million would also show the total number of organisms, say anywhere from 250,000 to two or three million, and which also showed coli in large numbers, that is sewage. 10

Q. Now, doctor, taking a substance containing B-coli, admittedly so, and I understood Mr. Newcomb to tell us this morning that that was sewage—do you consider that is necessarily sewage?

A. Why, no.

Q. There are substances which contain B-coli which are not sewage?

A. Why, yes; you could take a sample or two of water— 20

Q. You consider that the only thing to observe in water contamination is the presence of B-coli in sewage?

A. Not entirely.

Q. Assuming that, for example, urine, which contains no B-coli, but is in sewage, was transmitted into a water supply, would that tend to pollute it?

A. Unquestionably.

Q. Unquestionably it would?

A. Of course, I think that is self-evident.

The Vice-Chancellor—It is not so self-evident, 30 but it took a long while to get the answer.

A. I hope I am understood; I think if you take water and put urine in it, it would be contaminated.

The Vice-Chancellor—And if you place the water in the urine, the result is the same.

A. Of course, you are not considering purification.

Q. No, the question is whether the addition of water to urine makes the water impure.

A. That is self-evident.

Q. Taking ordinary sewage as we understand it, assuming that you eliminate from that sewage all the B-coli present by any method you please, and you place the residue in a water supply, would it or not in your opinion tend to pollute or corrupt that water supply?

A. While you would eliminate the coli, you would eliminate the other harmful—

The Vice-Chancellor—No he didn't do any such
10 thing.

A. Assuming that you eliminate the coli—I don't know why you should start an assumption—

The Vice-Chancellor—If you say you can't answer, that is sufficient?

A. I will try, but, as I said before, you want as much information as we do.

Q. Previous question read as follows: Taking ordinary sewage as we understand it, assuming that you eliminate from that sewage all the B-coli present by
20 any method you please, and you place the residue in the water supply, would it not in your opinion tend to pollute or corrupt that water supply?

A. I think it would, if it were possible.

Q. (By the Vice-Chancellor) He has stated it as possible; you are not dealing with that.

A. I understand, but I think one wants to be very clear—

Q. I do not see the slightest difficulty in understanding your answer if you said yes or no, or say that you
30 can't answer.

A. I don't want to say I can't answer the question, if you start out with a certain assumption; of course if you simply assume things, whether they are true or not, why then I will answer to the best of my ability. And I think that is true, that that would still be a contamination of the water granting that the B-coli was removed.

Q. (Further cross) Assuming that B-coli are added, the sewage goes in direct, the sewage goes in direct

without any purification of the B-coli, there is no question that that water is contaminated?

A. No, there is not.

Q. Now, your purification reduces the number of B-coli present; the B-coli in themselves are not harmful?

A. There would be a difference of opinion about that.

Q. In general acceptance they are not?

A. No, of course not in general acceptance.

Q. So that a direct sewage is only harmful, as I understand it, because of the fact that there may be patho- **10**
genic organisms in it?

A. That is right.

Q. Eliminate your pathogenic organism, and it does not do any harm to put sewage in water, according to your view?

A. You mean that purified material from which you do eliminate the coli?

Q. No, we have sewage with coli just as it comes out of the pipe, but eliminating any pathogenic organisms; in your opinion would that substance tend to pollute **20**
your water supply?

A. I don't think I understand your question.

Q. I am assuming that you can, by bacteriological or other tests, determine the absence in sewage of pathogenic organisms; would such sewage, in your opinion, contaminate water if placed in it without purification?

A. Of course, you are assuming so many things which are improbable that I have never had such a question put to me.

Q. I can't help that.

A. They assume such unnatural things; I am a **30**
scientific man, and I can simply look at things as they are.

Q. (By the Vice-Chancellor) You have stated a number of theoretic conditions wholly irrespective of actual conditions. I am not a scientist, but I can perfectly well understand the question addressed to you, and I am surprised that, assuming the condition of facts to exist

which is stated by counsel, which entirely relieves you of the finding of any facts, you are unable to express an opinion on the question asked.

A. It is so difficult.

Q. There is not the slightest difficulty in expressing an opinion or saying that you can't answer. It may be the question is not capable of answering, and if you are willing to risk your reputation by saying you can't answer it, say so.

10 *Q.* (Further cross) Taking the raw sewage and eliminating therefrom any pathogenic organism, would that raw sewage, in your opinion, if added to water, tend to corrupt or pollute it?

A. It would not necessarily pollute it.

Q. How many different water supplies have you examined?

A. Not a great many.

Q. How many different places have you tested water supplies that are contaminated or into which sewage is
20 being discharged?

A. Most of my work has been done on water in Philadelphia.

Q. How many analyses of water have you made of water in the past year do you suppose?

A. You mean of distinct places or of distinct water analyses? I frequently make 50 at one place.

Q. How many distinct places have you analyzed the water from?

A. Within the past year myself, simply two places.

30 *Q.* Do you know of any place, doctor, in which there is a direct effluent from a sewage bed discharged into a water-supply which is recognized as safe by competent authorities?

A. No.

Q. You spoke of Doctor Darlington, is he a bacteriologist?

A. Yes.

Q. Recognized as such?

A. Yes, sir.

Q. Is he recognized as a chemist?

A. He is recognized as a bio-chemist.

Q. Your criticisms of Dr. Fitz Randolph's test were on the assumption that but two tests had been made by Dr. Randolph?

A. That is all he stated.

Q. Suppose you learned that eight tests had been made by the doctor, would that change your opinion?

A. Yes, with regard to quantitative tests. Yes, because his tests might be construed as simply recognizing an organism per C. C. 10

Q. I assume if you found that 8 tests had been made, you would be more apt to assume that the results obtained were correct?

A. That there might have been one organism per C. C. In other words, his results could have been translated as being one organism per C. C. as easily as to say there were 1,000.

Q. Are you familiar with the "report of the Committee of Standard Methods of Water Analysis" to the Laboratory Section of the American Public Health Association? 20

A. I don't know the book; I know of the work published in their proceedings.

Q. They are recognized as being standard authority?

A. Yes.

Q. Were you aware of the fact that Dr. Fitz Randolph was one of the contributors to that work?

A. That may be.

Q. (Question repeated.) 30

A. I was not.

Q. Would your opinion of Dr. Randolph be effected by that fact if you learned such was the case?

A. My opinion of everybody's work must come under my own censorship of his work, and what is being done in actual practice, in laboratories like those to which I refer.

Q. I understood you criticised Dr. Fitz Randolph because he made but two tests, and you stated this was particularly strange because he had carried his examination to more elaborate or greater extent than you considered necessary, is that right?

A. Yes, sir.

Q. Are you familiar with the work of "Elements of Water Bacteriology," by Professor Winslow?

A. I am.

10 *Q.* Is it not a fact that he says, on page 60: "The test for colon bacillus may, however, be made still more delicate by the preliminary enrichment of the sample by growth in a liquid medium for twenty-four hours at thirty-seven degrees Fahrenheit, this greatly increasing the proportion of these organisms present before plating."

A. If you will also turn to page 48 you may have something which will enlighten you.

Q. I ask you if that is a fact?

20 *A.* It was not necessary.

Q. Did you do it?

A. I did not.

Q. Dr. Fitz Randolph did it?

A. He did.

Q. Was that one of the more elaborate methods which you criticised?

A. It is not the method which is usually followed in determining the coli in water, but in determining whether—

30 *Q.* Do you say it is improper?

A. It is not usual, not the practical method.

Q. Do you say it is improper?

The Vice-Chancellor—You may say you cannot answer, but you cannot remodel the question.

A. It is not.

Q. Therefore, do you differ with the text as laid down by Professor Winslow?

A. Another part of that will explain it.

Q. I ask you whether you differ with that text as read from the book?

A. I differ with that part; another part of the book will explain my reasons for that, if that can be brought in, page 48, you will see why I differ from that.

Q. Are you acquainted with Dr. B. H. Stone, of the Vermont Board of Health?

A. I don't know him personally.

Q. Do you recognize him as an authority?

At this point the further hearing was adjourned until 10 January 31st, 1906, at 11 A. M.

CAMDEN, N. J., January 31st, 1906..

The hearing in this cause was continued, pursuant to adjournment.

Appearances as heretofore noted.

Henry Cramer, cross-examination continued, by Mr. Duffield:

20

Q. When we were going over this matter yesterday you referred to potable water; what is your definition of potable water?

The Vice-Chancellor—If you do not object, I would like to have him define what he understands to be potable water used for public supply.

Q. I will alter my question to that. What would you define a public supply of potable water used for domestic purposes?

A. In order to be complete on that I would have to 30 make a statement in regard to the amount of constituents of various kinds that would be allowable.

The Vice-Chancellor—Answer according to your conscience.

A. There are two factors which always enter into a potable water; one is bacteriological, and the other is chemical. In a bacteriological definition, it is usually restricted to a water which would not run more than

1,000 total organisms, although this may vary, and to an elimination of coli, practically, with one cubic centimeter, I would not say more than between one and five, on litmus lactose agar plates. In connection with that a chemical examination is necessary. The amount of total solids would vary, but usually would not be more than say five or six hundred parts to the million. The nitrogen, as free ammonia, would not be more than one-tenth of one per cent., or one part of a million. The
 10 albuminoid ammonia might be about the same as the free ammonia. Nitrites should be absent. The nitrates might be present to the extent of four, five or six per cent. The chlorine should be, say, anywhere between twenty and thirty parts, certainly not more. I think that is what I would consider to be a good potable water.

Q. Now, can't you tell us in non-technical terms just what you understand a potable water to be, a drinkable water?

A. A drinkable water, yes.

20 *Q.* A water for public water supply for domestic purposes, a potable supply of that character must be a drinkable supply?

A. Yes.

Q. You would not consider, for example, that if soap-suds were placed in a water supply that that was a potable supply for public purposes?

A. No.

Q. Even if it did not contain the bacteriological constituents you referred to?

30 *A.* That is right.

Q. You would not consider if any substance which so beclouded the water as to render it, not necessarily foul, but unpleasant to the eye, would not that destroy its potable qualities, as the term is commonly understood?

A. Yes, it would, if those factors are considered in potable water.

Q. Assuming that the water had an obnoxious odor,

would not that destroy its potable qualities for domestic purposes?

A. It would.

Q. I understood you to say that you had experimented to quite a large extent on the subject of the application of copper to sewage in order to purify it?

