INTERNATIONAL JOINT COMMISSION

HEARINGS

OF THE

INTERNATIONAL JOINT COMMISSION

IN RE

REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS BETWEEN THE UNITED STATES AND CANADA

BEING PUBLIC HEARINGS HELD AT BUFFALO, N. Y., AND DETROIT, MICH., JUNE 21–27, 1916, AND OGDENSBURG, N. Y., AUGUST 25, 1916

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INTERNATIONAL JOINT COMMISSION.

CANADA.	UNITED STATES.
CHARLES A. MAGRATH, *Chairman.*	OBADIAH GARDNER, *Chairman.*
HENRY A. POWELL, K. C.	JAMES A. TAWNEY.
P. B. MIGNAULT, K. C.	R. B. GLENN.
LAWRENCE J. BURPEE, *Secretary.*	WHITEHEAD KLUTTZ, *Secretary.*

HEARINGS OF THE INTERNATIONAL JOINT COMMISSION IN RE REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

INTERNATIONAL JOINT COMMISSION,
Buffalo, N. Y., Wednesday, June 21, 1916.

The commission met at Buffalo, N. Y., Wednesday, June 21, 1916, at 10 o'clock a. m.

Mr. GARDNER. Gentlemen, you will kindly come to order. Perhaps it would not be amiss to say a word concerning the purpose of the International Joint Commission in meeting here at this time.

As you know, the United States and Great Britain entered into a treaty that was proclaimed in May, 1910, in which, among other things, they agreed that the boundary waters and waters flowing across the boundary should not be polluted to the injury of the health or property of the people on the other side. With the promulgation of that treaty the International Joint Commission came into existence. Its functions are dual; it has both judicial and investigative duties. In respect to this particular case the duties of the commission are purely investigative.

The question was referred to this commission to determine whether or not the boundary waters were being polluted in contravention of the treaty. The commission issued a progress report early in 1914, which set forth very clearly what had been ascertained, what had been demonstrated, up to that time. Subsequent to that, in following out the line of the second question of reference, the commission employed Prof. Earle B. Phelps, of the United States Public Health Service, to devise plans that might be applicable, especially to Buffalo and Detroit. Prof. Phelps has completed that work and his report has been submitted to you for your investigation.

The International Joint Commission has thought it wise to come here to Buffalo and hold these conferences with you for the purpose of determining whether or not we are in full accord with respect to the report made by Prof. Phelps, and, if not, in what way we differ and whether or not it will be possible to reconcile our differences, because the commission is anxious to work in harmony with you, as I apprehend you are with the commission.

NOTIFICATIONS OF THE SESSION.

By direction of the chairman the secretaries then read the notice of the meeting to be held at Buffalo, which was sent to interested municipalities and officials in the United States and Canada, together with copies of the report of the consulting sanitary engineer

of the commission, and also the list of the municipalities and officials to whom said notice and report were sent.

The notice and list are as follows:

NOTICE.

MAY 15, 1916.

DEAR SIR: I have the honor to inform you that the International Joint Commission of the United States and Canada will meet at Buffalo on the 21st day of June, beginning at 10 a. m., for the purpose of finally hearing those interested upon the question of remedies for the pollution of boundary waters. You are cordially invited to be present, together with your engineers, appropriate heads of municipal departments, and any others who may be interested.

I have sent you under separate cover several copies of the report of the commission's consulting sanitary engineer upon remedial measures and have also sent a copy to your clerk. I will be glad to supply additional copies if desired. Will you kindly acknowledge receipt of this letter and the copies of the report?

Through the courtesy of the city of Buffalo the hearing will be held in the Buffalo City Hall.

Very respectfully,

———— ————, *Secretary.*

MUNICIPALITIES AND OFFICIALS TO WHOM NOTICE WAS SENT.

The mayor, Buffalo, N. Y.
The mayor, Tonawanda, N. Y.
The mayor, North Tonawanda, N. Y.
The mayor, La Salle, N. Y.
The mayor, Niagara Falls, N. Y.
The mayor, Lackawanna, N. Y.
The mayor, Fort Erie, Ontario.
The mayor, Kenmore, N. Y.
The mayor, Trenton, N. J.
The mayor, Lewiston, N. Y.
The mayor, Youngstown, N. Y.
The Boards of Health of the States of New York, Ohio, and Michigan.
The Federal Board of Health.
The mayor, Bridgeburg, Ontario.
The mayor, Queenstown, Ontario.
The mayor, Niagara Falls, Ontario.
The mayor, Chippewa, Ontario.
The mayor, Niagara on the Lake, Ontario.
J. H. Jackson, Queen Victoria Park, Niagara, Ontario.
Owen McKay, Walkerville, Ontario.
William Simmons, clerk, Fort Erie, Ontario.
H. S. Phillips, Toronto, Ontario.
F. J. Anderson, city engineer, Niagara Falls.
W. C. Jepson, assistant engineer, Niagara Falls.
R. H. Field, Queenstown, Ontario.
J. S. Newman, civil engineer, Windsor, Ontario.
M. E. Brian, city engineer, Windsor, Ontario.
R. A. Land, clerk, Bridgeburg, Ontario.

(The chairman, specifically mentioning each municipality in the above list, called for the names of persons appearing in their behalf, as well the names of any others who desired to enter an appearance, and the following appearances were announced.)

APPEARANCES.

Prof. Earle B. Phelps, of the United States Public Health Service, Washington, D. C., consulting sanitary engineer to the commission.

F. C. Tolles, Mount Vernon, N. Y., assistant to Prof. Phelps.

W. J. Stewart, Ottawa, Canada, chief hydrographer of the Dominion of Canada.

F. A. Dallyn, Toronto, Canada, sanitary engineer, Provincial Board of Health of Ontario.

Dr. Edward Clark, of Buffalo, representing the Department of Health of the State of New York.

Dr. Francis E. Fronczak, health officer of the city of Buffalo.

Arthur Kreinheder, commissioner of public works and councilman of the city of Buffalo.

John F. Malone, commissioner of parks and public buildings and councilman of the city of Buffalo.

Charles B. Hill, commissioner of finance and councilman of the city of Buffalo.

Capt. George H. Norton, city engineer of Buffalo.

Carl L. Howell, assistant engineer in charge of sewers, department of public works, city of Buffalo.

George Clinton, of Buffalo, representing the Erie & Ontario Sanitary Canal Co.

F. C. Perkins, of Buffalo, N. Y.

R. L. Seelbach, of Buffalo, N. Y.

George R. Milks, secretary chamber of commerce, Lackawanna, N. Y.

O. E. Carr, city manager, Niagara Falls, N. Y.

William B. Bennett, city engineer, Niagara Falls, N. Y.

Secretary Kluttz read the following letter received from Mr. Theodore Horton, chief engineer, New York State Department of Health, under date of June 20, 1916:

NEW YORK STATE DEPARTMENT OF HEALTH,
Albany, June 20, 1916.

MR. WHITEHEAD KLUTTZ,
Secretary International Joint Commission,
Southern Building, Washington, D. C.,
City Hall, Buffalo, N. Y.

DEAR SIR: Commissioner Biggs wishes me to explain to you that owing to extreme pressure of duties in the department at this time it does not seem possible for him to have a representative of this department at the meeting of the International Joint Commission at Buffalo on June 21.

The commissioner wishes to assure you, however, of our continued interest in this subject, and to assure you also of our extended cooperation and assistance at any time so far as it is within our resources.

Very truly, yours,

THEODORE HORTON, *Chief Engineer.*

Mr. GARDNER. Mr. Clinton, do you appear in behalf of anyone other than yourself?

Mr. CLINTON. Mr. Chairman, I represent the Erie & Ontario Canal Co., which has a plan that will take care of all this sewage. That plan has been presented to this commission three times, and I, therefore, did not propose at this time to speak upon the subject. You have among your records a full exposition of the plan and what it is expected to do. I am here this morning rather as a listener. I expect subsequently to present our views to the council of the city of Buffalo, they having had no opportunity to investigate the questions. I have read your report, and I must say that it exhibits not only thorough research but also some——

Mr. TAWNEY. Mr. Clinton, will you allow me to interrupt you in order to ask a question? You have read the report of the consulting sanitary engineer of the commission, have you not? I refer to that

part of it at least which deals with the project in which you are interested as a means of sewage disposal.

Mr. CLINTON. Yes. In the press of business I have read it rather hastily and without making it a study.

Mr. TAWNEY. I wanted to ask if you took issue with the report of the consulting engineer with respect to the conclusions which he has reached regarding the drainage or diversion canal. Do you appear for the purpose of making any criticism of those conclusions?

Mr. CLINTON. No; not at this juncture. If the commission will permit me, I may subsequently submit a printed brief without taking the time here by either criticizing or attempting to modify in the minds of the commission the views of the experts. I think it would be a loss of time now and result in no good.

Mr. GARDNER. Mr. Kreinheder, I believe you were about to make a statement and were interrupted.

Mr. KREINHEDER. I was merely going to say that the city of Buffalo extends its greetings to this commission. Since your last meeting in this city Buffalo has taken on an entirely new cloak in that it is now governed under a new form of government, the commission form of government. All the powers for conducting the city's business are vested in five men. The propositions that this council has to deal with are many. One of them is the pollution of boundary waters, the subject that you gentlemen have under consideration at this time. The new administration since the issue of your report has not had time to go into it thoroughly in order to determine which of the six plans that you suggest is feasible. It may be that your commission can suggest which one of those plans is feasible. However, if that is left to the different cities it will be necessary, in order to satisfy our municipality and the taxpayers, to employ an engineer to go over your suggestion with respect to these different plans and determine which of them is the most feasible. After that determination is made there comes a question of providing the money, and that may possibly take considerable time, because without money these big projects can not be carried out.

Now, that in toto is our proposition to-day. The council is represented here and is very glad to extend to the commission every courtesy and at the same time do all we possibly can in order to bring out the points involved and see whether we can carry this matter to a proper solution. That is the attitude of the city of Buffalo, and we would like you gentlemen to so understand it.

Mr. CLINTON. May I be permitted to ask a question? The jurisdiction of this commission depends entirely upon the determination of the question as to whether the pollution of boundary waters affects the waters on both sides of the bounadry lines. If it does not, the commission of course has no jurisdiction, and it is not an international question. But I understand that the commission has heretofore determined that in the case of the Niagara River the discharge of sewage by the city of Buffalo does affect the international waters, and that therefore the question involved in this vicinity is an international question. Since the final determination of the location of the boundary line I think the prior attitude—if I may call it an attitude—assumed by the commission in that regard is strongly fortified; but I do not understand whether the commission has yet decided that the present and inevitable growth of the discharge of sewage into

the Niagara River so affects the health, the welfare, and I may say, to a certain extent, the business of both communities—that is, the community on either side of the line—as to make it necessary that no sewage from the city of Buffalo—and I may add Lackawanna—shall be discharged into the Niagara River through the lake. I do not recall in the reports any such decision.

Mr. TAWNEY. Is it not a fact that the bacteriological examination of the Niagara River shows conclusively that the waters are being polluted clear across the stream to an extent that is injurious to health and property on the other side?

Mr. CLINTON. I drew that conclusion from one of the reports made by the commission.

Mr. TAWNEY. That is included in the progress report, the report of the bacteriologists.

Mr. CLINTON. Yes; but I am not aware that the commission has decided that the extent of that is such that the discharge of sewage must be stopped.

Now, I regard that as of considerable importance not merely to my people but to the city of Buffalo, and I wish to say to this commission that I am more deeply interested on the part of the city of Buffalo than I am on the part of our proposed corporation. The expense to the city of Buffalo in caring for that sewage, if it must be taken out of the Niagara River altogether, will be tremendous. That is the reason I asked the question.

Your honorable commission will say to our people eventually that this sewage must be taken out. I think some limit has been placed upon it, but I regard that as merely tentative; it must be taken out eventually. Then it becomes a mere question for the city authorities to determine upon the methods of caring for the sewage.

Mr. TAWNEY. Mr. Clinton, speaking for myself as a member of the commission, I would say that the report of our sanitary experts submitted to the commission in January, 1914, shows quite conclusively that the waters of the Niagara River, together with the waters of other connecting rivers, are being polluted in violation of the treaty.

Mr. CLINTON. Yes; there is no doubt about that.

Mr. TAWNEY. It is not the function of the commission in this investigation to decide anything finally or to decide in advance whether or not we should recommend to the two Governments that the cities be called upon to do thus and so, but in the event that these waters are found to be polluted in violation of the treaty we are required by the two Governments to recommend to them what remedies we propose for this pollution, which is being allowed to go on in contravention of the treaty.

For the purpose of ascertaining the most feasible remedy the commission has employed consulting sanitary engineers, who have been engaged now for more than a year on investigations at Buffalo, Detroit, and other places. They have embodied in their report to the commission certain suggestions and recommendations with respect to remedies.

This report was sent out six weeks before this meeting to the various municipalities in order that they might familiarize themselves with the proposed remedies for the pollution which has been found to exist in violation of the treaty, and our purpose in being

here is to confer with the representatives of the various municipalities that are affected to ascertain what their judgment is as to the remedies which have been proposed by our consulting engineers. This information is desired by the commission before we submit to the two Governments a final report embodying our recommendations. We desire to see what suggestions or criticisms these municipalities have to make, because there is no denying the fact that pollution does exist in contravention of the treaty. That fact has been established by bacteriological examination. Nor is there any question that it must stop from an international standpoint. That is, both Governments, having solemnly agreed by treaty that such pollution should not be permitted to the injury of the health or property of the people of either country, that treaty obligation will have to be observed. Of course, it is the hope of the commission that these municipalities will cooperate as far as possible in agreeing upon some recommended remedy that will be practicable and feasible so that the two Governments may reach an agreement as to what should be done hereafter. As stated by the chairman, that is the purpose of our being here.

Mr. CLINTON. I understand the purpose of the commission in being here, and the purpose as stated by you is the position which the commission has taken from the beginning. I must beg the pardon of the commission in using the inaccurate word "decided." I should have said "concluded."

The problems, it seems to me, are of such a nature—I do not know that I ought to say this, as it seems to be offering advice to the commission—that after the city authorities have had ample opportunity to investigate the matter for themselves you would be able to arrive at results, and it would be more satisfactory to yourselves and to the city than to attempt to do it at this time.

Mr. TAWNEY. As I undersand it, our consulting sanitary engineers have been working here with the officials of Buffalo for over a year.

Mr. CLINTON. That is true.

Mr. TAWNEY. They were even advised when the report was submitted to the commission what the report would be, and we supposed by giving them six weeks' time in which to study the specific recommendations made by the consulting engineers that the municipal authorities here would be able to give the commission some information as to whether or not the proposed remedies reasonably meet with their approval.

Mr. CLINTON. Although I ought not to speak for the city government, as I am on my feet, will you permit me to say that a suggestion has been made and I will be presumptuous enough to answer it. It is suggested by our commissioner of public works and also a member of the city government that the recent change in our form of government has thrown upon the members of the council such a tremendous burden of work that it is impossible for them to determine from all points of view, financial and otherwise, in such a short time as six weeks what they will be willing to recommend to the citizens. The time has been too short, in other words.

Mr. TAWNEY. I do not think the commission contemplates asking any of the municipalities to join with it in recommending any specific remedies, but we want to hear what the municipalities have to say with respect to the practicability or advisability of the remedies that

are proposed. Of course the question of finance is one that will have to be taken up later.

Mr. CLINTON. It is a very serious question in this city and is directly involved in determining what they will recommend. While fully agreeing with the report of your experts, they might think that something less costly, something that would extend the burden over a greater period of time, would answer all the purposes and be of a nature that would satisfy your experts and accomplish the same results.

Mr. TAWNEY. Well, the commission has had this under consideration for nearly three years, as you will recall, Mr. Clinton; and the municipalities, especially Buffalo and Detroit, must have been studying the subject from the international standpoint, fully realizing, no doubt, that the time has come when they must cease using these rivers as open sewers and make some other provision for sewage disposal. It is not the desire of the commission to make arbitrary recommendations to the two Governments without conferring with the municipalities in order to get their views and to recommend that which is feasible and also desirable within their financial ability to comply with. That is one reason why we are trying in every way to cooperate with the municipalities that are interested.

Mr. CLINTON. No doubt that is a very gracious and wise decision on the part of the commission. I was simply trying to point out that it would be impossible, it seems to me, for the city government at this time to undertake to give views upon this subject. Councilman Hill is present and can speak upon that subject.

Mr. HILL. Why do you not let the city government speak for itself?

Mr. CLINTON. I have been drawn into this argument.

Mr. MALONE. As this is the last analysis of the financial proposition, I think Commissioner Hill, of the department of finance and account, as representing the city government, might throw some light on the matter from a financial standpoint.

Mr. HILL. With regard to that I would suggest that the commission, having held these hearings for several years, has probably found the simple and expeditious way of moving along. I would suggest that Prof. Phelps be called on for a statement. He would enlighten us as to his ideas regarding what ought to be done and the different methods proposed. Of course, the financial proposition come in eventually. When we have heard what methods the commission has to present we will be in a better shape to take the matter up.

Mr. MALONE. It was that thought that prompted me to suggest to our distinguished friend, Mr. Clinton, that "John speak for himself."

Mr. HILL. I think the only difference is that it would be better for us to speak later. I think we would save time in that way.

Mr. PERKINS. Mr. Chairman, would you hear a brief statement on the general subject? The question before the commission, I believe, relates to the effect on the people in the various cities of the pollution of the waters of the Niagara River that are used for domestic and sanitary purposes. Is it not true that, if there is not involved the water that is to be used for drinking purposes in the various cities, then very largely the pollution of the Niagara River is a matter that is not of such great importance? For instance, the city of Buffalo has pumping stations that will take care of the whole Niagara

frontier. If arrangements can be made through legislation whereby the cities of Niagara Falls, the Tonawandas, and Lockport can be supplied with pure water from these tremendous pumping stations, and the cost of water to them, as well as to the city of Buffalo, can be very largely reduced by taking care of the enormous overhead charges, it will very largely do away with the expenditure of $3,600,000 by Buffalo and smaller amounts by the other cities that are discharging sewage into the Niagara River.

The health of the people is affected only by the drinking of the water of the Niagara River, and the solution can be obtained at very much less expense to the city of Buffalo and the other cities involved.

The smell that arises at Niagara Falls, and regarding which complaint has been made, is not due to the pollution of Niagara River by Buffalo sewage, because oxidation of that sewage occurs and the tremendous current takes away any stench before it reaches Niagara Falls. The difficulty at Niagara Falls is due to the dumping of the sewage into the Niagara River and there being thrown back upon the people of Niagara Falls their own sewage; it is not due to the sewage of Buffalo or any other city on the Niagara River. The city of Chicago built a drainage canal, which, as you say, is an open sewer. It went to the expense of $100,000,000 to build that drainage canal, because formerly it was discharging its sewage into its own lake, the source of its water supply. It had no natural drainage canal such as Buffalo has through the Niagara River to carry off that sewage in a sanitary manner.

Congressman Mann, within the last few day, in discussing in Congress the La Follette amendment requiring Chicago not to take more than 250,000 cubic feet per minute from the lake through this drainage canal, when they are now taking practically double that amount, pointed out that any other way of correcting the sewage proposition for Chicago would have cost that city $250,000,000 instead of the $100,000,000 that it did cost, and yet that canal is a very slow-moving stream, carrying only 4,167 cubic feet per second, as required under the treaty. That is equivalent to only one-sixtieth of the amount of water that is passing through the Niagara River. If there were a drainage canal built from the city of Buffalo to Lake Ontario, it would carry only about 6,000 cubic feet per second under the treaty, and that is one-fortieth of the amount going through Niagara River at a tremendous rate of speed. The necessity for this tremendous expenditure is, I think, overestimated. I think when the drinking water of all those cities is provided for the expense will be absolutely nil. The water, as it absorbs the sewage in the drainage canal at Chicago, has its purification entirely through the free oxygen that is in the drainage canal as it passes along. Here in the Niagara River we have 60 times as much water to absorb the sewage, and it has more than 100 times the value on account of the tremendous current that forces the sewage up to the surface and utilizes the oxygen in the air to purify it long before it reaches those cities.

I would like to ask whether the question of the pollution of the Niagara River as it is considered by you is not entirely from the standpoint of the health of the people on both sides of the line, not only as to the odors that come from it, but also as a drinking proposition; that is, whether those are the only two problems that are being considered?

Mr. MIGNAULT. You have probably forgotten one thing which is very important, and that is that this is an international question. Even if you could supply water to these municipalities on your own side, that would not prevent the Niagara River being polluted to the danger of people living on the other side of the line.

Mr. PERKINS. On account of the tremendous current in the Niagara River, with the sewage from this side passing down, the cities of Bridgeburg and Fort Erie are free to take their water for drinking purposes on their side of the river, so that the international feature, I think, is largely eliminated, and the only other city is Niagara Falls, Ontario. There a great power canal is about to be installed, developing 3,000 horsepower and taking pure water from Lake Erie through the Welland Canal. There is a vast supply of which only a mere fraction is necessary for the city of Niagara Falls on the Canadian side. So you have eliminated all the troubles, so far as drinking water is concerned, of all those cities, and the question of drinking water, I think, is of vital importance. But we are going to spend $3,600,000 on the sewage proposition when a mere fraction of that amount will take care of the subsewage which without the slightest doubt needs renovating, especially in view of the fact that no solution in the way of chemical treatment could possibly make that water available to those people for drinking purposes along the lower Niagara. The chemists have confidence in both the sludge proposition and the other treatments. For instance, at Milwaukee they will even take a glass of the effluent and drink it, but it does not follow that the people of Tonawanda and Lockport should want that kind of drinking water when we can give them pure water from Lake Erie cheaper, on account of the tremendous pumpage facilities we have here, than they can pump it for themselves.

We need a filtration plant, and by spending $1,500,000 of that money for that purpose we could have a plant that would supply all those cities with the purest water 365 days in the year. It is true that during the stormy seasons we have periods when the water is in a very bad condition. The danger from typhoid, however, can be taken care of by treating the water with chlorine.

Mr. GARDNER. The difficulty is that there is no question referred to this International Joint Commission by the two Governments as to whether or not the people in any particular locality are getting pure water for drinking or domestic purposes. The question submitted to us to determine is whether the international waters are being polluted to the injury of health or property on either side of the line. The people here are interested in the question of pure water, and that applies all the way to Niagara Falls, but the people on the other side of the line would not be concerned at all about that. So that the question for the commission to determine is not whether or not it is possible for Buffalo and these contiguous towns to get pure water; but the question for us to determine is whether or not these waters are being polluted, in contravention of the treaty; and if so, what remedy we propose.

Mr. PERKINS. But the reason for the consideration of the pollution is the health of the people on both sides of the river. If the health of the people on both sides of the river can be taken care of, and it is only for drinking purposes, and you are producing an

effluent of 200,000,000 gallons that has been treated and used for drinking purposes by either side, it is dangerous, ultimately, because with the growth of this city to a million people, we will include the whole Niagara frontier as one city. It means taking care of the Canadian side, too, but what cities are there on the other side that are being injured?

Mr. GARDNER. I am not familiar enough with it to say.

Mr. PERKINS. There is not a town outside of Bridgeburg that is utilizing water from the Niagara River. There is only Fort Erie and Bridgeburg, and they have the purest water to take it from. They have the Niagara River, which runs at the rate of 6 or 7 miles an hour. They can get the purest water—and the finest of fish live there—if they take it from the upper intake. I believe the whole question is one that is very easily solved by economical means for the benefit of the people on both sides, at one-hundredth of the expense of the tremendous sewage disposal plant, which in itself will be unsatisfactory. You can not take the sludge and compress it within the city limits and dry it and sell it as fertilizer and not produce a worse sanitary condition than you have now. Then, the drainage canal from here across to Lake Ontario would be a slow-moving stream, as proposed by the Lake Ontario power canal sanitary proposition. That would cost $25,000,000, and would not be a solution of the difficulty, because it would be an open sewer, and would be in a worse condition than at present, because it would be a sluggish stream. There is no question but that this matter should be considered carefully.

Mr. GARDNER. I agree with you fully in that last statement.

Mr. TAWNEY. Do you say there is no pollution of these waters on the Canadian side by reason of dumping of raw sewage on this side of the Niagara River?

Mr. PERKINS. I say there is no place where they are using it for drinking purposes, and there is 60 times as much water passing through the Niagara River as at the Chicago Drainage Canal. That would not in any way interfere with the health of the people on the Canadian side; so that I do not think the Canadian side is interested as much as the American side.

Mr. TAWNEY. The hearing at Niagara Falls a year ago last September showed conclusively that the waters on that side are polluted from the intake or from sewage dumped into the river from this side.

Mr. PERKINS. Some of it gets across.

Mr. TAWNEY. Are they using that water for drinking purposes there?

Mr. PERKINS. Yes.

Mr. TAWNEY. I am referring to Niagara Falls intake.

Mr. PERKINS. I think the sewage at Niagara Falls can be taken care of by taking the drinking water from Lake Erie through the Welland power canal they are talking about.

Mr. TAWNEY. We have not power to compel the people over there to accept water from this side.

Mr. PERKINS. I was referring to the power canal proposed to be constructed by the Ontario government. There will be pure water to supply Niagara Falls, Ontario, and they will have better water than any water that has been treated after the sewage of Buffalo has been treated and these cities have gone into it.

Mr. DALLYN. We have been producing water from the lower Niagara River, at lower Niagara, for some 15,000 troops and a population of 5,000.

Mr. PERKINS. In reference to the aeration of the water, the Niagara Falls is the finest sanitation plant that could possibly be built—far better than any sanitation plant that could be built—for chemical treatment or otherwise, because the air is thoroughly distributed all through the water that comes down. The water becomes atomized, and the aeration of that water absolutely purifies it.

Mr. TAWNEY. In the lower Niagara?

Mr. PERKINS. As it goes over the Falls. Every bit of water that goes over the Falls is aerated.

Mr. TAWNEY. The experts show it is polluted from shore to shore.

Mr. POWELL. Do you mean that by sedimentation the heavy parts go to the bottom?

Mr. PERKINS. I mean the parts of sewage are so thoroughly diffused into the water and oxidized on the way down Niagara River that after going over the Falls it is practically sterilized.

Mr. POWELL. By what special creation have we some 30,000 or more bacilli or bacteria to the cubic centimeter on the Niagara River below the Falls? You evidently have not read the report. The thing is a perfect sewer below the Falls.

Mr. PERKINS. It is not from Buffalo sewage; it is the city of Niagara Falls sewage, which is dumped over the river bank and atomized, sending the odor back over the city.

Mr. POWELL. You will have to knock out of existence a great many facts that have been shown by a scientific examination of the water if you establish your proposition.

Mr. PERKINS. Has there been any report that it is Buffalo sewage that has caused the difficulty or the city of Niagara Falls sewage dumping into the lower river, with no aeration and a long trip through the Niagara River for 20 miles or more?

Mr. POWELL. There must be some peculiarities about Buffalo sewage——

Mr. PERKINS. I mean the water is good above the Falls but polluted by the sewers of the city of Niagara Falls, not Buffalo.

Mr. POWELL. We assume the excreta from the people of Buffalo is about the same as the excreta from the people in Tonawanda and other places downstream.

Mr. PERKINS. It is a question whether the Buffalo water has not been purified on the way down the Niagara River for 20 miles.

Mr. POWELL. Running water might purify itself.

Mr. PERKINS. The city of Milwaukee is aerating the water by putting compressed air through tanks, and that is one of the sewage-treatment propositions adopted recently. The Imhoff tank requires all kinds of arrangements; but they claim that the compressed air and activated sludge system is a far better scheme, using the free oxygen in the air to oxidize the impurities of the water. So that if Buffalo can give all these cities drinking water, and if they can also get it on the Canadian side from the lake, it would seem as though it would largely obviate the difficulty.

Dr. SY. Years ago I used to take the water below the Falls, and there is practically no purification by aeration.

Mr. POWELL. That statement is borne out by the report. The aeration is not sufficient. It does not purify it by going over the Falls.

Mr. PERKINS. Just one statement in reference to that Milwaukee sterilization plant. It is stated that they have the free oxygen of the compressed air for the oxidation of it. But here is the proposition: Chicago is taking care of the sewage without any treatment whatever through a drainage canal of 250,000 cubic feet per minute, and we have in Niagara River a natural drainage-canal proposition of 60 times the value of that drainage canal for diluting the water, with many, many times greater swiftness of current, or 25,000 cubic feet per second. The drainage canal at Chicago moves so slowly you can hardly see it. Why is it necessary to throw away the advantages of this tremendous Niagara River drainage canal which we have now, when it is not affecting the water, as far as the health of either American or Canadian citizens from typhoid is concerned?

Mr. TAWNEY. To what extent is the drainage canal of Chicago used for sanitary or domestic purposes?

Mr. PERKINS. It is simply a power and drainage canal; it is not supposed to be used at all for drinking purposes. If you can not use Lake Erie water, and if Niagara River must be used for drinking only after treatment, then I will acknowledge it is absolutely necessary to do something in reference to this pollution, but if it is possible to use the Lake Erie water in Canadian towns without this expense, it seems to me it is wise to do it; at least, for the immediate situation. When a great city is found on the Canadian side and they must draw their water from the Niagara River for drinking purposes, then it is time to take action. It would seem to be a tremendously expensive experiment to make with very little return.

Mr. TAWNEY. I want to read a paragraph from the report of our sanitary expert, the best that could be obtained in both countries. He says:

> The examination of samples taken from cross section below Buckhorn and Navy Islands showed undiminished pollution on the United States side. On the Canadian side, the water, though less polluted, was still dangerous, and should not be used without a most careful treatment; otherwise its use is liable to give rise to periodic epidemics of intestinal diseases.
>
> The results from the examination of samples collected in the gorge just below the two Falls demonstrate that the pollution coming over is more uniformly distributed. There is a popular impression that the action of the Falls tends to purify sewage. It does not remove it or its dangers. It simply mixes it more thoroughly with the water. The pollution below the Falls is gross.

Mr. PERKINS. Do you think your commission will recommend, even with the expenditure of $100,000,000 instead of $3,000,000 on the river for sewage treatment, the use of that water for drinking purposes?

Mr. TAWNEY. Have you read the report of the engineers as to how much was necessary to be expended for such treatment?

Mr. PERKINS. No; I have not.

Mr. TAWNEY. You are out ninety-seven millions.

Mr. PERKINS. The expenditure of between $3,000,000 and $3,500,000 means a vast amount to the taxpayers of this city and all those along the frontier. Will your commission recommend, after such a plant has been built, that water from Niagara, containing this large amount of bacteria, regardless of the chemical treatment, should be suitable or desirable to be taken for drinking purposes when pure

water can be delivered from Lake Erie by pumping stations on both sides at a far cheaper rate than they can build a plant to take care of the sewage? The small cities can not do it with the tremendous overhead charges and the inefficiency of small pumping stations, while we have two large pumping stations that cost, with intake tunnel, $10,000,000, and we can supply drinking water to all the frontier, if we only obtain the legal right to do it, cheaper than they can pump Niagara River water even after treatment.

Mr. POWELL. That is an alternative scheme you suggest. I think we are drifting away from the subject matter. There is no question the commission has come to the conclusion, rightly or wrongly, that a condition of affairs exists on the Niagara frontier that must be remedied; that the evil results of depositing sewage on one bank of the stream is felt on the other side of the boundary line, more particularly that which comes from the United States than the Canadian. We are here having gone to great expense in the formulation by our experts of schemes for the solution of this difficulty. We have not absolutely adopted any scheme as yet, but we have laid this scheme before the people on this frontier and up the Detroit River for their consideration. A couple of months' time has been at their disposal to take it up and consider it. We are here to see whether you accept it, or whether, instead of accepting it, you have any scheme to offer in place of this; and what you have to suggest, taking what you say at its face, is entitled to a great deal of consideration, but we can not take your ipse dixit for these matters as against scientific men. Is the city, and are the others who are interested, prepared to lay schemes before us, with any data that will reasonably back them up, for our consideration? That is the question.

Mr. PERKINS. But you are considering the drainage power canal from Buffalo to Lake Ontario, which means an open sewer which you are condemning as existing in Nagara River.

Mr. POWELL. We are not condemning anything. From a sanitary standpoint there is a condition of affairs which needs a remedy. Our expert has taken into consideration all the schemes, and he has made a report; and we have laid it before you and desire to know if you accept it or if you reject it, and have you anything to advance as a substitute for it.

Mr. PERKINS. I did not say you were condemning the sanitary canal but the pollution of Niagara River.

Mr. POWELL. We are not condemning anything.

Mr. PERKINS. You are condemning the pollution of the Niagara River as an open sewer.

Mr. POWELL. No. We have had Prof. Phelps and others to suggest a scheme, and we lay the results of their investigations before you, and we ask you, Do you accept it; and, if not, have you anything to offer in its place? We have not come to the point of deciding or rejecting anything yet. That will arise later.

Mr. PERKINS. Do you consider that a solution?

Mr. POWELL. I am not saying anything about that at all.

Mr. PERKINS. In the matter of a solution, we supply all the drinking-water requirements without the necessity of taking the water from the Niagara River but from Lake Erie, and therefore you have ten times better conditions than the Chicago Drainage Canal, which

has cost $100,000,000. If you can give us something better by spending $3,000,000 than the Chicago Drainage Canal, which cost $100,000,000—and we have just as good a thing here——

Mr. POWELL. We have nothing to do with Chicago at all. We are here for Niagara and the lake.

STATEMENT OF MR. O. E. CARR, CITY MANAGER, NIAGARA FALLS.

Mr. CARR. I am not here to criticize the findings of the commission in any way. I wish to represent my views and the views of the people for whom I speak. I wish to say the city of Niagara Falls expended something like $600,000 for the purpose of treating the impure waters which came down from Buffalo and points beyond, which water they had to drink. We have now in the Falls pure water, and we do not need their water. I want to say that in the construction of our sewer system something like a million and a half has been expended, and that while we did not have authority from the United States Government to construct the sewers as they were constructed they acquiesced in that construction, and now to spend something like $800,000 on new construction in order to treat the waters would be looked upon by the people there as a considerable hardship. I say that because we have already spent better than $600,000 for the purpose of treating our waters, in order to make them satisfactory. One point this gentleman raised seems to me to be good. That is, that even if all the suggestions which this commission has made with regard to the treatment of waters in Buffalo, Niagara Falls, Tonawanda, North Tonawanda La Salle, and other places are carried out, the waters even then in the Niagara River will not be fit for consumption. As long as the country tributary to the various small streams which flow into the Great Lakes and the Niagara River are usel in a more or less direct way for carrying off refuse the waters of the Niagara River will be contaminated to some extent; and any city will find it advisable to treat their waters before using them for drinking purposes.

In regard to that same matter, that is covered very thoroughly by the report of an investigation in reference to Cincinnati by Harrison P. Eddy, consulting engineer at Boston. He brought out the fact that the sewage of Pittsburgh, Liverpool, and all the cities above Cincinnati was thrown into the Ohio River, and that all those cities which took their water from the Ohio River found it necessary to treat it before using for domestic purposes, and the cities below Cincinnati would find that treatment also necessary before the water was used, and therefore he felt—and his report bears out his feeling—that a sewage-treatment plant for Cincinnati was at that time unnecessary, inasmuch as the waters of the Ohio River were sufficient to dilute the sewage which the city of Cincinnati threw into the Ohio River to such an extent that it was not a nuisance and did not give forth any bad odors. If it is true of Cincinnati, it is a thousand times more true of Niagara Falls, a city of 50,000 people, and the Niagara River, whose flow is perhaps five or six times the dry-weather flow of the Ohio River; and not only that, but through the gorge and rapids the tendency is to very thoroughly mix the sewage and the water of Niagara River to such an extent that at no time would there be any bad odor coming off from the water. I had just two points to

make: One is that the saddling of the cost of this treatment plant, something like $800,000, on the municipality of Niagara Falls would be a hardship on the people, and the maintenance of that plant would be an additional cost to the city, and I feel, as far as the city of Niagara Falls is concerned, that city being the last city on the line, it ought to be the last city that would be required by the United States Government to treat its waters, and especially so on account of the very thorough mixing of the sewage that comes from the Niagara Falls in the Niagara River. There is one more point in that same connection: I believe the chemical plants in Niagara Falls are discharging into the sewers, which tends to destroy the bacteria which normally would exist.