A. Not to sewage, my experiments have been largely with three kinds of water, using distilled water, using a water which had been filtered and sterilized, and then using water which we ordinarily consider as drinkable, 10 not filtering it and not sterilizing, and then using coli organisms and then studying the effect of the copper under those conditions.

Q. You have made experiments on the line of the effect of copper solution on bacteriological matter?

A. Yes, sir; strictly on coli, and to some extent on typhoid.

Q. You have specialized to some extent on those lines recently?

A. Yes, sir.

20

Q. You took up this Vineland work in the line of your experimental work in your laboratory, is not that so?

A. That is true, yes.

Q. I suppose your purpose was to demonstrate with practical results the theoretical results which you had reached by your experiments in laboratory work?

A. Not at all. I simply wanted to know; in fact I didn't enter into this thing; it is simply interesting for me to know what application there is in practice.

Q. Do you know of any authority that recommends 30 the treatment of sewage with this copper sulphate?

A. I only know in the last paper of Winslow's in the Technology Quarterly that he suggests it as possible.

Q. (By the Vice-Chancellor) Does the copper have to be presented into the water, in order to have this destructive effect on the bacteria; does it have to be presented to the water in soluble form, or will the mere presence of the metal have efficiency enough to destroy the bacteria?

A. That is it exactly, presumably the solution.

Q. Now, copper itself, if taken in sufficient quantity, is conceded to be unhealthful, is it not?

A. It is.

Q. What quantity of copper held in solution in water would rise to the dignity of being called unhealthful?

A. I can only say this: Very many experiments have been made on this question abroad, by people taking the copper in the form of pills, and reaching a quantity
10 which would be about five-tenths of a gram, that would be about seven and one-half grains, and no dangerous effects were noticed.

Q. What I want to get at from you, as a scientific man who has studied this subject, is, what is the distance in quantity between a sufficient supply of copper to destroy the bacterial germs which you have been referring to in your testimony, as one of the effects of the presence of copper, and the presence in the water, when used in a potable way for public supply to be unhealthful?

20 *A.* I can answer that in this way.

Q. What is sufficient to destroy one and when is it dangerous to the other?

A. Our experiments show that the copper foil such as I had here yesterday, that quantity placed in a pint of water, our experiments show would kill the typhoid and coli within four hours. In my family for a whole year all of the water which we drink, that is, myself, my wife, my child, and my servant, was practically
30 treated in this way, and during that year, most fortunately, we didn't call in a physician, and so we can conclude that our health was in no way impaired by that quantity of copper.

Q. What quantity of water did you put to the sheet which you produced, which was about as long as your finger?

A. I used a sheet about nine inches square to probably a receptacle, a stone filterer which probably contained half a gallon or six quarts of water.

Q. Constantly renewed as was necessary?

A. Yes. The beauty of this work was this, as long as the copper is under water, as long as there are not a great many solids in the water, the efficiency of the copper, that is it is not tarnished as in the coin, but retains its bright lustre and continues its efficiency.

Q. And renders sufficient of its body to accomplish the result of killing bacteria?

A. Yes, sir; the amount I would say which is in solution is so small, that unless large quantities are tested— 10
I refer to the experiments which were conducted by Nageli, I should conclude that probably there was one part of copper to one-thousand million parts of water.

Q. Sufficient to destroy the bacteria?

A. To destroy it. That is interesting because he showed the action on algæ, but later two other investigators, Israel and Klingman of Berlin, showed that in the same strength it would be toxic to destroy cholera and coli organisms.

Q. (Further cross.) Do you consider that copper in 20
the quantity that you have described would have any effect on sewage?

A. One thousandth part per million?

Q. Yes?

A. I doubt it; it might, but I doubt it.

Q. Do you know of any public water supply in which they have permitted a direct connection from sewage beds, applying to those sewage beds this copper treatment that you have described?

A. I don't know, direct.

30

Q. Have you heard of any?

A. I only know what Dr. Kellerman said.

Q. The gentleman who testified yesterday?

A. Yes, sir.

Q. You recall he limited his statement to water supply which had become contaminated by sewage being placed in it, as I recall the testimony, there was no direct sewage flow, simply a contamination of clear water in the stream?

A. No, I understand it was sewage which had been treated. The only difficulty there is that one must use very large quantities of copper.

Q. Would you recommend the establishment of a water supply, the placing of a sewage bed so close that the effluent therefrom could be deposited directly in the supply, even though the sewage beds were treated with copper solution?

A. I would have to know the position of the two. If
10 you mean, would I recommend the effluent water of a sewage bed to go directly into my water pitcher, I don't think I would, and have my food enter directly with that material.

Q. (By the Vice-Chancellor.) Why not?

A. Unless I could not get water any other way.

Q. Why would you not recommend it?

A. I don't think I would for reasons that anyone would not; here, for instance, was material coming in the nature of refuse from your neighbor's yard, and was
20 being purified even, and it was going directly into my water pitcher—

Q. (Further cross.) Then you would not care to drink of these various samples that have been produced?

A. I would not if I could get other water, it is true. I would not. That is, I would not do it regularly.

Q. Is it not a fact that this method of treatment with copper solution is largely in an experimental stage?

A. It is largely in an experimental stage.

Q. And it is a fact that so far as you have yet pro-
30 gressed with your experiment, you are still somewhat in doubt as to the exact methods which might finally be determined are proper for the treatment of these matters?

A. Not since the work which I have seen in Vineland.

Q. That has been demonstrated to you of the correctness of the theory which you had elucidated?

A. I want to modify that; I don't believe it would be possible to economically purify sewage as Dr. Keller-

man, for instance, testified, as to treating sewage directly with copper sulphate, but where you have septic action and filtration—

Q. Previous to that?

A. Yes, and with this modification I believe that eventually this will be required in the treatment of sewage, because you get rid by this means of the pathogenic organisms without any question, and I don't know of any plant which is in operation for the treatment of sewage where they do get an effluent which is properly 10 freed from coli.

Q. (By the Vice-Chancellor) You are speaking with reference to the Vineland plant itself?

A. I am carrying my thought just a step further in connection with whether I would recommend this treatment at Vineland, that under those conditions it is very desirable to use copper, and that by this process you get an elimination of bacteria, you have by the septic tank action, and the filtration, and this natural chemical purification also; so you practically have an effluent which, 20 so far as chemical constituents, the organisms which are injurious to health are practically reduced to a minimum, so you almost have a water which can be considered a good potable water. But it is merely a safe water; when I say I would not drink it, it is not because I consider it unsafe, but simply because I would not care to drink a water which I knew was somebody's urine, which, even though it had been purified; that is, if it were possible to construct an apparatus to show what you have is practically water, but if I knew it was somebody's water, I 30 would not want to drink it.

Q. You think your imagination would enter there?

A. Yes.

Q. (By the Vice-Chancellor) Do you think that is an element in a public water supply to be considered, the knowledge on the part of the public receiving a supply of water, that it was the recipient of the effluent from sewage waste; is not that an element to be considered?

A. It is an element.

Q. As to potability for the purpose of public supply?

A. It would be considered an element, but unfortunately all of the drinking water—you take the water in Philadelphia, practically represents the sewage all up the Schuylkill.

Q. But not concentrated and gathered together distinctly to the knowledge of the public as the effluent from a filtration of sewage, as I understand it. Do you
10 know of any sewage filtration beds which empty their fluid overflow into a stream supplying Philadelphia with water?

A. Practically the water which we get which is not filtered—

Q. No; what I call attention to is that consciousness of the public that the effluent into its water supply, even if absolutely chemically and bacteriologically pure is a sewage overflow. I want to know whether you don't consider that potability of water for the purpose of a
20 public use involves the consideration of the sense of disgust against such water on the part of the ordinary public. Is not that an element?

A. Yes, I think it is an element, and I may just go one step further and say if the people in Philadelphia didn't drink this sewage, they would get no water; that is the whole thing.

Q. No doubt about the actual fact?

A. Because above, the clouds above have the evaporated sewage, and if we knew that, when we are under
30 rain, we practically have that evaporated sewage, purified sewage—

Q. It arises from the dust of the city; you not only have it in evaporation, but the actual concrete article. When you come to consider the microscopic element you have a field which is very large.

Q. (Further cross.) I examined you somewhat on the criticism of Dr. Randolph's experiment; in order to be sure of that, I want you to tell me whether my recol-

lection is correct; you criticised these experiments, first, on the ground that he had not attained the total number of organisms, and second, that he hadn't made the requisite number of tests?

A. That is right.

Q. Was there any other criticism directed against Dr. Fitz Randolph's experiments?

A. The matter that the samples were not iced.

Q. Anything else?

A. There might be, but I think that is sufficient. 10

Q. That is all that I recollect that you testified to. Assuming that tests had been made in the way which would have been satisfactory to you, and in the method which you would have approved, of this effluent taken on the 20th day of January, which had disclosed the presence of B-coli in large quantities, what explanation would you give of the situation then?

A. I don't understand that question.

Q. Assuming that the coli discovered by Dr. Fitz Randolph had been obtained by methods which you 20 would have approved, what explanation could you offer for their presence there on the 20th day of January?

A. That is, if there was one to the C. C.

Q. If the fact was as Dr. Fitz Randolph testified—in other words, if you had obtained it by your method, what would have been your conclusion?

A. That some coli were passing through the filter beds.

Q. Is it not a fact that you were unwilling to accept Dr. Fitz Randolph's results, and therefore your purpose 30 was to discover some method of fault in his analysis?

A. Not by any means.

Q. I mean that possible in a less offensive way than I seem to have stated it. My thought was this: Assuming you yourself had reached these conclusions, would you not have, from your previous experiments reaching a certain conclusion, and finding the results on a specified day not to fit in with that conclusion, would you not have doubted your tests?

A. You mean to make that statement?

Q. (Question withdrawn.) I mean you had arrived by the 20th of January to a definite conclusion of the result of the treatment of sewage by copper sulphate?

A. I had one series of tests.

Q. You had arrived at a conclusion at that time?

A. With regard to the operation at Vineland, yes.

Q. Now, I say, assuming that you had taken samples from the effluent of the Vineland bed, which had produced results at variance with a conclusion which you
10 had reached, would you not have doubted the accuracy of your experiments rather than the conclusions which you had reached by previous experiments?

A. I certainly would.

Q. And, therefore, it is a fact, is it not, that when Dr. Fitz Randolph's examinations produced a result different from your conclusion, you at once assumed that his method of treatment must be at fault, is not that so?

A. No, for this reason; I have made so many ex-
20 aminations, only recently, and when I said I made one examination here recently, I was called to examine the water supply that a certain institution was receiving, I made twenty-five—I made tests of twenty-five different samples, this work covering three weeks, and my use of this test has shown that if you get one thousand coli to the C. C., you can get evidence in twenty-four hours by the method by which I proceeded; there is no question of it.

Q. You don't quite answer my question. It may be
30 my poor way of putting it, but I don't know, possibly I have gotten your views on that sufficiently. Assuming that there was any stoppage in the flow of this copper, so that the solution didn't continue flowing, either by freezing or in some other way; of course, it would be this pure sewage containing coli coming out of the effluent.

A. That is from the septic bed.

Q. No, from the effluent?

A. Yes.

The Vice-Chancellor—I understood it is the effluent into Tarkiln creek.

Mr. Duffield—That is what I mean.

A. Won't you repeat your question?

Q. Assuming that there is any stoppage in the copper sulphate caused by any reason whatever, the effluent passing into Tarkiln creek would then contain a large quantity of coli bacilli?

A. Yes.

10

Q. And might contain pathogenic organism?

A. Yes.

Q. The entire success of the treatment depends upon the continued flow of the copper sulphate?

A. Yes. I might say I visited Vineland the day when the boys were skating on this filter bed, when there was ice, but the effluent from the septic tank over the filter bed there was a continuous stream, and the copper was flowing into it, and the effluent was coming out of the filter bed into the creek.

20

Q. (By the Vice-Chancellor.) What is the nature of the copper solution, water?

A. Yes.

Q. What is it contained in?

A. In a barrel.

Q. Is a barrel exposed to the weather?

A. The barrel is exposed to the weather.

Q. Then is it not simply a matter of degree as to whether it still be frozen or not?

A. Mr. Newcomb has studied that matter, and I have 30 suggested various ways in which it might be—

Q. It is a question of cold?

A. It is, but it is not a matter that cannot be overcome.

Q. (Further cross.) That is the barrel, as I understand it? (Showing witness a photograph.)

A. It might be taken to be, but it is a barrel about that high.

Q. Do you recognize this picture which is here. I

show you *Exhibit C 6*, as indicating the barrel in question?

A. I think it is.

Q. I understand that solution can freeze if the weather is cold enough?

A. Why, yes; it will freeze if it is cold enough, but there is no question that there is no reason of its not being in solution. Even on that day the water was trickling out of the barrel, and with the provisions which
10 I have made, or suggestions which I have made to Mr. Newcomb, we could unquestionably make it so that there would always be a continuous flow.

Q. I assume if this filter bed freeze, that the diffusion of the copper will be less complete, will it not?

A. I don't believe so, because the copper is mixed through these pipes, and with a continuous flow of water, and so long as the water flows in there it must be diffused, and certainly when you take the result it shows a diffusion. There is practically less diffusion
20 when it is colder than when it is warmer, but the results show an elimination such as I have indicated.

Q. Assuming that there is placed in water otherwise potable, within your definition, water which contains an offensive odor, which has a cloudy substance, and which is drained from sewage deposited on filter beds, would that in your opinion either corrupt or impair, or tend to corrupt or impair the water in which it was placed?

A. If that effluent is just like we have here?

Q. I mean whether it would impair or tend to impair
30 the quality of the water in which it was placed?

A. It would not.

Q. (Question re-read as follows.) Assuming that there is placed in water otherwise potable, within your definition, water which contained an offensive odor, which has a cloudy substance, and which is drawn from sewage deposited on a filter bed, would that in your opinion either corrupt or impair or tend to corrupt or impair the water in which it was placed?

A. It might and might not, that is the answer.

Q. Would it not tend to impair it, it would have that tendency?

A. It might.

Q. Assuming that in this water was decomposed organic matter, that would tend to impair it, would it not?

A. It would, decidedly.

Re-direct.

Q. Taking that question right there, under the conditions we have at Vineland, there would be no tendency to corrupt or impair the water, would there? **10**

A. There would not, because the chemical examination shows that the effluent has no constituent which would tend to impair that water, and bacteriologically it is purer than the potable waters in most communities.

Q. (By the Vice-Chancellor.) You heard the testimony of the witnesses of both complainant and defendants, who appear to agree that the effluent carries an offensive odor, didn't you? **20**

A. Yes.

Q. And you took that into consideration with respect to the Vineland effluent, holding that the presence of the offensive odor does not tend to affect or impair its potability for public water supply?

A. That is right, because that is very soon eliminated. That is due to the harmless gases which are there, and I doubt very much if the water that was shown here, that was collected 200 yards below would show any of them. **30**

Q. The question was not addressed to you of water after it had flowed any distance; the question addresses itself whether with regard to the water of the effluent, as it leaves the pipe and its condition, unaffected, by any other change, considering the elements here admitted by both sides that it has an offensive odor as it issues from those pipes, do you say that the presence of that offensive odor in that water does not tend to corrupt and les-

sen its acceptance as a potable water supply; that water that flows out of the pipe, not what the mixture is afterwards.

A. That water as it is under those circumstances, the effluent from the pipe, it would tend to impair a water supply at that point.

Q. (Further direct) It was one of the coldest days this winter that you were at Vineland?

A. Yes, sir.

10 *Q.* What was the action of the barrel of copper that day?

A. It was a small amount of ice on the inside, but the copper solution was flowing from it.

Q. The copper solution can be regulated in such manner that there is no danger, can't it?

A. Yes.

Q. It is only a question of regulation, is it not?

A. Yes.

20 *Q.* Where does this copper mix with the water in the sewer beds; is it in the flowing stream, or does the water stand still?

A. As the water passes into the drain from the septic or settling beds, it is mixed in the pipes, or its passage to the filter bed.

Q. As the water flows from the septic beds to the filter beds?

A. Yes.

30 *Q.* Is the odor on the effluent pipes probably due to the growth in the pipe under the bed or in the effluent pipe?

A. It might be; it might be due to simply some of the methane and other gases which are here in the course of purification of that sewage, that is all where that is developed. I don't think anybody knows exactly. It is during the course of purification that gases of that kind are formed and developed in the settling bed, to begin with, to be carried on through. Some of them are eliminated.

Q. Are they at all harmful in any manner?

A. As they are dissolved in the water, no.

Q. Now to go back to the treatment of this sewage, how many parts of solid matter are there in sewage, roughly speaking?

A. There are about, that is calculated as we did before, per million, we would say about one-thousandth part, and in a sewage we usually have one part of solid to one-thousandths of water.

Q. How is it, then, if the sewage of Vineland practically consists of one-thousandth part of solid matter per million, that the effluent contains but one hundred and fifty parts of the solid?

A. The eighty-five per cent. is eliminated by the several processes under which the sewage is treated.

Q. That is as the sewage is treated on the bed?

A. As it is treated on the bed, it is decomposed most of that; that eighty-five per cent. would be represented in what goes off in the form of gases, harmless, like nitrogen, hydrogen, marsh gas and carbon di-oxide. 20

Q. Would you say that if there was soap suds in the sewer that it would be eliminated in this process of purification?

A. It certainly would, that is saying that the soap is a compound of an inorganic substance like sodium, and an organic matter like fats and so on, the sodium would pass through the effluent, but the other substances would be decomposed, so that you would get these gases, and they would be given off in the process or treatment.

Q. How much would you say the inorganic substance 30 in the effluent of Vineland was, about how much?

A. The total amount of inorganic material as we have calculated it, one hundred and fifty parts per million.

Q. That would show how much chemical purification?

A. That would show a chemical purification of eighty-five per cent.

Q. What is the eighty-five per cent. of the solid matter that is eliminated by this process?

A. It is chiefly the solids, which the organic matter, the faecal matter which is in that sewage, papers and things of that kind which are roughly calculated in that thousand part per million.

Q. How much nitrogeous matter would there be in the effluent?

A. There is about twelve parts per million.

Q. Then the amount of purification of organic matter at Vineland, as it passes from the beds to the effluent,
10 would be about how much, as compared with the raw sewage?

A. It would be probably ninety-five per cent., calculating the nitrogen as ammonia, of which it chiefly consists, and comparing that with the total amount of solids, which is organic.

Q. In what form is this ninety-five per cent. eliminated of organic matter?

A. This ninety-five per cent is chiefly eliminated in the form of these gases. This is eliminated in the form
20 of these gases chiefly in the action of the settling beds.

Q. Is there any way possible to purify sewage and not eliminate these gases?

A. Yes; in that case you get the putrifaction, or a nuisance to everybody—you will get a certain amount of gases, but they will be very offensive, and, of course, there is a slow decomposition which takes place, and it is likely, if you have certain inorganic substances there, as soda, you would have the production of a certain definite compound with soda, and so on.

30 *Q.* Then it is necessary to have some of these gases to show that purification is going on?

A. Yes.

Q. That is an indication?

A. That is an indication of the process of purification.

Q. And it is chiefly eliminated in organic matter in the way of gas, is it not?

A. Yes.

Q. Are there any analyses of the gases found in septic tanks?

A. Yes.

Q. Do you know of any?

A. Yes, in Rideal he says that the gases in septic tanks consist of hydrogen, nitrogen, marsh gas and carbon di-oxide.

Q. Now, I would ask you how the compound known as egg albumen is broken up—that is one of the substances found in sewage—is broken up.

Mr. Duffield—Are we not getting a little bit away from the case?

10

The Vice-Chancellor—We are, but I will allow him to show the process by which the final result was arrived at.

A. These substances Rideal gives in his book on sewage; he shows that when this is in contact with water that it breaks up into nitrogen, marsh gas, hydrogen and carbon di-oxide. In other words, his analysis of the breaking up of this organic compound is confirmed by an analysis of the gases which he has got in sewage.

20

Q. Some of these changes take place in the sewage before it reaches the disposal field?

A. Yes; it is not generally known, but it has been calculated that upon so much of an amount of solid matter as you have in the closet in a city home that probably not more than 10 per cent. of that will be found when you test that intake at the sewage disposal plant.

Q. In the process of purification of sewage, are those the only changes that take place?

30

A. No, there are others; in fact, you have the same change such as you have in the burning of wood, or any organic material; but the idea is to get complete combustion, and that complete combustion is what is known as nitrification, and in this process you have the confirmation in these nitrites and nitrates which we find.

Q. (By the Vice-Chancellor) That is what common people call rotting. Is not the same destruction of

organic life, resolving it into its original element, going on all the time?

A. It would be.

Q. The tree that falls down and decays is the same thing?

A. Yes, sir; the only thing is the scientific distinction between the two ways; one way it is putrefaction, where it is offensive or where it is not offensive, such as the making of fire.