Mr. POWELL. Do you purify your water in the city?

Mr. CARR. Yes. We were disgraced by having the highest typhoid death rate in the United States. At that time our water was not being treated.

STATEMENT OF MR. R. L. SEELBACH, OF BUFFALO, N. Y.

Mr. SEELBACH. I would like to ascertain if it is mandatory on the city to accept any plan the commission recommends?

Mr. TAWNEY. It would be mandatory if the two Governments, by treaty, agreed to the adoption of the recommendation; but as far as the commission's recommendation is concerned it is not mandatory. If the commission recommends certain remedies, and the two Governments, by convention or treaty, adopt the recommendation, it becomes the supreme law and would be mandatory upon the municipalities.

Mr. SEELBACH. If it could be shown to the commission in a reasonable time that a certain system would be more economical and hygienically superior to the proposition of the commission, would that be accepted?

Mr. TAWNEY. You appeared before the commission in 1914?

Mr. SEELBACH. Yes.

Mr. TAWNEY. And presented a plan of treatment?

Mr. SEELBACH. It was more upon the garbage proposition; but I have taken up this matter and submitted a plan. I have a scheme to burn the sludge.

Mr. GARDNER. The commission is here at this time for the discussion of the plans submitted by our engineer, as to whether or not they are acceptable; if not, what particular objection these different municipalities have to the plans as submitted in this report, and we can not take up anything that is purely outside of that question.

Mr. SEELBACH. I submitted my proposition to you people, and I never heard anything about it.

Mr. TAWNEY. I can say to you that it was disposed of as not coming within the purview of our investigation.

Mr. SEELBACH. I would like to know the facts in connection with that.

Mr. TAWNEY. I do not think it was formally disposed of, but that was the consensus of opinion it did not fall within the scope of the investigation.

Mr. SEELBACH. If I can show to the city of Buffalo that my system is more hygienic and more economical, would it have your approval?

Mr. GARDNER. I have no doubt it might have the approval of the commission informally, but I doubt whether they could take it up properly and consider it under the reference.

Mr. SEELBACH. But the city of Buffalo?

Mr. GARDNER. They can do as they please.

Mr. POWELL. Have you laid your scheme before the city authorities?

Mr. SEELBACH. Not as yet; I would like to.

Mr. GARDNER. You have not as many men to deal with as you had years ago.

Mr. SEELBACH. If the commissioners could find my statement there, I would like to make a correction.

Mr. TAWNEY. We have not it with us. You can address the secretary at Washington, or see him here personally, and give him any corrections you want to make.

Mr. GARDNER. I was going to make the suggestion that you might be allowed to make your correction at this time, if you care to. But we have not your statement here.

Mr. SEELBACH. I can not make it without the statement before me.

Mr. GARDNER. We do not seem to be getting anywhere; we are traveling around in a circle. I submit this proposition to you—whether or not we could take a recess, and your engineers or your representative men and our engineers spend the remainder of the day in going over this report, to see whether or not you can not come in here to-morrow with some tentative agreement at least as to what your differences are, whether they are irreconcilable, or what may be the prospect of coming to some understanding with each other. I want to repeat again that, under the terms of the reference, this commission has nothing whatever to do with the supplying of pure water to any of these municipalities. The question referred to us is to determine whether or not these boundary waters were polluted to the injury of health and property on the other side of the line, and if they were—and it has been clearly demonstrated that they were—what remedy we would advise and submit to the two Governments for their adoption. We are anxious to have the cooperation of the people here in Buffalo and elsewhere to work out a plan possibly that will answer the terms of the reference and make it as easy as possible for the people interested here and elsewhere. That is what we are here for. The commission could sit down in its offices in Washington or Ottawa and develop a plan, but we want to consider you people here; we want to work with you to devise a scheme that will be best for you and acceptable to the Governments at the least possible cost. That is my idea of the situation in a nutshell.

Mr. POWELL. I would suggest that Mr. Seelbach prepare a typewritten brief and give a copy to each member of the commission. If his idea is good, I, for one, would like to take advantage of it and have it considered, but you understand we can not adequately consider any scientific scheme here by simply an oral statement. You had better typewrite your brief and submit it.

Mr. SEELBACH. I can submit it. How long will you remain here?

Mr. GARDNER. We can remain here two or three days.

Mr. POWELL. And if it is not ready you could send copies to the Washington or Ottawa offices.

Prof. PHELPS. I would like to suggest that we have not heard from all the officials of Buffalo. Capt. Norton looks as though he had something to say, and it might be well to fill in time hearing what these people have to say.

STATEMENT OF CAPT. GEORGE H. NORTON, CITY ENGINEER, OF BUFFALO.

Capt. NORTON. I have had the honor of appearing before you several times in this matter, and at the earlier hearings I believe that you asked the city of Buffalo if we had any plan to suggest at that time, and, as city engineer, I said to you that I thought the ordinary procedure would be for you to hear the outline of such results as you expected should be accomplished, and I believe that was the opinion and advice of your sanitary consulting engineer—that the commission should outline a tentative policy and submit such to the city, and I am very much pleased that that has been done in the excellent way in which it has been done. In speaking of the plan itself as worked out in detail by Mr. Tolles and Prof. Phelps and your commission, the general plan for Buffalo for the collection of its sewage has followed the idea which the city has had as the probable solution, accepting the suggestion of your Mr. Tolles, which looks very reasonable—that we divert certain of our sewage from the easterly side of the city to the southern outlet instead of our middle outlet in Niagara River. That is a matter which can only be determined, as to its extent and advisability by making detailed plans both ways. That is a matter which will require careful engineering estimate. I believe Mr. Tolles has gone through that to some extent, but I do not think to the extent of the estimate of the parallel construction. That, then, would bring us down to the question of the extent of treatment, if such is to be undertaken. The suggestion which I have made heretofore was somewhat in parallel with what Mr. Carr has suggested, that there is one limiting condition of pollution in the Niagara River which, I believe, is not thoroughly covered by the examination of the experts as to the condition of pollution, and that was whether or not the pollution from surface drainage at times did not materially exceed the proposed limitation, that the conditions here at times make this river less desirable by reason of surface pollution; then we have a limiting factor in there which we have not met in the tentative plans proposed by the consulting engineers, and I think it should be given consideration in this study; that is, that you have at times conditions from surface drainage pollution which will exceed the limitation set up by sanitary engineers as one to be worked to in treatment of it. I think the engineers will agree that if you have that condition existing 10 or 15 days a year, which is detrimental to the citizens, it is not the average condition, but should be given consideration.

Mr. GARDNER. Is there any material increase in the sources of pollution?

Capt. NORTON. It would be in keeping with the normal population of the community. It is different here and on the other side of the river. I believe the normal rate of increase of pollution over there is not as great as that of the cities. The extent of this treatment as

recommended, I would say, would be rather more than I would have in mind for the city of Buffalo as being a solution of the problem, for this reason, that the report of the sanitary expert, which established a condition of water which might not impose an undue burden on the water-filtration plant, is based on the average pollution of the entire cross-section, and I should think that was a very reasonable solution for the smaller stream, but the question comes with the larger stream, where we can get a thread of water which is materially less polluted than the average, as to whether that should be given material consideration in a stream as large as this; that, instead of putting our basis of 500 B. coli per cubic centimeter over the whole cross section of the river, whether we should not take that for the whole section of the river, which is liable to furnish variable water to the various municipalities along the stream, allowing for all contingencies in the way of change of currents at various times. These are broad problems which can only be settled by the highest advice, and it would be well for the city to have that advice and go over these two or three different points before accepting in toto that extent to which the clarification or purification should be considered.

Mr. GARDNER. That is what the commission did. They advocated the employment of the best sanitary engineers.

Mr. TAWNEY. Besides the plan you have been speaking of, what would you say as to whether or not the commission would be justified in recommending to the two Governments that no raw sewage be deposited in any of the boundary waters?

Capt. NORTON. I believe that principle is correct, and that there should be some sewage treatment.

Mr. TAWNEY. You do not think these international waters should be used for discharging raw sewage from the cities bordering on them?

Capt. NORTON. No; I do not; and that is the consensus of sanitary opinion at the present time—that such a thing should not be allowed. With regard to Mr. Perkins's suggestion as to furnishing the water supply along the Niagara frontier, I have a reference to my first suggestion which I made to you when the matter was first submitted to the city, which you will find in the hearings of the International Joint Commission, in the document of 1915, on pages 41, 43, et seq., when that matter was discussed on behalf of the city as a possible solution. I am not in a position to speak as to whether the city of Buffalo would want to insist on that as a solution. It is one of the probable and reasonable solutions of the whole problem, but I suppose we are dependent upon your action in covering the conditions as they exist at large along the waterways. You must make some reasonable recommendation that will cover the whole situation, and if you do that what your attitude would be in regard to making an exception here would be an open question. There are many problems here, and I do not think the city has had a chance to give it detailed study. If they wish to go into this and arrive at a reasonable solution it might be well for the city to have some expert advice and go over the matters in detail.

Mr. TAWNEY. Has the city of Buffalo in the last year been making any study of this problem independent of the study made by the sanitary engineers of the commission?

Capt. NORTON. No, sir.

Mr. TAWNEY. I did not know whether Buffalo had or not.

Capt. NORTON. No.

Mr. TAWNEY. Do you think the city council or commission, whichever it is, will act upon your advice and take steps to obtain expert advice with respect to the modification which you suggested in regard to the plan proposed by our sanitary engineers?

Capt. NORTON. I think the council can answer better themselves.

STATEMENT OF MR. CHARLES B. HILL, COMMISSIONER OF FINANCE AND COUNCILMAN, OF BUFFALO.

Mr. HILL. I might take the liberty of speaking for the new council in that regard, and in answer I would say that we have a very high regard for our engineering department, and I have no doubt the council would follow the advice of the department in that respect. Of course, I am not in a position to speak authoritatively as to the policy of the new council.

Mr. TAWNEY. My reason for asking is this: We have had this matter under consideration now for about three years, and if the city of Buffalo contemplated in the near future taking up the study of the problem along the line suggested by Capt. Norton, the commission might hereafter delay final report until we had the judgment and advice or the conclusions of your city. It is not the desire of the commission to arbitrarily make recommendations without taking into consideration the wishes and the desires of the various communities affected. We want to give them a reasonable time.

Mr. HILL. I think the council feels that it is its duty to cooperate in every way with this commission and to take this matter under advisement in the way that Capt. Norton suggests. For myself—and I am in the same position as the other commissioners—I may say we took office only the 1st of January. This matter came to our attention only when the notice came in, and we have had time but for one informal discussion with the engineering department, so that, as a representative body, we are unable at this time, as I feel, to do justice to the matter at this hearing. I agree with the suggestion of the commission, and I think that that is the disposition that ought to be made of the matter, and give us time to take the matter up, which we will do.

Mr. TAWNEY. Speaking for myself, we want the cooperation of the two large cities on our side of the line in working out this problem, so that when it is worked out and embodied in our recommendation it will reasonably meet the approval of the people of these two great municipalities; and in that case it would be comparatively easy for the two Governments to follow the recommendations and make the necessary provisions. In that case our work will not be futile, otherwise it might go for naught. For that reason we want the cooperation of both cities.

Mr. HILL. Absolutely right, and I take the liberty of speaking for the council, and I say we are of a mind to give that cooperation, and we will certainly do it.

Mr. GARDNER. Can you give us approximately the time you will require to consider it?

Mr. HILL. You all know how such matters go.

Mr. POWELL. Or, rather, don't go.

Mr. HILL. I can say the matter will not be neglected.

Mr. POWELL. Have you done anything since you got the report in the way of considering the recommendations, or having them considered?

Mr. HILL. We had one meeting and one discussion with Capt. Norton occupying over two hours, perhaps.

Mr. POWELL. Will you really take it up seriously?

Mr. HILL. We will, because we appreciate the situation.

Mr. POWELL. This thing has been hanging three years.

STATEMENT OF DR. FRANCIS E. FRONCZAK, HEALTH OFFICER OF BUFFALO.

Dr. FRONCZAK. First of all, I want to congratulate the commission and engineers on the excellent report published in the document issued last March. It shows a most thorough study, and also shows that, notwithstanding statements made this morning, there is greater contamination below than above—at least more contamination. But there is one thing forgotten by the engineers in this report apparently that Capt. Norton has mentioned—that the surface drainage is not considered. I do not believe any city is justified in turning raw sewage into any stream of that kind. But even if we do treat sewage that way, we will still have an immense amount of surface drainage from contaminated streams.

Mr. POWELL. You mean out ide of the cities?

Dr. FRONCZAK. No, not outside; and that surface drainage will have to be considered all the time; in other words, no matter what is done about the disposal of sewage, you still must purify the water after it gets to the mains for drinking purposes. In Buffalo we have most excellent results; and I want to place in the record of the commission the fact that the use of chlorine gas has considerably reduced the number of typhoid cases in Buffalo. Last year, 1915, shows that, notwithstanding the fact that Buffalo was larger and more populous than ever before, we had fewer cases of typhoid fever than ever before in the history of the department of health. We had fewer deaths from typhoid in Buffalo last year than at any time in the history of the department. We had this year, from January 1 to June 20, only 61 cases of typhoid in Buffalo, and only 16 deaths, which is so low that the United States Government, the New York State department of health, and the scientific societies have complimented the city on the results attained, and this was due to the purification of the water supply by chlorine gas; and that is a thing that must be considered all the time on the question of pollution of these streams, not only the removal of the solids, the sterilization, or the removal of as much pollution as is possible, but the removal of danger of contamination from surface drainage. Incidentally I might state that since August, 1914, when the chlorine gas was used in Buffalo, the total number of bacteria, which, I believe, have run into thousands day after day in Buffalo, have fallen as low as four per hundred centimeters; and while in former years we had colon bacilli in the water, since 1914 to date only on one single day did we find colon bacilli. So that shows conclusively that the use of chlorine gas, the way we are using it, renders the water more safe, and that this will have to be considered in connection with the pollution of these streams.

Mr. TAWNEY. When did you commence the use of chlorine gas?

Dr. FRONCZAK. August, 1914.

Mr. TAWNEY. Two years?

Dr. FRONCZAK. Yes; only on one single day in all this time did we find colon bacilli where we formerly found it repeatedly, and the death rate of Buffalo for typhoid fever to-day is below 10 per 100,000 population. The fall has been so steady the last five years, and especially within two years, that the State department of health sent congratulations to the mayor of Buffalo and to the department.

Mr. POWELL. What was your death rate before?

Dr. FRONCZAK. Seventeen, 19, 25; last year it was below 10. It is growing less all the time, and Buffalo is a growing city.

Mr. TAWNEY. Were there any other changes made in your system to which any part of this could be attributed?

Dr. FRONCZAK. Yes; the new tunnel. With the construction of the tunnel we found a difference, and the fly exterminator contributed some. But the use of chlorine gas is the best investment Buffalo has made for the reduction of death rate that I know of.

Capt. NORTON. We started using water from the new intake in January, 1912, but it was not used entirely. There was some water used from the old intake. For 1912, 1913, and 1914 the death rate was 13½ per 100,000, and for the 10 years previous to the opening of the new intake it was 24½. So that we had a reduction prior to the introduction of chlorine gas of 12 per 100,000, and last year it was 10, and this year it is below that.

Mr. TAWNEY. You can not attribute the favorable result entirely to the use of chlorine gas?

Capt. NORTON. Two things. The other is getting into the best thread of the current, which was done on the advice of Mr. George Fuller, and that worked out well; and one of the points I tried to bring out before your commission—that where you had the thread of the current, which was apparently pure, compared with the remainder of the stream, perhaps the average condition over the whole thread of the current would impose somewhat of a hardship on the city of Buffalo in the way of reduction of 90 per cent which you propose here, which seems to me too high.

Dr. FRONCZAK. I would like to place some figures before the commission as to the death rate in Buffalo, as follows:

Total number of deaths for 1915	6,853
Total number of cases of typhoid fever for 1915	259
Total number of deaths from typhoid fever in 1915	46
Total number of deaths January to May, inclusive, 1916	[1] 3,374
Total number of typhoid cases to June 20	61
Total number of deaths January to May, inclusive	16

Mr. SEELBACH. I refer you to a journal published by the Society of Economic Industry, of London, England, dated June, 1915, a lecture given by J. Grossman on the disposal of sewage sludge. The article is very long, and I will quote the following:

It is to be hoped that draining this enormous waste of material which should go back to the land, and which represents a value of at least £2,000,000 per annum in this country, will not continue indefinitely, and that it will be recognized that sewage sludge is a national asset which should be dealt with by the Government in the interest of agriculture, to which a cheap and inefficient manure will be of incalculable benefit.

[1] Does not include stillbirths.

Mr. PERKINS. I will call attention to a statement by the commissioner of health of Chicago, Ill., that "For the 10-year period preceding the opening of the tunnel the typhoid rate was 57.9 per 100,000, and after the opening of the tunnel it was reduced to 5.39 per 100,000. I believe not only the drainage canal but the introduction of chlorine gas had an effect on that." This is from the remarks of John Dill Robertson, commissioner of health of Chicago, Ill., published in the Congressional Record. Here it is a question of international boundary streams; but what is there so sacred or so holy about international streams that they are different from the Mississippi River, where they encourage the introduction of all the Chicago sewage and everything into the river? There are millions of inhabitants on that river who take that water for drinking purposes, where here we are expected to spend two or three millions for sewage treatment, for the benefit of whom? On the American side they have the chlorine proposition, which has reduced the death rate of Niagara Falls. Here you have investigated the proposition years ago, before the chlorine gas was available for the sterilization of the water, and it is said we must decide on spending $3,000,000 of money to avoid pollution of Niagara River. It is entirely unnecessary.

Mr. POWELL. Can something practical come out of this? If you have a scheme to submit, put it on paper.

Mr. PERKINS. Inasmuch as all drinking water can be supplied from Lake Erie, for various purposes, that is a solution in itself. We have already a solution.

Mr. POWELL. Tell us what the cost of the trunk main is going to be.

Mr. PERKINS. Merely a few thousand dollars.

Mr. POWELL. Down to Niagara?

Mr. PERKINS. Through to Tonawanda, on this side; and this water-pipe line becomes the means for the distribution of a greater city, with its suburbs, which must have water anyhow.

Mr. POWELL. I doubt very much if $50,000 would dig your ditch.

Mr. PERKINS. I am simply talking of the main; I am not talking about the Canadian side; but I said $50,000 or $100,000 would carry the necessary water main for Tonawanda, or even as far as Niagara Falls, depending, of course, upon its size, providing for the future needs.

Mr. POWELL. We want facts, not the imagination.

Mr. PERKINS. The engineers could state this better; but it would be a mere bagatelle as compared with $3,000,000 for the sewage treatment necessary, and then the river water would not be desirable for drinking purposes.

Mr. GARDNER. Could Prof. Phelps make a statement in regard to the cooperation we are seeking and the desirability of it, and also what the gist of the reference is. It should be fresh in our minds before we talk ourselves.

Mr. POWELL. We have had it from Capt. Norton and the others. Ask the authorities of Buffalo city exactly what they want. Do they want a postponement of the hearing; and if so, how long?

Mr. KREINHEDER. How long would it take your engineer to make this study?

Mr. POWELL. Your engineers are working with them. They collaborated on this.

Capt. NORTON. The work the city did was in furnishing the information and discussing the differences here. We had a good many talks over the local conditions and getting such ideas as they had. There was no work done by the department of public works on the report further than a discussion in this way.

Mr. POWELL. And it takes a much shorter time to revise than it would to work out the scheme in the first instance.

Capt. NORTON. I do not suppose you would care to have us work out another plan?

Mr. TAWNEY. I was going to suggest that it might not be necessary to have a further hearing, as I understand Capt. Norton and Mr. Hill. What they contemplate doing is employing sanitary experts or engineers to go over this matter and consider such modifications as were suggested by Capt. Norton this morning, and their conclusions could be submitted to us in the form of a report to us without any further hearing. As I understand it the city of Buffalo does not wish to have any more hearings, but they wish to submit some considerations based upon reports from sanitary engineers.

Capt. NORTON. That would be my engineering idea, and in connection with that suggestion it would occur to me that the other cities might join in an examination of that kind, so that we could have their ideas.

Dr. CLARK. I am not able to speak for the council of Tonawanda or North Tonawanda, but I think that suggestion is a very good one, and they might cooperate in that.

Mr. POWELL. Mr. Hill, you and the commissioner of public works were authorized to speak for the city in that regard.

Mr. HILL. I believe we were, informally.

Mr. POWELL. The only point is that we have been so long over this there will be a good deal of criticism in regard to it. Now, we want a matter of hard and fast business. We do not want to hurry you at all, but to have some definite understanding.

Mr. HILL. In regard to that, after Mr. Tawney made some remarks to Capt. Norton, I thought perhaps I should say, speaking for myself, and indirectly for the council, I would not want it understood, so far as I am concerned, that we are committing ourselves to a possible modification of the plan that has been suggested.

Mr. TAWNEY. It is not so understood by me or anybody else. I used that merely as an illustration.

Mr. HILL. I wanted to avoid any possible misunderstanding.

Mr. GEORGE CLINTON, Jr. The last remarks made brought to my attention something that has been running through my mind during this hearing, and that is that it might be of some assistance if the city officials clearly understood the scope of this investigation. I have no doubt perhaps they might, but I confess I have not been able to get it clearly.

Mr. TAWNEY. We were just going to call on Prof. Phelps, our consulting engineer, to make a statement.

Mr. GEORGE CLINTON, Jr. I wish to ask one question in regard to it, and I will be through. The sanitary experts of the commission have determined that the city pollutes the water of the Niagara River by the discharge of sewage, and they have recommended certain means of stopping that pollution. Now, is not the province of this commission to determine the result that is to be obtained—that

is, the cessation of that pollution—leaving it to the city authorities to determine the means of putting a stop to it, with the advice merely of the commission? Is that statement correct?

Mr. TAWNEY. Not exactly, as I understand it.

Mr. POWELL. That has been my idea all along, but that is not the idea of the majority of the commission. My idea is that we should demand or ask for certain results. As to how those results are to be brought about, leave it entirely to the judgment of the municipalities. But we have gone further than that and have had the methods investigated.

Mr. MAGRATH. This is merely to show they are practical.

Mr. TAWNEY. The second clause of the reference clearly indicates that the two Governments expect the commission, in its final report, to recommend to them what remedies are advisable or necessary to prevent the pollution which we found existed in contravention of the treaty. The second clause of the reference reads:

> In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering those waters sanitary and suitable for domestic and other uses be best secured and maintained in order to insure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligations undertaken in Article IV of the waterways treaty of January 11, 1909, between the United States and Great Britain, in which it is agreed that the waters therein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other?

So that we must not only determine the effect of the pollution, but we must also recommend a remedy, and in order to recommend a remedy we have had these investigations made by the engineers and studied the problems.

Mr. GEORGE CLINTON, Jr. I had construed that as requiring a recommendation that was merely advisory.

Mr. TAWNEY. That is right; it is advisory and not mandatory. That is for the Governments to determine after we render our advisory judgment. It is then for the Governments to say whether that advisory judgment should be executed.

Mr. HILL. Answering the question of the commissioners as to the time the city may require to make this report which has been suggested, we would say six months.

Mr. MIGNAULT. Do you suggest that we hold another hearing in the city of Buffalo?

Mr. HILL. No; we acquiesce in the suggestion of Mr. Tawney in that respect.

Mr. GARDNER. Prof. Phelps, we have a few minutes left before recess, and the commisison will be glad to hear any statement you may desire to make.

Prof. PHELPS. Mr. Chairman, my suggestions are contained in this progress report, and I can only in the briefest way allude to the main features for the purpose of summarizing the whole matter and, perhaps, clarifying the present status as I see it.

When the commission met last in Buffalo, about a year and a half ago, it had arrived at the conclusion, based upon what is possibly the most elaborate investigation of stream-pollution conditions ever

made, that the Niagara River, in common with other frontier rivers, was being polluted in contravention of certain treaty rights. At that time the commission had had suggested to it by its engineers the proposition that it should prepare plans and make recommendations to the cities. The commission had not acted upon that recommendation, but had it under consideration. The cities were heard at that time, and the city engineer of Buffalo stated that it was the duty of the commission to make the first definite suggestion rather than to ask the city what it proposed to do on the mere statement of the fact of pollution.

The commission undertook thereafter the investigation of which you have just received the final report. It was not the purpose in making this investigation to attempt to determine the most feasible plan of remedy; it was merely the purpose to determine a feasible plan, a plan which, in the opinion of the engineer, would satisfy the requirements of the commission and would serve as a suitable remedy, under the terms of the treaty and the reference, for the conditions which the commission had found to exist. It seemed satisfactory to us if we could determine, as a result of the comparatively brief survey, a single suitable solution of this problem. In the search for such a solution many alternative plans were naturally investigated. I think the commissioner is a little mistaken in his suggestion made here that six alternative plans have been presented to the city for consideration. We have in fact presented all the facts and figures in connection with our studies, but definite recommendations along a single specific line are made.

Mr. POWELL. That simply means that you consider six schemes.

Prof. PHELPS. Yes, sir; and selected from those six the one that seemer to us the most advisable. We do not pretend that this rather brief engineering study is a sufficiently complete one for the city's needs. We do not doubt that, with the fuller engineering studies which will be necessary on their part before any plans are adopted, they will be able to arrive at even more satisfactory results than we have reached. The progress of sewage purification is so rapid that since the beginning of this investigation processes have been developed that look to-day most promising, and which may, before we arrive at any final conclusion in this matter, demonstrate a very great saving in expense. These things we have had in mind and have fully considered, but our purpose has been to show that at a certain definite figure the city can accomplish the results desired by the commission and by the two Governments.

In order to accomplish that result the commission first felt it necessary to interpret the terms of the reference, which were somewhat indefinite. It is stated in the reference and also in the treaty that the waters shall not be polluted on either side of the line to the injury of health or property on the other side.

Mr. MAGRATH. May I interrupt you to inquire if that international burden is greater than the ordinary national burden?

Prof. PHELPS. It is not so great; no, sir.

Mr. MAGRATH. I thought you might bring that out.

Prof. PHELPS. It was not so simple to determine just what——

Mr. POWELL. Pardon me. You say that the burdens imposed by the treaty on communities like the city of Buffalo are not so great as

the law of the United States or the law of Canada would impose upon these communities. Is that what you mean?

Prof. PHELPS. No, sir. May I return to that point later? I was about to say that it was not self-evident in the terms of the treaty and the reference just how much pollution could be permitted without permanent and definite injury to the health and property of those on the other side. It was necessary to seek advice upon that point, and it seems to me that that point is the only one susceptible of any difference of opinion. It must be understood, in the first place, that rivers of this sort can not be maintained in their pristine purity. They must serve for the natural drainage of populous areas, and they must be polluted to a greater or less extent. Furthermore, the city sewage can be treated to almost any condition desired. We can make drinking water out it if we want to, but the cost would be prohibitive. We can purify it to any degree varying from mere screening up to the drinking-water standard.

Now, how much pollution shall we permit in these rivers—how much ought we to permit, considering the economic aspect of the situation, and also to comply with the obligations of the treaty? Upon this point the commission sought the best engineering advice available, and obtained a definite statement of a limiting standard of purity beyond which it was deemed unwise to go for drinking-water supplies.

Now, there is no question here of using these supplies in their raw state; it is assumed to be the duty of all cities using these rivers to purify them to the best of their ability. It was only proposed that the rivers should not be polluted beyond a fit condition for further purification for domestic purposes. It is the most moderate and conservative standard that we can possibly propose.

Having arrived at this point of departure with respect to a standard, which is capable of some flexibility, and is, after all, only an opinion, the remainder of the work was purely an engineering study of the means necessary to accomplish the desired results. Those means, as I have stated, we have studied in some detail. We are satisfied that our figures are correct. We are satisfied that the city can do what has been recommended to the commission within the estimated cost. As I have stated, we believe they can do it for less money. The progress of sewage purification and the necessary additional engineering studies will undoubtedly bring about further economies. We are content, however, to rest upon the figures given. We believe that those figures are a reasonable and justifiable burden to impose upon this city.

Now, as to the standard itself. That is, of course, open to discussion. It may be too severe. The city of Niagara Falls seems to be quite content to purify this water as it is to-day. Other cities are not. There are upon record several cases of water filters or purification plants, treating water worse than our proposed standard, which have on occasions failed. The best engineering devices fail at times, and the water filter, or a sterilization plant, is at most a fallible engineering device. It is fairly satisfactory, but at times it fails, and it is our duty as sanitarians to provide a raw water for treatment at such plants of a character which will not impose too much of a

burden upon the water plant, which will not reduce the margin of safety below a reasonable point.

We had all these matters in mind in fixing the standard alluded to, and if any further discussion is desired as to the reasonableness of that standard, we shall, of course, welcome it.

Capt. Norton's suggestion this morning that instead of considering the entire cross section, we should consider the fact that the water is naturally better in some strips than it is in others, seemed to me to be a point well taken. Of course that is not a matter that we can deal with in figures. The only way we could handle the matter in figures was to assume that the sewage was mixed throughout the cross section, and it is shown in the report that that is probably the most extreme assumption. It gives us the worst water, because if it is not mixed throughout the cross section, then there are necessarily better and worse streaks than the average, and the better streaks would be available for a source of water supply. On the other hand, the flow of water in streams or lines is a matter which is not capable of definite engineering study. It is a matter which can be discovered only by experimental work on the river, and it is a matter upon which we do not dare to place too much reliance. There are in most rivers changes in the channels, in the drift of the current as effected by the direction of the wind; then various elevations and rates of flow modify the drifts to a certain extent. So I think we should be a little cautious in assuming that there are available at all times streaks of water better than the average. I do not doubt that there are in most cases just such conditions.

Mr. TAWNEY. Prof. Phelps, are these purer streaks, as you call them, continuous or liable to change?

Prof. PHELPS. They follow, in general, lines parallel to the river channel. As the river channel bends, if there is a heavy pollution on one shore, it tends to keep on that shore. The farther downstream we go the less definite become these stratifications.

Mr. TAWNEY. But these purer streams that Mr. Norton spoke of?

Prof. PHELPS. They follow too. The whole flow tends to be in parallel lines. Between here and Niagara Falls there is very definite evidence that the pollution tends to hug the shore and the water in the center of the river remains for the most part relatively purer. Below the Falls, in the gorge and the whirlpool, there is a complete mixing, so that with respect to the water supply below that point we would have to accept an average mixture.

Now, in answer to Mr. Magrath's question regarding these standards from an international viewpoint and the question of how much pollution crosses the boundary waters, I would say that the standards are much less severe than they would be if we had to consider the local situation. On the other hand, Mr. Powell mentioned the national laws. The State and National laws are very weak in our country, as is evidenced by the present situation, so that our international requirements as contained in these standards are more stringent than existing laws, but if a proper law against stream pollution, or any standards such as the commission is considering, were adopted by the Federal Government the local requirements would be more excessive than the international requirements. The pollution, in any event, tends to keep on the same side of the stream.

That is, it does not cross the boundary in any such concentration as exists along the shore of its origin.

The question has been raised here and seems to have been left a little bit in doubt as to whether the recommendations and particular devices of this report shall be mandatory. My personal opinion is that in general they should not. If the city wishes to take advantage of any of the newer processes of sewage purification and can save money thereby, we say Godspeed. We want you to do it. The commission wants to accomplish and is obliged to accomplish certain things, and it wants to see those things accomplished in the most economical manner. On the other hand, I think the gentleman who last raised this question had in mind the proposed drainage canal. That would, of course, accomplish all that is desired so far as the Niagara River is concerned. The commission is obliged to look beyond that, however, and if it is not satisfied that that remedy would accomplish all that should be accomplished as regards Lake Ontario, and if it is also convinced, as has been recommended, that that remedy will not be a satisfactory one from the point of view of the citizens of New York State, then I do not think that the commission would feel justified in accepting that as an alternative, even though it seemed more desirable for this immediate locality.

Mr. TAWNEY. What have you to suggest about the pollution from surface drainage which has been discussed here this morning and which it is claimed your report does not deal with?

Prof. PHELPS. I recall that Capt. Norton raised that point at our last hearing, and I have been unable to see that it is of very serious significance. There are two distinct classes of drainage which come under that classification, and I have no doubt Capt. Norton has them both in mind. First, there is the drainage of the rural community about here, and it is undoubtedly the fact that the little streams and brooks which flow into the river in this region in times of bad weather contain a great deal of surface wash and are undoubtedly highly polluted. Capt. Norton mentioned that specifically at the last hearing in this city. Then, there is the second class—the run-off during storms. It is an obvious source of pollution. In regard to the first matter, consideration of the populations existing in these rural regions in comparison with the populations of the cities will show, just from the point of view of the human population and human pollution, that their total effect must be rather small. The effect of animal pollution, while it is undesirable and places a load upon water filters, can be dismissed as regards direct effect upon public health and the quality of drinking waters.

The most serious aspect is the storm-water overflow from the city sewers. There is a very serious and heavy pollution, and in the present state of our knowledge it seems to me is one that we have just got to let pass.

I do not quite agree with Capt. Norton, if I understood him correctly, that the maximum condition of pollution during heavy storms fixes the limits or should in any way modify our limits of pollution. This is a thing added to all the rest. If we have a certain amount of sewage coming in we have something added in time of storm. That something may be a large thing, but it does not occur very many times in the year. Our computations show the actual amount of

sewage discharged in storm overflow during the year to be but a very few per cent. It surely is our duty to cut off the main source of pollution from the public sewers, even though we do have to ignore this storm wash which we admit is serious at times.

Capt. NORTON. If I may interrupt on that one point, I had that in mind, especially in connection with the threads of the currents which gave us the pure and impure waters, and that largely entered into the element of pollution at times.

Prof. PHELPS. Your thought is that the storm flow tends to mix those streams more than they would naturally be mixed?

Capt. NORTON. No; but that was one of the elements that would give us the average. Some of the elements of our street washing from our sewers was confined largely to the shore line and did not reach any thorough admixture.

Prof. PHELPS. In making these averages we used our best ingenuity to get a fair average from the analytical results. It is, of course, a difficult matter, and my only satisfaction in thinking that these averages are anywhere near correct is the fact that after the detailed study to which they were submitted they seemed to agree very well among themselves and as between the various cities. The pollution per capita of population in the Niagara River agreed very well indeed with that in the Detroit River, and I think, on the whole, by averaging the many thousands of analyses we were able to arrive at a fair statement. But you will recall that the individual figures did vary enormously. I have no doubt that the analytical results included a certain amount of this storm wash, and that the degree of purification which we have asked for will not probably bring down the result quite as low as we would figure. On the other hand, I do not think that the additional pollution due to storm wash is many per cent of the total and its significance is certainly not in proportion to its amount. I believe that is all I have to say, Mr. Chairman.

Mr. TAWNEY. Is there anyone present from Tonawanda or North Tonawanda? Lackawanna, I understand, was represented here this morning. Perhaps the representative of the State board of health, Mr. Chairman, will have something to say this afternoon.

Dr. CLARK. Is there any particular question you wanted to ask with reference to Tonawanda or North Tonawanda?

Mr. TAWNEY. We wanted to know if the suggestions made in the report are satisfactory?

Dr. CLARK. I do not know whether they have any representative here or not.

Mr. TAWNEY. They were notified, and they can not complain that the commission did not give them an opportunity to be heard.