10 *Q.* It is largely due to the question of rapidity?

A. For instance, you can burn wood so as to give lots of smoke, but you can also burn wood so as to give the products of combustion, carbon di-oxide and water and other gases.

Q. (Further direct) What do you say the general nature of sewage is, the changes in sewage and what are some of the compounds formed?

A. They are anærobic; that is, changed without the access of air, an ærobic, with the access of air, so that
20 you have the production of a large amount of gases which enter the air, discharge into the air, and a small amount which is held in solution.

Q. Then on what authoity would you say that nitrates and nitrites and ammonia compounds which exist in water are in themselves harmless?

A. Leffmann, in the American Journal of Pharmacy, of which I am editor; I am now publishing a paper by Dr. Leffmann, in which he discusses potable water from the point of view that it might be used in the making of
30 medicines, and he distinctly states that the nitrites, nitrates and ammonia which are present in water are in themselves harmless, but they merely indicate a previous condition of pollution.

Q. Why has so much stress been laid upon the amount present in this case of nitrites and ammonia and nitrate?

A. For a long while there was no better method of determining whether a water contained sewage or not, and the simple way was to take good potable water and

add a good amount of sewage, and a chemical analysis showed when there was a small amount of sewage, say one one-thousandth part contamination, that you would get a high amount of ammonia, nitrites and nitrates. But at the present time we have better tests than those for determining the character of a water, because a water might be passed upon as being a good water, and yet be a disease producing water.

Q. What would you say was the source of danger in the water?

A. These pathogenic organisms.

Q. The bacteria?

A. The bacteria, as well as if there is any decomposed organic matter, I think that would be undesirable, but it is chiefly the organic matter.

Q. In figuring now the pathogenic organism, is it the number that it is based on?

A. We cannot estimate the pathogenic organisms like typhoid in water, but the test as to whether there are any pathogenic organisms in the water is usually indicated 20 by the presence or absence of the coli bacilli, which is more resistant than the pathogenic bacteria, and which is usually an accompaniment of sewage, particularly when it contains animal excremental matter.

Q. Just briefly state from your knowledge of the sewage beds at Vineland what purification they get, what is their efficiency?

Mr. Duffield—Haven't we gone over that before?

The Vice-Chancellor—If it is mere repetition, I 30 cannot see any advantage. If counsel thinks he omitted anything I will let it go in.

Mr. Bartlett—I would just like him to summarize very briefly the result. I want to show the efficiency of the plant.

The Vice-Chancellor—I understood him to testify to that in chief, and he was cross-examined upon it. If you can say that you omitted to ex-

amine on any specific matter I will permit it, but merely to repeat is of no advantage.

Mr. Bartlett—I think that was possibly brought out clearly before.

Q. What were your figures on the reduction there, can you just state them in a word or two?

A. Do you mean earlier, with regard to the efficiency as to the organisms, or generally with regard to the chemical—

10 Q. Chemically and as to the efficiency?

A. The efficiency is practically an elimination of eighty-five per cent. of the solid matter; an elimination of organic matter of probably ninety-five per cent., an elimination of total organisms of ninety-nine and one-third per cent., and of coli 99.99, and so on.

Q. Then taking all these facts into consideration, would you consider that a safe effluent to pass into water which was furnished as a household supply?

A. It would be.

20 Q. Do you know of any analysis of sewage which would show, either chemically or bacteriologically a purification greater than that at Vineland?

A. I don't.

Q. What does Winslow say on the sterilization of sewage?

A. He discusses it in a recent paper to which I have just referred, and states that it is very likely that in the next few years it will be obligatory to make an effluent which is bacterially free, or certainly one which is free

30 from pathogenic organisms.

Q. Do you think we are accomplishing that at Vineland?

A. As far as I can see you are.

Q. I want to correct one statement, Mr. Duffield asked you yesterday, quoting from Prescott and Winslow, whether the statement there was a fact and you referred to page 48; what does page 48 show?

Mr. Duffield—I think he should read from the book.

Q. Reading from Winslow's "Elements of Water Bacteriology," page 48, the following:

"Thus it is clear that organisms growing at the body temperature and those fermenting lactose are not numerous in normal waters, the total count rarely exceeding fifty, with acid producers generally entirely absent. On the other hand, the numbers on the litmus lactose agar plate will be likely to run into hundreds with a good proportion of red colonies when polluted waters are examined. The methods is, therefore, one of the most useful at the disposal of the bacteriologist. It yields results within twenty-four hours, and the conclusions to be drawn from it are clear and definite."

What have you to say as to that, Professor?

A. That is a statement which I entirely agree with. I find it to give the very best result, not that I disagree with the previous statement; I didn't mean to say that, that the statement which was made by counsel for the complainant; may I say just one word?

Q. Yes.

A. The test which is used by Doctor Fitz-Randolph is one which is better used as an indication of a small amount of coli rather than in this quantitative way. That is, it is usually employed in using bouillion in that way to using Parietta solution with bouillion, as we have indicated in my method of examination.

Q. You would not consider then that Dr. Fitz-Randolph's examinations were complete, would you?

A. I think they show this; I think they show coli, but I would take exception to their showing that there was a thousand to the C. C. That would be the only point; I don't think it is a good quantitative test. I think they show coli; I don't think there is any question about that, because they are likely to be there.

Q. Would you want to condemn a water on Dr. Winslow's examination?

A. I certainly should not.

Q. In examining the samples of water of Vineland, how many different samples were examined by you; how many different waters?

A. Taking the surrounding country, probably twelve or thirteen.

Q. And the result of your examination at these different times shows an effluent that was satisfactory to you?

A. Shows a very satisfactory effluent.

Q. From your knowledge of the Vineland sewage
10 beds, is there any danger of Tarkiln creek being overflowed by raw sewage in case the beds become clogged?

A. No, there are three settling beds and eight filter beds, and I don't see how they could not take care of a matter of that kind.

Q. You consider then the Vineland sewage plant an efficient one in every way?

A. I certainly do.

Q. And the effluent a safe one to be discharged in Tarkiln creek?

20 *A.* Yes, a safe one.

Re-cross.

Q. I show you samples D, effluent from exit pipe No. 1, and samples D, effluent from exit pipe No. 3, produced yesterday, will you aggitate that to some extent and look through it. Look at effluent from pipe No. 1; now will you look at effluent from pipe No. 3; do you see particles of foreign substance in there?

A. Yes.

30 *A.* Are you able to tell us what those are?

A. They are probably Zoogloea of organisms.

Q. Now, won't you smell each of those; have not they each a decided odor?

A. They have a peculiar odor.

Q. What do you think the odor is produced from?

A. From the growth of the organisms which are in that effluent?

Q. Those are partially decomposed organic matters?

A. Those are organisms which have grown in there at the expense of the substances which are in the water; distilled water would show that same thing.

Q. I call your attention to sample T. C., purporting to be water taken from Tarkiln brook at the point where it enters Parvin branch; look at that; particles don't seem to be in that, to that extent at all?

A. No, they are not.

Q. Would you consider placing a water having the odor which is found in sample D from exit pipe No. 1 **10** and sample D from exit pipe No. 3 and containing the amount of organic matter which these seem to contain, into water similar to that found in sample T. C., would tend to corrupt or impair the quality of that water in T. C.?

A. That sample would as you have it there.

Q. In other words if you put same D into T. C. it would tend to corrupt and impair it?

A. Yes, sir; as you have it.

20

Re-direct.

Q. As it runs from the effluent pipe from the Vineland sewer beds into Tarkiln branch, would it tend to corrupt the water?

A. On a mere technicality—that effluent from the sewer bed is not the same as this water which you have here.

Q. (By Mr. Duffield.) Didn't you take those samples yourself?

A. Pardon me, but a water, a good, potable water **30** might show—

Q. Did you take that sample?

A. I didn't take this, no.

Q. Assuming you discovered these were taken on the same day, one from Tarkiln branch and the other an effluent from the sewer pipe, and have had substantially the same treatment since that time, would you say that pouring the sample of the effluent into the sample of

water would tend to corrupt or impair the quality of the water?

A. Samples on the same day—I have to consider what you mean by corrupt and impair water.

Q. You answered in regard to the question which I asked you, that it would tend to corrupt or impair it?

A. I think I did.

Q. And then you attempted to qualify it by the statement that it was a fair test, because the samples had been
 10 standing some length of time from the time they took them. I simply ask you whether or not, assuming that the samples were taken on the same day and received the same treatment, that your answer would still be that it would tend to corrupt or impair it?

A. I will say yes, but you have to consider two things, it would not tend to corrupt it, to make it an unsafe water. If you mean that it is not as good as the best
 20 potable water, or the best water, or what would be considered good drinking water, I will say that it would tend to corrupt in that sense.

Q. Would it not tend to impair the quality of the pure water, to place in it an effluent containing that organic matter?

A. To place it directly into that?

Q. Yes.

A. Yes.

Q. (Further direct.) I take it, you mean placing one sample bottle into the other sample bottle?

A. Yes.

30 *Q.* There is some difference where water is kept in bottles?

A. Yes.

Q. How would it be in passing from the effluent pipe directly into the stream; that could not be compared with mixing the water from one sample bottle to the other, where they had been kept a week?

A. That is why it is difficult to answer a question of this kind, because my own examination of this same

water shows there is no pollution in that water which you have there.

Q. Which water?

A. Sample T. C., your water taken from that same point.

Q. (By Mr. Duffield.) That water does not seem to have become impaired so far as quality goes since it was taken from Parvin's branch?

A. Yet it contains that same water.

Q. Answer the question, please?

10

A. I beg pardon, yes.

Q. It don't seem to have been impaired?

A. No, it is not.

Further direct.

Q. Waters kept as those are in samples T. C. and D. the composition changes, does it not?

A. The composition is apt to change in them.

Q. It would not be a test as to the water passing direct from the pipes into Tar Kiln Branch?

20

A. It would not, because there would be a further purification in that water, just as this water T. C. practically is that water simply further down the stream, that is all.

Edwin Leigh Newcomb recalled for the defendant.
Direct examination, by Mr. Bartlett.

Q. Did you secure some samples of the effluent of the Vineland sewage beds for C. B. Cochran?

A. Yes, sir.

30.

Q. What date did you secure them?

A. January 17th, 1906.

Q. You secured those for Mr. C. B. Cochran, the witness who has testified on the part of the defendant here in this case, did you?

A. Yes, sir.

Q. And you delivered them to him?

A. The samples were left to the college; he wrote me he would send a messenger for them.

Q. Did his messenger come and get them?

A. He must have got them, because he got the samples.

Mr. Duffield—I am willing to admit that the samples which *Mr. Cochran* examined were the samples actually taken from the beds. I meant to admit that yesterday; I am sorry if I occasioned the recalling of this witness, because I have no doubt that they were samples taken from the effluent, and I admit that they are.

Q. I show the witness a bottle marked sample E, and ask him what that contains.

Mr. Duffield—That seems to me immaterial.

A. The sample E is a sample of the raw sewage as it comes to the purification plant at Vineland.

Q. Out of the sewage pipe?

A. Right out of the pipe, just before it gets to the septic beds.

Q. (Witness is shown bottle sample F, and is asked)
20 What is that?

A. That is a sample of clear sewage which is ready for the copper sulphate and filtration treatment, not yet treated with copper, immediately after it leaves the septic bed.

Mr. Bartlett—I offer those two samples in evidence.

M. Duffield—I don't think they are material, but I won't object to them.

The Vice-Chancellor—I will admit them. I think
30 all of the processes antecedent to the effluent being discharged from the pipe into Tar Kiln creek, whether they are forceful to show much or little, are forceful to show something, and are, therefore, admissible.

Q. Then I ask you sample F, is that the fluid as it passes from the septic beds before it is treated by copper?

A. It is.

Q. And what other treatment is applied to that fluid beside the copper treatment?

A. Filtration.

Q. And then after that it goes where?

A. After it has been treated with sulphate of copper and filtered, it runs into the under-drain, and from the under-drain out to the effluent pipes.

Q. I want to show the amount of purification in the sewage before it is treated with copper or before it is filtered. What is the amount of copper used per day? 10

A. 25 pounds per day.

Q. That is all.

Cross-examination, by Mr. Duffield.

Q. Taxing this sample F produced, I understand that is the same as sample E, except that sample F has gone from your settling beds into your filtration beds?

A. No; sample F is collected right where it leaves the settling bed; has not yet got into the settling bed, right where it comes out. 20

Q. Then sample E is the sewage in its original condition?

A. Right.

Q. Sample F is sewage in the condition in which it runs out of the settling bed?

A. Yes.

Q. And sample D is the effluent which comes out of the pipe from the under-drain?

A. Right.

Q. The only change in sample F from sample D is the fact that sample D has been filtered and received the treatment of copper; am I right? 30

A. Sample D has been treated with copper and filtered.

Q. Otherwise it is the same substance as sample F?

A. Sample F is not.

Q. Sample D is the same substance as sample F, save so far as its constituents have been changed by filtration and treated with copper?

A. Sample D is the same, except with what effect we get by treatment with copper and filtration.

Q. Sample E is the same constituent as sample F, is it not, except so far as solid matters have been eliminated by what you call your septic process?

A. Except so far as the action is produced in a septic tank, they are the same.

Q. Sample D is the same substance as is found in sample E, except so far as sample D has been subjected, 10 first, to septic treatment in your settling bed, and subsequently to a filtration treatment and a copper treatment; is that so?

A. Sample D is the result of treating or submitting sample E to the septic beds where they get the septic action, and then submitting that effluent, which is sample F, to copper treatment and filtration.

Q. Now, professor, I understood you to say that in your judgment sample D, or the effluent which came from the exit pipe, was not sewage. There is no ques- 20 tion that sample E is sewage?

A. No question that sample E is sewage.

Q. There is no question that sample F is sewage?

A. No question.

Q. Then the change from sewage to non-sewage takes place between the time that sample F is converted into sample D; am I right?

A. Sample F is not the sewage that sample E—

Q. Won't you answer my question? My question is this: Sample F you admit to be sewage; sample D, you 30 say, is not sewage; therefore I say the change between sewage and non-sewage must take place in your process between the time that sample F is converted by it into sample D; is that so?

A. Sample F is sewage after it has had septic treatment.

Q. Is it in your opinion sewage or not?

A. It is not sewage to the same extent as sample E is.

Q. Is it sewage at all?

A. It is to a certain extent.

Q. Does it contain sewage?

A. It does.

Q. Does sample D contain sewage?

A. It does not.

Q. Then the sewage is eliminated between the time sample F is taken, before it reaches the condition found in sample D?

A. Part of it is.

Q. And part of it between the time that sample E is 10 taken?

A. Right.

Q. At what point in your procedure does this substance cease to be sewage and become a substance not sewage, if you can tell us?

A. At the time when the sewage organisms, the pathogenic sewage organisms have all been exterminated.

Q. Assuming that you were able to exterminate from sample E all the pathogenic sewer organisms to which 20 you have just referred, would the substance then remaining be, in your opinion, sewage or not sewage?

A. It would probably be considered as sewage.

Q. I ask you for your opinion?

A. It would not contain any pathogenic organisms.

The Vice-Chancellor—He didn't ask you that.

Q. I ask you if you would call that sewage if the pathogenic organisms were eliminated from sample E?

A. Yes.

Q. That is, the residue you would still call sewage 30 after you had eliminated the pathogenic organisms; would the residue be considered by you as sewage?

A. It would.

Q. Would you consider it so?

A. I would.

Q. Would you consider sample F as sewage if the pathogenic organisms were eliminated therefrom?

A. I don't think I would.

Q. I want to find out at just what stage in this process you consider that sewage ceases to be sewage, and becomes some other substance which you say is not sewage?

A. I think that would generally be considered as sewage at that point. That is, there is still a small amount of solid faecal matter in that sample F.

Q. Then would sample D be what is generally considered as sewage?

10 *A.* No, sir.

Q. That is all.

Mr. Bartlett—I want to offer in evidence the four photographs produced by the defendant, being of the sewage beds of Vineland and marked *Exhibit D 4, D 5, D 6 and D 7.*

Q. What was the date of the location of those sewage beds at Vineland?

A. The sewer beds I believe were located November, 1900, in the fall.

20 *Mr. Bartlett*—Then I want your Honor's ruling, the defense wants to show that the sewage beds were located under the direction and approval of the Sewage Commission, and their instructions were followed, which you rejected.

The Vice-Chancellor—Do you propose to offer or show any authority in the State Sewage Commission by their act of location to relieve you from the operation of the statute of 1899, page 73?

30 *Mr. Bartlett*—I might possibly want to show that.

The Vice-Chancellor—If you do I will allow you to offer it, if you propose to follow it out by showing the location by authority of the State Sewage Commission?

Mr. Bartlett—I want to show that it worked a change of that act, that we were relieved of the burden of that act.

The Vice-Chancellor—That the authorization by

the Sewage Commission of Vineland to the location of its filtration beds, justifies the overflow into Tar-kiln stream.

Mr. Bartlett—Yes, by that act on page 50.

The Vice-Chancellor—If you want to show compliance with any statutory condition which justifies your clients' action, I think you are entitled to prove it.

Mr. Duffield—Our position is that the act creating sewage commissions does not modify this act. 10
There is a clear cut issue between us on that point.

Mr. Bartlett—I refer to the laws of 1899, page 536, sections 6 and 7, and to the Act of 1890, page 113.

The Vice-Chancellor—I call Mr. Duffield's attention to section 7 of the Act of 1899, page 538, of the act entitled "An Act to prevent the pollution of the waters of this State by the establishment of a State Sewerage Commission, and authorizing the creation of sewerage districts and 20
district sewerage boards, and prescribing, defining and regulating the power and duties of such commissions and such boards." I think I ought to have that before me. Perhaps counsel can agree about it.

Mr. Duffield—I will agree that if the Secretary of the State Sewerage Commission were called as a witness he would testify that these beds were located at this particular place under the approval of the State Sewerage Commission; that they were built with the consent of the State Sewerage Com- 30
mission. If he were present I would object to that testimony and ask the ruling of the Court.

I am willing to admit further that if the secretary were called as a witness he would testify that at a meeting of the commission held June 25, 1900, plans were submitted for approval providing for a sewer system consisting of intermittent filtration beds for the borough of Vineland in Cumberland

county; and further at a meeting of the commission held on July 20th, 1900, the following resolution was passed: "*Resolved*, That the plans for a sewer system and the disposal of the sewage of the borough of Vineland, submitted to the commission be approved, subject to such conditions as this commission shall from time to time require."

I also object to this evidence.

10 The Vice-Chancellor—I will admit the testimony qualifiedly assented to by Mr. Duffield as above, and notwithstanding his objection to its pertinence as evidence in the cause.

Mr. Bartlett—I desire to offer all these samples, samples consisting of three samples D, three bottles labeled samples D, one labeled T. C., one labeled sample F, and one labeled sample E, which have been exhibited to the witness and identified and are now offered in evidence on the part of the defendant.

20 Admitted.
Defendant rests.

Dr. Raymond B. Fitz-Randolph, re-called in rebuttal on the part of the complainants.

Direct examination, by Mr. Duffield:

Q. You heard the testimony of the expert called by the defendant, in which some criticism has been made of your method of analyses or of tests for bacteria, have you not?

30 A. I have.

Q. Three criticisms were directed as to the method used by you for the detection of bacteria in the samples which you took of the effluent of the sewer beds, first that you didn't ice the samples taken by you; what have you to say in regard to that?

A. My object in examining those samples was simply to determine the presence or absence of coli bacilli. My experience has been and also the experience of others

that coli bacilli, unlike to other water organisms do not increase in water or sewage to any detectable extent within a few hours. Any change which occurs would be slight and would be in the nature of the diminution of the number of bacilli present rather than an increase. It is therefore unnecessary to keep samples at a low temperature when tests for bacilli coli are to be made within a few hours after the samples are collected. In fact sudden chilling of samples of water will usually result in a marked diminution in the number of bacteria present. 10

Q. Have you any authority for those statements, or are they based upon your own experience?

A. They are based upon my own experience and upon the experience of others, who have worked on this line. I don't now recall any printed statement to that effect, but there probably are some.

Q. The second criticism that I recall was that you had not tested this effluent for the total number of organisms that might be found therein; what have to say about that? 20

A. I did not so test the effluent.

Q. Why not?

A. My object in testing this effluent was to determine whether or not it was possible for pathogenic bacteria to be present in it. I was not interested in the total number of organisms present, which may be of importance in the periodical examinations of filter beds for the purpose of control, but which has no very direct bearing upon the actual dangerousness of sewage or water. 30

Q. Does the number of bacteria that may be present in a given quantity of water determine the safety or dangerousness of water with accuracy?