Dr. CLARK. You spoke about the chlorination of water. I think one of the most remarkable instances of reduction of typhoid fever in treating water with chlorine gas was manifested in the city of Lockport. Getting water from the same source for the 12 months before they used the chlorination process they had 53 cases of typhoid fever, and in the 7 months after chlorination of the water in the following year they had 3 cases. The Tonawanda, North Tonawanda, and Lockport intakes are all in practically the same thread of water.

Mr. TAWNEY. What effect has chlorination upon the potability of the water?

Dr. CLARK. There is a difference of opinion with regard to that. A great many people in Buffalo complained of the chlorine tasting in the water before the chlorine was ever put into it. After it was put in they did not complain. Dr. Fronczak received dozens of letters asking that they stop using chlorine when there was no chlorine whatever being used. The amount of chlorine that is necessary to destroy pathogenic life can not be tasted.

Speaking of this surface-water drainage I think that is a question that applies more largely and more directly to smaller communities. It is well known that in some of the rural communities there have occurred some of the greatest typhoid-fever epidemics that we have ever had. In Plymouth, Pa., there occurred one of the greatest typhoid-fever epidemics that the world has ever seen. A little trout stream was contaminated by a patient that came in there. The discharges were simply not disinfected by the physician or the nurse, but were thrown out upon the ground, and when the spring rains came a serious epidemic occurred. An epidemic through surface contamination occurred at Ithaca. I think it applies more to rural communities. The State Department of of Health of New York has recommended the chlorination process, and I think it has been proven beyond any peradventure that if the apparatus is carefully watched and the proper amount of gas is liberated into the water it is almost a sure preventive of typhoid fever, but an apparatus such as is manufactured now becomes corrupted to a certain extent, and unless cylinders are provided for weighing the chlorine you can not rely on the automatic weighing. Through the North Tonawanda intake recently we had quite a number of cases of typhoid fever, and by positive demonstration we discovered that they were using less than half the amount of chlorine they were supposed to use because the treating apparatus did not work.

Mr. TAWNEY. The State Board of Health of New York has had this report of the consulting sanitary engineer now for some two months for study. Have you given any study to the problems that are discussed in that report?

Dr. CLARK. That would be a matter beyond my jurisdiction. It would be taken up entirely by the engineer division of the department at Albany.

Mr. TAWNEY. Do you know whether or not they have studied those problems?

Dr. CLARK. Located here, I have charge of five counties in western New York. I represent the department locally, but I am not connected very much with the Albany office.

Mr. POWELL. Prof. Phelps, I would like to have you bring out clearly before the gentlemen present the object and policy in making your studies. It was not with the idea, I presume, of imposing on the city of Buffalo or the city of Detroit any particular system, but it was to show to both communities that the result you thought advisable could be worked out at a certain cost, and if they could work them out more cheaply than that it is not your purpose to interfere with them. Was that your idea?

Prof. PHELPS. Yes, sir.

Mr. POWELL. That is one object. The other was in the capacity of an adviser to point out some feasible method by which it can be done if they choose to adopt it, and I understand you to say that they might, by further study, reduce the cost or make changes in particular features of the scheme which might be more feasible than even the scheme which you have recommended?

Prof. PHELPS. Yes, sir.

(Thereupon, at 1 o'clock p. m., the commission took a recess until 3 o'clock p. m.)

AFTER RECESS.

The commission reconvened at the expiration of the recess.

Mr. TAWNEY. Gentlemen, the principal purpose of the session this afternoon is to afford an opportunity to the representatives of any of the cities and towns in the vicinity of Buffalo that were not present this morning to appear at this time and be heard in their own behalf with respect to the report of the consulting engineers. Tonawanda and North Tonawanda are two of the principal towns, I believe, that were not represented this morning. Is there anyone now present representing those communities? If there is no one to be heard, I do not know of anything further.

It is the wish of the commission to have a conference before leaving Buffalo, if possible, with the mayor and the members of the city council on this subject, with a view to seeing just what can be done to facilitate the matter of their considering and reporting to the commission their views with respect to the remedies that are proposed by our consulting engineer. I understand that they are engaged officially this afternoon in the council chamber.

(Upon the arrival from the council chamber of the members of the city council the commission went into executive session.)

INTERNATIONAL JOINT COMMISSION,
Detroit, Mich., Monday, June 26, 1916.

The commission met at 10 o'clock a. m.

Mr. Gardner presided.

Mr. GARDNER. Gentlemen, in calling this meeting to order I think I can truly say that the International Joint Commission obtain as much pleasure in coming here to Detroit at this time as it is possible for any body of men to receive that are engaged in trying to analyze and work out to a practical solution a question of the nature of the one that brings us here. We are especially glad because of the good spirit that has been manifested by the people of Detroit and this community in times gone by.

As you know, the two Governments referred to this commission for determination the question as to whether or not the boundary waters or waters flowing across the boundary were being polluted in contravention of the treaty, in which they agreed that the waters on neither side of the line should be polluted to the injury of health or property on the other. The commission in determining the first question of the reference employed that eminent bacteriologist, Dr. Allen J. McLaughlin, who made the investigations. Early in 1914

the commission issued a progress report in which it was verly clearly set forth that the waters along some portions of the boundary were being seriously and grossly polluted. Following that the commission employed Prof. Earle B. Phelps in reference to the second part of the reference, which requires this commission to report to the two Governments—

In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained in order to secure the adequate protection and development of all interests involved on both sides of the boundary, and to fill the obligations undertaken in Article IV of the waterways treaty of January 11, 1909, between the United States and Great Britain, in which it is agreed that the waters therein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.

Prof. Phelps completed his work some two months ago, and copies of the report have been submitted to the authorities of the city of Detroit and the other municipalities involved in this investigation. The commission thought it advisable, before issuing its final report to the two Governments, to come here and have a conference with you to see in what way, if any, there is going to be any serious disagreement in regard to the projects submitted by Prof. Phelps. I say projects, because he has submitted in five different methods or plans his ideas as to how this result can be best obtained. We have come here this morning with the expectation that you will take up these several projects and discuss them with the commission to show wherein, if in any way, we differ and whether or not such differences can be reconciled.

Before proceeding with the discussion of these several projects I will ask the secretary to read the call for the meeting.

(The secretaries then read the notice of the meeting to be held at Detroit which was sent to interested municipalities and officials in the United States and Canada, together with copies of the report of the consulting sanitary engineer of the commission, and also the list of municipalities and officials to whom said notice and report were sent.

The notice and list are as follows:)

NOTICE.

MAY 15, 1916.

DEAR SIR: I have the honor to inform you that the International Joint Commission of the United States and Canada will meet at Detroit on the 26th day of June, beginning at 10 a. m., for the purpose of finally hearing those interested upon the question of remedies for the pollution of boundary waters. You are cordially invited to be present, together with your engineers, appropriate heads of municipal departments, and any others who may be interested.

I have sent you under separate cover several copies of the report of the commission's consulting sanitary engineer upon remedial measures, and have also sent a copy to your clerk. I will be glad to supply additional copies if desired. Will you kindly acknowledge receipt of this letter and the copies of the report.

Through the courtesy of the city of Detroit the hearing will be held in the Detroit city hall.

Very respectfully,

——— ———, *Secretary.*

MUNICIPALITIES AND OFFICIALS TO WHOM NOTICE WAS SENT.

The mayor, Detroit, Mich.
The mayor, Port Huron, Mich.
The mayor, St. Clair, Mich.
The mayor, Marine City, Mich.
The mayor, Algonac, Mich.
The mayor, River Rouge, Mich.
The mayor, Ford City, Mich.
The mayor, Ecorse, Mich.
The mayor, Wyandotte, Mich.
The mayor, Trenton, Mich.
The Boards of Health of the States of New York, Ohio, and Michigan.
The Lake Carriers' Association.
The mayor, Sarnia, Ontario.
The mayor, Amherstburg, Ontario.
The mayor, Windsor, Ontario.
The mayor, Ojibway, Ontario.
The mayor, Mooretown, Ontario.
The mayor, Corunna, Ontario.
The Dominion Marine Association.
The Canadian Pacific Railway Co.

(The chairman, specifically mentioning each municipality in the above list, called for the names of persons appearing in their behalf, as well as the names of any others who desired to enter an appearance, and the following appearances were announced:)

APPEARANCES.

Prof. Earle B. Phelps, Washington, D. C., United States Public Health Service, consulting sanitary engineer of the commission.

H. C. McRae, Baltimore, Md., assistant to Prof. Phelps.

Leslie C. Frank, Washington, D. C., United States Public Health Service, representing the Federal Health Service in relation to steamboat pollution.

Dr. J. W. S. McCullough, Toronto, Canada, Provincial Board of Health of Ontario.

F. A. Dallyn, Toronto, Canada, sanitary engineer, Provincial Board of Health of Ontario.

W. J. Stewart, Ottawa, chief hydrographer of Canada.

Hon. Oscar B. Marx, Detroit, Mich., mayor.

Edward D. Rich, Detroit, Mich., State sanitary engineer.

James W. Follin, Detroit, Mich., assistant to the State sanitary engineer.

E. L. Waterman, Detroit, Mich., assistant to the State sanitary engineer.

George H. Fenkell, Detroit, Mich., Department of Public Works of Detroit.

Clarence W. Hubbell, consulting engineer, of Detroit.

John F. McKinlay, Detroit, Mich., secretary Detroit Board of Health.

Henry Vaughan, Detroit, Mich., epidemiologist, Detroit Board of Health.

R. U. Pryer, director of laboratories, Detroit Board of Health.

Dr. William H. Price, Detroit, Mich., health officer, Detroit.

Col. William Livingstone, Detroit, Mich., representing the Great Lakes Carriers' Association.

Morris Knowles, of Pittsburgh, Pa., representing the Great Lakes Carriers' Association.

A. H. Dittoe, chief engineer, Ohio State Board of Health, representing State Board of Health of Ohio and also the Great Lakes Pure Water Association.

Francis King, K. C., Kingston, Ontario, representing the Dominion Marine Association.

Alexander Adams, Ecorse, Mich.

Russell A. Murdock, C. E., Ecorse, Mich.

Mason L. Brown, River Rouge, Mich.

William G. Perry, Ford City, Mich.

Dr. W. Lambert, Wyandotte, Mich., mayor.

H. L. Blomshield, C. E., Trenton, Mich.

Max Jennings, St. Clair, Mich., mayor.

W. M. Barron, superintendent of waterworks, St. Clair, Mich.

Prof. C. L. Weil, C. E., St. Clair, Mich.

William Wollatt, Walkerville, Ontario, president Essex Border Utilities Commission, representing Ford City, Walkerville, Windsor, Sandwich, Sandwich West, and Ojibway, Ontario.

C. J. Montrieul, Ford City, Ontario, mayor.

A. W. Jackson, Windsor, Ontario, mayor.

M. E. Brian, Windsor, Ontario, city engineer.

Adolph Sloman, Detroit, Mich.

Mr. FENKELL. Mr. Chairman, we were notified of the meeting to-day, but we had no notice of the time at which the meeting would be held.

Mr. TAWNEY. The notice that was sent to the mayor stated that the meeting would be held at 10 o'clock a. m.

Mr. FENKELL. The mayor had been out of the city for several days, and about a week ago he came home sick. He has been ill in bed ever since. He hopes to be at the city hall some time to-day if possible. He intended to be here at the beginning of your meeting, and his absence is accounted for by his sickness.

Mr. TAWNEY. Well, he has relied, I presume, for his information upon the studies of those problems that were made by yourself and your assistants, has he not?

Mr. FENKELL. I may say that Mr. Hubbell's report was turned over to the printers as soon as received. A copy of my letter transmitting the same to the council and the summary in his report were printed in the council proceedings. We have not received printed copies of his report yet. Mr. Hubbell, the engineer who made our investigation, told me this morning that he hoped to have copies by noon.

Mr. TAWNEY. Is Mr. Hubbell here?

Mr. FENKELL. He is not here. He will be here some time this morning. He came in and asked me what time the meeting would be held, and I told him that I had not heard, and he went out. That was about half an hour ago.

Mr. GARDNER. What time do you use here, eastern or central time?

Mr. FENKELL. We use eastern time. I sent notices to the members of the board of health, the health officer, the sanitary engineer, members of the board of water commissioners, their secretary and general superintendent, the common council, members of the committee on

health and city hospitals, members of the committee on sewers, Mr. Hubbell, and perhaps others. I told them of the meeting to be held to-day, but I did not state any time. Very likely a notice giving the time of the meeting at 10 o'clock was received in my office, but I do not remember seeing it. It is probably an oversight on my part.

Mr. TAWNEY. Mr. Rich, before beginning the hearings the commission would like to know what the relation of the State is to the public health and the sewage question of the city of Detroit. Has the State board of health supreme control?

Mr. RICH. That, Mr. Commissioner, is set forth in a law known as act 98 of the public acts of 1913, of which I think we furnished you a copy some two years ago.

Mr. TAWNEY. When we were here before?

Mr. RICH. Yes. As we understand it, that gives the State board of health authority to order whatever changes may be deemed necessary in any water in the State for purposes of public health.

Mr. TAWNEY. Has that authority been questioned heretofore by the city of Detroit?

Mr. RICH. Not in court. I do not know whether it has elsewhere or not.

Mr. TAWNEY. Mayor Marx, have you any information on that subject?

Mr. MARX. I do not recall any.

Mr. RICH. The matter of Highland Park was involved to some extent, but that has been settled.

Mr. TAWNEY. So up to the present time under the existing law the State board of health has the power to order any remedial measures that it may deem necessary to protect the public health?

Mr. RICH. That is the way we understand the law, and that was the intention when it was passed. It has not been definitely tested in court yet.

Mr. TAWNEY. At the suggestion of the chair we will proceed to hear the representatives of the State of Michigan with respect to the remedies that are proposed by the consulting sanitary engineer of the commission. It is our understanding, Mr. Rich, that your office has been giving considerable attention and study to the various alternative plans proposed by the consulting sanitary engineer of the commission. I think it would be advisable to hear the representatives of the State first.

Mr. RICH. Mr. Chairman and gentlemen of the commission, I regret to say that we have not given the alternative plans very much consideration. We have not had the report long enough to be able to do so. It seems to me that the function of the office which I represent is to judge not so much the economical features that arise with respect to the various questions coming before us as the sanitary features, although we are always glad to give the municipalities what assistance we can in the economical solution of their problems. But we understand that the law first contemplates our passing upon the plans from the sanitary standpoint and giving our opinion as to whether or not they will produce the results desired, with perhaps not very much regard to the cost, although as engineers we could hardly pass by that important feature as a matter of conscience.

We have been very much interested in the studies being made, and, in fact, have done quite a little in the way of investigation ourselves

since the termination of the work of this commission. We have in progress now a report of our studies of the municipalities below Detroit, having for its object the determination of the factors entering into the production of the abnormal typhoid death rate which has existed for a number of years. A careful study has been made of each particular case so far as we were able to find it.

Mr. POWELL. How long before your report will be printed?

Mr. RICH. Probably two or three months. After that we expect to proceed to remedial measures at once; that is, the different municipalities will probably be called before the State board of health for a hearing, giving them a chance to express their opinion as to what should be done and what they are willing to do; and if they are not willing to do anything, or if they seem to be too slow, undoubtedly the State board of health would set a time within which they must conform to its orders. That has been done to some extent already with the city of Monroe, and proceedings are going forward as rapidly as we could expect there for a purified water supply. Some steps are being taken looking to the treatment of sewage. We hope that similar results may be obtained in the other municipalities below Detroit.

Mr. POWELL. Have you adopted any standard for purification of sewage?

Mr. RICH. We feel that we are indebted to this commission for a very fine determination of that point, and I might say that we are practically relying upon that entirely.

Mr. POWELL. Then you agree with us in that?

Mr. RICH. We have accepted the views of your consulting engineers almost entirely. We feel that it was very wise indeed.

Mr. TAWNEY. Have you gone sufficiently into the proposed remedies for sewage disposal to enable you to express any opinion whatever with respect to the efficiency of the remedies proposed by our consulting engineer?

Mr. RICH. In a general way; yes. From what we have been able to learn with regard to the proposition for screening sewage and afterwards treating it with a disinfectant we would not feel sufficient confidence in that to recommend it. The other methods proposed we would concur in. We concur in the judgment of the engineers with reference to the methods, but regarding the particular location of plants we are unable to express our opinion at the present time owing to the fact that we have not gone into that as carefully as we would like to do. In fact, I hardly think we would have time to go into it enough to feel sufficiently justified in expressing a very definite opinion as to the particular location of plants; in other words, as to the economics of the question, but we do feel like approving fully the views of Prof. Phelps, Mr. Hubbell, and Mr. McRae in these matters. I think they will agree with me that screening is hardly to be relied upon.

Mr. TAWNEY. Have you given any consideration to the proposed consolidation of the various villages around Detroit into one general or Detroit metropolitan sanitary district?

Mr. RICH. I have given some personal thought to it, but there have been no steps taken as yet looking toward a special investigation of that matter. I am very much interested in it. I am at the present time very much in favor of a thorough study as to the feasibility of

such an organization. I believe it is the only feasible solution of the whole problem.

Mr. TAWNEY. From an economical standpoint, do you think it would be advantageous both to the city and to the surrounding municipalities?

Mr. RICH. I do, yes; and I think it would be advantageous from every standpoint.

Mr. TAWNEY. Are you conducting your studies, then, with reference to the consolidated sewage district suggested by the consulting sanitary engineer?

Mr. RICH. No; we are not. We have not gotten as far ahead as that yet. We are simply studying the present condition, and whatever we recommend will probably be of such a nature that no great amount of money would be lost if consolidation should be effected later, but it would be more immediately available for the alleviation of existing conditions.

Mr. TAWNEY. Are you contemplating any improvement in the matter of sewage disposal for the city of Detroit independent of any recommendations of this commission?

Mr. RICH. No; we are not.

Mr. TAWNEY. Have you made any bacteriological examination of the waters of the Detroit River independent of the examination which was made by our bacteriologists?

Mr. RICH. We have made some this summer in connection with the water as it is supplied to the other municipalities, not making a study of the river as a river, but, taking it as it comes through the means of these municipalities below, we have made some studies.

Mr. TAWNEY. How does your examination compare with the examination of the cross sections of the river made by our bacteriologists?

Mr. RICH. They could not be compared, because all the water that is taken from these intakes comes from a single point in the river. We have not taken any samples in the river any more than last year we took some few samples from the western end of Lake Erie which coincided in a general way with the findings of the bacteriologists of this commission, except that our samples were taken at other points and showed what might be expected from theirs.

Mr. TAWNEY. As the chief State sanitary engineer, what would you say, Mr. Rich, as to the thoroughness and completeness of the work of the consulting engineers in their study of the problems that are involved here in the city of Detroit?

Mr. RICH. I think it has been very fine, indeed. I do not believe I could speak too enthusiastically upon that point. I am very much pleased, indeed, with the results obtained and the way in which the work was done, and that especially in connection with Mr. Hubbell's work on the part of the city. It is a fine thing.

Mr. MAGRATH. You feel that we were justified in undertaking the work?

Mr. RICH. I do, indeed; and I think it is a great contribution to the future as indicating the way in which such problems ought to be attacked and worked out.

Mr. POWELL. Have you given any consideration to the disposal of the sludge that would be the result of screening and sedimentation?

Mr. RICH. Not any more than our general reading of the subject. We have not made any studies of local conditions. Sludge obtained

from fine screening would probably need to be disposed of by incineration or else taken to a long distance from the city and buried; but probably that would be too much for the city of Detroit.

Mr. POWELL. The city of London has installed, and the city of Glasgow, Scotland, was about to install when the war broke out, a system which makes it a decided success from an economical standpoint. They deduce a lot of chemicals from the sludge. You have not given any attention to that?

Mr. RICH. You do not know what they produce?

Mr. POWELL. Yes; some of the things they produce are gasoline, carbolic acid, and a pitch. I think there are nine by-products that they dispose of.

Mr. RICH. No; I am not familiar with the details of that.

Mr. TAWNEY. I understand you to say, Mr. Rich, that, while you have read the different alternative plans or remedies proposed by our consulting sanitary engineer, you have not given them sufficient study to determine what, in your judgment, would be the most desirable and the most economical in practice?

Mr. RICH. No; I do not think so.

Mr. TAWNEY. You do not desire to express an opinion on either one of them?

Mr. RICH. Only that I think we would be justified in saying that we believe the tankage method, followed by sterilization, would be superior to screening methods.

Mr. MIGNAULT. That is, you prefer the process of sedimentation to that of fine screening?

Mr. RICH. That is it. That is as far as we would feel justified in going.

Mr. TAWNEY. Have you any opinion to express as to whether there should be one hour or two hours of sedimentation?

Mr. RICH. No. I think that would depend considerably upon the character of the sewage. We have made no tests whatever of the time required for the Detroit sewage. In fact, we have made no tests of any sort on the Detroit sewage.

Mr. TAWNEY. Have any of your assistants anything to offer independent of what you have set forth?

Mr. RICH. The two men who made the actual studies down the stream from here are present, and if you would like to hear from them at this time or at a future time they will be available. Mr. Follin had charge of the field work in the investigation at Ford City, Wyandotte, and Trenton.

STATEMENT OF MR. JAMES W. FOLLIN, OF DETROIT, ASSISTANT TO THE STATE SANITARY ENGINEER.

Mr. FOLLIN. Mr. Chairman and gentlemen, the survey which Mr. Rich has explained to you and which Mr. Waterman and I made at Ford City, Wyandotte, and Trenton, was made primarily to determine the conditions existing in connection with the high typhoid death rate in those communities and to determine what should be done to remedy those conditions. I have here a digest of the work as we planned it and carried it on which I will go over with you. The necessity for these surveys was shown by the high typhoid death rates in these communities.

Mr. TAWNEY. What were those death rates?

Mr. FOLLIN. They are given in this statement which I will read:

A sanitary survey in the villages of Ford and Trenton and in the city of Wyandotte has recently been made by E. L. Waterman and J. W. Follin under the direction of the State sanitary engineer and by authorization of the State board of health. The necessity for such surveys was shown by a study of the typhoid fever death rates in these communities. This study disclosed the following facts:

In Ford the average death rate during the period of 1904–1915, inclusive, was 364.5; the maximum was 849, occurring in 1907; the minimum was 126, occurring in 1908.

In Wyandotte the average death rate during the period of 1900–1915, inclusive, was 87.2; the maximum was 144, occurring in 1913; the minimum was 12, occurring in 1911.

For Trenton the average death rate during the period 1904–1915, inclusive, was 94.8; the maximum was 243, occurring in 1913; the minimum was 0, occurring in 1905, 1910, 1912, and 1914.

The objects of these surveys were to determine in each community—

1. The general sanitary condition.
2. The quality of both private and public water supplies.
3. The adequacy of present sewerage systems and the extent of their use.
4. The amount of typhoid fever and probable reasons for its presence.

The surveys were begun on February 15 and completed on May 1, 1916. They were carried on simultaneously in each community. Frequent bacteriological tests on the public and private supplies were made, the location of existing sewers was determined, also the number and character of connections to them, the history of the typhoid-fever cases occurring during 1914, 1915, and the first four months of 1916 was ascertained. A study of the data collected shows that the following conditions exist:

The village of Ford obtains its water supply from the Detroit River through an intake located at the harbor line. This water is supplied to the consumers without treatment. A 12-inch and 42-inch sewer empty into the river above this intake and a 36-inch sewer discharges at a point some distance below. A private sewer from the industrial plant of the Michigan Alkali Co. discharges into the river at a point about 50 feet downstream from the water intake. Float measurements made at a time when a southeast wind was blowing showed that the effluent from this sewer was undoubtedly carried past the water intake. The results of bacteriological analyses on the village water showed that it was badly contaminated at all times and at no time fit for drinking purposes. The histories of typhoid-fever cases in Ford showed that in practically all cases the infection was obtained from the village water supply. There was a remarkable absence of secondary or contact cases. The general use of outside closets which discharge into the sewer, but which are not provided with flushing devices, is to be deplored.

The city of Wyandotte obtains its public water supply from the Detroit River, the intake pipes extending out a distance of approximately 150 feet from the shore. In March, 1914, hypochlorite of lime treatment of the water was begun. Our bacteriological analyses show that out of 35 tests the treated water was satisfactory in only 15 instances, or 43 per cent of the time. The city sewerage system has four points of outlet—all into the river, but at points below the water intake. Many of the connections to the sewers are of the same nonflushing, outside closet type that is prevalent in Ford. The typhoid-fever case histories all point to the city water supply as the probable source of infection. There are a few private water supplies which are obtained from wells. An examination of these supplies shows that most of them are uncontaminated at present.

The village of Trenton gets its water supply from the Detroit River, the intake pipes extending out about 200 feet from the shore line. This water is supplied to the consumers without treatment. Bacteriological examinations show that this water is polluted at all times and absolutely unfit for drinking purposes. There are many private wells in Trenton and nearly all of them show sewage contamination. This is probably due to the fact that there is no general sewerage system in the village and consequently outdoor privies are common. Where plumbing has been installed the sewage is carried to open drains in most cases, where direct connection to the river is not feasible. There are 20 private sewers emptying into the river above the water intake, and the village authorities have recently decided to add a public sewer to this number.

General sanitary conditions in the village are exceedingly poor and the village authorities seem very unconcerned when these conditions are called to their attention. The study of the typhoid-fever cases occurring in Trenton during 1914 and 1915 shows that a majority of the cases are due to the polluted public water supply, but that some may be attributed to general insanitary conditions, such as open drains, outside privies, and polluted well supplies.

REMEDIAL MEASURES.

Filtration of the public water supplies is necessary in all these localities. It is advisable to install intercepting sewers in Fort which will carry all sewage to a point near the southern boundary of the village where a treatment plant consisting of Imhoff tanks followed by chlorination should be installed. This will protect the Ford water supply from contamination by sewage from the village and also lighten the load on the Wyandotte water filtration plant. Better raw water can be secured at Wyandotte and Ford by the extension of the intake pipes into the river channel. The best location for the intakes can only be determined by a careful investigation of the quality of the water at different points in the cross section.

At Trenton filtration of the public water supply and a general sewerage system which will properly sewer the entire village and carry the sewage to a point well below the water intake are the essential measures immediately necessary for the proper safeguarding of the public health. As Trenton is the farthermost downstream community of importance, we do not feel that a treatment plant is necessary at the present time. However, we shall insist on a design for the sewerage system which will contemplate treatment of the sewage should such treatment become necessary in the future.

Below Trenton on the Michigan side of the river we have only one city of any size; in fact, only one community which takes its water supply from water which is affected by the Detroit River. That is the city of Monroe, of about 7,500 people. It is situated on the River Raisin, which obtains its water from the western end of Lake Erie. The studies made by the engineers of this commission have disclosed the fact that the sewage of the Detroit River contaminates the waters of Lake Erie to a point as far as the islands which separate that portion of the lake from the rest of Lake Erie.

Mr. TAWNEY. How many miles is it?

Mr. FOLLIN. I do not know exactly.

Mr. TAWNEY. About 18 miles, is it not?

Mr. FOLLIN. It is probably a little farther than that. Last summer we made an investigation with respect to typhoid fever conditions at Monroe and found that although not started by the city water, the city water then did spread an epidemic of typhoid fever in the town. We made some investigation of the waters immediately in the western end of the lake next to their waterworks intake and found that they were not of sufficient quality to enable the water there to be made fit for domestic purposes by chlorination alone. We accordingly called a meeting of the State board of health, at which the officials of Monroe and the officials of the Monroe Water Co., a private company, were called in for consultation. They expressed their willingness to go ahead and complete the filtration works for the city. Those details are now being worked out. No definite order was made by the board of health in that instance because it was not deemed necessary.

So our statement that possibly the village of Trenton alone need to immediately treat its sewage is based on our local conditions along the Michigan shore and not on any study of conditions that might exist on the other side. But our recommendations to them are that

their plans be so drawn that treatment works can be installed when necessary. Trenton is now very seriously in need of the installation of a good public water supply, and we would certainly endeavor to hasten the time when they can have such a supply.

Mr. TAWNEY. All the sewage of these cities that you have mentioned is deposited in the Detroit River in a raw state?

Mr. FOLLIN. In a raw state; yes, sir. There is no treatment whatever.

Mr. GARDNER. They are all below the city of Detroit?

Mr. FOLLIN. They are all below Detroit.

Mr. TAWNEY. You are a sanitary engineer, are you not?

Mr. FOLLIN. Yes, sir.

Mr. TAWNEY. You are a graduate of the State university at Ann Arbor?

Mr. FOLLIN. I am a graduate of the State university at Ann Arbor; yes, sir.

Mr. TAWNEY. How long have you been in practice?

Mr. FOLLIN. I have been with Mr. Rich, at Lansing, for one year and have been graduated three years.

Mr. TAWNEY. Have you given any study at all to the report of our consulting sanitary engineer in regard to remedies for the pollution of the Detroit River?

Mr. FOLLIN. I have given only general consideration to it in the same way that Mr. Rich has, realizing that your problem was——

Mr. TAWNEY. From the study that you have given to it, what have you to say as to the thoroughness of the work that was done?

Mr. FOLLIN. We consider that the work has been very thoroughly carried out, and that the recommendations made are very feasible.

Mr. TAWNEY. Does the State Board of Health of Michigan agree with the sanitary experts generally that no raw sewage should be deposited in any stream that supplies other municipalities or localities with water for domestic and sanitary purposes?

Mr. FOLLIN. Personally we feel very strongly that way, but we realize that those opinions can not be forced within a very short time onto the municipalities in Michigan; but such an ideal condition must come slowly.

Mr. TAWNEY. What have you to say as to the standard of purification recommended by the consulting engineers in this progress report?

Mr. FOLLIN. I do not feel that I am in a position to comment on that, although from the little study I have given the matter I believe it is very reasonable. I might explain one other thing. Our reason for studying only Ford City, Wyandotte, and Trenton below Detroit on this side of the river and not studying the river at River Rouge and Ecorse was because the Detroit water supply is furnished to River Rouge and Ecorse and that the river supply is first used below Detroit at Ford City. It was our intention to first study those conditions because they related to the purity of the water in the Detroit River.

Mr. POWELL. I understood you to say that in one of these municipalities in which the water was treated it was found afterwards on examination to be unfit for drinking purposes.

Mr. FOLLIN. Yes; I did say that. During the course of our investigations we made 35 examinations of the treated water at Wyandotte,

covering a period of several months. During that time we found only 15 of those samples to show the water fit for drinking purposes only 35 per cent of the time.

Mr. POWELL. That is, after it had undergone the process of sterilization?

Mr. FOLLIN. After it had undergone the treatment of hypochloride of lime.

Mr. POWELL. Have you figures as to the condition before it underwent the treatment?

Mr. FOLLIN. We have those figures. In no case was the raw water fit for drinking purposes without treatment.

Mr. POWELL. Can you give the result of your bacteriological examination?

Mr. FOLLIN. We have a report now under preparation which will give these figures in detail, and we hope to have that out within several weeks.

Mr. POWELL. You can not speak from memory?

Mr. FOLLIN. Yes; the raw water was not fit.

Mr. POWELL. But that is a general statement. Do you remember how many B. coli to the cubic centimeter there were?

Mr. FOLLIN. We have not that data with us; no, sir.

Mr. TAWNEY. Will your other assistant have the figures?

Mr. RICH. I would like to have Mr. Waterman speak with reference to the attitude taken by the municipalities which we investigated. The statement read by Mr. Follin is the advance sheet of our report. It is the conclusions that are come to in our report. The report will contain more than this contains, but this is a digest of what will be the findings.

STATEMENT OF MR. E. L. WATERMAN.

Mr. WATERMAN. I can not add very much to the statements which Mr. Rich and Mr. Follin have already made, but I would like to say something in regard to the attitude which the village and city authorities in the places which we have investigated have taken toward these surveys. We found that at Ford village the authorities were very enthusiastic toward this investigation. They evidently wanted to learn just what the conditions were, and they were eager to get our opinions as to the means of correcting the conditions now existing. At Wyandotte the city authorities showed some enthusiasm, but we did not find them as enthusiastic as we felt they should have been over an investigation of this kind. I might say that the city of Wyandotte has been struggling with the problem of public water supply for some eight years, and that during that time many bacteriological examinations and chemical examinations of the water have been made at the State board of health laboratory, and at one time a consulting engineer was employed to make preliminary plans for a water filtration plant; that this proposition was defeated by a vote of the city; and that since that time very little has been done. The only thing was the introduction of a hypochlorite of lime treatment in March, 1914. As already stated, our investigations showed that a hypochlorite treatment is not adequate to give the city of Wyandotte a safe water supply. In the village of Trenton, I am sorry to say, the attitude

of the village authorities has been more unfavorable than favorable. They do not seem to realize the importance of improvements in the sanitary conditions, and we have met with very little cooperation from the authorities themselves. I think that this is about all that I can add to the statements already made.

Mr. GARDNER. Do you think there is any growing interest in this matter?

Mr. WATERMAN. I should say that in Ford village and Wyandotte there is undoubtedly a growing interest, and that among a very few people in Trenton, that you might call thinking people, there is a growing interest, but the general attitude is not favorable.

Mr. GARDNER. They are not all thinking people.

Mr. POWELL. There is one point you are clear on, and that is that chlorination is not sufficient for the purification of the water down there for drinking purposes?

Mr. WATERMAN. Yes.

Mr. POWELL. It would have to be supplemented or preceded by sedimentation or screening?

Mr. WATERMAN. You are speaking of the water itself?

Mr. POWELL. Yes.

Mr. WATERMAN. We feel that filtration of the water supply is necessary, followed by chlorination.

Mr. TAWNEY. Is this contamination of the waters of these various places due to the sewage which they themselves deposit in the water raw, or is it due to the pollution that is put in above raw, that goes farther out in the stream?

Mr. WATERMAN. In the case of Ford City, I would say that the sewage of the village itself undoubtedly contaminates an already polluted supply, and the same is true of Trenton, although undoubtedly the pollution which enters the river from the city of Detroit is more or less mitigated before reaching Trenton. At Wyandotte the sewers are all below the water intake, but the sewers from the village of Ford are above and undoubtedly pollute that supply.

Mr. TAWNEY. How far above?

Mr. WATERMAN. I would estimate the nearest one was about a mile above the intake, and there are two others within a distance of 2 miles from the intake, both entering directly into the river at the harbor or dock line——

Mr. TAWNEY. And the intake at Wyandotte is how far out?

Mr. WATERMAN. The intake at Wyandotte is approximately 150 feet out, so that whatever pollution comes in at this point 1 mile or 2 miles above would probably be diffused that distance from the shore at least, probably more.

Mr. MIGNAULT. What is exactly the position taken by the citizens of Trenton?

Mr. WATERMAN. I do not think the citizens, as citizens, have had very much opportunity thus far to express themselves on the question. It is really the village authorities.

Mr. MIGNAULT. Well, substitute in my question "the village authorities" for "the citizens"; what position do they take exactly?

Mr. WATERMAN. They take the position that everything is all right down there, and that there is no reason in the world why they should not go on putting in sewage in the water.

Mr. MIGNAULT. They are not impressed by the statistics which have been read here.

Mr. WATERMAN. Those statistics have not yet been presented to them.

Mr. TAWNEY. Nevertheless they have been informed of those facts.

Mr. WATERMAN. Yes; they have been informed of the facts, and the majority of the village council have, by their acts, shown that they do not appreciate those statistics which have been brought to their notice.

Mr. MIGNAULT. What exactly were the powers of the State board with regard to a city like Trenton, in order to compel it, if necessary, to take the necessary measures for water purification or treatment of sewage?

Mr. WATERMAN. The powers of the State board, I think, have been outlined by Mr. Rich, and if I repeat, I am trying to repeat what he said, that the State board has the power to order any improvements in the sewage systems of the village necessary in the opinion of the State board for the betterment of public health.

Mr. MIGNAULT. No such order has been given so far?

Mr. WATERMAN. No. We feel, and are rather certain, that such orders will be given, if necessary, after the completion and adoption of our present report.

Mr. POWELL. I suppose they would rather run the risk of death than face the certainty of increased taxation.

Mr. WATERMAN. That seems to be the opinion, although one useful fact has been brought out by our investigations, and that is that the old residents of these towns and cities are, for the most part, immune to typhoid fever. It is the newcomers who come on, usually within six months time of taking up their residence there, who are liable to take it.

Mr. POWELL. The old ones are immune.

Mr. WATERMAN. They have either had it some time in the past or have become so used to the water supply that the typhoid germs diffused into their system do not affect them at all.

Mr. POWELL. There is such a thing as being immune from it.

Mr. WATERMAN. I think so.

Mr. POWELL. I may say, Mr. Rich, as you are aware, the commission has had before it since August, 1914, the pollution investigation. We have carried on two distinct pieces of work. I am not looking for any compliments to the commission, but, as the representative of the State of Michigan, are you willing to go on record, first, as to the value and character of the work which we have done under the two branches of the investigation, and, second, the diligence and thoroughness with which both have been conducted?

Mr. RICH. I am heartily so. I believe that there has been no previous examination of this wide character and extent carried on anywhere—at least, none has come to my notice—and I feel that the work of the commission has been of great value to us in our work, not only in the specific material studied and the ground covered but in the general principles evolved from that study. We feel that we have been equipped with ammunition that is going to be very useful to us.

Mr. TAWNEY. You mean useful throughout the State?

Mr. RICH. Yes; and for all time to come, as assisting us in formulating our policy in a great many cases. We also feel that the investigation, after the first study, has been very thoroughly carried on, indeed. Mr. McRae's studies here were prosecuted with keen insight into the requirements of the question. As far as speed is concerned, I do not well see how the results could have been obtained any more promptly than they have been. The only delays that I have been able to notice in the procedure from the start to the finish was while the material was in the printer's hands, and I do not see how that could be construed as delay in the ordinary sense. There was the unavoidable wait for the material to be placed in such shape that it could be put before the people.

Mr. TAWNEY. Dr. McCullough, you represent the Province of Ontario, which has jurisdiction along the water front, has it not? Can you give the commission any opinion with respect to the work of the Province in connection with the subject and water purification on your side of the line?

Dr. MCCULLOUGH. Would you like me to outline the policy of the Province?

Mr. TAWNEY. Yes. We have had the policy of the State on this side and it would be appropriate to have the policy of the Province of Ontario on the other side.

STATEMENT OF DR. J. W. S. McCULLOUGH, OF TORONTO.

Dr. MCCULLOUGH. In the Province of Ontario the provincial board of health has control of the establishment of waterworks and water-purification works, sewage works, and sewage-disposal works of all kinds. No water plant can be established by any municipality or by any individual for public use unless the consent and approval of the provincial board of health, to which body all plans must be supplied, is obtained.

Mr. GARDNER. How long has that condition existed?

Dr. MCCULLOUGH. Since 1912; it exists in its present state since 1912. It did exist previously for some years, but not in a satisfactory condition. No municipality can raise money on debentures without the approval of the provincial board of health for works of the character I have mentioned, and we have further power to force extensions. We have also power, under certain circumstances, to allow the municipality to establish works of this kind and raise money without the consent of the people, and in a number of cases that has been done.

Mr. GARDNER. Without limitation?

Dr. MCCULLOUGH. Without the vote of the people and without any limitation.

Mr. TAWNEY. Except the exigency of the case.

Dr. MCCULLOUGH. Yes; it is the policy of the board, of course, as a rule, not to interfere in that way, but to have the people vote on on a money by-law. Now, there is another way a municipality can establish works of utility, and that is by having a two-thirds vote of the council. It is a sort of local improvement; that is, for extension of sewers.

Mr. GARDNER. The provincial council?

Dr. MCCULLOUGH. No; the municipal council.

Mr. TAWNEY. Has your board recently made any surveys for the purpose of ascertaining the conditions along the Detroit River on your side in regard to the villages or cities located there?

Dr. MCCULLOUGH. We were concerned in making the first progress report. The Provincial Board of Health of Ontario, as you will remember, supplied laboratories.

Mr. TAWNEY. You were associated with Dr. McLaughlin in that—you and Mr. Dallyn?

Dr. MCCULLOUGH. Yes.

Mr. TAWNEY. I thought it was well to get in the record the policy of the provincial board.

Dr. MCCULLOUGH. The policy of the provincial board is, broadly speaking, along public-health lines. We are satisfied that the water supplies are accountable for a good deal of disease of an intestinal character, and it is our object to lessen the amount of pollution of the boundary waters as much as possible and have the waters purified as much as possible. Just recently we have been able to secure a purification plant at Niagara, on the Lake, where there is a military concentration camp, under an arrangement of this kind. The municipality is bearing half the expense and the Federal Government is bearing the other half, because it is such an important matter from the point of view of having the troops there supplied with good water.

Mr. MIGNAULT. Is that water furnished to the municipality generally, or simply to the camp?

Dr. MCCULLOUGH. At Niagara on the Lake it is a municipal water supply. They simply pump it from the Niagara River and clarify it. It requires to be very heavily chlorinated, because it is badly polluted. Then, in addition to that, the military authorities have provided this year a portable violet-ray plant, whereby the water supplied for cooking and drinking purposes to the soldiers' camp is purified.

Mr. MIGNAULT. That is merely for the water supplied to the camp?

Dr. MCCULLOUGH. Yes; but not that will be further improved by the town having a filtration plant. the cost of which will be borne jointly by the Federal Government and by the municipality.

Mr. GARDNER. Do they take the water from above or below the Falls?

Dr. MCCULLOUGH. Niagara on the Lake is at the mouth of the river, away below the Falls; about 12 miles below the Falls.

Mr. MIGNAULT. Some members of the commission had the advantage of seeing the filtration plant at the camp last week.

Dr. MCCULLOUGH. That is the violet-ray plant. It does the work very well; but, of course, it is only a small affair.

Mr. POWELL. There is filtration in connection with that?

Dr. MCCULLOUGH. Oh, yes. That plant was designed by the engineer of the provinicial board of health, and by him supplied to the military authorities.

Mr. TAWNEY. What is the standard of purity that your board of health follows?

Dr. MCCULLOUGH. With regard to the sewage?

Mr. TAWNEY. Yes; standard of purification.

Dr. McCULLOUGH. We think that, for these international waters, there should be sedimentation and chlorination. We would be satisfied with that.

Mr. TAWNEY. The standard of purification is 90°, is it not?

Dr. McCULLOUGH. The standard as to purification for water——

Mr. TAWNEY. I mean for sewage. What is the standard for sewage?

Dr. McCULLOUGH. I think it is something like that laid down in the report.

Mr. TAWNEY. I wanted to find out if it corresponded with the standard established by the engineers in this report.

Dr. McCULLOUGH. We would be satisfied with that; but we are not satisfied to confine it to two areas, as proposed in the report to-day.

Mr. TAWNEY. Two areas?

Dr. McCULLOUGH. That is the Detroit area and the Buffalo area. We think there are other points to which the investigation and purification should extend.

Mr. TAWNEY. It should not be limited to these two areas?

Dr. McCULLOUGH. No.

Mr. MIGNAULT. Would you kindly say at what points on the international waterways you consider these methods should be employed?

Dr. McCULLOUGH. I think at all the points indicated in the first progress report. In that report this commission says that the waters are polluted to the detriment of either one or the other side. We think the commission should stick to that, and carry along its work to include all of these areas.

Mr. MAGRATH. You are just reiterating the position you took at Washington?

Dr. McCULLOUGH. Exactly, sir.

Mr. TAWNEY. Mr. Dallyn, you are the chief engineer of the Provincial Board of Health of Ontario, are you not?

Mr. DALLYN. Yes.

STATEMENT OF MR. F. A. DALLYN, OF TORONTO.

Mr. DALLYN. I am the provincial sanitary engineer, attached to the Provincial Board of Health of Ontario.

Mr. TAWNEY. Have you anything to add to what Dr. McCullough has said regarding the policy of the Province with respect to the purification of sewage and water for domestic and sanitary purposes in these boundary waters?

Mr. DALLYN. There is one matter, I think, that is worthy of further note, and that is as to whether it would be any advantage to either the municipalities, the Provinces, or the States, to be restricted, as they are in the report of the commission, to a specific method of meeting the commission's requirements. There seems to be some doubt as to the proper way to interpret the reference—as to whether the commission is supposed to report some definite way in which a standard is to be attained or whether the two Governments meant that a prescribed standard could be reached at a reasonable expense through at least one method. Speaking as an engineer, not as the engineer of the Province, I would say we do not want to be hampered by any restriction in that respect on the part of the commission. We

do need a standard of purity for sewage effluents. It is very necessary. We can hardly advance any further without one, but we do not want to be hampered by any particular way of arriving at any desired result. As to whether we will adopt two hours' sedimentation and Imhoff tanks, or a different type of tank, and one, two, or four hours' sedimentation is a question that requires study for each separate municipality. It will depend upon the character of the local sewage. And with the developments that are taking place in sewage disposal it is quite conceivable that half an hour's sedimentation may be a practical limit, with some particular type of tank. We do not want to be tied down to two hours' sedimentation. And then as to the method of sterilizing the effluent, your report indicates that bleaching powder, or liquid chlorin, will be the agents to effect this. Possibly we will not want to be hampered by a provision as to these. The experiments at Milwaukee indicate that a higher bacterial removal than you are calling for on these waters can be obtained by aeration of sewage by the activated sludge process. This method may not be practical at all centers; it will be practical at some.

That is just the position, I think, that most of us engineers will take with reference to your report upon remedial measures. We are very much in sympathy with the effort toward setting a standard of purification for these boundary waters. It is needed. Some of us feel that the only feasible and practical way of accomplishing the desired end is by standardizing the sewage effluent, by saying just what percentage of matter in suspension you want removed and what bacterial removal you want. I think the sewage treatment standards suggested by Prof. Phelps are practical ones and will occasion very little disputing.

Mr. MAGRATH. You do not want to be hindered from going as far as possible?

Mr. DALLYN. We certainly do not, sir. As to the construction and location of interceptors, of course, it is recognized by the engineers that the commission has had a very difficult problem, and that, with the time available, they have made a very valuable report as to the feasible way of handling the question, but there are a great many studies that will be required to be made before a municipality should be tied down to any particular route. Your proposal may show the natural route to utilize, but there might be difficulties in construction which can not be anticipated, without a great deal of survey work, by testing the substrata, finding what is below, whether sand, rock, quicksand, or clay, which might be overcome by deviating from the prescribed route, even though the excavation were heavier. Surveys can not be made in a short time. I feel also that our municipalities heretofore have not had appropriations with which to make investigation as to whether the routes suggested by you are practicable. The money that the commission has expended on this work, of course, is not adequate to make a very minute survey; and when you realize that in order to examine this report properly each of these municipalities has to spend from $10,000 to $20,000 you realize that it is quite a large undertaking for them to do at a very short notice. It is work that will require probably a year to investigate. I believe that is all I desire to say.

Mr. POWELL. You mean, by further investigation, having soundings and test pits along the route?

Mr. DALLYN. Oh, yes; and by cross sections of sewer, whether it is cheaper to use brick, or concrete, or vitrified block. There is a good deal of research work to be gone into before deciding upon work costing large sums of money.

Mr. POWELL. You speak of the purification of the effluent up to a certain standard. Would you have that standard fixed without regard to whether the effluent is flowing into a small or large stream? Can you fix it absolutely, without regard to the size of the stream, or the quantity of water that was in the stream to dilute it?

Mr. DALLYN. The sedimentation part of it should be fixed absolutely. I do not see any difficulty in doing that. There appears to be no practical or structural difficulty in requiring a certain percentage removal, or a given number of parts per million, of residual suspended matter. As to the number of bacteria to be removed, I think that could be more flexible, depending entirely upon the use the stream was to be put to, whether as a channel of commerce, or used largely as a pleasure resort, or whether it had no particular value in either of those spheres. We have in our Province a great deal of trouble by reason of townships complaining against the discharge of raw sewage, or even treated sewage, from some of the municipalities, saying it affects cattle. It is a disputed matter, but they certainly have the law on their side, and can compel the municipalities to purify to a much greater extent than some of you might think advisable.

Mr. POWELL. What is the growing consensus of opinion in respect of the purification of the effluent before allowing it to go into the stream?

Mr. DALLYN. Well, there seem to be two schools—the school of cranks, asking a high standard, and the conservation school, who want to use our natural resources to the utmost extent, and who sometimes overlook some of the changing factors which are not usually taken into consideration. I belong to the school of cranks, as I told you before, and I would like to see some better standard adopted than might immediately appear necessary, as in education we require to learn more than our vocation appears to demand when measured by practical methods of the conservation school.

Mr. POWELL. Great Britain seems to head the movement in purification of streams.

Mr. DALLYN. They have much smaller streams.

Mr. POWELL. It is a different problem, on account of the different quantity of water in the streams.

Mr. DALLYN. They lack the water-supply problem, and have to treat the sewage from the æsthetic point of view more than any other. I have in mind the ability of the stream to take up the putrescible matter, without giving out odors. In places where several centers must utilize the same stream there must needs be a more intense purification than where one center only enters it. With your problem the purification as to bacterial removal will have to be some function of the population in the congested centers. In other points, like Sarnia and Port Huron, the bacterial degree of pollution is not very heavy, not reaching the 500 standard Prof. Phelps recommends as being considered a contravention of the treaty, and the function of population does not amount to very much, so here you would have to

treat it very much better than you apparently need. As a rule, when you use chemicals to disinfect sewage, you get no action at all until you remove about 60 per cent. You get a 60 per cent removal or you get nothing. It seems to be inert; and then you have to increase your quantities till you get up to 100 per cent removal, the last 10 per cent taking almost half as much again as the 90 per cent.

Mr. POWELL. Your idea is that under no circumstances should there be any discharge into the large or small stream without purification to the extent of sedimentation?

Mr. DALLYN. I believe our civilization has reached a point now where, as far as self-respect goes, we are required to separate the gross solids from the liquid matter before discharging them into any stream.

Mr. TAWNEY. Do you desire to be heard at this time, Mr. Sloman?

Mr. SLOMAN. Not necessarily at this time, but at such a time as is convenient to the commission.

Mr. TAWNEY. Do the representatives from any of the cities on the United States side wish to be heard before taking recess?

STATEMENT OF MR. MASON L. BROWN, RIVER ROUGE, MICH.

Mr. BROWN. As the representative of the River Rouge Village, I wish to say a word. I have also been authorized to make objections for the village of Ford and the city of Wyandotte. My objections have been placed before the commission by the gentleman who has just spoken, and I think I can add nothing more to his remarks. The objections are purely local and are engineering features, and as to the desirability of purifying the sewage before entering into the stream, I think all these villages are in accord, and very anxious to do whatever is right and necessary on that. In regard to River Rouge, I may say that we have a separate system there. We realized what was coming some six years ago, and we provided for it, and all we have to do now is to put in the purification plant. Our objection in regard to River Rouge is a local one, and the engineer who has just spoken has outlined it, and if we are not tied down to the exact locality, as shown on your engineer's plan, we are thoroughly satisfied. We would rather object to the location, if we have to follow his suggestion. We can only say that the present pumping plant there is ample, without putting in an intercepting sewer, saving some $20,000 odd.

Mr. TAWNEY. Are the municipalities you are now speaking for included in the proposed consolidated sewage district, referred to in this report?

Mr. BROWN. They are not.

Mr. TAWNEY. Then the plan for sewage treatment recommended by the consulting engineers does not apply to the municipalities you represent?

Mr. BROWN. It does. The Rouge and Wyandotte are both specifically mentioned, and it is for those I am speaking. We are very anxious to have this carried out. It is simply a matter of local detail. We would like to have some changes, and we would get the same and possibly better results and at a great saving to these cities. In other words, we could do away with the interceptors.

Mr. TAWNEY. Have you any plan to suggest?

Mr. BROWN. Taking the report of your engineer as it stands, it calls for an intercepting sewer. The treatment plan is per capita, and the maintenance the same. In looking over this report I find there is very little difference in regard to the cost of construction and maintaining the treatment plan for either a small population or a large one. In other words, in the village of Ford we have three outlets, and instead of building an intercepting sewer, tearing up all their pavement, why could we not put in those three plants, dividing it up, providing the figures in that report are correct? The same as to Wyandotte. I am simply taking the report as it stands. I do not see any necessity for an intercepting sewer.

Prof. PHELPS. I may merely say, in reference to what Mr. Dallyn has said, that it is not anticipated that we would be fortunate enough to find in our brief survey the most feasible and the most economical plans. There is no intention of insisting upon the plans specifically, and if the cities and towns interested are able to save money and accomplish the result the commission desires to accomplish, we say Godspeed. It is results we are after. It is quite proper that the city shall take advantage not only of their more detailed and accurate engineering knowledge of the local situation, but also of those tremendous improvements in sewage disposal which are going ahead so fast it is difficult to keep track of them.

Mr. POWELL. Take that particular point of treating all the sewage at one point, or at three points; that is, having an intercepting sewer or not having one.

Prof. PHELPS. The engineer can advise him if he is correct. My personal experience would lead me to doubt whether he can save money by building three plants instead of one. However, if he can save money let him do it.

Mr. BROWN. I just took the statement of the report itself. It took so much per capita and disregarded the population entirely. We have never made an detailed figures. This came up hurriedly, and we have nothing to suggest. We are heartily in favor of the improvements, but in regard to the commission tying us down as to details, we would like to know how much limit we have if we get results.

Mr. TAWNEY. Have you any objection to or criticism upon the standard of purification set forth in the report, or, in other words, have you any criticism upon the result that is to be attained with respect to purification of water mentioned in the report?

Mr. BROWN. No criticism whatsoever.

Mr. TAWNEY. The municipalities you represent are entirely in accord with the report, so far as it relates to standardization?

Mr. BROWN. Absolutely.

Mr. POWELL. You recognize the obligation of your community to get rid of the sewage, but you want to do it as economically as possible.

Mr. BROWN. That is exactly the fact.

Mr. POWELL. You do not quarrel with the onus being thrown upon you to do it in some way?

Mr. BROWN. No. All these villages seem to be very willing to do something, and they are anxious. They know of this investigation, and they have delayed works on that account, and they are very anxious to do the best possible good for all.

Mr. TAWNEY. Your present population is 15,000?

Mr. BROWN. That is the population they gave for River Rouge, but I think it is not as large as that. I think you will find the present population is only about half of that.

Mr. TAWNEY. Is there anyone here representing any of the other municipalities on the United States side?

STATEMENT OF ALEXANDER ADAMS, OF ECORSE, MICH.

Mr. ADAMS. I am here representing Ecorse, and the council there met and said they were in accord with the arrangement. They wanted some system of treating the sewage, but nothing has been done at all. The water supply there is furnished by the Detroit water board.

Mr. TAWNEY. The council has taken action in the matter, you say?

Mr. ADAMS. No; they have not taken action.

Mr. TAWNEY. Have they taken any action in approving or disapproving of the report of our sanitary engineer?

Mr. ADAMS. They approve of the idea set forth in the report.

Mr. TAWNEY. With respect to the treatment of sewage and the purification of the water?

Mr. ADAMS. Yes.

Mr. TAWNEY. Then is Mr. Murdock here?

Mr. ADAMS. I represent Mr. Murdock.

Mr. TAWNEY. Is there anything further? Do you occupy any official position in the village?

Mr. ADAMS. None at all.

Mr. TAWNEY. Have you any information as to whether or not the council contemplate, in the near future, proceeding with work which they recognized as being necessary for the purpose of purifying the sewage, and so forth?

Mr. ADAMS. They have not yet. They have proposed to put in some extensions to the present system, but not purifying it.

Mr. MAGRATH. You understand that they anticipate looking for certain results in the way of improvement in the treatment of the sewage?

Mr. ADAMS. Yes.

Mr. POWELL. You are to be congratulated, because you recognize the obligation and propose to face it like men.

Mr. ADAMS. Yes; it is our opinion something should be done, and we want it to be the best arrangement.

Mr. TAWNEY. Anyone here representing Trenton?

Mr. BLOMSHIELD. Yes. I would like to take it up this afternoon. I have thought of some notes I would like to jot down.

Mr. TAWNEY. Mr. Jennings is here, representing the city of St. Clair. What is your official position, if any?

Mr. JENNINGS. Mayor of the city of St. Clair.

STATEMENT OF MR. MAX JENNINGS, OF ST. CLAIR, MICH.

Mr. JENNINGS. I am mayor of the city of St. Clair.

Mr. TAWNEY. Have you or your sanitary engineers received the report of our consulting engineers with respect to remedying the pollution of these waters?

Mr. JENNINGS. We have.

Mr. TAWNEY. Have you any suggestions or criticisms?

Mr. JENNINGS. No.

Mr. TAWNEY. Or any statement you would wish to make?

Mr. JENNINGS. I was in hopes we would have the engineer with us to-day. He is not here. I presume he will be here this afternoon. It has been placed in his hands, and he assured me he would be here to present his views this afternoon. The superintendent of the electric light and waterworks understands the situation better than I do.

Mr. TAWNEY. You have had the report studied by your engineer?

Mr. JENNINGS. It has been placed in the hands of Mr. C. L. Weil; he is not our engineer, but is the consulting engineer of the Diamond Crystal Salt Works, and it may be he will be here right after lunch.

STATEMENT OF MR. WILLIAM WOLLATT, OF WALKERVILLE, ONTARIO.

Mr. TAWNEY. Mr. Wollatt, you represent Walkerville?

Mr. WOLLATT. In connection with the Essex Board of Utilities Commission.

Mr. TAWNEY. That is for Essex County?

Mr. WOLLATT. For the municipalities in Essex County, opposite Detroit, beginning with Ford, Walkerville, Windsor, Sandwich, Sandwich West, and Ojibway. That is running down the river.

Mr. MAGRATH. The extreme distance between the two points is what?

Mr. WOLLATT. Probably about 12 miles.

Mr. GARDNER. Have you full jurisdiction over the whole territory?

Mr. WOLLATT. This bill which I have in my hand gives the commission complete jurisdiction. This is an act passed by the Ontario Legislature last session. We just simply wish to report that this act has been granted to the utilities commission, and we are getting busy. We have a meeting this week, at which action will be taken as to what the outcome will be of the matters under discussion. We are in deep sympathy with the water question and the sewage matter; but just what the utilities commission will do we can not say at the present moment. We are not that far advanced yet, except to say, of course, that we will have to be governed by the provincial board of health.

Mr. TAWNEY. You are subject to the Ontario or Provincial Board of Health?

Mr. WOLLATT. Yes.

Mr. TAWNEY. Have you given any study, or have your engineers given any study, to the report of the sanitary engineers of this commission?

Mr. WOLLATT. No; not yet.

Mr. MAGRATH. Have you organized yet?

Mr. WOLLATT. Just last week, so far as the appointment of a chairman and secretary; but no further organization. We will do that this week.

Mr. MAGRATH. What are your purposes?

Mr. WOLLATT. The bill sets out that we may construct main waterworks, which will be a system taking in from Ford to Ojibway and sewers in similar manner, if they are thought desirable. Whether it will be done under this or individually the commission have not

got that far yet. We are in a preliminary stage in regard to that yet. We thought we would come here and let you gentlemen know we are alive to this situation, and that we have taken action in having this bill passed.

Mr. MAGRATH. Your utility commission exists purely for water problems?

Mr. WOLLATT. Water and sewage. We are hoping to include other matters later, such as town planning, and so on. That will come later.

Mr. MIGNAULT. Is your commission already named?

Mr. WOLLATT. Yes; and the commission has been appointed.

Mr. MIGNAULT. Is the commission appointed named in the bill?

Mr. WOLLATT. The municipalities are named in the bill, with power in the municipality to name their commissioners, the mayors being ex officio members.

Mr. POWELL. Have you copies of that bill?

Mr. WOLLATT. No. I can let you have this, and we can probably secure more for you, if necessary.

Mr. MIGNAULT. The commission has been formed already and constituted?

Mr. WOLLATT. Yes.

Mr. MIGNAULT. And proposes to consider these problems?

Mr. WOLLATT. Yes.

Mr. MIGNAULT. And that is the position you take?

Mr. WOLLATT. That is our position.

Mr. MIGNAULT. You have doubtless received the report of our sanitary engineer?

Mr. WOLLATT. Yes.

Mr. MIGNAULT. Have you any remarks to make with respect to it?

Mr. WOLLATT. No; I must confess that I have not, because I have not studied the situation.

Mr. MAGRATH. Who are the officers of the commission?

Mr. WOLLATT. Myself, as chairman—William Wollatt—and J. E. Hoan, Walkerville, secretary. We have no further officers appointed yet, although this bill empowers us to engage engineers and various other officers as we may find necessary as we proceed. The municipalities, we may say, have all consented; that is, the municipalities named and included in this for the commission to take the matter of sewer and water out of their hands and place it in the hands of the commission.

Mr. MAGRATH. What led to the obtaining of that commission? Was it dissatisfaction with the present conditions over there?

Mr. WOLLATT. Not altogether. We had in view a very large growth on that side of the border, and we were not as well provided with water as we thought we ought to be, and that was one of the main things; then the unsatisfactory conditions entered into it.

Mr. TAWNEY. I suppose economic considerations entered into it?

Mr. WOLLATT. Yes; that entered into it partly.

Mr. MAGRATH. Are you prepared to indorse the results of the examination and the recommendation by our sanitary experts?

Mr. WOLLATT. That is a question I would hardly like to answer at this time without having the proper consultation with the engineer who may be appointed to go into the matter in detail. We are heartily in sympathy with the proposition to obtain pure water.

That is what we want, but just how we shall obtain such we can not at this moment say.

Mr. MAGRATH. But you realize that you must live up to the treaty conditions; that you must not pollute water to the injury of health or property on this side of the boundary?

Mr. WOLLATT. Yes; and we presume they will not do anything on this side to injure us.

Mr. TAWNEY. Have you copies of the report?

Mr. WOLLATT. I believe we have.

Mr. TAWNEY. One has been sent to all the villages, and I did not know whether your board had one.

Mr. WOLLATT. Yes; we have one.

(Adjourned till 2.30 p. m.)

AFTER RECESS.

The commission reconvened at the expiration of the recess.

Mr. TAWNEY. Mr. Jennings, we will hear you now.

Mr. JENNINGS. Gentlemen, I am not prepared to say very much on this preliminary report that has been made, the engineering part of it being out of my line, but I will say for the city of St. Clair that we indorse this project in principle, although perhaps the engineering points of it we might not agree with.

Mr. TAWNEY. You mean that your city indorses the results of the investigations so far as they relate to the treatment of sewage and the purification of water?

Mr. JENNINGS. Yes, sir; we are heartily in sympathy with the purification of water. We think it is necessary and we certainly shall do all we can to push the project along.

Mr. TAWNEY. Have you any criticism to make in respect to the standards proposed for the treatment of the water?

Mr. JENNINGS. Nothing that I know of. The preliminary plans as drawn up by your engineer I will leave for Prof. Weil, of St. Clair, to discuss with you. He is the consulting engineer of the Diamond Crystal Salt Co., and a man who is well up in his line.

STATEMENT OF PROF. CHARLES LEWIS WEIL, OF ST. CLAIR, MICH.

Prof. WEIL. Mr. Chairman, Mayor Jennings asked me to look over the plans and the report of the consulting engineer of the commission, which I have done. I am not here to report upon these plans from the standpoint of an engineer, but I am here simply as one having some interest in what should be done. What I have to say could hardly be construed as other than the impressions of one who has read the report and looked over the plans and is interested in the outcome. In fact, until Mr. Gardner made some statements to me here to-day I did not know just what the object of this meeting was. I understood that we were here to be instructed and not to make comments. So that, as I am trying to emphasize, what I have to say will be rather in the way of my impressions than carefully thought out criticisms or considerations.

As Mayor Jennings has said, I was impressed with the report in its entirety and not only as it relates to St. Clair but, seeing it for

the first time yesterday. I admit that I read pretty nearly the whole report.

I was impressed with the fact that the plan proposed for St. Clair divides the city into two sections, with the point of purification as a division, and that might be objectionable from a real estate standpoint. It may not be practicable to do otherwise, but that is what they have done at St. Clair. Sewage disposal should be at the outskirts and not in the center of the city.

Again, I was impressed with the fact that the Diamond Crystal Salt Co., which is the chief industry located at St. Clair, is at the proposed point of purification and disposal. That might constitute a hardship for the leading industry of the town. The Diamond Crystal Salt Co. has recently expended a great deal of money for a new intake pipe 24 inches in diameter and 350 feet long. It has recently expended a large sum of money for a filtration system to filter all the water that goes into the plant, to the salt beds, and through its vessels. It is expending a large sum of money for sterilizing the brine and carrying it to a temperature of 280° F. before it is used.

It may be known to this commission that experiments made in France show that pathogenic germs live for six months in brine not subjected to a temperature of 100° C. The department in France that made the experiments corresponds to our bureau in the United States having to do with pure foods and drugs. In France they were even going so far as to prohibit the sale of so-called natural salt, sea salt, and so forth, for the table, on the basis of impurity. The ordinary vacuum plant, as you may know, carries a temperature of only about 120° F., and that does not destroy pathogenic germs in brine.

As I have stated, the Diamond Crystal Salt Co. has gone to a very large expense to produce pure salt. The location of a plant of the kind mentioned at that point, notwithstanding the amount of proof that could be brought to bear to show that harmful results would be a minimum, might possibly be very objectionable. I can say that, in my individual opinion, and not speaking for the company, I feel that the company would be willing to cooperate with the city of St. Clair to secure a location that would be more advantageous to this plant. I am not criticizing the proposition, bu simply stating that the proposed location may be objectionable, and I may be wrong with regard to that.

Another impression that I got from the report was this: I found that it says that the population of this city has no increased in 25 years. I think that is about right. I also found in looking over the report that they would pay over 2 to 1 to maintain this plant if it were put in as proposed; that is, the cost of maintenance would be, roughly speaking, 2 to 1; say, 50 cents perhaps in Detroit and 90 cents in St. Clair, something like twice the expense on a city that is in no way an increased menace if it has not changed its conditions at all. Therefore it would appear to me as a taxpayer and one interested from the outside that the installation of such a plant at the undivided expense of a small city like St. Clair might perhaps be a burden, and hardly a just burden, on the taxppayers when this is, in a measure, an international matter. I understand from Mr. Barron that the city would be subject to a considerable expense

through its change in pavements if the plan at present proposed is carried out.

The summation of what I have had to say is probably this: That interested in the improvement of and desirous to combine in this plan, a small city like St. Clair has to be very guarded in its commendation or acceptance on account of the conditions that might be imposed through a too hasty conclusion in the matter. I think that is about all I have to say.

Mr. POWELL. What is the population of St. Clair?

Prof. WEIL. Three thousand.

Mr. TAWNEY. You probably observed in reading the report of the consulting sanitary engineer that three possible sites for the treatment plant were studied, and I understand that the one that is recommended here is the one that you are objecting to.

Prof. WEIL. Yes, sir.

Mr. TAWNEY. Have you considered the objection stated by the engineers to either of the other two?

Prof. WEIL. Yes; as I recall, I have. I think it was simply a matter of expense. Is that correct?

Mr. TAWNEY. Yes. One of them was abandoned without detailed study, because it obviously required an unduly expensive intercepting line. Another site located on the west side of Pine River was studied in detail, but was found to require a more expensive system of interceptors than the one east of Pine River, which is shown on plate No. 16, and that is the plan that I understand you object to.

Prof. WEIL. May I ask the commission a question?

Mr. TAWNEY. Certainly.

Prof. WEIL. Is it good engineering to reject the most expensive site on the ground of expense when it is an international matter?

Mr. TAWNEY. I did not quite catch your question.

Prof. WEIL. Would the commission consider it good engineering to reject a certain site on the ground of expense when it is an international matter?

Mr. TAWNEY. It would be if an equally available site could be obtained for a less expense.

Prof. WEIL. Is this not a third selection, this last one that was selected?

Mr. TAWNEY. Yes; it was selected in preference to the other two.

Prof. WEIL. On the grounds of expense?

Mr. TAWNEY. Yes.

Prof. WEIL. That means, then, that the expense is to fall on the municipality?

Mr. TAWNEY. No; the selecting of the third site, as I understand it, was to save expense to the municipality.

Prof. WEIL. But that means that the expense must fall on the municipality?

Mr. TAWNEY. Yes.

Prof. WEIL. In a big question of sanitation like this, should the matter of expense be the question of a municipality that is not growing?

Mr. TAWNEY. Here is the situation: These waters into which you are discharging your raw sewage are international waters. The result is the contamination or pollution of these waters, which, whether it does now or not, may in the future result in a violation of the treaty

between the United States and Great Britain. The two Governments, which have agreed that neither will permit on their respective sides the pollution of these waters to the injury or health or property on the other, have a right to put a stop to it by requiring the municipalities which are thus offending against the treaty to either treat their sewage or discharge it elsewhere than in these international waters.

Now, the purpose is to find the most practicable and economical method for the treatment of the sewage by these cities that are using these international waters as open sewers. We are engaged in an effort to carry out the provisions of the treaty, or to advise the two Governments how the provisions of the treaty may be carried out with the least possible expense to the municipalities that are using these waters as open sewers for the purpose of disposing of their raw sewage, and the only methods that our consulting sanitary engineers have been able to devise and recommend are those which are proposed here.

I did not quite get your objection to the third site suggested by the consulting engineer—I mean the site east of Pine River, which is indicated on plate No. 16.

Prof. WEIL. I made two objections to it, one the location with regard to the main manufacturing industry of the town.

Mr. TAWNEY. How would it affect this salt industry?

Prof. WEIL. I have tried to explain how it might affect it. I think you will appreciate that all I have said is tentative. I have explained that the company has gone to a very large expense to do what, in so far as I know, no other salt company in the world is doing—filter all the water that goes into the beds and into its plant and sterilize the brine. Now, the location of this plant in the immediate vicinity of the salt works might have a very bad effect, so far as impression is concerned.

Mr. TAWNEY. Sentimental?

Prof. WEIL. Not at all; but actual physiological and psychological effect.

Another point I tried to bring out was that it divided the town into two districts, when in my opinion it would be to the advantage of the town to have this proposed plant for purifying located on the outskirts of the town.

There is one question that I would like to ask now: Is it likely to be the recommendation of the commission in furtherance of what you have cited in regard to the treaty that these things shall be carried out even if they constitute a hardship on the particular ownership, municipality, or village?

Mr. TAWNEY. That depends altogether upon whether the sewage which they are discharging crosses the boundary and constitutes what the treaty describes as an injury to health or property on the other side. If it does, it would have to be prevented, or else the treaty obligations between the two nations would be violated. Of course, if the water beyond the boundary is not polluted at all by reason of the discharge of raw sewage on either side, then the discharge of that sewage would not be in contravention of the treaty; but if it crosses the boundary into another country to the injury of the health or property of the people of that country, it would have to stop or the two Governments would have to rescind or enforce their treaty obligations. It would be a question of fact as to whether or

not the pollution extends across the boundary to the injury of the health and property of the people on the other side. If it does it would have to be stopped, no matter what expense might be imposed on the people who are offending against this provision of the treaty. That is my interpretation of the provisions of the treaty, and I think it is the interpretation of the members of the commission generally.

You can readily understand and appreciate the position that this commission is in. We are created an international tribunal for the purpose of carrying out the provisions of a treaty which has been entered into by two great countries. There will be no hardship imposed upon any community if that community is not offending against the provisions of the treaty. If the people of any community are offending against the provisions of the treaty, they will have to take some means of preventing that which constitutes a violation of the treaty. I do not say that St. Clair is doing that, but if the conclusion of the commission should be that that is a fact with respect to St. Clair, it would have to adopt some method for the treatment of its sewage.