A. No; in a general way it is an indication—I am speaking now of water—it might or might not be an indication of such a substance as an effluent from a sewage filter bed.

Q. Doctor, the third criticism that I recall was that

the number of tests made by you—how many tests did you make, in fact?

A. On the sample taken when?

Q. On January 20th?

A. From the last pipe down the stream you mean?

Q. Yes?

A. Eight altogether.

Q. Did they all disclose the presence of coli?

A. They all did.

10 *Q.* What did that tend to show?

A. That tended to show, in the first place, that the coli bacilli was actually present in the effluent; that did show it; and, in the second place, it tended to show, as I testified before, that approximately the number of bacilli coli present was in the neighborhood of one in every one one-thousandth of a cubic centimeter.

Q. There was some suggestion made by the last witness as to the contradiction in the text-book to which you both referred; I forget the name?

20 *A.* Winslow and Prescott.

Q. Can you clear that matter up for us?

A. I would rather have the book before me, if I might.

Q. The pages were 48 and 60?

A. The book is called "The Elements of Water Bacteriology, by Prescott and Winslow." On page 60 the statement is made: "The test for colon bacillus may, however, be made still more delicate by a preliminary enrichment of the sample by growth in a liquid medium
30 for 24 hours at 37° centigrade."

Q. Did you follow that in your experiment?

A. Yes, that is part of the method which I use, and I agree with this statement.

Q. That is a more exact method?

A. It is a more delicate method. By that I mean a method based on that will frequently detect the presence of the coli bacilli when it would fail to show on the litmus lactose agar plate.

Q. Now, referring to the method referred to on page 48 of the writer, will you look at that?

A. I understand the statements in question are here, the last two sentences: "The method is, therefore, one of the most useful at the disposal of the bacteriologist. It yields results within 24 hours, and the conclusions to be drawn from it are definite and clear." Am I correct in that?

Q. I understand that is the point of criticism.

A. I would like to be sure of that so that I can answer it properly. 10

The Vice-Chancellor—That is the answer to the question Mr. Duffield asked you.

A. This statement is perfectly correct. In my opinion the litmus lactose argar plate is a very important method of procedure in certain kinds of bacteriological work. It yields results which, while they do not indicate with any great degree of precision the number of coli bacilli actually present, yet which, when the samples are taken from the same source, are more or less comparable with each other. The results are obtained at a small expenditure of time and labor, and in controlling the work in the examination of numerous samples at short intervals at the same plant, the results are of great value. They are of not so great a value in the comparison of samples from different sources. 20

Q. There has been some suggestion made here that possibly the different results which you obtained were due to carelessly taking samples; will you describe again—I think you did—the method in which you took the samples? 30

A. I didn't describe it in as great detail as I should have done.

Q. Do it, please.

A. The samples were collected in closed stopper bottles, which had been previously sterilized by myself at a temperature of 160° centigrade in a dry sterilizer for an hour and a half. As soon as the sterilizer was

cold enough to permit the bottles to be touched the stoppers were immediately closely covered with sterilized tin foil in order to protect the lips of the bottles from outside contamination. They were further immediately wrapped in paper and kept in that condition, with the exception of one momentary unwrapping for the purpose of fixing a label on the side of the bottle, until the samples were taken. The samples themselves were collected by loosening the tin foil around the neck
 10 of the bottle to such an extent that the stopper, together with the tin foil, could be removed together. The stopper and tin foil over it were held by me in one hand, and not permitted to come in contact with anything. The sample was collected by holding the bottle near the base in the other hand, allowing the effluent to run into it directly from the pipe until the bottle was about half full. The bottle was then inverted, shaken, and that portion of the effluent contained in it permitted to run out. This process was repeated twice. The bottle was
 20 then filled nearly to the neck, immediately the stopper and tin foil tightened around the neck, the bottle re-wrapped in its paper and so transported to the laboratory.

Q. Have you ever heard of any more careful method of taking samples than that employed by you in the taking of these samples?

A. I can see no valid criticism to that method.

Q. Doctor, we had a number of discussions here on various definitions; I would like to ask you if you won't
 30 define for us your idea of potable water?

A. That is a definition that is a little hard to make sufficiently exact and at the same time sufficiently comprehensive.

Q. Give it not so much from the technical standpoint as what is commonly understood by potable water?

The Vice-Chancellor—Won't you take in the qualification of the statute of 1899, page 73. I notice there are several there. It is not only potable

water, but the statute declares it to be to secure the purity of the public supplies of potable waters in this State.

Mr. Duffield—I will withdraw the last question.

The Vice-Chancellor—It contemplates water for public supplies.

Q. What would you say as to water which might be used for a public supply of water for domestic use in cities and towns? What would be the character of a water which would come within that phrase?

10

A. Such a water should not possess an objectionable odor, taste or appearance. It should not possess an amount of total solids which is so high that the water will have any effect upon the consumer; that is a question which need not be considered in this State, for there are no waters of that character within the State. It should be absolutely protected from the entrance of pathogenic bacteria of any description whatever.

Q. Do you consider that a substance containing an offensive odor and cloudy in character, containing some 20 decomposing animal matter, could be placed in a stream of water used for a public supply of water for domestic use without either corrupting or impairing or tending to corrupt and impair the quality of such water in which it was placed?

A. At the point where it was put in?

Q. Yes?

A. I do not.

Q. In your opinion, can the effluent from a sewer bed, after being treated with copper sulphate, be safely placed 30 in a water used for a public supply of water for domestic use?

A. That depends upon the character of the effluent; I have never seen such an effluent.

Q. Could it be done, in your opinion, without corrupting or impairing, or at least tending to corrupt or impair such water?

A. I believe, at least from a theoretic standpoint, that

it is possible in a work properly designed, properly built of suitable materials, properly managed, to so purify a sewage that the effluent from the beds will not corrupt or impair the public water supply; I have never seen such effluent. I think such effluent would be theoretically possible.

Q. But in practical experience you have never found one?

A. I have never come across one.

10 *Q.* Do you consider that a substance containing the quantity of bacilli that you found by your analysis, the effluent of these filter beds to contain, could be placed in a public supply of water which was intended for domestic use, without impairing the quality of that water?

A. I do not; I would regard such an effluent as potentially dangerous.

Q. You have inspected these sewer beds at Vineland a number of times?

A. I have twice.

20 *Q.* What have you to say in regard to the efficiency of those beds based on your experience?

The Vice-Chancellor—You mean the efficiency to do the work, or the efficiency of the management to conduct the work?

Q. No, the efficiency of the beds to do the work, and also the efficiency of the conduct, including both points?

A. My knowledge regarding the actual working of the beds would be drawn from the technical and bacteriological examinations which I have made, and they
30 are that the filter beds are not worked properly. The proper nitrification is not going on, and the effluent is consequently only about, very roughly speaking, half purified from a chemical standpoint. I have no doubt the per cent. of bacteriological purification is greater, but the nitrification is very unsatisfactory.

Q. In your opinion did the effluent which you analyzed contain sewage?

A. It is the product of sewage.

Q. (By the Vice-Chancellor) Does it not contain the actual sewage itself in the same component part, though not all?

A. Not in the same component parts, the sewage has been materially changed in its discharge through the plant.

Q. Take the particles of water which come in that sewage, would not the same particles pass out?

A. Yes; they would not be changed; some of the other constituents would be changed.

10

Q. (Further direct) You heard the testimony of Professor Newcomb, a witness called on behalf of the defendant, to the effect that samples taken by him on the 23d of January produced red colonies which he subsequently determined were not coli. Do you recall his testimony in that regard?

A. I recall testimony of that sort, but I think it was testimony by Professor Cramer.

Q. Don't you recall Professor Newcomb testifying to some experiments which he made which disclosed some 20 red colonies which caused him to suspect the presence of coli, and which, by subsequent examinations through some method producing gas, he came to the conclusion were not in fact coli; what have you to say in regard to the conclusion which he reached from his experiments; do you consider they were accurate?

A. If he detailed his experiments complete, I don't think he is justified in judging that the organism which produced red colonies is not coli simply because it produced gas, having an improper gas formula. That, I 30 understand, was substantially the nature of his testimony.

Q. I understood that Professor Cramer testified that in some of his analyses he had found bacilli of the character of B-coli which were not, in fact, B-coli?

A. I recollect that testimony.

Q. Do you know of any such bacilli?

A. There are bacilli; there are organisms which will

produce red colonies on the litmus lactose agar, but are not coli?

Q. Would it make any difference in the tests as far as the purity of water were concerned, whether these were coli or another living organism?

A. It would make some difference. The status of this allied organism is not so well defined as that of the bacilli coli. Their significance are not so well established. It is probable that they do indicate, as well as
10 the cold bacilli, that there is sewage pollution, but their indication is by no means certain. They are not in the same class as regards certainty as a coli bacilli.

Q. That is all.

Cross-examination, by Mr. Bartlett:

Q. You stated that the filtration beds of the Vineland sewer plant in your opinion were not working properly, didn't you?

A. I did.

20 *Q.* Did you make any analysis of the raw sewage as it comes down to the bed?

A. I did not.

Q. Did you make any analysis of the sewage in the settling bed?

A. No.

Q. Did you make analysis of samples taken after the copper was put there?

A. No.

Q. Or from the filtration bed?

30 *A.* No; I made analysis only of the material which was taken from the effluent pipes.

Q. You say coli don't increase within a few hours after a sample may be gathered?

A. That is my exxperience under the condition under which I took samples and transported them; I want to limit that statement to those conditions.

Q. Are you aware that in a paper delivered by Johnson at the proceedings of the New England Water

Works Association, December, 1905, pages 520 and 521, he showed that coli bacilli increase in one hour from 29,000 to 40,000?

A. I was not aware of that.

A. And that in one hour from 300,000 to 380,000?

A. No, I have not seen that paper, I am not familiar with anything that it contains.

Q. You read into your testimony a short statement from the elements of water bacteriology by Professor Winslow on page 60?

10

A. I did.

Q. Stopping at the temperature thirty-seven degrees, will you continue and read until I say stop?

A. Beginning where?

Q. Beginning, following the answer to your question, to read on page 60 of that work. You read a short statement, and commencing with the ending of your statement, will you read?

A. Where did I end?

Q. You ended "24 hours at 37°."

20

A. That is in the middle of a sentence. "thus greatly increasing the proportion of these organisms present before plating. As suggested in the classic researches of Theobald Smith (Smith, 1892) this method may be made approximately quantitative by the inoculation of a series of tubes with measured portions of the water. If, for example, of ten tubes inoculated each with one one-hundredth of a cubic centimeter, four show that B-coli, we may assume that some forty of those organisms were present to the cubic centimeter."