Prof. WEIL. Then, what is the object of this meeting?

Mr. TAWNEY. To ascertain what objections the various communities have to the plans proposed by the consulting engineer for the treatment of the sewage, so as to avoid any violation of this treaty.

Prof. WEIL. If I understand your last remarks, it is perfectly immaterial what objections we may have.

Mr. TAWNEY. No; if the communities have any better method than the one proposed, one that would be less expensive and equally as efficient, the commission would be very glad to hear of it. This is simply a report to the commission by the consulting sanitary engineer employed by the commission for that purpose. The commission has not formulated its conclusions, and before formulating them it desires to hear from the various communities affected by the recommendations of our consulting sanitary engineer.

Prof. WEIL. Of course, you understand that what I have said has been in the way of interrogation rather than criticism.

Mr. TAWNEY. Well, we are endeavoring to answer your interrogations to the best of our ability.

Mr. MIGNAULT. We would like to hear any criticism that you think proper to make as to the methods suggested by the consulting engineer.

Prof. WEIL. In a general way I have already stated what the objections are.

Mr. MAGRATH. The objection that you have stated is one relating to the location. Is there any objection with respect to the burden that this proposed plan would entail upon the community?

Prof. WEIL. Yes.

Mr. MAGRATH. The burden is fixed here, an actual charge per capita.

Prof. WEIL. What is it for Detroit?

Prof. PHELPS. It is 54 cents.

Prof. WEIL. Then, it is nearly twice as much for St. Clair as for Detroit. I do not think that is fair.

Mr. POWELL. That is the necessary result of doing things on a larger scale.

Mr. JENNINGS. On our plan there for interceptors I notice that they are running down Riverside Avenue. It might be a question for your engineer to consider, whether it would not be possible to place these interceptors one street farther back from the river. Riverside Avenue is a paved street. It is a concrete pavement, and perhaps the expense of digging that up and repaving it would be more than it would cost to take a street farther back from the river.

Prof. PHELPS. That is absolutely immaterial to us, sir.

Mr. JENNINGS. They can be placed anywhere?

Prof. PHELPS. Anywhere that you please.

Mr. POWELL. Prof. Weil, I suppose you and the community in which you live recognize the necessity of doing something to prevent this evil?

Prof. WEIL. I think you will find I stated at the outset that we recognize that very fully and are anxious to cooperate in its prevention.

Mr. POWELL. You recognize that something should be done to prevent the raw sewage from going into the river?

Prof. WEIL. Yes, sir.

Mr. POWELL. All that you are aiming at is to have it done as inexpensively as possible?

Prof. WEIL. Yes; and not arbitrarily.

Mr. POWELL. There is no desire to take anybody by the throat; this is a friendly consultation.

Prof. WEIL. I understand that, but we would like know what is going to be done.

Mr. POWELL. To the general scheme proposed by Prof. Phelps you have no objection; your objections apply only to the details of working it out?

Prof. WEIL. As to the general scheme for St. Clair?

Mr. POWELL. Yes.

Prof. WEIL. Do you mean the use of the interceptors, and so forth?

Mr. POWELL. Yes.

Prof. WEIL. That is so very general that I could hardly have any objection to it. There is nothing different in that from what has been done for years.

Mr. POWELL. It is only the details of working out the scheme to which you object?

Prof. WEIL. Yes.

Mr. POWELL. And those objections you have spoken of?

Prof. WEIL. Yes; I have tried to cover them.

Mr. TAWNEY. Mr. Knowles, we will hear you now, as representing the Great Lakes Pure Water Association.

STATEMENT OF MR. MORRIS KNOWLES, OF PITTSBURGH, PA., REPRESENTING THE GREAT LAKES PURE WATER ASSOCIATION.

Mr. KNOWLES. As I stated this morning, there is another representative of the Great Lakes Pure Water Association, Mr. Theodore M. Leison, who will speak for that organization. He could not be here this afternoon, but will be present to-morrow morning. You may consider that he will be the official representative of and will speak for the association.

While I am on my feet, and speaking entirely personally, I would say that I was very much gratified to hear the remarks of Prof. Phelps that the suggestions in the report should be considered as such and not necessarily as determinative plans, because it seems to me that, above all, the initiative should be left to the communities to work out their own salvation as long as that may result accordingly in a general, well-defined policy; I think it is helpful to us as engineers to realize that as coming from your engineer, Prof. Phelps. It seems to me that this policy is a well-considered one, so that all of us who are interested in sanitation ought to work toward the fruition of such a plan. It is necessary that separate places shall have separate solutions dependent upon topographical conditions.

Mr. TAWNEY. Mr. Knowles, you have had sufficient time and opportunity, have you not, to give some study to the report of our consulting engineers?

Mr. KNOWLES. I think I may have had sufficient time, but I do not know that I have given it sufficient study, because I have many other things to do.

Mr. TAWNEY. From the time you have given to the study of the report have you any criticism or suggestion to make as to the result, especially with respect to the standards of purification which have been recommended by our consulting engineers?

Mr. KNOWLES. As long as they can be considered generally and subject to consideration for each particular locality by a continuing body, no; but if they should be made once for all determinative, I would think that would be an error, because the art is changing so fast that such a position ought not to be taken by any body of men at any time.

Mr. TAWNEY. Let me understand you. You mean, do you, that there should be sufficient flexibility in the standard fixed to enable a continuing administrative body charged with the duty of supervising the execution of the recommendations to make such changes as are necessary to suit local conditions?

Mr. KNOWLES. And changes in the art as time goes on.

Mr. TAWNEY. Changes in the art of treatment; that is what you mean?

Mr. KNOWLES. Yes, sir; changes in the art both of treatment of sewage and the purification of the water.

Mr. TAWNEY. Then, from your studies of the proposition do I understand you to suggest that the most efficient and satisfactory results would be obtained by the creation of an international administrative body for the purpose of looking after the purification of water and treatment of sewage along these international boundary waters?

Mr. KNOWLES. I have not studied the machinery of legislation closely enough to express an opinion upon that final thing. I do believe that no effective progress can be made without some continuing body being on the job all the time. I presume it goes without saying that this being an international question it shall finally rest in some international body. I, however, couple that with the thought that the initiative should not only rest with the given municipality, but probably a still further initiative with the governing body representing that Province, that State, or that Government; the final question being left to the international body to determine the larger

questions of policy. The way to get good work is to put responsibility for detail upon the person who carries it out.

Mr. POWELL. That is good policy in all government, political or otherwise.

Mr. KNOWLES. That is right.

Mr. POWELL. While we all recognize that sanitary science is in a condition of change or progress, yet we can not sit still and do nothing. We must live up to the light that we have for the time being. So that we could not lie by and do nothing simply because there is a possibility of other methods being invented or coming to light within a certain period of time in the future. We have to do what is best at the present moment under the present light. You understand that condition?

Mr. KNOWLES. If you ask that as a question, I would say, yes, that is true. It is neither necessary to stand still nor to fix a criterion that is good forever. The way in which those things are handled by the departments of health in the States, and I presume in Dr. McCullough's department, is that a given project is acted upon at a given time with the light that the people then have, but frequently there are clauses which say that if at any time it appears that the works are not adequate, or something else is required, the right is reserved to the governing body to stipulate further requirements.

Mr. POWELL. That is, you do not want the process of evolution to cease?

Mr. KNOWLES. No, sir. The important thing to consider is that this is not the only measure of public health which is before the people at this time. There are many other things upon which public money can be spent, and it is the measure of this thing with the other things to help public health that should be considered in any large questions of policy.

Mr. TAWNEY. Mr. Knowles, are you prepared to give the commission any information regarding the treatment of sewage by aeration?

Mr. KNOWLES. No, sir.

Mr. MAGRATH. Do you think we are proceeding along the right lines in making these engineering suggestions as to these interceptor sewers? Do you think that those suggestions will be in line with any future development?

Mr. KNOWLES. Well, the relative advantages of long interceptors compared with small unit plants is all a question of finance coupled with some question of real estate development policy, but, of course, with any large body of water directly in front of a long community the place to which the sewage must go is that body of water. The most direct means is generally the most economical means, and the measure of cost of a number of plants compared with the cost of an interceptor is what is needed to find out whether the interceptor is advisable or not. No one can say what is most acceptable in either case.

Mr. TAWNEY. What is your position, Mr. Knowles?

Mr. KNOWLES. I am a consulting sanitary engineer in general practice.

Mr. TAWNEY. Located where?

Mr. KNOWLES. In Pittsburgh, Pa. That is my home now. I have practiced over the United States.

Mr. TAWNEY. Are you connected officially with the Great Lakes Pure Water Association?

Mr. KNOWLES. Yes, sir; I am a member of that association.

Mr. TAWNEY. From your knowledge of the reference submitted to the commission by the two Governments and your knowledge of the scope of the investigation, what have you to say with reference to whether or not thus far the investigation has proceeded practically and as speedily as would ordinarily be expected under the circumstances? I am asking you the same question that Mr. Magrath asked this morning of the chief sanitary engineer of the State of Michigan, merely for the purpose of getting on the record an expression of your views.

Mr. KOWLES. I think good progress and good judgment up to date have been shown, provided the criteria be taken as not too absolute; and the statement made by Prof. Phelps this morning is very helpful along that line.

Mr. TAWNEY. Have you any knowledge as to the time that was consumed in the investigation of a similar subject in the Mississippi River on account of the alleged pollution of that river by the Chicago Drainage Canal?

Mr. KNOWLES. No: I do not know the exact time. It was some considerable time. I think it must be remembered that in any of these matters it not only takes time for an investigation, but it takes a good deal of time for necessary assimilation and education.

Mr. TAWNEY. Yes; and time thus spent is well spent.

Mr. KNOWLES. It is not lost.

Mr. TAWNEY. We will now hear what Mr. Sloman, a member of the bar of the city of Detroit, desires to say on this subject.

STATEMENT OF MR. ADOLPH SLOMAN, OF DEROIT, MICH.

Mr. SLOMAN. Prefacing what I have to say, I desire to state that I was born and brought up in the city of Detroit. I have practiced law during the past 37 years. I have had a summer home during the past 18 years at what is called Sans Souci on the St. Clair River about midway between Detroit and Port Huron.

Some little time before your commission was appointed, on an occasion when my eldest daughter was down in the city and there was apparently an epidemic of typhoid she contracted typhoid fever, and we came near losing her. It was that which caused me to interest myself very much in this question of the water supply and its pollution.

Our summer home has a frontage of about 1,400 feet on the river, on the south channel, where all the boats pass. Only as recently as two weeks ago last Saturday there came down the river a quantity of oil in the form of scum that covered the river from the center clear to the shore. An east wind that was prevailing at the time blew that stuff over to the shore, and the launches and rowboats stationed at the dock were covered with that oil clear to the gunwales. It was almost a day before we could get a drop of drinking water from the river. It was that situation that I called to the attention of the minister of fisheries, to which the letter that I have here is a reply. The oil supply supposedly came from the Imperial Oil Co.

at Sarnia. The quantity was simply enormous. It came down in spots, covering an area of over 40 feet square. It looked like filth.

Mr. POWELL. Was it black?

Mr. SLOMAN. No; it was a dark brown.

Mr. GARDNER. Was it raw oil as it comes from the earth?

Mr. SLOMAN. Evidently so. Underneath that, of course, the marks of the oil were apparently in the usual form in which it is found floating on the water.

Mr. TAWNEY. Has that condition happened only once?

Mr. SLOMAN. No; it has happened before, but not to the extent that it did at the time I refer to. No one who has lived up there and has seen conditions and is at all familiar with fishing can help but realize that another happening of that kind will interfere seriously with fishing.

Mr. MAGRATH. You had better read that letter that you received from the minister of fisheries.

Mr. SLOMAN. This letter comes from the deputy minister of the naval service. When this condition presented itself I at once got in touch with the United States Engineer office in the expectation that some one on the American side who had the power would take some steps to prevent its recurrence. Upon calling up the Engineer office I found that Col. Patrick was about to start for the Mexican border, and he could not give it any attention. He was fearful that the matter might not receive proper attention from his office, and it was not strictly in his line. Inasmuch as the stuff had apparently come from the Canadian side, I got in touch with the minister of fisheries, because I understood that on a former occasion they had gone after this oil company. It is not an uncommon occurrence to find oil in large quantities coming down the river there. Over in Mitchells Bay large quantities of carp have died as the result of an accumulation of that stuff that has floated or drifted over there on account of the wind. In reply to my communication I received the following letter:

OTTAWA, *June 22, 1916.*

SIR: I have your letter of the 19th instant with regard to the pollution of the Michigan side of the St. Clair River by heavy deposits of oil, apparently coming from a plant operating at Sarnia, Lambton County, Ontario.

Your representations will be referred to the department of game and fisheries, Toronto, which administers the fishery regulations for Ontario, and immediate attention will be requested in the matter. I am, sir,

Your obedient servant,

G. J. DESBARATS,
Deputy Minister of the Naval Service.

ADOLPH SLOMAN, Esq.,
Counselor at Law, Suite 330, Penobscot Building, Detroit, Mich.

In trying to ascertain what was the real prolific cause of the fouling of the water supply I tried to decide in my own mind in watching the boats pass by to what extent they were responsible for the contamination of the water supply. I wish you gentlemen could have the privilege of standing with me on my dock some night to see the condition of the water. You would raise your hands in holy horror and say, Is it possible that this is the stuff which the people are obliged to drink? The rays of light penetrate the water and show the impurities in it. There are no words that can express the

foul condition of that water, and we get our drinking water from that source.

Mr. TAWNEY. What is the relation of the boat traffic on the river to this pollution?

Mr. SLOMAN. With regard to the sewage?

Mr. TAWNEY. Yes.

Mr. SLOMAN. I believe that at least a quarter if not a third of the foul matter that is deposited in the river comes from the vessels. And I want to say to you that I have never been able to understand how the rights of human life ought to be set to one side for the rights of property, what earthly justification there is for allowing these vessels to deposit their foul matter in the river when they could take care of it by incinerating plants. They may say it would put them to some inconvenience. What of it? I think we have a right to have health considered first. Not only that, but take the condition that existed 25 years ago. The water of the Detroit River was considered the finest in the world for drinking purposes. The city was comparatively small as considered to its population of to-day; the tonnage was small as compared with what it is to-day; but with the increase of this tonnage and the increase of population, together with the fact that vessels have been built in the past few years of heavy draft, it has been utterly impossible for nature to take care of what it would ordinarily take care of in the matter of pollution.

It is usually said that water purifies itself every 7 miles. These vessels coming along there churn that water up above the intake pipe and the northeast winds blow that stuff over. Those boats with big drafts churn up that stuff all the way up to the ship canal, and with the wind blowing from the northeast, it riles over the city supply intake.

Mr. MIGNAULT. Where is your property?

Mr. SLOMAN. At Sans Souci, which is on Harrisons Island, about 3 miles southeast of Algonac, on the south channel of the St. Clair River.

Mr. MIGNAULT. How far from Sarnia?

Mr. SLOMAN. It is about midway between Detroit and Sarnia, and Sarnia is directly opposite Port Huron.

Mr. MIGNAULT. Then, it would be about halfway between Sarnia or Port Huron and Detroit?

Mr. SLOMAN. Approximately.

Mr. MIGNAULT. Of course, the pollution which you mentioned comes from above.

Mr. SLOMAN. It comes from above. At Algonac the oil apparently does not go down the north channel, but goes down the south channel. When an east wind is blowing it can be plainly seen on the shore. For a week no woman could attempt to step on that shore without ruining her dress.

Mr. MIGNAULT. Did I understand you to say that your property is on an island?

Mr. SLOMAN. It is on Harrisons Island; directly opposite is Squirrel Island, and directly opposite that is Warpool Island.

Mr. MIGNAULT. Your property is on the American side?

Mr. SLOMAN. It is on the American side.

Mr. POWELL. Did you make any inquiries as to how the Imperial Oil Co. allowed this stuff to escape?

Mr. SLOMAN. No; I did not get up there. It has not been my privilege to get up there since this occurrence, but I at once got in touch with the authorities that I thought would handle that situation.

Mr. POWELL. It may have been due to carelessness.

Mr. SLOMAN. It looked as though they had let go what might be considered a tremendous quantity of oil. No ordinary quantity could have made a showing such as that did.

Mr. MIGNAULT. How often has it happened?

Mr. SLOMAN. In different forms it has been going on for four or five years. It has come down two dozen times—not in that quantity, but the water would show traces of oil below the surface and on the surface.

Mr. MIGNAULT. Do you mean that it has happened two dozen times in a year?

Mr. SLOMAN. No; during that period of the past four or five years. But it is not only that; when an east wind blows we get on our shore the garbage and foul matter that comes from the vessels. This year it is particularly hard on us because there never were so many vessels going up and down the river as there are to-day.

Mr. POWELL. How long ago since this happened?

Mr. SLOMAN. Two weeks ago last Saturday.

Mr. POWELL. Coming up the bay this morning, at this end of the Livingstone Channel, just about the Limekiln Reef, there was a lot of stuff on the surface that looked like raw sewage.

Mr. SLOMAN. Well, there probably was; but the Limekiln crosses below the city of Detroit, while this was above.

Just a thing or two more I would like to say in that connection. As I say, I was born and brought up here in the city of Detroit, and I will give way to no one in the matter of loyalty to the city of my birth, but Detroit is confronted with a problem that she must absolutely take care of, no matter what the cost is. It is merely a question of time when the water supply will be absolutely unfit for drinking purposes. We are drinking to-day chlorinated water. It was only a matter of a year or two ago when they cleaned out the reservoir of the waterworks, and I would hate to tell you what they found. There were two skeletons among the objects found there and a lot of very foul matter. The middle and wealthier classes are not drinking Detroit water; they are drinking well water, simply because if they use Detroit water they must drink this chlorinated water. The question is whether Detroit ought not to build in the future so as to conserve life rather than property or expense.

The city of Grand Rapids was confronted with a similar condition in 1913. Grand Rapids is a city of about 115,000 inhabitants. They undertook to discharge their sewage into the Grand River, and one of the towns below there filed a bill in the State court for an injunction to restrain the city from letting its sewage go into the river. I would like to call your attention to that case because it is full of facts; it is full of the testimony of the engineers.

Mr. POWELL. The plaintiff's appeal succeeded?

Mr. SLOMAN. Yes; the injunction was granted, and the city of Grand Rapids was given one year in which to take care of that sewage matter. When it comes to the question of what Detroit

should do in the way of purifying its waters, I am not prepared to give any technical information—that is for the engineers—but I do wish to say to you that if you will examine this case you will find testimony of some of the ablest engineers in the State of Michigan as to what ought to be done. If I may be permitted, I would like to call attention to some features of that case.

Mr. POWELL. Give the full citation of the case.

Mr. SLOMAN. The case is reported in One hundred and seventy-fifth Michigan, page 503. The title is Attorney General ex rel., Township of Wyoming *v.* City of Grand Rapids.

Mr. POWELL. That suit was brought on behalf of the Commonwealth?

Mr. SLOMAN. It was brought on behalf of the village of Grandville, which felt the effects of the foul matter that was being deposited in the river. The court in that case said:

This is a proceeding by information in the nature of a bill in equity filed in the name of the attorney general upon the relation of the township of Wyoming, through its township board, its board of health, and its supervisor, and upon the relation of the village of Grandville in said township and certain riparian owners upon Grand River in said township against the city of Grand Rapids, its common council, its board of public works, and board of health, to declare and to abate and restrain the continuance of an alleged public nuisance. The nuisance is claimed to result from acts of the city of Grand Rapids in conveying through artificial means its sewage into the Grand River, which flows down the river and is cast upon the land below that city, and particularly upon those lands which are adjacent to and within the village of Grandville, and there created a public nuisance. It is also claimed that the emptying of sewage into the river so pollutes its waters as to constitute a nuisance in the waters themselves by reason of the odors therefrom and the contamination therefrom.

The city of Grand Rapids is located upon both sides of Grand River; its population in April, 1909, when the bill was filed, was upward of 110,000; its sewage is carried into the Grand River through sewers, which aggregate upward of 171 miles in length, without purification of any character. In addition to this the night soil from the outlying houses which have no sewer connection is collected in barrels and dumped into the Present Street sewer, and flows into the river. The township of Wyoming is located south of the city of Grand Rapids; the river, after passing through the city, flows southerly and westerly between the townships of Wyoming and Walker. On the south bank of the river, at a point where it turns abruptly to the west, and about 7 miles below the city of Grand Rapids, is located the village of Grandville, with about 750 inhabitants. Considerable area in Grandville is low; there is a ridge of high ground along the river bank, which is 5 or 6 feet higher than the low ground behind it.

It appears that the river overflows its banks once or twice a year; at these times of overflow a large area in Grandville is flooded, and the river becomes very much wider than it is ordinarily and the current increases rapidly. As the river goes down and after the water ceases to flow back into the river a pond of about 20 acres is left in the edge of the village, the escape of the water back into the river by flowage being prevented by the higher ground next to the river. The water left in this pond is from 4 to 6 feet deep, and gradually disappears through evaporation and seepage into the soil.

It is the claim of the complainants that the emptying of the large amount of sewage produced in Grand Rapids into the river contaminates its waters and fills them with impurities which are carried down the stream as it flows to, and into, or through the village; that, as the water goes down, the substances and impurities which are in it, due to the sewage, whether visible or invisible, are left upon the surface of the ground, and there decomposition creates such odors as to constitute a public nuisance in the village. The most of the houses in Grandville surround the flooded area, and there are four houses and eight privies within the area covered by water in ordinary flood. There are many more houses and privies covered by the highest water known in Grandville.

Now, you have identically the same situation here that they had. You have the towns below us here of Wyandotte, Trenton, and others that abut on the Detroit River. They occupy the same position with regard to the city of Detroit as did this town of Grandville with regard to the city of Grand Rapids, and, inasmuch as the city of Detroit sooner or later is going to be confronted with the question of whether or not they must take care of the sewage as between those towns and it, just so the question might as well be disposed of by Federal legislation.

Mr. POWELL. In the absence of any special statutes on the part of your State, your common laws are precisely the same as the Canadian common law of Ontario, and the principle is very clear. I do not think there is any necessity of citing any authority on it. Every lower party is entitled to have the water flow to him in its crystal purity.

Mr. SLOMAN. There is no denying that proposition. This case is only interesting, gentlemen, with reference to the fact that it involves the inquiry as to what could or might be done to overcome the difficulty. In that respect it applies here very strongly. That is why I read portions of this authority at this time:

The bill of complaint, among other things, states that the system of sewers in the city of Grand Rapids does not cover the entire city, there being about one-quarter of the inhabitants of said city who do not discharge their refuse, of the character ordinarily discharged into and carried away by sewers, into the sewers of the city, but who discharge and deposit their filthy and unhealthy refuse into vaults and cesspools; that in the past such refuse, night soil, and unhealthy substances have been, and were at the time of filing the bill, collected by scavengers for said city and carried into the country, outside of said city, where the same was buried in deep beds, without creating any nuisance and without injury to the health of the surrounding neighbors; that there was, at the time of the filing of the bill, under contemplation by the said city of Grand Rapids, and its said authorities had recommended and intended and threatened to put into operation, a plan whereby the said refuse and night soil, then collected by its scavengers, would be carried to and emptied into the said Prescott Street sewer in said city; that the authorities had voted and determined to dispose this refuse and night soil, and they were about to commence the emptying of said sewage and night soil into the said sewer and were at the time taking steps, or about to take steps, through the expenditure of public money, for the emptying of said refuse and night soil into the said sewer.

The bill states that the night soil so collected amounted at that time to from 150 to 180 barrels a day, and if emptied into the said sewer would be carried into the Grand River and would greatly add to the pollution and contamination of its waters, and that the same would create a public nuisance in the rendering of the waters of said river injurious to users thereof; and by the overflows of said river and through deposits along the banks thereof of deleterious, unhealthful, and noxious substances and through the creation of noisome and unhealthful odors arising from the waters of said river so contaminated an additional public nuisance would be created; that the township board of health of the township of Wyoming had taken action in the matter, in accordance with the statute, and had published this action, in which it protested against the emptying of sewage and night soil into said sewer, as contemplated by the city, and had declared the same to be a nuisance and a source of filth and cause of sickness in said township, and injurious to the health of the people thereof. * * *

The bill further claims that the use of the waters of said Grand River by the said city in the manner which was then contemplated would be improper, unwarranted, and unlawful, and would constitute a daily menace to the lives, health, and comfort of the persons residing along said river and in the township of Wyoming and in the village of Grandville and would fill the air with noisome and noxious odors and pollute the air in the neighborhood and render it unfit to breathe; and that the said city could satisfactorily and economically

dispose of its refuse matter, night soil, and sewage in any other manner or through different methods than were then contemplated, without injury to the health or lives of persons and without creating a public nuisance.

The bill prays that a permanent injunction be granted against the city of Grand Rapids and its said boards, officers, and agencies, restraining and preventing it, or them, from continuing to discharge the sewage which it then discharged into Grand River and requiring it to abate the nuisance which it then maintained in the pollution of the waters of said river. It also prayed that an injunction issue restraining said city and its said officers and agencies from carrying into effect their threatened and contemplated plan of emptying into said sewer the refuse matter and night soil then being collected by the scavengers of said city for the purpose of conveying the same into the Grand River, and that they be restrained and prohibited from taking any action or in any manner ordering the performance of any act on the part of any of its officers or boards having the tendency to carry into effect the said threatened action, which would result in said nuisance.

The court in this case enters very largely into a discussion of the expert testimony that was given with regard to the relative situation of the town, the amount of filth that was deposited in these waters, the extent of the pollution, the size of the city, and the means and ways whereby this pollution might be overcome. It gives the testimony of the experts, and one of them I have particularly in mind was a witness named George S. Pierson.

The witness, George S. Pierson, called by the complainant, testified that he was a civil engineer and had made a specialty of sanitary engineering for 25 or 30 years; that his work in a large measure required the supervision of plants for water purification and installation of septic tanks; that he had supervised sewage purification plants at Hermosa, Cal.; El Paso, Tex.; Marshalltown, Iowa; Fond du Lac, Wis.; Jackson, Durand, Ithaca, Bay View, Charlevoix, and Lake Cora, Mich., and quite a number of smaller installations; that he had visited most of the plants in operation in Massachusetts, including those in Worcester, Amherst, Andover, Gardner, Framingham, Natick, Brockton, Lawrence, and others; that those plants were in successful operation when he visited them; that he had experience in estimating the cost of erection and maintenance of such plants. The witness described modern methods of sewage disposal, including septic tanks, and that the septic tank is almost universally used in this country in the first and even in the final stage of the process; that this accomplishes sufficient purification of the sewage so that it can be emptied into a stream without damage or creating a nuisance; that the septic-tank process is in successful operation in cities the size of Grand Rapids; that the recent tendency had been to relieve streams from pollution by purifying the sewage; that a sewage purification plant of a city the size of Grand Rapids is feasible; that the cost of operation of a septic tank is nominal, only an occasional cleaning, at periods varying from three months to six years; that the water consumption of a city is an indication of the amount of its sewage, because practically the entire water consumption finds its way into the sewers; this may be increased by rains carrying with them the street washings; that in providing a septic tank to ascertain its size we ascertain the daily total flow.

The witness further testified that he had made a general estimate which would be sufficiently large to cover the cost of a sewage-disposal plant for Grand Rapids, and he could positively say the cost would not exceed his estimate; the approximate cost would be $1 per capita; for a city the size of Grand Rapids it would be about $100,000; this is based upon separate septic tanks without the cost of connecting the sewers; that the cost would not vary much whether one or more tanks were used; that if a separate tank were installed at each sewer outlet the cost would be slightly more, probably not more than 25 or 50 per cent; that there is a slight odor from a septic tank, not materially different from the odor of any sewer discharge; if the tank discharges below the water level the odor is masked; the septic tank alone reduces the amount of organic matter in the sewage and the number of disease germs and brings it into such condition that upon discharge it is rapidly purified; that the odor would not last long after the discharge; it would be very much minimized from the sewage being put into the water and the duration of the odor would be less, and it would disappear within a very few hours; that in his judgment the sewage of Grand Rapids in Grand River would not purify itself before it

reached Grandville; that unless the stream has a very rapid flow there is immediate sedimentation when sewage is discharged into a watercourse; that it continues until a good part of the solids are lodged on the bottom of the stream; that if there is a considerable sedimentation between Grand Rapids and Grandville the effect of high water would be to dislodge it and carry it on; that the pollution of the stream at that time would be much increased from what it would be if the current did not take up this discharge; that the increased pollution of the water caused by this would be apt to leave deposits at Grandville that would increase the smells.

On cross-examination the witness testified that his statement as regards the sediment on the bottom of the river was not based on actual tests in Grand Rapids; that it depended to a considerable extent on the rapidity of the flow; that material settling to the bottom of the stream would not cease to be contaminating for quite a long time and would never become pure with additional material from day to day; that he was not familiar with the river between Grand Rapids and Grandville; that sewage odor from a stream within clearly defined banks would not be particularly noticeable for a great distance, it might for 5 miles, but would be reduced; that he had made no test between Grand Rapids and Grandville to see what settled to the bottom of the river; that his statement was general from what he supposed, and that he did not know the velocity of the stream between the two points; that while there is no great amount of purification in a sluggish stream in a distance of 6 or 7 miles, the faster a stream flows the farther the impurities are carried in a given time; that it might be said it was the general rule in Michigan for cities having sewer systems to carry the sewage into streams; that Grand River at Jackson is smaller than at Grand Rapids, and that Jackson has the largest municipal sewage-reduction plant that he knows of in this State; that the sewage there is purified by filtration; that the largest plant he ever established is at Auburn, N. Y. (50,000 to 75,000 inhabitants); that Worcester, Mass., with a population of 125,000 to 150,000, has such a tank; that the contaminating influences of the sewage of the city the size of Grand Rapids would not be as great if the sewage were not carried out into the river by artificial means, as there would be purification of the organic matter by the soil; and if it were not for the sewers there would be very little contaminating influence upon the waters of the river.

And they then proceed to discuss the judgment of other experts, who are referred to in the opinion. The opinion is somewhat at length, and I do not care to take up the time of the commission by reading it, but will be very glad to leave the book with you during your visit, or you can take it along with you and return it to me.

Mr. MIGNAULT. What was the order?

Mr. SLOMAN. Requiring them to proceed to establish a septic tank, and at a later time the court gave the city a year in which to do it. That same situation presents itself with regard to Detroit. Every one of these towns and cities abutting on the river are in identically the same position as the city was when it filed the bill.

Mr. POWELL. Why did the owners not file a bill before?

Mr. SLOMAN. I think they were guilty of doing the very same thing as the city of Detroit was. If you gentlemen had a large farm and a lake upon it, and anybody filled it with excreta, you would not drink the water, but we are drinking from a pond in which millions, I might say, deposit their filth and excreta. I took this matter up, when my daughter took ill, first with the city board of health. Mr. Keefer was the health officer, and he attributed the typhoid to the milk supply rather than the water, but was willing to cooperate in any measure that would bring about a change in the conditions that existed. I then took it up with the State board of health, and finally with Washington, and shortly afterwards it was

found that there was an arrangement between Great Britain and the United States for the appointment of an International Joint Commission, and finally your body was appointed. I got in touch with Chairman Tawney, giving him some data in regard to this matter, and I had hoped to be present at the former meeting of the commission, but was unavoidably called from the city, which made it impossible for me to appear before you. Upon the land we take care of our sewage through cesspools, which consist of practically a large dry-goods box, made of 2-inch boards, rather than of the thin material of which dry-goods boxes are made, inverted, with the opening off, so that the opening is right under the soil and the sewer pipes are connected with it. The soil is of a sandy, gravelly character, which carries off the impurities.

Mr. TAWNEY. How deep are your cesspools?

Mr. SLOMAN. We can not go down below 4 feet before we strike the water, but there are proprietors above me who run their sewers into the river.

Mr. MIGNAULT. All these sewers are private sewers?

Mr. SLOMAN. Yes.

With a view of getting the latest thought on the subject, I got in communication with the health board at Lansing, and desire to submit Bulletin No. 2 of the public health board of this State, for the sewage disposal of single houses and small institutions, in which they deal with the question of disposing of the sewage of the schools where they have not sewer facilities. They also give a diagram of a septic tank, by which it is claimed the solid matters are taken up with the earth, while the water that comes out of the septic tank is pure water. If it were possible to build septic tanks for Detroit, whereby the excreta might be disposed of in the soil and the pure water brought to the river, the danger would be reduced to the minimum, but unless Detroit takes some active and effective measure along that line we will be confronted in a short time, especially with the tremendous increase in our population and with the great increase in the industries, with an increased death rate. It is merely a question of time when the death rate will be appalling. I say that with a due sense of the responsibility I am assuming and an appreciation of the facts. I have watched this thing very carefully and studiously. One moment more on the question of cost. The question of cost ought not to be taken into consideration at all. You can not measure the loss of lives by cost, and the city of Detroit can not afford to destroy the unique position it occupies among the States of the Union by being backward in the matter of taking care of its sewage and by losing such a water supply as it had years ago, when it was the proud boast of the city of Detroit, which to-day it is not. To-day it is a stench in the nostrils of every community where they take the water from the river passing by their doors. I sincerely hope the Federal Government will take the matter in hand in such a way that it will not be optional with the cities to determine whether or not they will spend the money, but that measures will be passed providing means for dealing with the waters on the Great Lakes, and that the engineers will deal with the question in the best light; but foremost of all, you must stop the boats from depositing excreta in the water,

and if you do not, no matter what you do, you can not take care of this pollution. It is simply awful. Just think of the traffic running up and down the river, and all that foul stuff and oil and grease and dirty water deposited in front of your doors. We have the boats passing in front of our doors every day, and when you stop to think of it, it is an awful matter and Congress should not wait a moment to take action on it. If you do not the upshot will be you will kill every fish in the river; you can not help do it. If we have a continuation of what has occurred during the past two or three weeks, from my knowledge and experience as a fisherman who has been going up along the river for the last 30 years, you will kill every fish in the river, because the foulness gets to the bottom and permeates that entire body of water, and nature, struggling as hard as she will, can not possibly take care of it.

I just wish, as a lay citizen, only having the interests of my city at heart, and feeling that the matter of life and health is of greater concern than profit, to urge that you will in your report, as far as it lies in your power, bring to the attention of Congress the really awful condition that exists along our shores, and ask that some measures be taken to remedy something which, if it is not remedied soon, will result in a tremendous loss to the city, which you will be sorry for in later days.

I thank you, gentlemen.

Mr. TAWNEY. We will proceed now with the statements of those who are here to speak for the lake traffic associations, and before doing so we will hear Prof. Phelps on the subject of pollution by means of lake traffic.

Prof. PHELPS. The progress report of the commission has sufficiently placed on record the statement of the extent and distribution by shipping interests. It will not be necessary for me to make any further statement than to bring out two points of distinction between this peculiar type of pollution and that with which we have been dealing in the case of the cities. The first of these is due to the movable character of this sort of pollution, whereby it may and does pass within close proximity to the waterworks intake of the city. The second of these is due to the fact that the steamboat traffic is confined in lines, the result of which practice is the pollution of the steamboat's own water supply by steamboats which have preceded it. The importance of this matter, which was emphasized in the progress report, led us in the United States Public Health Service to undertake a solution, a possible means of remedying the situation which would satisfactorily dispose of these things without undue expense or undue inconvenience to the city interests. These investigations have been proceeding now for nearly two years, and I am going to ask Mr. Leslie C. Frank, the sanitary engineer of the United States Public Health Service, to describe to you the character of the investigation and the type of apparatus which he has designed to meet the situation, together with some remarks upon the application of the apparatus at the present time.

Mr. TAWNEY. State what investigations the Government has made and the results.