30

Q. Stop there. How many tubes did you use?

A. Eight altogether.

Q. In order to determine one-thousand coli in a C. C.?

A. In order to determine that approximate number of coli bacilli; yes, and they were made in four dilutions.

Q. But to determine that they were one-thousand, how many tubes?

A. I don't understand what you mean.

Q. How many tubes did you use of dilution, one in a thousand?

A. Two.

Q. And this says ten, does it not?

A. Let me see; I think it does; yes, ten tubes.

Q. Reading from Professor Winslow's Elements of Water Bacteriology, page 112, it reads at the bottom of the page as follows: "The full bacteriological analysis should then consist of three parts—the gelatin-plate
10 count, as an estimate of the amount of organic decomposition in process; the total count, the count of red colonies, on litmus lactose agar, as a measure of organisms which form acids and thrive at the body temperature; and the study of a series of Dextrose-broth tubes for the isolation of colon bacilli and streptococci"?

A. Yes.

Q. Do you approve of that?

A. I would hardly call that a full bacteriological analysis; there are other things which might profitably be
20 done under certain circumstances.

Q. Then yours will be an incomplete analysis, as you didn't do this?

A. It was incomplete with reference to this; it was perfectly satisfactory to determine the point I was anxious to determine.

Re-direct.

Q. What do you mean by a reference to this; what is the test in the book used for?

30 *A.* When I say in reference to this I am referring to this statement as to complete analysis.

Q. Was it your purpose to make a complete analysis or simply to detect the presence of coli?

A. Simply to determine the presence and the approximate number of bacilli coli.

Q. Why did you use two tubes instead of ten; what was the effect of that as far as the accuracy of your experiment went?

A. In my opinion the using of two tubes is sufficiently accurate, when the very variable nature of the material tested is taken into consideration. There is no necessity using a method which gives results of a much higher degree of accuracy than is necessary. I mean there is no necessity for using a method which gives results whose accuracy is in reality fictitious.

Q. Then your analysis was accurate from a qualitative standpoint, though it might have been more complete from a quantitative standpoint?

10

A. It was entirely accurate from a qualitative standpoint, and from a quantitative standpoint it was sufficiently accurate for the purpose for which it was used.

Q. Assuming that eight tubes that are tested all disclosed coli, does that disclose a large or small number?

A. That depends upon the amount used, the presence of the coli bacilli in two tubes, each of which was inoculated with one one-thousandths of a cubic centimeter, the liquid under examination certainly indicates, to put it in a very conservative fashion, that there were a considerable number of those organisms present.

20

Q. That is all.

Case closed.

Adjourned until March 28th, 1906, 11 A. M., for argument.

OPINION.

SYLLABUS.

30

1. The principle upon which subsequent legislation will operate to repeal prior legislation, without an express repealing clause, is that where there are two acts on the same subject effect will be given to both, if possible. If the two acts are repugnant in any of their provisions the later act operates to repeal the earlier to the extent of the repugnancy. Where two acts are not in express terms repugnant, if the later act covers the whole subject of the earlier act, and embraces new provisions, plainly showing that it was intended as a substitute for the earlier act, it will operate to repeal that act.

2. The provisions of Chapter 41 of the Laws of 1899 (*P. L. 1899, p. 73*), authorizing the State Board of Health to enjoin the pollution of potable waters, held to be repugnant to and repealed by Chapter 72 of the Laws of 1900 (*P. L. 1900, p. 113*), in cases where the alleged pollution occurs by reason of the operation of a municipal sewer plant constructed and operated under and pursuant to the directions of the State Sewerage Commission appointed under the latter act.

3. Semble, Chapter 41 of the Laws of 1899 (*P. L. 1899, p. 73*), is wholly repealed by Chapter 72 of the Laws of 1900 (*P. L. 1900, p. 113*).

- 10 Final hearing on bill, answer, replication and proofs.
THE ATTORNEY-GENERAL, for complainant.
HERBERT C. BARTLETT, for defendant.

LEAMING, V.-C.—The bill in this cause is filed by the Attorney-General at the relation of the State Board of Health under the provisions of chapter 41 of the laws of 1899 (*P. L. 1899, p. 73*) to restrain the borough of Vineland from discharging the effluent of the filtration beds of its municipal sewer system into the waters of Tarkiln Branch, a tributary of Maurice river.

- 20 It is contended upon the part of defendant that the provisions of the act referred to are repealed by subsequent legislation. As the jurisdiction of this court in this case is dependent upon the provisions of that act, which by its terms confers upon this court a special statutory jurisdiction in this class of cases (*The State, ex rel. Board of Health of New Jersey. vs. The Diamond Paper Mills, 18 Dick. 111; S. C. on appeal, 19 Dick. 793*), it is manifest that if subsequent legislation has operated to effect a repeal of the act in question the bill
- 30 in this cause must be dismissed.

The principle upon which subsequent legislation will operate to repeal prior legislation without an express repealing clause has been frequently considered by the courts of this State, and is well defined. Where there are two acts on the same subject, the rule is to give effect to both, if possible. If the two acts are repugnant in any of their provisions, the later act operates to repeal the earlier to the extent of the repugnancy. Where two

acts are not in express terms repugnant, if the later act covers the whole subject of the first, and embraces new provisions, plainly showing that it was intended as a substitute for the earlier act, it will operate as a repeal of that act. *McNeely vs. Woodruff*, 1 Gr. (Law) 352, 356; *Naylor vs. Field*, 5 Dutch. 287; *McGavisk vs. State Morris & Essex R. R. Co.*, 5 Vr. 509, 511; *Industrial School District vs. Whitehead*, 2 Beas. 290; *Ruckham vs. Ransom*, 6 Vr. 565; *Morris & Essex vs. Com'r of R. R. Taxation*, 8 Vr. 228, 230; *S. C.*, 9 Vr. 472; 10 *State vs. Chambersburg*, 8 Vr. 258, 447; *Landis vs. Landis*, 10 Vr. 274, 277; *State, North Ward Nat. Bk. vs. Newark*, 10 Vr. 380, 391; *Roche vs. Jersey City*, 11 Vr. 257, 259; *Mulligan vs. Cavanagh*, 17 Vr. 45, 49; *Bowyer vs. Camden*, 21 Vr. 87; *Haynes vs. Cape May*, 23 Vr. 181; *DeGinther vs. N. J. Home*, 29 Vr. 354, 357; *Anderson vs. Camden*, 29 Vr. 515, 521; *Camden vs. Varney*, 34 Vr. 325, 329; *Bracken vs. Smith*, 12 Stew. 169, 171; *Mersereau vs. Mersereau*, 6 Dick. 382, 385; *Hotel Registry Cor. vs. Stafford*, 41 Vr. 528, 537. 20

The act under which this proceeding is brought is entitled "An Act to secure the purity of public supplies of potable waters in this State," and was approved March 17th, 1899. The first section of this act forbids any sewage or other polluting matter, which will corrupt or impair or tend to corrupt or impair the quality of the water into which it is discharged, or which will render or tend to render such waters injurious to health, to be placed or discharged into any stream or tributary or branch thereof, from which is taken, or may be taken, 30 any public supply of water for domestic use in any municipality, above the point from which any such municipality shall or may obtain its supply of water for domestic use. A proviso exempts from the operation of the act any municipality which, at the date of the passage of the act, has a public sewer system, legally constructed under public authority, discharging its sewer into any such stream. A penalty of one hundred dollars

is provided for each violation of the provisions of the act, and each week's continuance, after notice by the State or local Board of Health to abate or remove, is made a separate offence. The second section of the act provides a summary proceeding for the recovery of the penalties in an action by either the State Board of Health or the local board. The third section gives to the State Board of Health the general supervision, with reference to their purity, of all rivers, brooks, streams, &c., the
 10 waters of which are or may be used as the source of public supplies for domestic use. The fourth section provides that instead of proceeding to recover the penalty named in the first section, the State Board of Health may, through the Attorney-General at its relation, file a bill in Chancery to enjoin the violation of the provisions of the first section of the act.

At the same session of the Legislature an act was passed entitled "An Act to prevent the pollution of the waters of this State by the establishment of a State
 20 Sewerage Commission, and authorizing the creation of sewerage districts and district sewerage boards, and prescribing, defining and regulating the powers and duties of such commission and such boards." *P. L.*, 1899, page 536). This act was approved March 24th, 1899. This latter act was amended in 1900 (*P. L.* 1900, page 113) by a re-enactment of the entire act with some minor changes and several important additions. The amendatory act defines the full scope of purpose of the Legislature, and any legislative intention to super-
 30 sede and annul the operation of the Act of March 17th, 1899, will be found in this amendatory act. This act retains the State Sewerage Commission created by and appointed under the Act of March 24th, 1899, and increases the salary of its members and removes the limitation upon the annual appropriation to cover the expenditures of the commission. It makes it the duty of the State Sewerage Commission to investigate the various methods of sewage disposal to enable it to make proper

recommendations and to investigate all complaints of pollution of waters which shall be brought to its notice, and if the commission find that any of the waters of the State are being polluted, to the injury of any inhabitants of this State, either in their health, comfort or property, it is made its duty to give notice to the person or municipality so polluting the waters to cease, within a time to be fixed by the commission, not exceeding five years, and to make, within the time fixed, such disposition of the sewage or other polluting matter as shall be ap- 10
proved by the commission, and any failure to obey such finding of the commission is made unlawful. Any person or municipality aggrieved by the finding of the commission is given an appeal to the Court of Chancery, which court is empowered by the act to affirm the finding of the commission or to reverse or modify such finding in whole or in part. The act makes it unlawful for any person or municipality to build any sewer or drain from which it is designed that any sewage or other harmful matter, solid or liquid, shall flow into any of the waters 20
waters of this State so as to pollute or render impure said waters, except under such conditions as shall be approved by the commission and makes it unlawful for any person or municipality to build or operate any plant for the treatment of sewage or other polluting substance, from which the effluent is to flow into any of the waters of this State, except under such conditions as shall be approved by the commission to whom any new plans must be submitted before building. The act further provides that the commission may apply to the Court of 30
Chancery for an injunction to prevent the violation of the provisions of the act, and it is made the duty of the Court of Chancery to restrain violations in such cases. The act also makes elaborate provisions for the formation of sewerage districts embracing two or more municipalities for the establishment of sewerage systems, which may include the scientific treatment of sewage and

sewage matters and the effluent thereof, the initiatory proceeding being a petition to the commission, followed by a public hearing and a final order of the commission creating the district and defining its boundaries. Such sewerage districts, after the election and organization of their officers, are made bodies corporate, with power to sue and be sued, purchase and condemn property and issue bonds and to construct and operate sewerage systems within the created districts, but at all times under the
10 supervision and control of the State Sewerage Commission. The waters of this State, as defined by the act, do not include the ocean or any waters separating this State from any other, unless such waters are used for potable purposes.