STATEMENT OF LESLIE C. FRANK, OF WASHINGTON, D. C., SANITARY ENGINEER, UNITED STATES PUBLIC HEALTH SERVICE.

Mr. FRANK. As Prof. Phelps has told you, the Public Health Service, realizing the probable future necessity of treating the sewage from vessels in some way or another, has endeavored to find a practicable solution. So that for the past two years we have been studying various methods, and we have been experimenting with what seemed to be the best method.

The method of traffic-sewage control is to provide storage tanks for the sewage so equipped that the sewage is both automatically disinfected and automatically discharged by means of steam or other heating element when it has reached a certain predetermined level in the tank. This method has been described in Reprint No. 247 of the Public Health Service reports. Briefly, the device consists of a tank, as shown in the illustration, with a sewage influent pipe penetrating nearly to the bottom; a discharge pipe having its influent end near the bottom of the tank, and rising up through the tank to a point above it; a float and valve with a lost-motion connection; and a steam influent pipe. The operation of the tank is simple. When the sewage has reached a certain predetermined level the float automatically turns on the steam, which escapes into the sewage through a number of small holes. All of the heat of the steam, of course, is given up to the sewage, which rapidly approaches the boiling point. As soon as the boiling point is reached, but not before, pressure is developed in the tank and the sewage is forced up and out through the discharge pipe. When, owing to this discharge, the sewage level in the tank has dropped to a predetermined minimum the float, through its lost-motion connection, turns off the steam and the tank is ready for the next cycle of operation.

There are a number of distinct advantages of this method:

(*a*) It depends upon heat for its disinfection efficiency, and heat is generally acknowledged, as above noted, to be very thorough in its action.

(*b*) Its action is entirely automatic. This eliminates the uncertainties of manual operation by a large number of employees.

(*c*) If fresh sewage enters the device while it is being discharged, the discharge immediately ceases.

There is no danger, therefore, of fresh sewage being carried out untreated. This advantageous feature is due to the fact that as soon as any fresh sewage enters the device its contents are chilled to a temprature at which pressure is impossible. The new mixture must again be brought to the boiling point before further discharge will take place.

(*d*) It permits toilet doors to remain unlocked over drinking-water areas.

(*e*) It permits toilet doors to remain unlocked while waiting in stations. This latter has, of course, no public-health significance, but it does concern very nearly the comfort of the passengers. In lieu of locking the toilet doors while standing in stations, the porter has merely to turn off a steam valve penetrating the car floor external to the toilet. The tank can be designed with a sufficient reserve capacity to care for any reasonable period of waiting. The objection will be raised immediately, of course, that the porter may forget to

turn on the valve when the train leaves the station. This is true, but forgetfulness of this sort will rapidly create its own remedy. For, at the station stop immediately subsequent to the complete filling of the tank and its consequent dribbling, the fact of the porter's forgetfulness would be made painfully evident by toilet discharges upon the station platform. It should be remembered in this connection that the porter can not help himself in such an emergency by locking the toilet doors.

The above device is now being experimented with upon a stationary basis in order to secure the maximum simplification of details and to secure data upon steam consumption, and bacterial efficiency. As soon as these studies are completed experimental devices will be placed upon vessels and railway coaches and tested in actual service. It is believed that the cost of operation will be extremely low. Rough preliminary office estimates indicate that the cost of disinfection with the above device should not be over two-tenths of a cent per cubic foot of sewage disinfected. This preliminary estimate is based upon the assumption that 1 pound of coal in the average modern locomotive will evaporate 6 pounds of water, and that locomotive coal costs $1.50 per ton delivered into the locomotive. This certainly should be more than sufficient allowance for radiation.

Based on the above estimate, sewage disinfection for a railway coach which used 10 cubic feet per day for toilet flushing will cost about 2 cents per day. The cost for steamers will probably be somewhat higher owing to the greater amount of water used per toilet flush.

An estimate of 5 or 10 cents per closet per day would seem reasonable. The steamers could, of course, reduce this considerably by substituting railway toilets for their present equipment.

That is, briefly, a description of the manner in which the tank works.

Mr. POWELL. What temperature is the water?

Mr. FRANK. We have been experimenting with the tank since January, and in none of our tests has the temperature at which discharge began been lower than 190° F., and that has only been when I have put steam in at such a high rate that it rose through the water so rapidly to the surface as not to condense as in the usual adjustment. In practically all of the experiments where I have so adjusted the steam valve—mind you, this has an automatic adjustment, too—as to cause the time of heating to be about 15 or 20 minutes, the temperature has always been between 200 and 212, practically boiling, always above the killing temperature for pathogenic organisms. I should say it was, roughly, about——

Mr. POWELL. One hundred and seven?

Mr. FRANK. No; about 160° F., which is equivalent to 60° C. The device may be regulated so that the discharge is never under 200. I think that the effect of the temperature can be illustrated by the results of our tests. We have never in any case been able to recover B. coli from the effluent, except once, in a great many tests. I have forgotten how many there were. In this one case I put the steam at such a high pressure that the discharge took place in only two or three minutes. Now, it is possible, in the manner of installing the device upon a vessel, to make it absolutely impossible

for that to take place. I say that because I have been operating with 100 pounds steam pressure in Washington and reducing it down to about 5; and it is always possible on some vessels to make the line carry anything you want by a proper reducing valve. And if this line can be brought to somewhere about 10 to 15 pounds per square inch it is physically impossible for the discharge to take place in anything less than 10 or 15 minutes.

As regards what has been done toward installing the device on vessels, this experiment has been almost entirely due to the courtesy of Col. William Livingstone, president of the Lake Carriers' Association. As you will remember, some time ago he offered to provide for the commission one or more vessels for experimentation. He has now made good that promise, and last week I was in Cleveland, and initiated the installation of the apparatus with which I have been experimenting in Washington since January upon the *D. G. Kerr*, just recently off the ways, and now completed, I believe, from what I heard in Cleveland. The installation of the device will be completed about to-morrow, and the first trip of the vessel is scheduled to begin Wednesday morning. I expect to make that trip on her. In regard to the future experimental work with the device, I do not think it ought to be too quick. I think we ought to take a fair amount of time to satisfy ourselves as to the manner in which the device works. I do not think one or two trips are enough to tell whether it will work or not. We have been experimenting with the device upon a stationary basis at a pumping station. That means no motion of the device; and it is certainly desirable to determine how it will act on a rolling vessel, and that will be the object of the present experiments during the coming season.

Mr. MIGNAULT. Do you foresee that the rolling of the vessel will make any difference?

Mr. FRANK. At present I can not see any definite trouble that is likely to result. With the rolling of the vessel I foresee that when the tank is half full the surface of the water in the tank may be caused to sway at an angle depending upon the rolling of the vessel.

Mr. MIGNAULT. What is the size of the tank?

Mr. FRANK. This tank with which I have been experimenting, which is designed for a group of toilets, is 24 inches in diameter by 30 inches long, and I have instructed them to place it longitudinally with the ship, so that the least wave action will take place from rolling. The ship on which this has been placed, for example, is 500 or 600 feet long and does not receive much effect from pitching. It is too long for that on the Great Lakes, but it does experience rolling, so that I have exposed the short portion of the tank to the rolling. The only thing that I can see might happen is this, that before the tank fills to the point where, normally, the steam is turned on automatically, the wave action will turn on the steam so that steam will enter the device. Also, if the tank is in the act of discharging, and the vessel rolls, and, say, of it is half discharged, then if one side of the tank on which the float is situated should be temporarily depressed, it would shut off the steam before the sewage had quite discharged. But I can not see any harm in it. It simply, momentarily, during the storm, reduces the capacity of the tank and makes the steam turn on oftener and reduces the capacity of the tank. That is the only effect I can see. I am also anticipating a possible knock-

ing of the float on the inside of the tank by the insertion of stoppage lugs fitted by buffer springs. If the rolling were serious the buffer might be knocked against the top of the tank and be water-logged, and I am endeavoring to stop that by the insertion of buffer lugs.

Mr. TAWNEY. What is the capacity of your tank in gallons?

Mr. FRANK. About 70 gallons.

Mr. TAWNEY. Would that suffice for a fairly large vessel?

Mr. FRANK. That would suffice only for about half a dozen toilets, and if a vessel had a group of half a dozen toilets in the rear and half a dozen forward they would require to have two tanks. It is not necessary to delimit the side of the tanks to say how large the tanks should be. I think it would be much wiser to let that problem be solved for each particular vessel. The older vessels have a great many toilets, and would require more tanks. The newer vessels, which have fewer toilets, would have correspondingly fewer tanks.

Mr. TAWNEY. What is the cost of the outfit?

Mr. FRANK. It is difficult to say, but I should say it would not be expensive. The experimental tank which we have built in Washington, which is designed for six toilets, cost $600, but remember that is experimental, and one of the engineers whom I had to help me put three-sixteenths steel. That is more like building a warship, and it does not require to be so heavy. In practice it would not come to that.

Mr. MIGNAULT. Could you install it in vessels already built?

Mr. FRANK. It depends on the character of the vessel. I think it is comparatively easy. The *D. G. Kerr* has been built already and had the soil pipe already inserted. The master mechanic, with whom I was talking yesterday about the installation of the device, stated that he thought it would take, roughly, 24 hours to install that tank.

Mr. MIGNAULT. In what part of the vessel is it placed?

Mr. FRANK. This particular experimental tank is being placed aft. Of course the tanks in practice would be placed wherever the soil pipes happened to be built.

Mr. TAWNEY. Is this a freight vessel?

Mr. FRANK. Yes. The cost of the operation, I think, will be almost negligible. We had this experimental device installed in the sewage pumping station in Washington, where we had a steam pressure of about 100 pounds per square inch and boilers of about 100 horsepower. It was impossible at any time to observe any effect whatever on those boilers when this device was receiving steam at its maximum flow, and I simply mentioned that to indicate that there would be no observable, even temporary, effect upon the steam supply for the engines in the vessels. There is no such great consumption of steam. I can explain to you steamboat people when I say that a half or three-quarter inch pipe will carry all the steam you need.

As regards the cost of operation, I have not the figures with me just now, but I computed, theoretically allowing 100 per cent additional cost for radiation, and I got 13 per cent for everything, including the amount by which the steam had already condensed in the pipe lines. I think the cost of operation goes away down to point zero something. If you figure it out upon the theoretical heat units that are known absolutely to be in the steam, there is no other conclusion

but that the cost of operation of the device is negligible, and that the only thing which really need concern you is the cost of installation of the device. However, as regards operation, I think it would be better to wait for confirmation after the device is tried.

Mr. TAWNEY. Is the only contamination of the water by steamboats that which is discharged from closets?

Mr. FRANK. I think it can safely be assumed that the only part of steamboat discharge which has a pathogenic significance is that coming from the closets and urinals. I do not think any other particular discharge need concern us.

Mr. TAWNEY. The meats, or anything of that kind, can not become affected, being thrown into the water? Would that not have some effect?

Mr. FRANK. I do not know, but I think that the frequency of occurrence of infected meats upon vessels would be so low that any infection of the waters due thereto would be negligible and would be dissipated quickly.

Mr. POWELL. You could take care of that as a separate problem; give it a dose of steam.

Mr. FRANK. I think some kitchen rules could be formulated that would take care of that.

Mr. POWELL. What temperature Fahrenheit would you say?

Mr. FRANK. You could so regulate the device that it would be physically impossible——

Mr. POWELL. But what degree of heat?

Mr. FRANK. Between 200 and 212. The device can be regulated so that it will never discharge under 200, and is practically always 210. At centigrade the pathogenic temperature is 60.

Mr. TAWNEY. Don't you think the complete sanitary requirements should call for some sterilization of refuse matter of the kitchen? If you were prescribing sanitary rules to be observed by the lake carrying trade, would it not be wise to make some provision for sterilization of refuse matter from the kitchen in the form of infected meats, or anything of that kind?

Mr. FRANK. I do not think I would be prepared, without a good deal further thought, to say so. I have not given it any thought in the past.

Mr. TAWNEY. I was trying to get at whether your system would be complete in itself for the purpose of preventing contamination of these waters by reason of steamboat navigation.

Mr. FRANK. I believe it could be safely said that, inasmuch as probably away over 99 per cent of all infected pollution which is discharged from the vessel is discharged through the toilets and urinals, emphasis might reasonably be laid only on those for the present, until it is definitely shown that real infection can result from the meats or kitchen waste. As I say, I have not thought of the problem in connection with the kitchen, and I really do not know whether you could, by discharging this waste, produce much affection or any affection.

Mr. POWELL. It would not be a difficult matter to sterilize them with an iron tank with a cover to prevent the escape of steam and a cock to turn on the steam. It is easy enough.

Mr. FRANK. Yes. If the meat or any of the feed were in large pieces, all that would be necessary would be to chop it up into relatively fine pieces.

Mr. POWELL. It would not cost more than $25 or $30.

Mr. FRANK. I would not place it quite so cheap.

Prof. PHELPS. It could all be burned in the furnace.

Mr. POWELL. There is very little new under the sun. Very nearly this same appliance has been in use on the Muskoka Lakes in their steamboats.

Mr. FRANK. Then I will be interested to know how it works.

Mr. MIGNAULT. You are not in a position to estimate the cost.

Mr. FRANK. I would prefer to wait until these experiments furnish me with actual figures on board ship.

Mr. TAWNEY. It is comparatively small.

Mr. FRANK. I think it could be safely said to be negligible, as far as steam consumption is concerned.

Mr. SLOMAN. Have you made any inquiry as to whether or not the garbage could be disposed of by an incinerating plant?

Mr. FRANK. No; I have not.

Mr. SLOMAN. Or whether the cost of an incinerating plant would exceed the cost of the plant you have in mind?

Mr. FRANK. I think Prof. Phelps's suggestion to simply throw the kitchen refuse which is thought to be infected into the furnace is the most simple and obvious that has been suggested.

Mr. SLOMAN. Your plant does not take care of anything but the excreta from the closets?

Mr. FRANK. It does not.

Mr. SLOMAN. So that the vegetable matter and all that would have to be dealt with. After you have sterilized it you would throw it into the water?

Mr. FRANK. Yes.

Mr. SLOMAN. After you have sterilzed it and cast it into the water and it goes to the shore, would it not become a menace again by coming back into the water?

Mr. FRANK. No; because the pathogenic organisms can not grow.

Mr. SLOMAN. Is it not a fact that in erecting ordinary dwellings they have an incinerating plant, by which they take care of the garbage by burning it?

Mr. FRANK. It may be done in country homes, but it is not done on vessels.

Dr. MCCULLOUGH. I am much interested in the description of the device given by this gentleman, and I may say that on the Muskoka Lakes, where about 30,000 people go every year, we carry out in principle what he proposes. We have not the automatic device that he has, but what we have answers the purpose very well. The sewage all goes into a large tank, and live steam is turned into that for 20 minutes. The requirement is that the effluent shall not be poured into any of the harbors; it must be turned into the middle of the lake. All the steamboats are under one company, and they are very willing to carry out this device or arrangement because it is a good advertisement for them. They are catering entirely to passenger and freight and bringing people to this summer resort, so that our task in getting them to establish the arrangement is an easy one.

Now, we are beginning to establish similar arrangements on the boats plying around Georgian Bay. With regard to the garbage which is thrown from the boats, I do not think we have very much complaint about the Muskoka Lakes, because it is eaten up by the gulls and birds found in large numbers on the waters. I am very much interested in the description of this device, and will be glad to know it is a satisfactory one, because if it turns out to be so, it will probably be established on our boats when any new ones come in to be equipped.

Mr. MIGNAULT. Regarding the tank installed on the Muskoka Lakes, is the effluent rendered harmless?

Dr. MCCULLOUGH. I think undoubtedly, because the steam is turned in for 20 minutes, and I think that would settle everything.

Mr. POWELL. What is the cost of the plant?

Dr. MCCULLOUGH. It is comparatively small.

Mr. DALLYN. I think about $100 would be the cost.

Mr. TAWNEY. I have here a letter which the chairman asked me to present. It reads as follows:

SEWERAGE COMMISSION OF THE CITY OF MILWAUKEE,
June 20, 1916.

Hon. O. GARDNER,
Chairman, International Joint Commission,
Federal Building, Buffalo, N. Y.

MY DEAR SIR: Your letter of June the 19 addressed to Hon. Daniel W. Hoan, mayor, city of Milwaukee, has been referred to me for reply.

With the permission of the Sewerage Commission of the city of Milwaukee I should be glad to attend your meeting, to be held at Detroit on Tuesday, June 27, to assist you in any way I can in the discussion for adoption of the most feasible and efficient system for the disposal of sewage pollution of the cities which affect the boundary waters.

I am sending this communication to your address at the Federal Building, Buffalo, also the Federal Building at Detroit, and Southern Building at Washington, D. C.

Upon my arrival at Detroit on Tuesday morning I will call at the Federal Building about 10 o'clock.

Very truly, yours,

T. CHALKLEY HATTON, *Chief Engineer.*

P. S.—My engagements are such that I must leave Detroit for Pittsburgh the night of June 27.

Mr. TAWNEY. Mr. Livingstone, is it your desire to present to the commission anything on this matter of remedies for the pollution of these waters occasioned by steamboat traffic?

STATEMENT OF COL. WILLIAM LIVINGSTONE, OF DETROIT, MICH., PRESIDENT LAKE CARRIERS' ASSOCIATION.

Mr. LIVINGSTONE. I do not think I have anything to present different from what I stated to the commission before. I stated that so far as our Lake Carriers' Association was concerned we would gladly cooperate with you in carrying out the objects by every means in our power, and at that time, in the course of the long discussion that ensued, I stated that I would be glad to put a boat or two, or more boats, as the case might be, at your disposal, to test any plan which the health board wanted to try out. Mr. Frank went over the ground. It is useless for me to repeat that. He came to me and I arranged to put a boat at his disposal. He has the apparatus in-

stalled, and he can have the use of her for testing as long as he pleases. Our thought about the matter summed up is this: We are willing to cooperate with you in any way in our power, but we have this feeling about it decidedly, that, whatever apparatus is adopted we feel that it ought to be thoroughly tested and carried beyond the experimental stage, so to speak, and that the experts should be satisfied that the plants installed will accomplish the purpose for which they are installed, because otherwise, if we were to adopt a mechanical device to accomplish this purpose and to put it on board our boats costing a great many thousand dollars and then found after we had installed them that they would not work properly and had to tear them out, the result would be a loss of time and money, and no possible good would result. We have some 16 steamers, and naturally the cost would be great. We feel now that it is just in the experimental stage. We do not feel that the time has arrived at which the health bureau are prepared to say, "If you install this device it will be satisfactory and accomplish the result"; but as soon as they are prepared to say, "We have tested this out; we have given it a thorough test; and we are satisfied in our minds that it will accomplish the purpose set forth," then we will say, "Go ahead."

May I add one thing? I want it to be clearly understood that I am not asking that our boats be exempt from any part of their duty to be performed to the general public, but it seems to me the matter has been overstated, to some extent. I am not putting it in by way of defense or expiation. I may say that we have in our employ approximately 17,000 people. If you take all the men employed on all the boats on the Great Lakes—call it 25,000, if you please—we employ the majority of them, and it must be remembered that they are not depositing their sewage or excretion into the water at any one point, and the idea that they can pollute and contaminate the waters to the same extent that this great city of 700,000 inhabitants can, with the sewers flowing into the river, is simply impossible.

Mr. TAWNEY. It is not only the sewage deposited by the employees of the vessels you speak of, but the steamboat population of the Great Lakes in 1913 was 50,000,000 souls.

Mr. LIVINGSTONE. I know that; we carried nearly 14,000,000 out of Detroit. I am not making any defense. I am not asking that they be treated differently from any other citizens of the United States. We do not ask for one blessed thing in the way of exemption. We stand up and try to do our full share as citizens of the country. I have lived in Detroit all my life, nearly, and have a large family, and am just as much interested in Detroit as any man living here can possibly be, and just as anxious we should get pure water to drink as any man living. I am not putting it upon the ground of cost either. It is not a question of dollars and cents. I want that understood. The point we want to be satisfied on is that it will work efficiently.

I have been connected entirely with freight boats. The average crew is about 25. The passenger boats carry a larger complement. Unless I misunderstood him, Mr. Sloman said that the water board sent me a letter, I think, nearly, if not quite, two years ago and asked that on account of the intake pipe near Detroit, which is up at the head of Belle Isle on the American side, we should make some arrangement that for several miles above that we would have our closets closed until we had passed that intake pipe. We complied

with it, and I am not sure whether all the passenger lines complied with it. I know I personally asked them all, and I am reasonably sure the request was complied with. Nothing was deposited anywhere near the intake pipe. I went into this matter fully and exhaustively at the last meeting of the commission, and we stand now just where we did then. Anything you gentlemen decide, after giving it careful and exhaustive study, we stand ready to abide by, but we think it has not yet been tested out sufficiently, and I think Prof. Phelps will agree with me that they have not yet got to the point where they will say it will do the work.

Mr. MAGRATH. Mr. Sloman made quite a point about the garbage from steamers as being an injury to property. There must be a tremendous amount of garbage where there is such a heavy passenger traffic each season.

Mr. LIVINGSTONE. That is true. Where do you live, Mr. Sloman?

Mr. SLOMAN. Up at Sans Souci.

Mr. LIVINGSTONE. On Harrisons Island?

Mr. SLOMAN. Yes.

Mr. LIVINGSTONE. I will say that the orders are peremptory that no garbage shall be thrown into the river, but, of course, it is impossible to control all our vessels.

Mr. SLOMAN. What is done with it?

Mr. LIVINGSTONE. Sometimes it is thrown into the Lakes, but I do not claim to make any point on that, because it is not handled as well as it should be handled, but we do the best we can with the facilities we have. However, I want to emphasize one thing—that the orders are peremptory that in the St. Clair and Detroit Rivers no garbage shall be thrown, and you know that I know whereof I speak. The man that is reported for doing that will get the short shrift. Of course it is clearly understood that we have careless employees the same as anybody else. Sometimes on a dark night, if the cook thinks it is too much trouble to put the garbage into a receptacle which we provide for it, he throws it over the rail. I presume that sometimes happens, but I am speaking of the general orders. If I have not filed the sanitary rules which we have published, I will be glad to file them. These rules are given to all the members of the crews.

Mr. SLOMAN. Have you ever ascertained the rules in Europe on the vessels? You have traveled on them?

Mr. LIVINGSTONE. I know nothing, except being a passenger on the ocean. I know the methods of taking care of the garbage for the cities generally.

Mr. SLOMAN. Would you think burning garbage by an incinerating plant on the vessel, and keeping the excreta from the closet in a sealed can and distributing on the land would cost more than the apparatus your engineers are figuring on?

Mr. LIVINGSTONE. I can not answer that question. I have to refer these matters to those men who are experts.

Mr. MIGNAULT. Would it be possible to incinerate the garbage?

Mr. LIVINGSTONE. Oh, yes; I think it would. I am not prepared to say just how. You can do anything, but the question is as to how practical it will be. It may be so difficult to carry out as to make it impossible. There is nothing you can not do if you try.

Mr. POWELL. You can throw it into the furnace. That is incinerator enough.

Mr. MIGNAULT. That would hardly be a method.

Mr. LIVINGSTONE. I am not here to suggest a plan. I am here to tell you we will adopt any feasible plan you suggest. We simply say the experiments have not gone far enough.

Mr. TAWNEY. Mr. King, have you anything to offer as the representative of the Dominion Marine Association?

STATEMENT OF MR. FRANCIS KING, K. C., OF KINGSTON, REPRESENTING THE DOMINION MARINE ASSOCIATION.

Mr. KING. Just a word. I will ask the commission to pardon me if I should repeat a little of what the President of the Lake Carriers' Association has said, as I was not able to catch all that he said—in fact I must confess that I failed to hear a great part of his remarks, owing to the noise outside. But I began to pay strict attention when this gentleman [Mr. Sloman] preferred that very vehement indictment against the vessels passing through the waters in question. I am not going to say very much on that point, but I ask the commission to weigh the accuracy of his statements in some measure by the accuracy of his knowledge of the position of the owners of these vessels. I do not think I have to repeat to the commission, but I will say it again for this gentleman's benefit, and the commission will pardon me. What we said at the previous session of the commission at Detroit—and what I am sure Mr. Livingstone has already said, although I could not hear him—was that we were in an attitude of cheerful willingness to place ourselves in the hands of the commission, and I speak on behalf of all the tonnage on the Canadian side between Port Arthur, the head of the Lakes, and Montreal. We place ourselves in the hands of the commission, trusting the commission will only bring into force, or recommend that the respective Governments pass legislation that will be fair and reasonable. We want to do what is right. We are as much interested as anybody in preventing the pollution of the waters, and I urge—and I wish to emphasize it very strongly—that nothing should be done without the fullest and most complete test. I think the commission is at one with that suggestion and will act upon it.

With regard to what has been done by Prof. Phelps and Mr. Frank, I trust that nothing will be done until you have had the fullest and most complete test of the proposals. I submit the test should be had not only on one trip but throughout the season, that it should include all weather and should include all seasons, and it should deal with the question of interference by frost, that the test should be carried out not only on the large freighters but on passenger boats, on which the conditions may vary, and that it should be carried out on boats of different sizes and engaged in different trades. It would be a matter of multiplying the test by three or four or five in order to cover the various conditions; but I do ask that this delay should take place, not for the purpose of postponing unduly any action that ought to be taken by vessel owners, but because the conditions are so different from those in regard to municipalities. In a municipality a tremendous amount of money is going to be spent before one knows absolutely what the effect is

to be, and you are practically committed to that scheme. In the case of a boat you have an opportunity to decide upon the best scheme, having regard to the practicability, the cost and effectiveness, and I trust the commission will be governed to some extent by the consideration of cost, if it is to be granted.

Mr. TAWNEY. Would you consider it a hardship if the steamboat companies were required to place an apparatus on one of their boats at their own expense, with the understanding that if satisfactory they should complete the equipment on all their vessels; otherwise it would go no further?

Mr. KING. I do not quite understand the suggestion.

Mr. TAWNEY. Would the companies consider it a hardship if they were required to install one of these machines at their own expense for experimental purposes, that they should pay for it at their own expense——

Mr. KING. And if it was bad not to install it on the others?

Mr. TAWNEY. Let the commissioners decide whether they should go on or not?

Mr. KING. The vessel owners are willing to do whatever is right, and possibly this machine may not be the best. We do not know what may be invested in the next year or two. In view of the infinitesimal proportion of the sewage which can be credited to the boats, immediate haste is not necessary, and if it is going to take 5 or 10 years to settle the question with regard to the municipalities, it would be better to spend the money for the purpose of testing rather than committing ourselves to one appliance which may not answer the purpose. I am not urging delay for the sake of delay.

Mr. TAWNEY. I gather from your statement that the steamboat companies would not be willing to install this apparatus on all of their boats simply upon the result of one test.

Mr. KING. No.

Mr. TAWNEY. That being the case, in order to get something which would be satisfactory to the steamboat companies, we would have to install this or some other apparatus on two or three boats, or a sufficient number of them to satisfy the steamboat companies that they were feasible and practicable, at the expense of the two Governments, which this commission has not the power to do. The question was whether or not, to carry out your idea, if we could possibly do so, the steamboat companies were not willing to install a few of these machines on these boats at their own expense, for the purpose of testing their feasibility and practicability.

Mr. KING. I am not in a position to give an answer on that point on behalf of the companies.

Mr. TAWNEY. We are not in a position to commit the two Governments.

Mr. KING. I do think both associations are willing to do whatever you would consider reasonable in that way, and I think it might be possible here and there to effect an installation, in order to get a sure test of the appliances. I do not say that should be done, but I think the vessel owners are willing to do it. I think the first cost should be borne by the public till the inspection is done.

Mr. TAWNEY. I am glad to get your idea.

Mr. KING. Our attitude is one of absolute fairness in the matter. May I say one more thing in regard to the point I was urging, per-

haps unduly? That is the lack of necessity for haste in the case of a vessel. You spoke of the steamboat population of the boats. May I point out that that population is a population as individuals for periods averaging from an hour to a day. They are not engaged in the pollution of the waters for 365 days in the year. That consideration is somewhat overlooked. One more remark: It was suggested by Prof. Phelps that steamboats ought to be dealt with at present, in spite of the municipalities' pollution, because of the fact that they pass the intake pipes for the waterworks systems. May I suggest that while the tests are going on, it would be a simple matter to devise rules whereby lavatory doors are locked just as they are locked on trains, at times when the contamination might take place? They could be closed when they are passing in close proximity to the intakes. A move in that line might possibly meet what was in Mr. Phelps's mind.

Mr. TAWNEY. Is it not a fact that there is danger also on account of vessels taking their water for drinking purposes in polluted areas?

Mr. KING. I do not think that is a danger which the commission should deal with. I think we can carry it out by orders that the water should not be taken except in certain restricted areas.

Mr. TAWNEY. Is it not a fact that considerable typhoid fever has been caused by that means in the past?

Mr. KING. I can not admit that. I know of one case where a suit was entered at Rochester, and tried, but no decision yet. I know of no other cases.

Mr. TAWNEY. I know of several cases in southern Minnesota attributed to that.

Mr. KING. At the same time, I must admit that contamination does exist.

Mr. MIGNAULT. There is a great probability of contamination.

Mr. TAWNEY. In the matter of taking water ballast in polluted areas and discharging that ballast in less polluted areas, as they arrive near the ports—what have you to say to that? Would it be a hardship if they were required not to take on water ballast in polluted areas, or else not to discharge it in the less polluted areas?

Mr. KING. I do not think it would be a hardship, except in cases where the exigencies of navigation required them to fill their tanks before they got out of a certain area. There are cases where boats must have their tanks filled before they get out of the landlocked harbor. A boat coming from Kingston must have her tanks filled before she gets into Lake Ontario.

Mr. TAWNEY. Could there not be some regulation in regard to the discharge of that ballast in the vicinity of intakes?

Mr. KING. I think that could be sufficiently covered with the one provision. They have to keep her sufficiently trimmed in stress of weather.

Mr. SLOMAN. You spoke a moment ago about the cost of trying out the question and solving the problem—that it should not be thrown upon the vessel owners. Mr. Livingstone had made an offer—at least he has done something toward experimentation at considerable cost——

Mr. KING. Excuse me; it is at no cost to Mr. Livingstone or the Lake Carriers' Association. I understand it is borne by others.

Mr. SLOMAN. Is that so?

Mr. TAWNEY. Yes.

Mr. SLOMAN. Would it be any cost to your vessels to try out the incinerating of your garbage by putting it in your furnace?

Mr. KING. I do not think so.

Mr. SLOMAN. Would it involve a large cost to have a septic tank in your holds, running your closets to that tank, sterilizing the contents and bringing it to port, and carrying it away to the land somewhere? Would that involve a large cost?

Mr. KING. I think it would, but I do not know. I have no direct knowledge of that.

Mr. SLOMAN. What do you think as to whether or not that would be a practical way of solving the problem?

Mr. KING. I would not set my judgment up against that of Prof. Phelps and Mr. Frank, who have gone more deeply into the subject than I have.

Mr. FRANK. I think that may be answered by saying that in order to store all of the sewage for a voyage until a port is reached the tank would have to be many times as large as this small stream tank which I have described, and the cost would be almost, although not quite, proportionate to the volume. In addition, the expense of disposal after the land was reached would have to be met. I think it may be stated without any doubt whatever that any device holding the sewage throughout a whole voyage would obviously cost much more than a device for holding it for about two hours.

Mr. POWELL. Mr. King, you are willing to do anything that we may prescribe, but you ask us not to recommend that you be required to spend money on schemes that in their experimental stage may prove abortive?

Mr. KING. Quite true.

Mr. TAWNEY. I understand that the representatives of the city of Detroit will not be ready to proceed until the session to-morrow morning. Is there anyone else here who desires to be heard?

STATEMENT OF MR. H. L. BLOMSHIELD, OF TRENTON, MICH.

Mr. BLOMSHIELD. I would like to speak on behalf of the village of Trenton. I am sorry that I am here to represent a village that has shown such half-hearted interest in the recommendations of your consulting sanitary engineer, Prof. Phelps. The attitude taken by the village authorities is no doubt due to the fact that local conditions have called for much quicker action on the part of the State board of health in recommending certain remedial measures for their local benefit.

It has already been stated that there are about 12 sewer outlets above the intake, and it has been urged upon the village authorities to construct a 12-inch intercepting trunk sewer to divert this sewage below the intake.

It has appeared to the majority of the residents that the tail end of the district has been tackled first. I can say that I believe they will be in hearty accord with any remedial measures your commission may adopt for the entire district.

From a standpoint of economy and future supervision, I believe a metropolitan district could best serve the Michigan side. I derived this thought from a lecture on the "Metropolitan District of Boston,"

by Mr. Frederick Fay before the District Engineering Society several months ago.

I have read several press reports on this subject as viewed by Mr. Hubbell, our district consulting sanitary engineer. As outlined, I believe the district would extend from the Macomb to the Monroe County lines. It appeals to me more forcibly in that each community will be served alike and pay pro rata for benefits derived.

In going over the past history of improvements recommended for Trenton, I will say that about seven years ago an extensive combined sewerage system was planned at an estimated cost of approximately $50,000, which the people voted down. They have never had the opportunity to vote on a sanitary system, which I believe would cost about $18,000.

The finances of the village are in such shape that this price would go beyond the 5 per cent mark of bonded indebtedness. I might give the figures showing the present condition of the finances. In the meantime, before I give that I would like to ask a question. If recommendations are carried out in the several districts, does the commission give any method of raising the funds necessary to carry on such work?

Mr. TAWNEY. That is a matter that the commission has not yet considered at all, and I do not know whether it is within the scope of our work.

Mr. BLOMSHIELD. If the several districts had the funds with which to do it, I believe that some of these measures would have been taken up long ago. The assessed valuation of our village in 1915 was $555,200, bonded as follows: Highway-improvement bonds, $6,500; electric-light plant, $7,500; other bonds, $6,125; total, $20,125; of which $3,500 has been paid off, leaving a balance to be paid of $16,625. One per cent, which is the allowable limit for any improvements in any one year for any special kind of improvements, would make $5,552; or 5 per cent, which is the total limit of bonded indebtedness, would make $27,760, of which $16,625 has already been bonded, leaving a balance of $11,135, which you see is very much less than would pay for a sanitary sewerage system which the village surely needs.

I have acted as village engineer for Trenton during the past year, and without funds to promote any measures of sanitary work or water purification we are very much handicapped. If the commission in recommending any remedial measures could also embody any method of raising funds to carry on the work, it would be greatly appreciated.

Mr. POWELL. Why do you recommend the metropolitan district—on account of the saving?

Mr. BLOMSHIELD. On account of the saving to the smaller districts per capita.

Mr. POWELL. You would not have the overhead charges to meet?

Mr. BLOMSHIELD. That is it; and that is something that the smaller communities could not stand.

Mr. MIGNAULT. What is the borrowing power of Trenton to-day?

Mr. BLOMSHIELD. Five per cent; but they have $11,000 yet to borrow.

Mr. MIGNAULT. Is there no provision to meet a case like that where certain improvements are ordered by the State board of health?

Mr. BLOMSHIELD. I believe 5 per cent is the point set by the State law for villages.

Mr. TAWNEY. It is set by your constitution, is it not?

Mr. BLOMSHIELD. Yes.

Mr. MIGNAULT. In a case like that, where it is a matter of public necessity, have you not the power to levy a special assessment?

Mr. BLOMSHIELD. Nothing we know about yet. We have asked several authorities on that and we have not been enlightened on that subject.

Mr. POWELL. As a matter of fact, what is your head of taxation, the village?

Mr. BLOMSHIELD. The village. The village takes in a very small area. It should be enlarged. That is one method that would be furthered.

Mr. POWELL. Have you a county tax besides that?

Mr. BLOMSHIELD. Yes.

Mr. POWELL. And a State tax?

Mr. BLOMSHIELD. And a State tax. Our taxes now are $17.50 per thousand, or $1.75 per hundred. That is the total tax for the village.

Mr. POWELL. That is all combined?

Mr. BLOMSHIELD. That is all combined.

Mr. POWELL. Well, you are happy boys.

Mr. MIGNAULT. I understand your chief objection is lack of funds with which to carry out the improvements?

Mr. BLOMSHIELD. That is it.

Mr. MIGNAULT. If that were removed, there would be no difficulty?

Mr. BLOMSHIELD. There would be no difficulty. As I say, if some system were laid out for the entire district the village of Trenton would be heartily in accord with such a system. Due to the local conditions which have prompted immediate action, they feel that they are being called out to start the thing.

Mr. MIGNAULT. There is no intention to single them out.

Mr. BLOMSHIELD. I realize that.

Mr. MIGNAULT. Our desire would be to treat them all alike.

Mr. MALONE. Do you not think that if the Federal Government were to impose a penalty for not putting in a filtration plant that they would find ways and means of getting the necessary money to put it in?

Mr. BLOMSHIELD. I guess they would.

Mr. TAWNEY. Is there any other person here that desires to be heard this afternoon? As there is not, the commission will take a recess until 10 o'clock to-morrow morning.

(Thereupon, at 4.15 o'clock p. m., the commission took a recess until 10 o'clock a. m. Tuesday, June 27, 1916.)

INTERNATIONAL JOINT COMMISSION,
Detroit, Mich., June 27, 1916.

The commission met at 10 o'clock a. m.

Mr. GARDNER. Gentlemen, the hearing this morning is for the purpose of listening to the representatives of the city of Detroit, and, as I understand that we will have to vacate this room at 4 o'clock this afternoon, it will be necessary for us to get busy. We will first hear from Mr. Fenkell.

STATEMENT OF MR. GEORGE H. FENKELL, COMMISSIONER OF PUBLIC WORKS OF THE CITY OF DETROIT.

Mr. TAWNEY. Mr. Fenkell, will you please state what the city of Detroit has done in connection with the consulting engineer of the commission in the matter of investigating the remedies for existing pollution? Before you go into the technical matters, kindly give a sort of summary or history of the part your city has taken and what they are doing.

Mr. FENKELL. Your commission met in Detroit about a year and a half ago, and immediately after that meeting I asked the common council for funds to begin work on an investigation as to conditions existing in the Detroit River. Only $15,000 has been provided. Shortly after that Mr. Clarence W. Hubbell, of Detroit, was engaged to make an investigation and report. A little later he occupied joint offices with Prof. Phelps.

That investigation was carried on until Mr. Hubbell's report was submitted, about four weeks ago. It was put into the hands of the printer immediately and yesterday we received the first copies. I was able to deliver only three copies to you yesterday. I hope soon to have more from the printer. That report was submitted to the council shortly after it was received from Mr. Hubbell. The summary was printed in the council's proceedings, a copy of which, I believe, was mailed to your commission.

Because of the haste in getting the report to the printer the typewritten report was not read generally. In fact, I think I was the only one that was able to look the report over before it went to the printer. None of the Detroit officials is familiar with Mr. Hubbell's report except such portions as appeared in the council's proceedings.

Mr. TAWNEY. Mr. Hubbell and the sanitary engineer of the commission, then, were working together for the last year, were they?

Mr. FENKELL. I think so. Just how they divided the work and how they carried out the details I am unable to state.

Mr. TAWNEY. They were jointly studying the same problem at the same time.

Mr. FENKELL. They were.

Mr. TAWNEY. Now, what have you to say, Mr. Fenkell, in regard to the plans recommended by the consulting sanitary engineer of the commission, and how do these plans compare with the plans or remedies proposed by Mr. Hubbell, your sanitary engineer?

Mr. FENKELL. I am unable to state exactly. I have read Mr. Hubbell's report through twice, and I have read Prof. Phelps's report through, but I have been unable to make any extended study of the matter. So far I hardly think anyone has, except it be Mr. Hubbell.

Mr. TAWNEY. Has your municipal government here considered the question of the standards for sewage treatment and water purification recommended by the sanitary engineers of the commission?

Mr. FENKELL. So far as I know, it has not received any extended study, except by Mr. Hubbell. Mr. Hubbell's report was transmitted to the common council, and it was submitted to the proper committee, but the committee have been unable to take any action in the matter, or study it, because of our inability to furnish copies of the report.

Mr. TAWNEY. Has the city at this time in contemplation anything looking toward sewage treatment, independent of any international question involved in the pollution of the Detroit River?

Mr. FENKELL. No more than is covered by Mr. Hubbell's report.

Mr. TAWNEY. You have no specific plan in preparation, is what I mean.

Mr. FENKELL. No, sir.

Mr. TAWNEY. Are you treating your sewage here at all?

Mr. FENKELL. In no way whatever.

Mr. TAWNEY. You are discharging raw sewage into the Detroit River?

Mr. FENKELL. Yes, sir.

Mr. TAWNEY. That is the outlet for all your sewerage system?

Mr. FENKELL. Yes, sir.

Mr. TAWNEY. All of your sewers discharge into the Detroit River?

Mr. FENKELL. Yes, sir. Some do not discharge directly into the river, but they reach the Detroit River eventually.

Mr. MIGNAULT. Ultimately all of the sewage goes into the Detroit River untreated?

Mr. FENKELL. Yes, sir.

Mr. TAWNEY. Where do you get your water from?

Mr. FENKELL. It is taken from a point about 700 feet above Belle Isle, in the American Channel.

Mr. TAWNEY. Have you a filtration plant there?

Mr. FENKELL. Detroit has no filtration plant.

Mr. TAWNEY. Do you chlorinate the water?

Mr. FENKELL. The process in use is chlorination. Mr. Leisen, the general superintendent for the water commission, is present and can explain that to you in detail.

Mr. TAWNEY. Mr. Magrath calls my attention to the fact that we went into that matter when we were here a year and a half ago.

Mr. FENKELL. I think, if I may be permitted to make the suggestion, that there have been some changes in the method of treating the water since then.

Mr. TAWNEY. Well, that is important. Now, Mr. Fenkell, before we hear Mr. Hubbell, is there anything else in relation to the subject that you desire to bring to the attention of the commission at this time?

Mr. FENKELL. There may have been explained to the commission the ordinary way in which the city would proceed to get the funds and go ahead with work of this kind. My understanding is that it would first be necessary for the council to direct that the matter be voted on by the people. It would then go up at a regular election, and in order for the work to be authorized or the bonds to be issued it would have to receive 60 per cent of the votes cast. The work would be carried out by and through the department of public works working with the common council. I can give you still further details regarding that, if you wish, as well as copies of the law relating thereto.

Mr. TAWNEY. What is the present bonded debt of the city of Detroit?

Mr. FENKELL. I will secure that data and give it to you later.

Mr. TAWNEY. You have a limited amount of bonded indebtedness to which the city can obligate itself, have you not?

Mr. FENKELL. It is limited. I will give you that data later.

Mr. TAWNEY. That limit is 5 per cent of the assessed value of the property, is it not?

Mr. FENKELL. I am unable to state.

Mr. GARDNER. Any such limitation as that is a constitutional provision of the State, is it not?

Mr. FENKELL. I am unable to state the amount. Detroit now has home rule, and just what the limitation is when the people vote on a question of that kind I am unable to state. Would the chairman like to have me secure that data?

Mr. GARDNER. We would like to have it.

Mr. FENKELL. I would suggest that if you have any other questions of that kind you give me a list of them, and I will secure the desired information for you, or you can call on the city comptroller and secure the information from him.

Mr. TAWNEY. We desire simply to ascertain what the position of the city would be with reference to carrying out any plan looking to the prevention of this pollution which now exists. That would be the only way in which it would be material for us to know whether the city was situated so that it could carry out any reasonable recommendations that might be made.

Mr. MAGRATH. You are filing with us a copy of the report of Mr. Hubbell, are you not?

Mr. FENKELL. So far I have furnished 3 copies. I have received only 12 printed copies and have been able to give reports to only three of the departments of the city that I thought would be interested. I shall be pleased to furnish the commission additional copies as soon as we receive them. We hope to receive them to-day or to-morrow.

Mr. MIGNAULT. I understand you to say that no action has yet been taken on Mr. Hubbell's report.

Mr. FENKELL. No action whatever. Upon its receipt it was transmitted to the council, and within 48 hours it was in the hands of the printer.

Mr. MIGNAULT. It was referred to the committee, I suppose, for consideration and printed as all public documents are printed. Is that correct?

Mr. FENKELL. The report was referred to the committee on sewers. Only my letter transmitting the report and the summary of Mr. Hubbell's report were printed in the council's proceedings because of the necessity for cuts, maps, and so forth.

Mr. MIGNAULT. Is it contemplated to take any action on Mr. Hubbell's report?

Mr. FENKELL. That is something that I am unable to say. The matter is now before the sewer committee of the common council, and in the natural course of events it would be considered by that committee and a report thereon submitted to the common council. The matter could then be acted on by the common council, or any action could be taken that the council saw fit.

Mr. TAWNEY. How many members constitute the council?

Mr. FENKELL. There are 42 members.

Mr. MIGNAULT. I understand you also to say that before any final action would be taken on Mr. Hubbell's report the matter would be submitted to the taxpayers.

Mr. FENKELL. In order to issue bonds.

Mr. MIGNAULT. Simply to issue bonds?

Mr. FENKELL. Yes.

Mr. MIGNAULT. Otherwise, it would not be submitted to the taxpayers?

Mr. FENKELL. Probably not unless it required a change in the city's charter. A change in the charter requires a vote of 50 per cent or more.

Mr. MIGNAULT. And to issue bonds you require 60 per cent?

Mr. FENKELL. Yes; 60 per cent. The vote on the Belle Isle Bridge bonds a year ago failed because it received only 58 per cent.

Mr. MIGNAULT. That was the case of a contemplated bond issue?

Mr. FENKELL. Yes.

Mr. MAGRATH. Mr. Fenkell, I see that in your letter to Mr. Hubbell, dated November 25, 1914, you decided to submit certain problems for his consideration, the second one being, "To what extent does the city of Detroit sewage pollute American waters so as to render them unfit as a source of raw water for filtration purposes?" Mr. Hubbell's reply to that certainly has the right ring to it. It is stated in paragraph No. 7 of his report, which reads as follows:

> In regard to the second part of the problem as to what expense would be justified for sewage treatment, it is difficult to formulate an answer in terms of money alone. However, it is believed that, aside from the international features of the problem, the combined benefits which would accrue from a more cleanly water front, purer water at the bathing beaches and summer playgrounds, reduction in typhoid and other water-borne diseases, due to the use of sewage-laden water along the river front; betterment of raw-water supplies for the municipalities below the city, and the protection of Detroit's water from gross sewage pollution at times when the Detroit River flows backward amply justify the expenditure required for sewage-treatment works as above outlined. In round figures, the cost would be about $6,000,000, and in my judgment the expenditure of this sum would be justifiable.

I would like to say, Mr. Chairman, that I think this commission should put itself on record with Mr. Fenkell to the effect that we have been in a delicate position and have had a delicate piece of work to attend to, and the city of Detroit has played up magnificently in connection with this investigation. I think it is only fair to make that admission to these gentlemen. So far as I am concerned as a member of this commission, I appreciate the good work that the city of Detroit has done, and I am quite confident that the city of Detroit will do its duty in the matter. I think, Mr. Fenkell, that we are indebted to you and to your mayor and the members of your city council for the way in which you have always met us here in connection with this problem.

Mr. TAWNEY. Mr. Chairman, I desire to say that I think that expresses the views of the commission generally. There have been certainly very high appreciation and cooperation in the city of Detroit, and we have every reason to believe that the city will join in any recommendation we may make to the two Governments for the purpose of solving this problem.

Mr. FENKELL. I may say, Mr. Chairman, that it has been our endeavor to work along the lines laid down by the commission, and I know it is the wish of the mayor to do what he can to further your efforts and to work in cooperation with the cities and towns on the Canadian side of the river. He feels that the American cities and

the Canadian cities are so closely knit together that the welfare of one must work for the welfare of the other. I know that he wants to do everything he can to further anything that will be beneficial to the cities on both sides of the river.

I want to thank the members of this commission, both officially and personally, for your kindness in the matter, and to assure you that we shall welcome any suggestion that you may have to offer, and we will continue to work along lines that may seem to you and to your commission to be proper and right.

If there is any further information that I can give you, I shall be pleased to do so. The mayor would have been here this morning had it been possible, and he may be here later. Should there be any information that you would like me to secure, I would be glad to obtain it from the comptroller, the corporation counsel, or any of the other city officials.

Mr. TAWNEY. I think the information that the commission would like to have, Mr. Fenkell, is the present bonded indebtedness of the city, and, if there is a limitation upon the power of the city to incur obligations of that kind, what that limitation is and how near you have reached it. If you will kindly have prepared a statement along that line, we will incorporate it in the record as a part of your statement of this morning. If you have nothing further to say, we will now hear Mr. Hubbell.

(The information called for with respect to the assessed valuation of property and the bonded indebtedness of the city of Detroit appears in the statement of Mr. George Engel, the city's comptroller.)

STATEMENT OF MR. CLARENCE W. HUBBELL, CONSULTING SANITARY ENGINEER OF THE CITY OF DETROIT.

Mr. TAWNEY. Mr. Hubbell, I think you had better state for the record what work, if any, you have done in connection with the consulting engineer of the commission and what duty you were required to perform in connection with this problem. First, let me ask you if you reside here in the city of Detroit?

Mr. HUBBELL. Yes, sir; I do.

Mr. TAWNEY. You are a consulting sanitary engineer, practicing here in the city of Detroit?

Mr. HUBBELL. Yes, sir.

Mr. TAWNEY. How long have you been engaged in the actual practice of your profession?

Mr. HUBBELL. I graduated from the University of Michigan in 1893 and have been engaged in engineering work ever since. About a year and a half ago Mr. Fenkell, the commissioner of public works for the city of Detroit referred to me three problems to be reported upon.

The first problem was that I review the data and conclusions of the international joint commission for the purpose of enlarging on any phase of the matter that might be necessary in order to determine what preventive or remedial measures are required with reference to Canadian waters.

The second problem was, to what extent does the sewage of the city of Detroit pollute American waters so as to render them unfit as a source of raw water for filtration purposes?

The third problem submitted was, by what means, if any, should the city of Detroit undertake to purify the sewage, and what expense would be justifiable for that purpose?

Mr. TAWNEY. That was in November, 1914, was it not?

Mr. HUBBELL. Yes, sir.

Mr. TAWNEY. Since that time have you been engaged in working out these problems for the city of Detroit?

Mr. HUBBELL. Yes, sir.

Mr. TAWNEY. During that time was the sanitary consulting engineer of the commission engaged in the study of the same problems here in the city?

Mr. HUBBELL. During a portion of that time he was.

Mr. TAWNEY. And you worked in conjunction with him?

Mr. HUBBELL. Through the cooperation of Prof. Phelps and Mr. McRae, who was in charge of the Detroit station, we engaged joint offices for the study of what to me was the third problem submitted. The cooperation was very close in working out the details connected with the third problem submitted to me.

Mr. MIGNAULT. That is as to remedial measures?

Mr. HUBBELL. Yes, sir; by what means, if any, should the city of Detroit undertake to purify the sewage.

Mr. TAWNEY. Since the report of the commission's consulting sanitary engineer has been made have you had an opportunity to examine and study it?

Mr. HUBBELL. I have examined it; I have not studied it closely in all its details.

Mr. TAWNEY. You have made a final report to the city council of Detroit as a result of your investigation and study?

Mr. HUBBELL. Yes, sir; a copy of which report I have here.

Mr. TAWNEY. So far as the remedies for the pollution of the Detroit River as it extends beyond the boundary are concerned, do you know to what extent your report corresponds with the report of the consulting sanitary engineer of the commission?

Mr. HUBBELL. In working out the problem jointly we came to a practical agreement in the matter.

Mr. TAWNEY. You are familiar with the alternative propositions which the consulting sanitary engineer has submitted to the commission, are you?

Mr. HUBBELL. Yes, sir; entirely so.

Mr. MIGNAULT. There are six alternative measures referred to. Our consulting engineer has expressed a preference for two of those measures. Did you agree practically with his choice?

Mr. HUBBELL. Yes; we were practically agreed as to the methods that were most desirable and most fitted for the conditions that exist at Detroit.

Mr. TAWNEY. You also agree with the consulting engineer of the commission with respect to the Detroit metropolitan drainage district; that is, taking in the suburban villages around here, as I understand it?

Mr. HUBBELL. I think that such a plan, if it could be consummated, would be desirable.

Mr. TAWNEY. Two main reasons that are given for the consolidation of this area into one drainage district are, first, preventing dis-

putes between the various communities, and, second, effecting economies and producing more satisfactory conditions generally by means of comprehensive planning. Your studies were made along the line of a metropolitan district such as is described here in this report?

Mr. HUBBELL. They do not depend on that entirely for their carrying out. The success of the scheme for purifying or treating the sewage should not depend solely upon the establishment of a metropolitan district.

Mr. POWELL. It could be worked out as an independent system?

Mr. HUBBELL. It could be done so, although it would be an advantage to have it worked out as a metropolitan district. I might say, in connection with that, probably an easier and more feasible way of working that out would be by annexation by Detroit of territory that immediately needs development, and that would not require the machinery or legislation that the other scheme would.

Mr. MIGNAULT. Are there many outlying districts which would have to be annexed to the city of Detroit?

Mr. HUBBELL. No; there are not many; if a working basis could be arranged between the existing municipalities as has already been done through the courts in the case of Highland Park.

Mr. TAWNEY. In your report to the city council, Mr. Hubbell, do you recommend the same standards of purification recommended by the consulting engineers of the commission, both as to sewage and water, or do you treat the standards at all?

Mr. HUBBELL. I have gone into some detail in regard to the 500 B. coli standard, and I believe it to be conservative and reasonable as borne out by data and facts.

Mr. TAWNEY. Did you go into the matter of standard of purification of sewage or treatment of sewage, to what extent it should be purified?

Mr. HUBBELL. In a general way only. Accepting the 500 B. coli standard, the indications are that approximately 90 to 95 per cent purification would be needed bacterially to our sewage to meet that standard. That, however, is a question for the future to determine. It is, in my opinion, a little doubtful as to just what percentage of bacterial removal would be required in order to produce that result, but from my studies I concluded that from 90 to 95 per cent would be required.

Mr. MIGNAULT. And could be realized?

Mr. HUBBELL. Yes; and could be realized; there is no question about that.

Mr. POWELL. I gathered the impression from your report, by a hasty glance at it, that while you did not quarrel with the standard of 500 B. coli per 100 cubic centimeters you inclined rather to a more severe standard.

Mr. HUBBARD. Well, that question is involved with the one of seasonal variation. I made quite extensive studies to determine the seasonal variations in the Detroit River independent of the data that was shown in the International Joint Commission's first report. I found that for normal conditions in the Detroit River the number of B. coli present was, perhaps, two and a fourth times the average in the summer time, and about one-quarter of the average in the cold months, following approximately the temperature curve.

Mr. TAWNEY. To what condition do you attribute that increase in the summer? In your judgment, has navigation anything to do with it?

Mr. HUBBELL. In my judgment, the navigation has very little to do with it, because the curve falls before navigation stops.

Mr. POWELL. What is the crisis in the curve—in what month?

Mr. HUBBELL. June, July, August, and September are the high months. The highest point of the curve which I determined for the entire river was in September, but for the waterworks' intake it was in August.

Mr. MIGNAULT. Is it possible to explain why pollution is higher in the summer months than in the winter months?

Mr. HUBBELL. I have made no attempt to explain that. I merely report the fact that it is so on the Detroit River.

Mr. MIGNAULT. I gather that that is a fact which can not be questioned, but is not so easily explained.

Mr. HUBBELL. I concur in that expression; yes, sir.

Mr. TAWNEY. If I understand you correctly, then, Mr. Hubbell, your recommendations to the city on this subject are practically in accord with the recommendations of the consulting engineer of the commission as to the remedies for the existing pollution?

Mr. HUBBELL. We reached the same conclusion as to the method to be adopted, if any is adopted.

Mr. TAWNEY. I think, Mr. Chairman, that we ought to have Mr. Hubbell's report made a part of the hearings for the purpose of using such portions of it in the proceedings as the commission may hereafter desire.

(The report of Mr. Hubbell was received as a part of his statement before the commission on the question under consideration.)

Mr. TAWNEY. Is there anything further, Mr. Hubbell, that you desire to present to the commission on this question?

Mr. HUBBELL. I have expressed myself fully in my report, and there is nothing further, unless there are some questions that you wish to ask me.

Mr. GARDNER. I think your report is an admirable one and does you great credit.

Mr. TAWNEY. Will the comptroller of the city of Detroit kindly state for the record the assessed value of the property of the city and the present bonded indebtedness?

STATEMENT OF MR. GEORGE ENGEL, COMPTROLLER OF THE CITY OF DETROIT.

Mr. ENGEL. I had rather have about 15 minutes for the purpose of preparing such a statement and submit it to you in writing. Our gross debt at this time is about $20,000,000 in round figures; the net debt about $12,000,000. Our limitation is 4 per cent, and the assessed valuation something over $700,000,000. So you see we have a leeway of something over $16,000,000. Our net debt is very small, probably smaller than that of any city of its size in the United States. I will have a statement prepared for you.

Mr. TAWNEY. We will incorporate your statement in the record.

Mr. POWELL. Do you mean the assessed value of real estate or the combined real and personal valuation?

Mr. ENGEL. Combined real and personal.

Mr. TAWNEY. And the limitation applies to the combined valuation?

Mr. ENGEL. Yes, sir; and that is 4 per cent.

Mr. POWELL. Have you any rule that you observe in respect to valuation?

Mr. ENGEL. We are supposed to assess at cash value, full value, 100 per cent.

Mr. POWELL. The market value?

Mr. ENGEL. Yes, sir.

Mr. GARDNER. What is your rate?

Mr. ENGEL. About $18.50 per thousand for next year.

(Mr. Engel later submitted to the commission a statement of the bonded debt of the city of Detroit, which is copied into the record in full, as follows:)

Statement of the bonded debt of the city of Detroit.

Assessed valuation, 1916			$731,991,960.00
Limitation of debt:			
Four per cent of assessed valuation		$29,279,678.40	
Less water bonds authorized		2,000,000.00	
			27,279,678.40
Outstanding bonds:			
Public sewer	$5,604,000.00		
Public improvement	535,000.00		
Public lighting	1,406,000.00		
Public school	8,767,000.00		
Public building	1,493,000.00		
Boulevard improvement	700,000.00		
Park improvement	650,000.00		
Park and boulevard	497,000.00		
Museum of art	50,000.00		
Hospital	100,000.00		
Library	750,000.00		
Grade	150,000.00		
Annexed district	484,756.63		
Water bonds	1,947,000.00		
		23,133,756.63	
Exempt from limitation:			
School	8,767,000.00		
Library	750,000.00		
Annexed district	44,000.00		
Water	1,947,000.00		
		11,508,000.00	
		11,625,756.63	
June 1, 1916, sinking fund:			
Cash	184,461.95		
Securities	4,736,608.57		
Annexed district	24,287.00		
	4,945,357.52		
School and library apportionment	1,046,485.09		
		3,898,872.43	
Net debt under limitation			7,726,884.20
			19,552,794.20

STATEMENT OF T. CHALKLEY HATTON, OF MILWAUKEE.

Mr. TAWNEY. You are here on the invitation of the commission, and the invitation was extended to you because of your experience in the matter of sewage treatment in the city of Milwaukee and also because of the efficiency with which we are advised your plant is being operated. Give such information to the commission as you are prepared to give us concerning the method you have in use there, and also as to its efficiency and operation. We will be very glad to have you give us any opinion, based on your knowledge and experience, that you care to.

Mr. HATTON. It may be that I can best describe this process and the results we are getting from it by giving you the situation in Milwaukee, which is somewhat, as I take it, comparable with some of the situations here. We discharge the crude sewage from the city of Milwaukee into three rivers, from whence it flows into Lake Michigan, and 3½ miles away from the harbor entrance we take our water supply, in a depth of 50 feet. At the present time the water supply is being partially or entirely sterilized by the use of liquid chlorine. There is at the present time about an average of sixty millions of sewage per day being discharged into Lake Michigan.

Mr. TAWNEY. Sixty million gallons?

Mr. HATTON. Yes; and during this time the lake for an area of about 25 square miles has become polluted, B. coli being retained in that entire surface of the lake; and at all times we find the presence of B. coli at the intake of our water supply, but the treatment of liquid chlorine has, with one exception, enabled us to sterilize the water with about twenty-eight hundredths to thirty-hundredths part of liquid chlorine. Last February we got a little larger quantity of B. coli than usual because of four or five days of southeastern storm, and in spite of the fact that we put all the liquid chlorine in and more than the water would absorb, we got a typhoid-fever epidemic in three or four weeks of about two hundred and some odd cases. Now, that is the situation in Milwaukee, and for the purposes——

Mr. POWELL. Before you pass on, you say 25 square miles has become polluted?

Mr. HATTON. Yes.

Mr. POWELL. How far into the lake would the pollution extend?

Mr. HATTON. About 5 miles; 3 miles on either side of the harbor and 5 miles from the shore. The city is located on Milwaukee Bay, which is a long crescent, about 10 miles from point to point.

Mr. POWELL. How far from the outlet of the sewer to the intake?

Mr. HATTON. Three miles and a half; and in addition to that, there is a breakwater, which is supposed to partially prevent the water from flowing from the harbor toward the intake.

Mr. POWELLL. You pursued your investigations beyond the 5 or 6 miles?

Mr. HATTON. Yes. Prof. Whipple was employed to do that, and he did it very thoroughly for many more miles than 25 square miles.

Mr. POWELL. Did he discover traces of it farther than that?

Mr. HATTON. Yes; even farther than that; traces of it 6 miles away to the north of the intake, but faint traces. It was a question with

us, when the matter of sewage disposal came before us, of not only treating the sewage so that the water could be properly treated by filtration or chlorination subsequently, but it was also a question of getting rid of the sludge from any sewage-disposal treatment which we might put in, because there was no waste ground in the vicinity of Milwaukee upon which sludge could be disposed of, and the consensus of opinion of the citizens of Milwaukee was that the sludge should not be deposited in the lake, no matter how far out. The feeling was very strong. I might say, in introducing that matter, that in 1910 a board of consulting engineers advised that disposition of the sludge, and that feeling had been growing in the minds of the citizens for three or four years before I went there, until it had assumed the attitude that it would not be public policy to discharge the sludge into the lake, no matter how far out, partially due to the large amount of shipping which is and was expected to come into the harbors of Milwaukee, and also from the fact that ships did take their water supply from that lake before entering the city; so that it was a matter of taking care of our sludge——

Mr. POWELL. Before you pass to that, how does the current compare with the current in the other Lakes? There is less current in Michigan Lake?

Mr. HATTON. Yes. The currents are influenced particularly by the winds.

Mr. POWELL. There is very little setting of the water out toward the strait?

Mr. HATTON. Very little. The general idea has been advanced, by those who have studied the matter, that the water passes south on the west side of the lake and to the north on the east side of the lake, requiring approximately 10 years to make the entire circuit.

Mr. POWELL. Is there any continuous flow out of the lake, or does it flow in, on account of evaporation?

Mr. HATTON. I think there is a flow out of the lake. I think the record was taken some 12 or 14 years by the United States engineer at that time, and he printed quite an elaborate report.

Mr. TAWNEY. Through the straits?

Mr. HATTON. Yes; but just what that report contains I am not familiar enough with it to say.

Mr. POWELL. The flow is always out?

Mr. HATTON. Yes.

Mr. MAGRATH. I have an idea that the water works inward sometimes?

Mr. HATTON. Well, it comes down, as I say, on the west side, passes round Chicago, and comes up on the east side, and passes out in the straits; at least, that is my opinion.

Mr. MAGRATH. I may be wrong, but I had an idea that the current moved inward sometimes, and sometimes outward.

Mr. HATTON. Well, possibly so. This is the general tendency of it, but I think it does sometimes pass out and in, according to the direction of the winds.

Mr. POWELL. The Chicago Drainage Canal is not equal, I suppose, to the inflows from the surrounding country. It does not balance it?

Mr. HATTON. Well, I think not. It is claimed here very recently that the waters taken from the Chicago Drainage Canal have low-

ered the waters in the connecting streams some 5 or 6 inches. How true that is I am not prepared to say. Now, before deciding upon the method of sewage disposal for Milwaukee we built rather an elaborate experimental station, in which we tried to put all those modern methods of sewage disposal now prevalent in this country and abroad, and I think we had 23 different processes going on there at one time—one of the largest experimental stations carried on in this country for sewage disposal purposes.

Mr. MIGNAULT. When was it established?

Mr. HATTON. In the middle of 1914. We have been operating it just about two years. We tried out in that experimental station the Imhoff tank, so-called settling tank, sprinkling filters, coloidal tanks, electrolytic processes, chemical precipitation, chlorination, and finally, what we called the activated sludge process, which we have been trying out now for a year this month.

Mr. MAGRATH. Where did that process originate?

Mr. HATTON. Well, that is a question. Mr. H. W. Clarke, of the Lawrence experimental station of Massachusetts, claims he discovered it. Dr. Gilbert J. Fowler, of Manchester, England, now of India, has assumed the discovery of it and developed it in a laboratory way perhaps further than anybody else up to the time we took care of it in Milwaukee. He started his experiments in 1914, or late in 1913, and we started our experiments in 1914, late in 1914. But it has been developed in Milwaukee to a greater extent than anywhere else, either in Europe or United States. We started with a laboratory investigation. From thence we went to tanks, holding or treating 70,000 gallons a day each, and from thence we have gone to tanks treating 1,600,000 gallons a day, which are now being operated and have been operated since last January. The process, stated briefly, consists of, first, coarse screening the sewage, running it through coarse screens, then into tanks of any depth to suit the conditions and the situation, say from 10 to 20 feet.

Mr. POWELL. That is the residue after the first screening?

Mr. HATTON. That is the raw sewage after it has been coarse screened. Then the raw sewage is run into these tanks, which have in the bottom some method of diffusing air which is discharged into the bottom of the tank at low pressure, just sufficient pressure to keep the liquor agitated; while in there this liquor passes through this tank, taking a certain time in accordance with the standard of purification required, from two hours to four hours, during which time it is being agitated and aerated by the air. From these tanks it passes into a sedimentation tank. All of these tanks are practically one tank divided by a wall separating the aerating tanks from the sedimentation tank. After settling in the sedimentation tank from 45 minutes to an hour, or an hour and a half, according to the character of the effluent you require, it then passes out into the point of final discharge. The sludge which settles out of the liquor into the sedimentation tank is then pumped back and discharged into the raw sewage as it enters, or while passing into the beginning of the aerating tank. The surplus sludge which settles in the sedimentation tanks is treated otherwise, which I will describe later. The process is one of aeration and nitrification practically. The sewage does absorb a great deal of oxygen from the air which is

forced into it through these diffusing methods. The sludge, however, which we return and keep intimately mixed with the sewage at all times is perhaps the chief medium of purification, because that sludge is filled with microorganisms and nitrifying organisms, which really do the purification work, and that is the reason that it is called activated sludge, because it is so filled with the nitrifying organisms, and the more active the sludge is the more rapid and higher degrees of purification you secure. It is a natural process entirely, simply intensified by artificial means. To show you the activity of that sludge, we got the raw sewage, perhaps a million bacteria per cubic centimeter, in the first aerating tank, within half an hour; the sludge contains anywhere from fifteen to twenty million bacteria per cubic centimeter. In this sludge we give the bacteria the natural environments for their work. We give them food, lodging, and air, and that is just exactly what aerobic bacteria need, and the desire is to have intensified the aerobic bacteria, which we have at all times when the plant is being properly operated. Now, that is a brief description of it.

Mr. POWELL. That is the only purpose of aeration?

Mr. HATTON. No; there is another purpose of aeration, and that is the intimate mixture of the sludge with the liquor. That can be done mechanically with a little bit of air put in; but to do it mechanically would increase undoubtedly the cost and the operating expenses. In order to clarify the liquor it is not only necessary to nitrify it, but it is necessary, as we call it, to scrub it, and we remove the colloidal matter by means largely of scrubbing. To describe that in a layman's way, not in a chemical way, the colloidal matter in sewage rests in the interstices between the globules of water, like water rests in the interstices of the sand at the seashore. Now, if you disturb that sand on the seashore, the water runs out and the sand becomes free of it. If you scrub the globules of water together violently, the colloidal matter is detached from the water and the water becomes clear. That is as near a layman's description as I can give you, and we have tried the experiment out in our experimental station, to see whether there is any odor in that sewage, and we have thought that there is to a certain extent, not altogether. Now, the question as to how to dispose of this sludge is one of the greatest problems in sewage disposal in the world; and I think if any of you went over to Toronto, which I had the pleasure of visiting three weeks ago, you would see the difficulty that Toronto is up against in getting rid of its sludge, as are all other cities in the United States, whether it be Detroit or Buffalo, Cincinnati, Philadelphia, or New York—well, I will not say New York and Philadelphia, because they are out at the ocean, and they have a chance to get rid of it, but inland cities will have this difficulty.

Mr. POWELL. They are taking it up in New York.

Mr. HATTON. Yes; they may be able to discharge the sludge in the sea, but inland cities on the Great Lakes or rivers are going to be up against the proposition as to how to get rid of the sludge. Then any method of sewage disposal which will enable the cities to get rid of the sludge, whether it be at a profit, or whether it be to break even, or whether it be at a loss, and yet to get rid of it to the advantage of the agricultural element of this country and indirectly to ourselves, will be that system of sewage disposal which will un-

doubtedly meet the conditions of the large cities. That is the proposition which is primarily confronting us in Milwaukee, as I started out to say, and in all of this investigation there has been no doubt evinced in the last three months by the leading consulting sanitary engineers in the United States who have visited our plant that the purification of the sewage has been solved within reasonable cost, but there has been a great deal of doubt in their minds that the disposition of the sludge has been solved, and I have told them that within 90 days——

Mr. MAGRATH. Did you say that there was a feeling that the problem had not been solved?

Mr. HATTON. They felt that the question of the disposal of the sludge had not been solved, although we had solved the question of the disposal of the sewage.

Mr. POWELL. They all recognized that the purification of the sewage could be accomplished?

Mr. HATTON. They all recognized that the purification of the sewage could be accomplished in that method at a reasonable cost. But now we have solved practically the question as to the disposal of the sludge. It is true we have not reached those definite figures of cost which are necessary to convince the average municipal officer, but we are proceeding very rapidly, and we have our own figures which we feel are perfectly safe. In March for 10 days we dewatered this sludge by compressing. Now, for two weeks we have dewatered the sludge, and are drying the sludge, and reducing it into the form of a fertilizer of low grade, which is marketable anywhere in Chicago, and marketable along the eastern coast, through the chemical company—I forget the name of the chemical company there, but it is the largest fertilizing company in that district. They have offered us a yearly contract for all the sludge of the character that we have submitted to them that we could produce, based on the market value of the ammoniacal nitrogen contained in the sludge, the potash, and the available phosphoric acid. We have been testing this sludge day by day for two weeks, and we have averaged from that sludge 5 per cent of ammoniacal nitrogen—about sixty-seven one-hundredths per cent is available of phosphoric acid, and nine-tenths of 1 per cent of potash. Altogether that sludge is worth in the market, based on those ingredients alone, $15 a ton. There is no doubt about reducing it to a fertilizer basis. We have the apparatus and are doing it.

Mr. TAWNEY. Have you ever undertaken to extract anything else from this sludge, such as oils?