This summary of the provisions of the two acts is *deigned* to be complete enough to disclose their relative scope and purpose. It will be seen that the purpose of the later act, as stated in its title, is to prevent the pollution of the waters of this State by the establishment of a
20 State Sewage Commission, and authorizing the creation of sewerage districts and district sewerage boards. With the primary aim to prevent the pollution of the waters of this State the act appears to have adopted, or undertaken the adoption of a complete and self-sufficient scheme to the accomplishment of that end. In the proposed accomplishment of that end the provisions of the act seem to cover the entire scope and operation of the earlier act. A State Sewerage Commission is created with broad and comprehensive powers and duties, which
30 appear to be not only appropriate but ample to meet and eradicate all conditions which may occasion water pollution within the State. The earlier act is not operative against municipalities with sewer systems which existed at the date of the passage of the act; the later act includes not only a means for their correction, but also a complete means for the prevention of future contamination, existing evils being corrected through the means provided in section 5 of the act and new pollutions

being prevented by the provisions of sections 6, 7 and 8. The waters brought under the protection of the later act include all the waters within the contemplation of the earlier act and other waters as well, the earlier act being limited to potable waters. A special statutory jurisdiction is given to this court by the later act to prevent by injunction all violations of the act; this provision is essentially the same as a corresponding provision in the earlier act. The only feature I find in the earlier act which may be said to be in any sense broader than the 10 later act is that the former act forbids pollution (except as to municipalities with sewer systems already constructed) in any event and irrespective of whether or not injury is sustained; whereas the later act guards against pollutions by giving to the State Sewerage Commission supervision and control of the methods of construction and operation of all works, and permitting no works to be constructed or operated except under such conditions as shall be approved by the commission, thereby leaving the possibility that the commission may, 20 through error of judgment, permit the operation of imperfect works. This difference in the two acts would seem to be the basis of the present litigation, for by the proofs it appears that the works of defendant municipality were constructed and are being operated pursuant to the consent and approval of the State Sewerage Commission, and complainant's contention is that notwithstanding that fact potable waters are being polluted through the operation of these works. It appears manifest, however, that in the enactment of the amended 30 sewerage act now under consideration the Legislature intended to bestow upon the State Sewerage Commission the power and duty to fully supervise and control the entire subject of pollution of public waters occasioned by the discharge of sewage, drainage or other polluting matter into such waters and the power and duty to prevent such pollution; and this manifest legislative purpose clearly negatives any possible legislative

intent to preserve to the State Board of Health the right to enjoin the operation of works which have been constructed and are being operated pursuant to the consent and directions of the State Sewerage Commission. Any conception that the Legislature intended to preserve to the State Board of Health the powers contended for includes the assumption that the State Sewerage Commission would fail in the performance of the duties imposed upon it, and is not to be entertained. It necessarily follows that the provisions of the earlier act, in so far as they may seem to authorize the State Board of Health to maintain an action of the nature of the present one against a municipality operating a sewage disposal plant which has been constructed and is being operated pursuant to the consent and directions of the State Sewerage Commission, are repugnant to the provisions of the earlier act, and, in consequence, repealed to that extent at least. More than this, it is unnecessary for me to decide in this case, but I entertain the view that the legislative intent was to adopt an entirely new system for the protection of the public waters of the State and to substitute the provisions of the new act for those of the old originally designed for the same purpose, and that the later act operates to repeal the earlier act in its entirety.

The conclusion I have reached rendered a discussion of the testimony unnecessary. I may say, however, that the testimony (which was taken before my predecessor in office and transcribed for my use) does not lead me to the conclusion that the fact is satisfactorily established in this cause that the effluent of defendant's works corrupts or impairs or tends to corrupt or impair the waters into which it is discharged. The testimony touching this disputed fact is almost wholly that of chemists and bacteriologists. It appears to be accepted as a scientific fact that pathogenic organisms, like typhoid germs, cannot be estimated; but that the recognized method of ascertaining whether or not any pathogenic organisms

exist in water is to ascertain by certain recognized bacteriological tests the presence or absence of bacillus coli communis. If coli are found to exist in considerable numbers the conditions are believed to be conducive to the propagation of pathogenic organisms. The coli are, in themselves, harmless, and the number that may safely exist in water is not entirely certain; one thousand coli to the cubic centimeter is believed to disclose a dangerous condition of the water. The testimony in behalf of complainant is that of Dr. Raymond B. Fitz-Randolph, 10 a chemist and bacteriologist, who made chemical analyses of water taken from the effluent February 20th, 1905, April 24th, 1905, and November, 1905, and a chemical analysis and bacteriological examination of water taken from the effluent January 21st, 1906. This witness pronounces the effluent impure and claims to have discovered the presence of coli in a dangerous degree in the bacteriological examination made of the water taken January 21st, 1906. Four scientific experts who have made numerous examinations of the 20 effluent, some chemical and some bacteriological, testified in behalf of the defence in opposition to the testimony of Dr. Fitz-Randolph. Some of these witnesses have given a great amount of time to the examination of the effluent at various periods and to personal examinations of the operation of the works. These witnesses entertain the view that the waters flowing from the filtration beds are pure and do not contaminate or tend to contaminate the waters of Tarkiln branch into which they flow. In view of the testimony in behalf of de- 30 fendant I do not think that a conclusion could be justified to the effect that defendant is violating either the letter or spirit of the statute under which this cause is brought. It is admitted that the effluent has a disagreeable odor. This odor is explained to exist by reason of suspended but harmless gases which disappear when the effluent is discharged. The testimony also discloses that the filtration works of defendant municipality are con-

structed and operated under the most approved modern system, and a perusal of the testimony goes far to satisfy me that if the works in question fall short of accomplishing a degree of purification which will permit their operation under the terms of the earlier act there is little hope of any sewer filtration works being successfully operated if that act should be held to be still operative. I make this appended suggestion by reason of the fact that Section 12 of the Sewerage Commission Act of 1900 contemplates the operation of sewage disposal works for the scientific treatment of sewage matter and the effluent thereof. I will advise a decree dismissing
10 the bill, with costs.

FINAL DECREE.

This cause coming to be heard at the present term of the Court of Chancery, before Honorable Edmund B. Leaming, one of the Vice-Chancellors of this court, to whom said cause had heretofore been referred, to
20 hear the same for the Chancellor, and advise what order or decree should be made therein, in the presence of the Attorney-General, Robert H. McCarter, and the Assistant Attorney-General, Edward D. Duffield, of counsel with the complainant, and Herbert C. Bartlett, of counsel with the defendant, and the pleadings and proofs having been read, and the arguments of the respective counsel having been heard and considered, and it appearing to the Court that the complainants are not entitled to the relief sought and prayed for in their bill of com-
30 plaint against the defendant, the Borough of Vineland.

It is on this thirteenth day of November, A. D. nineteen hundred and six, by his Honor William J. Magie, Chancellor of the State of New Jersey, ordered, adjudged and decreed that complainant's bill be and the same is hereby dismissed with costs as to the defendant, the borough of Vineland.

And it is further ordered and decreed that the complainant pay to the said defendant the costs of this suit to be taxed.

W. J. MAGIE, C.

Respectfully advised:

E. B. LEAMING, V. C.

NOTICE OF APPEAL.

The State of New Jersey hereby appeals from the final 10
decree made by the Chancellor in the above-stated matter, on the fourteenth day of November, nineteen hundred and six, whereby the said Chancellor ordered and adjudged that the bill of complaint of the complainant in the above-entitled cause should be dismissed with costs to the Court of Errors and Appeals in the last resort in all causes.

Dated November 22d, 1906.

ROBERT H. McCARTER,
Attorney-General. 20

I conceive there is good cause for appeal in the above-stated cause.

ROBERT H. McCARTER,
*Attorney-General and
Counsel for the State of New Jersey.*

Due and legal service of the within notice is hereby acknowledged this thirtieth day of November, 1906.

HERBERT C. BARTLETT, 30
Sol'r of Defendant.

PETITION OF APPEAL.

*To the Honorable the Court of Errors and Appeals in
the last resort in all cases:*

The petition of the State of New Jersey, the appellant in the above-stated cause, respectfully shows that your petitioner is aggrieved by a final decree made in the Court of Chancery of New Jersey by his Honor William
10 J. Magie, Chancellor of the State of New Jersey, bearing date the fourteenth day of November, in the year of our Lord one thousand nine hundred and six, wherein the said the State of New Jersey, at the relation of the Board of Health of said State, was complainant, and the said the borough of Vineland was defendant, in this respect, to wit, that the said decree adjudges that the bill of complaint of the complainant in said cause should be dismissed with costs.

And your petitioner appeals from the whole and every
20 part of said decree upon the ground that the same is erroneous, for that said decree should have adjudged that the relief prayed for in said bill of complaint be granted.

Your petitioner therefore prays that the said decree of the said Chancellor may be in all things reversed, set aside and for nothing holden, and that your petitioner may have such relief in the premises as to this Honorable Court shall seem meet.

ROBERT H. McCARTER,
30 *Attorney-General, Solicitor for and
of Counsel with the State of New Jersey.*

Due and legal service of the within petition is hereby acknowledged this thirtieth day of November, 1906.

HERBERT C. BARTLETT,
Sol'r of Defendant.

ANSWER OF DEFENDANT AND APPELLEE.

The answer of the above-named defendant and appellee to the petition of appeal of the above-named complainant and appellant.

This appellee, not acknowledging all or any of the matters which in said petition of Appeal are contained to be true, for answer thereto, nevertheless, says and admits that a decree was, on the fourteenth day of November, nineteen hundred and six, made and entered in the Court of Chancery, in the cause for that purpose mentioned in the said petition, as is therein stated; but as to the substance and form thereof this appellee prays to refer thereto when the same shall be produced, and this appellee is advised and believes that the said decree is agreeable to equity, and it prays that the same may be affirmed with costs to be adjudged to this appellee.

HERBERT C. BARTLETT,

*Solicitor for and of Counsel with
Defendant and Appellee, the Borough of Vineland.*