Mr. HATTON. We have, through the firm of Susenberger & Sons, of Chicago—no, it was a branch of Susenberger & Sons, of Chicago, which carries on the fertilizing end of the Susenberger & Sons' business. They extracted the fats from the sludge, and turned the residue into fertilizer. But we do not have more than 2 or 3 per cent fats in our sewage, and that percentage of fats is not harmful to fertilizer, and it does not pay to take it away from the sludge. Unless you get at least 10 or 12 per cent of fat in your sludge, it does not pay to remove it, as I am told by those who are in the business of manufacturing fertilizers.

Mr. TAWNEY. Do you know that there is in operation in England now a plant where they are extracting from the sludge gasoline and lubricating oils and pitch?

Mr. HATTON. Well, yes; I have read of it in a casual way.

Mr. TAWNEY. And nitrates, and carbolic acid; is that right, Mr. Phelps?

Prof. PHELPS. Yes.

Mr. HATTON. I never go away without my box, and I want to show you some samples which I have here.

Mr. POWELL. You sell this stuff for $20 a ton?

Mr. HATTON. No; $15.

Mr. POWELL. What does it cost to put it in a salable condition after it is taken out?

Mr. HATTON. Six dollars a ton.

Mr. POWELL. You have a profit of $9 a ton?

Mr. HATTON. Approximately $9 a ton. You understand the ammoniacal nitrogen varies, of course, and that cost is based upon the ammoniacal nitrogen, and our average is 5 per cent so far. In wintertime I imagine it will grow less. In July, August, and September it will grow more. It is true we have a very strong sewage, containing, for the last month, for instance, 369 parts of suspended matter. That is a good deal stronger than the average municipal sewage. It is industrial sewage, largely. Now, I do not want you to think these samples I am showing you are picked out samples. These are samples which a good many gentlemen present will tell you they have seen in our plant that they have visited day by day. This was taken yesterday at noon and delivered to me in the afternoon. This is a bottle of the raw sewage, after passing through the half-inch screen. I am now showing you a bottle of the sewage taken from the aerating tanks, containing about 25 per cent of activated sludge, the nitrifying media which purifies the sewage, and I am now showing you the effluent passing away from the sedimentation tank 4 hours and 45 minutes after it passed into the influent tank. So far as we can determine, there is a trace of suspended matter in that sewage. Of course we could not determine whether it was stable or not, because that takes time. It was taken out yesterday, but my chief chemist, who brought the samples to me, told me there was no doubt about the stability of that liquor.

Mr. MIGNAULT. Have you analyzed it to determine whether there subsists a certain amount of B. coli?

Mr. HATTON. No; this was taken yesterday; but we do get some B. coli; we do not get complete sterilization. We attempt to get 95 per cent reduction of bacteria in our effluent. We have not had occasion yet, except when our plant was broken down, or the lake was so high that it backed into our plant, to reduce our standard. We could always get 95 per cent, and we more often got 98 or 99 per cent. I do not know whether I should show you this box I have here very closely, because it does not smell very well.

Mr. TAWNEY. You do not deodorize your sludge?

Mr. HATTON. No. I am showing you now a sample of the pressed sludge.

Mr. TAWNEY. The reason I ask that is that I saw a sample of pressed sludge recently, treated by the process I mention in operation in England, where there was absolutely no odor to it at all.

Mr. HATTON. There is no odor in this sludge until it has been out in the air 24 hours. Then it begins to get very odorous. That is the pressed sludge ready for the dryer. When that came out there was

no odor except an earthy odor. I am showing you now a sample of the dried sludge ready for the fertilizer.

Mr. TAWNEY. That is in ground form?

Mr. HATTON. No; that it not ground. That is just as it comes out of the dryer. Some of it would have to be ground no doubt; we are expecting to grind it.

Mr. MIGNAULT. The dried sludge has no smell?

Mr. HATTON. The dried sludge has no smell. There it is; it has been on my desk for a good long while. We obtain about half a ton of this dried sludge per 1,000,000 gallons of sewage treatment. It means that we would get about $7.50 per 1,000,000 gallons out of our sludge, and spend from $3 to $4 getting it out of the sewage, making a profit of from $3 to $4.

Mr. POWELL. The process of sedimentation in that bottle has just taken three minutes and a half.

Mr. HATTON. That is where we were deceived in designing our sedimentation tanks. As a matter of fact, there is a lot of finely suspended matter, and it is that finely suspended matter which takes the time to settle. But I want to draw your attention to the absence of colloidal matter, and I want to say also that, outside of broad land irrigation, or slow sand filtration, I think I am justified in saying there is not any other method of sewage disposal process which will so effectually take the colloidal matter out of sewage, and make the sewage at least satisfactory, ethically, to all the cities and municipalities. I am quite sure if you can discharge an effluent of that kind in any of the rivers and waters between Canada and the United States that no citizen of Canada or no citizen of America can possibly object. He goes largely by what he sees, not by the ingredients which some chemist tells him are in the water.

Mr. TAWNEY. Have you any of the by-products you extract from the sludge?

Mr. HATTON. We do not attempt to extract any by-products. We propose to sell the sludge as a fertilizer in the shape I have shown to you in this box. I might say that there is no other process of sewage disposal at present in common use in America favorable to this locality comparable with this process, except Imhoff tank and sprinkling filters, followed by final sedimentation.

Mr. TAWNEY. What is this process called?

Mr. HATTON. Activated sludge. We tried out the Imhoff tank process with chlorination in this same sewage, and found the cost a little bit less than the cost of this process, without finally disposing of the sludge. We also tried out Imhoff tank, followed by sprinkling filters, and found the cost much more than this process. We also found, in our climate of Milwaukee, that, instead of averaging two and a half million gallons, or getting two and a half million gallons per acre per day through sprinkling filters in wintertime, there were three months that we could not get more than a million and a half. We also found that up to the present date we have not been able to dry sludge in the open air coming from the Imhoff tank from the first of last November up to the present day, and in making our estimates, we do not believe we could get three months in the whole year in this climate—I am speaking of Milwaukee—when we could dry sludge effectually from the Imhoff tank or any other sedimentation process. We have too much rain in June to dry sludge, and the

only way we could possibly dry Imhoff tank sludge was by covering with glass, heating the place, as suggested by a gentleman in Cleveland, Ohio.

Mr. MIGNAULT. How long does the drying process last?

Mr. HATTON. Well, that is all according to the weather. If the weather is very nice and warm, and we have the sun, and not too damp, it will dry out in about two weeks; it will dry into a spadable condition in five to six days in good dry weather, but if there is a little bit of rain comes along overnight, or if it is alongside a lake, and there is considerable moisture or damp, it may take two or three days longer.

Mr. POWELL. How do you dry the sludge?

Mr. HATTON. In a drier, an industrial drier, just the same as they use in the packing houses in Chicago and many of the breweries and many other places throughout the United States in industrial works.

Mr. MIGNAULT. Does it require much space?

Mr. HATTON. No: the amount of land which we have laid out to treat a hundred million gallons a day, which is the quantity we will have to treat, is 20 acres; that is, including our pumping stations, our ministration houses, sludge-disposal houses, and everything concerned. In fact, to be distinct, this system can treat from ten to twelve million gallons of sewage per acre per day.

Mr. TAWNEY. What does it cost?

Mr. HATTON. The cost of the treatment?

Mr. TAWNEY. The installation?

Mr. HATTON. About the same as the Imhoff tank. I say that because we worked out the Imhoff tank layout, and also our activated sludge layout, upon the same ground, and it broke even as to cost.

Mr. MIGNAULT. When you say you make a profit on the sludge, in the disposal of it, what cost do you consider?

Mr. HATTON. I did not catch that.

Mr. MIGNAULT. When you say you make a profit out of the disposal of the sludge, what cost do you consider? The cost of the drying——

Mr. HATTON. The cost of the drying, the cost of the dewatering, the cost of the freight and the overhead charges of the machinery necessary to dewater and to dry, and the attendance cost—all those have to be taken into consideration.

Mr. POWELL. You take the raw sewage that comes from the tank?

Mr. HATTON. We take the raw sewage as it comes from the sedimentation tank containing 97 per cent of water and deal with that.

Mr. POWELL. That all enters into cost?

Mr. HATTON. Yes.

Prof. PHELPS. That is $6?

Mr. HATTON. Yes.

Prof. PHELPS. Would you tell us the cost of the aeration in preparing the sludge?

Mr. POWELL. That would be taken into account as against some other system.

Mr. HATTON. I think I have that. I will read to you from a copy of the Second Annual Report of the Sewage Commission of the City of Milwaukee of 1915:

The cost of the activated sludge, continuous flow, with a removal of 95.5 per cent bacteria—

I say that because the cost of the operation and the plant depends entirely upon the character of effluents you want to secure. A lower grade of effluents lowers the first cost and operating cost, so this is based on a removal of 95.5 per cent, which is our standard——

The disposal of sludge in cost per million gallons, $3. The interest and depreciation on the cost of the plant, based at 7½ per cent, $2.81. Cost of operation, exclusive of sludge, $2, making a total cost of $7.81 per million gallons treated.

From this $7.81 must be taken the value of the recoverable sludge, which, as I stated to you, so far in our investigations has been $3 per million gallons, or making a total net cost of $4.81 per million gallons, which includes overhead charges.

Mr. TAWNEY. What was the cost of your Milwaukee plant?

Mr. HATTON. Well, we have a 1,600,000-gallon plant now. The aggregate cost of our total plant is estimated to be about two and a half million dollars—will be that much.

Mr. TAWNEY. And that will take care of——

Mr. HATTON. A hundred million gallons.

Mr. POWELL. What is your population?

Mr. HATTON. The present population, 450,000; we are building a plant to provide for a population of 800,000.

Mr. MIGNAULT. What is the per capita cost?

Mr. HATTON. I have not worked it out.

Mr. POWELL. Does the cost decrease relatively in larger plants?

Mr. HATTON. Quite so; yes, sir.

Mr. POWELL. It is not adding simply a unit?

Mr. HATTON. No. Of course, the cost of this plant largely depends upon the cost of the air. The larger the air plant the less the cost of air. We figure our cost of air based upon a cost of electricity of seventy-seven one-hundredths per cent per kilowatt hour, which is the rate fixed by the Wisconsin Railway Commission for that sort of power; so that that rate is actually fixed.

Mr. POWELL. Is that power quite an item in the cost?

Mr. HATTON. Quite an item; the biggest item in the cost; the cost of power for compressing the air—that and the overhead charges, such as the interest on the money invested.

Mr. MIGNAULT. Are you aware whether power is more expensive in Milwaukee than in Detroit?

Mr. HATTON. I am not; I do not know what the cost of power is in Detroit.

Mr. POWELL. About what is the cost of horsepower? What is the cost to you people?

Mr. HATTON. I say it costs us seventy-seven one-hundredths of a cent per kilowatt hour, and horsepower is about three-quarters of a kilowatt in round numbers—six-tenths of a cent, I should say.

Mr. MIGNAULT. Is there any nuisance resulting from the drying process?

Mr. HATTON. No. The gases must be washed, and then after passing through the washer are taken into the plant itself—into the liquor, and the liquor is a deodorizer; so there is no odor arises from the cooking of the sludge, as we call it.

Mr. MIGNAULT. That is the drying of the sludge?

Mr. HATTON. Well, that is what we call cooking.

Mr. POWELL. This is not the same principle of the two tanks where the material is taken into one tank and has a certain bacterial operation, and then passes into another tank, and then finally into beds?

Mr. HATTON. No.

Mr. POWELL. You know the system to which I refer; they had it in England in one place, and then started it in Canada, and it was not a success?

Mr. HATTON. That is, they passed from aerating beds——

Mr. POWELL. No; they passed first into an inclosed chamber, where the bacteria destroyed it.

Mr. HATTON. I should imagine, from what you say, that must be the process by which both the aerobic and the anaerobic bacteria are the destroyers.

Mr. POWELL. Exactly.

Mr. HATTON. We do not want any anaerobic bacteria in our process, because it produces septic action, which is inimical to our process, because it absorbs the oxygen and interferes with the efficiency of the process.

Mr. POWELL. Can you take the sludge from the Imhoff tank and use it, or treat it the same as you are treating the sludge there in Milwaukee now?

Mr. HATTON. We can; but the trouble is that the sludge from the Imhoff tank, as we have found it in Milwaukee, only contains about from 1 to 1½ per cent of ammoniacal nitrogen at most, and that does not pay for its recovery. I want to say another thing about this which is of interest. There is no odor about the operation of the plant at all. You can stand over one of the tanks as it is being aerated and have no odor come to you, or no odor throughout the entire plant, unless you let the sludge stay undried.

Mr. TAWNEY. To what do you attribute the lower percentage in the sludge taken from the Imhoff tanks?

Mr. HATTON. The fermentation process removes the ammonias from the sludge. Well, practically all the reduction of the sludge in the Imhoff tank proposition is the fermentation process, and of course that removes a large portion of fertilizer values in the sludge.

Mr. MAGRATH. Are there any weak features in this process that you look forward to correcting?

Mr. HATTON. There are some problems which we are investigating, with a view of getting a more economical use of the air, and thus a lower cost of operation, and that problem concerns the diffusion of the air in the tanks. We are trying out three methods of diffusion. We are not prepared to say yet which is the most economical. I am giving you the figures based upon that which we have used, and our whole efforts now are being directed to reducing the amount of air used. That is the principal point which we are investigating at the present time.

Mr. TAWNEY. How does the operating cost of your system compare with the operating cost of the Imhoff tanks?

Mr. POWELL. The operating cost of the Imhoff tank is considerably less than the operating cost of our tanks. They have no air to pay for, and very little plant attendance to pay for.

Mr. MAGRATH. As I understand you, the cost to the municipality under your system is less than the cost under the other system?

Mr. HATTON. The cost of the Imhoff tank, you mean?

Mr. MAGRATH. Yes.

Mr. HATTON. That is true of installations of any magnitude.

Mr. TAWNEY. Installation, but not operation?

Mr. HATTON. On both—that is, taking into consideration the value of the sludge recovered.

Mr. MAGRATH. Your system costs the municipality less than the other system?

Mr. HATTON. Providing they sell the sludge. I want to make it plain to you gentlemen that I am not giving you this information as it may pertain to Detroit or Buffalo or any other city, but as it concerns Milwaukee, because I am not in a position to speak of it here, not knowing your situation.

Mr. TAWNEY. You state that you recently had your plant examined by a number of the leading consulting sanitary engineers of the country, and that while they all agreed that your system was successful, so far as purification of sewage was concerned, they expressed doubt as to the disposing of the sludge. On what do they base their skepticism or doubt with reference to the sludge disposal?

Mr. HATTON. Past experience.

Mr. TAWNEY. Your past experience?

Mr. HATTON. No; past experience of the sanitary engineers who have expressed that doubt. As I started to say, or I think I did say at the beginning of my remarks, that disposition of the sludge was the greatest problem, both in Europe and America, and this was so easy, apparently, to dispose of, that they were from Missouri and had to be shown.

Mr. TAWNEY. After seeing the way in which you disposed of sludge in Milwaukee plant, did that satisfy them or remove their doubts as to the efficiency of your method?

Mr. HATTON. They have not seen it yet.

Mr. TAWNEY. I thought you said they personally visited it.

Mr. HATTON. They have personally visited it. We put it in operation, but our press broke down. We have only put this portion of it in operation in the last two weeks, and it is only now we have begun to dry it; we did not have a dryer before.

Mr. MIGNAULT. Do you use the rotary dryer?

Mr. HATTON. The rotary direct dryer.

Mr. MARGATH. I interrupted you when you were about to say that in 90 days you would demonstrate something, and you stopped.

Mr. HATTON. I told these engineers that in 90 days I would demonstrate the possibilities of disposing of the sludge, but I have already demonstrated it before the end of the 90 days. I think I said that at Syracuse some time ago in an address I delivered.

Mr. MAGRATH. In an address made, I think, in 1915 you expressed some doubt as to the efficacy of your method in winter months?

Mr. HATTON. Yes; I did; and in order to try out this system in Milwaukee during the winter months was the purpose of building this 1,600,000-gallon plant which we are now operating; that was the primary object of building that plant, which cost us $65,000, and we got it in operation the first week in January and we have operated it since continuously with temperatures as low as 20° below zero, with a clear effluent during the cold winter months coming out of the plant as that effluent which you see there in that bottle. We had no freezing and no trouble with ice. We had, of course, much lower

nitrates in our effluent than we had in the summer months; in fact, we had very little nitrates, but we kept up the stability about 104 to 110 hours' average; some of them went up higher. We go on the basis of 5 days' stability test instead of 10 days. The American Public Health Association suggest that five days is all we need.

You ask me about the relative cost of the Imhoff tank installation and operating as compared with the activated sludge. Our investigations in Milwaukee show that the cost of the Imhoff tank, without sterilization, is $6.20 per million gallons—that includes all overhead charges—as against $7.81 for the activated sludge. The cost of the Imhoff tank——

Mr. TAWNEY. Is that an estimated or actual cost?

Mr. HATTON. That is the cost from the operation of our plant.

Mr. TAWNEY. Actual operation?

Mr. HATTON. Actual operation.

Mr. TAWNEY. Is it not an estimated cost?

Mr. HATTON. No. The cost of the Imhoff tank with sterilization, reducing the bacteria 85 per cent, was $9.51 per million gallons, as against $7.81 for the activated sludge. Mark you, the bacterial removal in the activated sludge was 95.5 per cent for that cost, whereas the bacterial removal in the Imhoff with chlorination was 85 per cent; and we attempted—and the report is in here—to sterilize our Imhoff tank effluent to that point comparable with the activated sludge, and found that the cost of the process was about $14.50 per million gallons.

Prof. PHELPS. How much chlorine does that represent?

Mr. HATTON. Eight and five-tenths parts, which costs $5 per million gallons, based on 7 cents per pound; that is 3 cents per pound less than we were paying for it; and we believed—in fact, we were assured—that if we bought it by carload lots we could get it for 7 cents per pound at that time.

Mr. POWELL. Now, circumstanced or conditioned as Milwaukee is, how does the cost of disposing of your sewage, as at present carried on, compare with what it would be if you dumped it in its raw state into the lake, that is taking the raw sewage when it comes from the end of the sewage pipe? Is Milwaukee the gainer or the loser by disposing of the sewage as you suggest?

Mr. HATTON. Well, undoubtedly the gainer.

Mr. POWELL. That is, by treating the sewage as you treat it, and disposing of the product, the fertilizer, Milwaukee is the gainer, as against dumping it in its raw condition into the lake?

Mr. HATTON. Decidedly.

Mr. POWELL. That is something consequential.

Mr. HATTON. Yes.

Mr. TAWNEY. Financially, it is disposing of the sewage at a profit, as I understand?

Mr. HATTON. Oh, no; I do not want you to think that. We do not get enough profit out of our sludge to pay for the treatment of the sewage.

Mr. TAWNEY. That is the inference I drew from your answer.

Mr. MIGNAULT. What you say is that it pays to dispose of the sludge after the treatment process?

Mr. HATTON. Yes; there is a profit in it, but not sufficient to pay for the whole cost.

Mr. MIGNAULT. When the sludge has been treated you calculate the cost of drying it and disposing of it, and you make a profit out of it?

Mr. HATTON. Yes.

Mr. POWELL. Take a million gallons of sewage at the point of delivery here in Detroit, and assume Detroit to be circumstanced or conditioned just the same as Milwaukee is from a sewage standpoint, what would it cost to bring that sewage up to the point at which you take it for the purpose of manufacturing into fertilizer?

Mr. HATTON. It costs $7.81 per million gallons, and we get therefrom practically $3. I am taking the lowest estimate now, making a cost of $4.81 for the treatment of sewage. I think that answers the question.

Mr. TAWNEY. For 1,000,000 gallons?

Mr. HATTON. Yes; per million gallons.

Mr. POWELL. Where does the $3 come in?

Mr. HATTON. It is the profit from the sludge.

Mr. TAWNEY. Deducting the cost of treating it?

Mr. HATTON. Yes.

Mr. POWELL. The actual cost is $4.81.

Mr. HATTON. Yes.

Mr. POWELL. Following up the question Mr. Magrath asked you, to anticipate any necessary outlays you made for improvements, without regard to this, taking the machinery as it is to-day, is there anything that you think would come in to disturb these features and upset them in the present conditions?

Mr. HATTON. As to the process?

Mr. POWELL. Yes.

Mr. HATTON. Nothing that has been discovered so far.

Mr. POWELL. You do not anticipate anything?

Mr. HATTON. Nothing at all; if I did, sir, I would hardly be warranted in recommending to my board the expenditure of two and a half millions for this process. That is the best way to answer that. We have adopted this process, and are going ahead to built it as soon as we get our land, which has to be condemned partially.

Mr. MAGRATH. Before you leave the subject, many municipalities, as you know, dump crude sewage into flowing water, and consequently they have not arranged their collecting sewers at any particular point. In the application of this system of yours is it necessary that there should be a collection of the sewage at some particular point, or could it be applied quickly to those existing municipalities?

Mr. HATTON. That is one of the features about the process. While it is always desirable to get one point to dispose of your sewage, where the cost is considerable for intercepting sewers to get at that one point it is better to divide up those numbers of points, providing you can do so without nuisance and at less cost than the intercepting sewers, and with this process it can be built and operated in the heart of the city without any nuisance arising. I think that answers the question, does it not?

Mr. MIGNAULT. Is there any difference in that respect between your treatment and the Imhoff tank treatment?

Mr. HATTON. I think not. There is no odor that is objectionable about an Imhoff tank.

Mr. MIGNAULT. I mean as to the necessity of intercepting sewers?

Mr. HATTON. I think not.

Mr. MIGNAULT. In either case, the question of intercepting sewers is a question to be considered, according to the layout of the ground?

Mr. HATTON. No; not altogether that; according to the layout of the ground and according to the process which you propose. If, for instance, you should go beyond the Imhoff tank process and put in sprinkling filters or nitrifying beds, then you would have to get outside of the city, in order to prevent the nuisance arising from those beds.

Mr. MIGNAULT. Perhaps I did not make my meaning clear. Is there any advantage in your system as to the multiplying of the treatment works, in order to avoid the construction of intercepting sewers?

Mr. HATTON. Between the two works?

Mr. MIGNAULT. Yes.

Mr. HATTON. No; I think not.

Mr. POWELL. Your process is not affected by atmospheric conditions at all?

Mr. HATTON. No; except that——

Mr. POWELL. Except extreme cold?

Mr. HATTON. Yes. We have to use more air in the cold weather than we do in the warm weather, in order to get the same quality of effluent, approximately this winter 12 per cent more air.

Mr. POWELL. It means practically 12 per cent additional cost?

Mr. HATTON. Of the air alone; but this cost I have quoted is the actual cost of summer and winter conditions.

Mr. FENKELL. May I ask a question? To what extent would it be necessary to allow untreated water to escape because of rainstorm?

Mr. HATTON. We are anticipating at the present time, or will anticipate in this plant, 150 gallons of rain water per capita; that is all the rain water that will be carried to the plant, and that rain water will be treated the same as the dry-weather flow. The balance of the rain water will go into the river.

Mr. POWELL. That is per diem?

Mr. HATTON. Per capita; 150 gallons per capita per day.

Mr. DOW. May I ask the witness whether I am correct in my summing up of the advantage of his method over the Imhoff tank method, in that it tends to reduce the net cost by producing a readily marketable fertilizer; that is the essential advantage. Am I correct in so understanding?

Mr. HATTON. Not altogether, sir. As far as your statement goes, it is correct, but to get a removal of 95 per cent of bacteria from the raw sewage, it costs considerably more to do it by the Imhoff tank and sterilization than it does by this process. I just quoted the figures.

Mr. DOW. Then initially, the advantage is that, with equal operating costs a higher removal of bacteria is possible by this process?

Mr. HATTON. Yes.

Mr. DOW. And in addition thereto, there is a certain commercial advantage, in that the product is readily marketable?

Mr. HATTON. Yes.

Mr. DOW. Much more readily marketed than the Imhoff product?

Mr. HATTON. Yes; that is true.

Mr. Dow. As regards the latter phase of the situation, am I correct also in my supposition that the present prices for fertilizers are abnormal, having regard to the prices prior to the war, say 1914?

Mr. HATTON. No; the price of two and a half per unit is the price that existed prior to the war; the price of ammonical nitrogen to-day is considerably higher than that.

Mr. Dow. The figures given are based upon what might be considered normal markets, and not upon the present very abnormal prices?

Mr. HATTON. Yes; for instance, phosphoric acid is worth to-day 10 times as much as the quotations I have used in making my valuations.

Mr. TAWNEY. Have you any questions, Prof. Phelps?

Prof. PHELPS. No.

Mr. DALLYN. Just one point that Mr. Mignault brought out. Comparing the results of your process with the Imhoff tank, Mr. Mignault rather concluded that the Imhoff tank could be used in the same location as your plant. Is it not true that the effluents from the two types of treatment compare as the two samples on the table, activated sludge effluent being clear, and that from the Imhoff tank turbid and discolored, similar to raw sewage?

Mr. HATTON. That is true. I answered that with the idea of nuisance to the adjacent neighbor.

Mr. DALLYN. What is your actual saving, as you actually contemplate placing interceptors, collecting the sewage, in the adoption of your method?

Mr. HATTON. We are saving about $2,000,000 in carrying out the subaqueous tunnel a mile and a half out to sea, as the original board of engineers suggested.

Mr. POWELL. I understood you to give that as the esthetic feature?

Mr. HATTON. Yes; not only esthetic feature, but the purification feature; in other words, the local engineer has indicated that he would not permit, with his sanction, any sewage disposal plant which would deposit that much suspended matter in the harbor.

Mr. MIGNAULT. The question I put to you was to ascertain, in case they decided to establish other treatment plants in order to avoid constructing sewers, whether your system had any advantage over the Imhoff-tank system?

Mr. HATTON. As I answered your question before, I was looking upon it with a view to nuisance to the neighborhood. As to nuisance which might arise from the discoloration of the water, I should say the Imhoff tank would be far more deleterious in that respect than our process; but as to nuisances arising in the waters due to decomposition, assuming that the sterilization of the Imhoff tank liquor is complete, then the two plants would be practically equal, as to nuisances arising outside of the discoloration of the water.

Prof. PHELPS. In regard to the matter which Mr. Mignault has brought out, I think it should be stated that, as far as the city of Detroit is concerned, and also as far as Buffalo is concerned, the question of interceptors, or of local plant, was not determined by the character of the treatment, but was determined solely by the physical conditions—that is, it was impossible for us to locate the local plants and thus save the interceptors, by reason of the levels of the sewers and the inaccessibility of available land. We did consider local

treatment, and if it had been feasible it would have represented considerable saving. The determination is not conditioned by the character of the treatment.

Mr. TAWNEY. Have you anything further to say?

Mr. HATTON. No.

Mr. TAWNEY. On behalf of the commission, I desire to extend to you our sincere thanks for your appearing before us, coming from Milwaukee for that purpose, and giving us the very interesting and clear statement you have concerning the operation of your plant in Milwaukee and the process of it.

Mr. POWELL. We can all assent to that.

Mr. GARDNER. Without any question.

Mr. MIGNAULT. You refer to the published report of the city of Milwaukee. Is that available?

Mr. HATTON. I would be glad to give it to the commission. I am sorry to say it is the last one.

Mr. TAWNEY. That is the only one you have?

Mr. HATTON. Except our own office copy.

Mr. MIGNAULT. And the process is described?

Mr. HATTON. Quite well; and the results.

Mr. MAGRATH. I suppose it is impossible to get copies of this any place?

Mr. HATTON. Well, there are some of them in public laboratories throughout the country and among engineers; but we had a pretty lively demand for them and we only had 500 copies issued, and they are all gone. That is a copy I picked up on my desk yesterday.

Mr. RICH. Mr. Chairman, I have a brief statement here regarding lake currents which would elucidate what Mr. Hatton was not quite familiar with.

Mr. Goddard, assistant engineer at Grand Rapids of the United States engineer office, read a paper before the Engineers' Club, of Grand Rapids in April, 1916, which included his own experience, as well as a compilation of the results of the studies of others and covering a number of years. His conclusions were that the currents in the Lakes are produced primarily by the winds and secondarily by variation in barometric pressure.

Wind currents follow the direction of the wind.

Pressure currents flow from high to low pressure areas.

The flow through the Straits of Mackinac in either way, according as the above conditions prevail.

STATEMENT OF MR. THEODORE A. LEISEN, GENERAL SUPERINTENDENT OF THE WATERWORKS OF THE CITY OF DETROIT.

Mr. TAWNEY. Mr. Leisen, you are the president of the Great Lakes Pure Water Association, are you not?

Mr. LEISEN. No, sir.

Mr. TAWNEY. Are you connected with that association?

Mr. LEISEN. I have a letter from the secretary asking me to represent the association at this meeting.

Mr. TAWNEY. Have you examined this report of the consulting engineer of the commission?

Mr. LEISEN. I regret to say that I did not see that report until yesterday at noon, and I think you can realize that I have not. While

I had endeavored to read over a part of it I have not been able to digest it.

Mr. TAWNEY. What are the functions of your organization?

Mr. LEISEN. The functions are largely the questions from the sanitary point of view of preserving the purity of the waters of the Great Lakes.

Mr. TAWNEY. It is a voluntary organization?

Mr. LEISEN. It is a voluntary organization without any official standing. It is simply an auxiliary to the health departments in an unofficial way, I should say.

Mr. TAWNEY. Where are the headquarters located?

Mr. LEISEN. Practically they have no headquarters.

Mr. POWELL. Who are the officers?

Mr. LEISEN. Mr. Paul Hansom, of the Illinois State Board of Health, is the secretary; and Dr. Charles J. Hastings is president.

Mr. POWELL. Has your organization followed the work of the International Joint Commission in this investigation?

Mr. LEISEN. My familiarity with the organization is almost nil. As I say, I had a conversation with Mr. Hansom in New York relative to the matter a few weeks ago, and he asked me if I was still a member of the association. As a matter of fact, that did not come to a definite point until I got his letter asking me to represent them here. Officially, I am not in a position to say very much about the association or what they have done. It is a newly organized body.

Mr. POWELL. When was it organized?

Mr. LEISEN. Some time during the past years.

Mr. POWELL. What are its purposes?

Mr. LEISEN. I think the preservation of the purity of the waters of the Great Lakes.

Mr. TAWNEY. And also the connecting rivers, I suppose?

Mr. LEISEN. Well, yes.

Mr. TAWNEY. Have you any statement which you desire to make to the commission in respect to the pollution of these waters?

Mr. LEISEN. As you understand, I am the general superintendent for the board of water commissioners here in Detroit, and as such have charge of the water supply. So, naturally, my interest from that point of view would be toward——

Mr. TAWNEY. You appeared before the commission two years ago, when we were here, did you not?

Mr. LEISEN. Yes, sir.

Mr. TAWNEY. And at that time you gave us full and detailed information concerning the water purification?

Mr. LEISEN. I believe the points were generally covered then.

Mr. TAWNEY. Have you the same process now that you had at that time?

Mr. LEISEN. With this difference: At that time we were treating the water with hypochloride of lime as a disinfectant. We have since changed to liquid chlorine treatment.

Mr. TAWNEY. What has been the result?

Mr. LEISEN. There has been no radical difference in the result. The results obtained from the use of hypochloride of lime have been almost identical with those obtained from the use of liquid chlorine; possibly some elimination of the taste in the water. I do not believe

the complaints of taste of chlorine have been of any moment at all since the liquid-chlorine process was adopted. To that extent I consider it an improvement and it is a little more cleanly. It is a nicer process, more methodical, and more mechanical in its methods.

Mr. TAWNEY. You have only one intake?

Mr. LEISEN. Yes.

Mr. TAWNEY. What is its capacity?

Mr. LEISEN. It is 10 feet in diameter and a little over 300 feet long. Its capacity, of course, would vary with the head permissible on the shore end.

Mr. TAWNEY. How many gallons are you consuming per day?

Mr. LEISEN. We are consuming at the present time about 130,000,000 to 160,000,000 gallons per day.

Mr. TAWNEY. That is, a day of 24 hours?

Mr. LEISEN. Yes. Our highest hourly capacity for any one period was at the rate of about 190,000,000 gallons per day of 24 hours.

Mr. TAWNEY. The hour consumption was at that rate?

Mr. LEISEN. That was the peak load, yes; for one hour during the past year.

Mr. TAWNEY. Have you studied this problem in connection with the matter of sewage disposal at all, or do you deal entirely with the water end of it?

Mr. LEISEN. I have no official connection with the sewage disposal proposition; but my interests are simply those of an engineer in the problem, and as a citizen.

Mr. TAWNEY. Have you had any cases of typhoid fever in the city of Detroit in the last year or two?

Mr. LEISEN. Yes; there have been cases, not abnormal. The typhoid-fever death rate has been reasonably constant for the last few years and comparatively low.

Mr. TAWNEY. Have you gentlemen any questions to ask? If not, that is all, Mr. Leisen. Are there any other gentlemen here representing the city of Detroit who wish to be heard on this subject? I see that the mayor of the city has just come in, in time to witness the closing of these hearings. He may have something to say. If he has we shall be glad to hear from him.

Mr. MARX. I do not know really what you have done this morning.

Mr. TAWNEY. Well, gentlemen, it seems that this closes the hearing. In concluding the hearing I have been requested, on behalf of the commission, to extend to the mayor of the city of Detroit and the council of the city our sincere thanks for the courtesy which has been extended to us in giving us the use of this council chamber. I can assure the mayor and the council that the commission sincerely appreciates, not only the courtesy that has been extended to us, but also the hearty cooperation which we have received from the officials of the city since the beginning of the investigation, and we sincerely hope that when our final recommendations are made to the two Governments they will receive the approval and support of the city of Detroit and of the neighboring cities as well. Thanking you gentlemen for your appearance and courtesy, I will state that the hearings are now closed.

Mr. MARX. I want to assure you of our continued cooperation.

(Thereupon, at 12.30 o'clock p. m., the hearings were closed.)

INTERNATIONAL JOINT COMMISSION,
Ogdensburg, N. Y., Friday, August 25, 1916.

The commission met at 10 o'clock a. m.

Mr. Gardner presided.

Mr. GARDNER. Gentlemen, you will kindly come to order. In August, 1912, the Governments of Canada and the United States jointly referred to the International Joint Commission for investigation and report, under the terms of Article IX of the treaty of January 11, 1909, certain questions relating to the pollution of boundary waters. Briefly stated, these questions are: What are the extent, causes, and localities of such pollution? How may such pollution best be remedied?

It is safe to say that of all the questions with which the commission has had to deal this is by far the most important. Nothing can be more vital than the conservation of health, and that is precisely the object of this investigation. The population directly tributary to the boundary waters between Canada and the United States amounts to over 7,000,000, and it is estimated that over 15,000,000 are carried annually in steamboats on these waters. The pollution of boundary waters is a direct menace to every one of these millions of citizens of the two countries. Its prevention will be of incalculable benefit.

In investigating the first question the commission was fortunate enough to secure the services of Dr. Allan J. McLaughlin, of the United States Public Health Service, and now commissioner of health of Massachusetts. Associated with him were Dr. J. W. S. McCullough, Prof. John A. Amyot, and Mr. F. A. Dallyn, of the Provincial Board of Health of Ontario. Under the direction of these officers bacteriological surveys were carried out throughout the boundary waters, from the St. John River in the east to the Lake of the Woods in the west. They also had the cordial cooperation of the Public Health Services of both the Federal Governments and of the States and Provinces on these boundary waters. The results of this investigation were embodied in a progress report submitted to the two Governments in 1914, to which was appended a very complete report by the sanitary experts of the commission, outlining the extent of pollution in the different localities and the causes to which it was attributed.

Having disposed of the first question, the commission took up the second, as to remedies. As a first step, a conference was arranged in New York with six eminent sanitary engineers, George W. Fuller, Earle B. Phelps, and George C. Whipple, of the United States, and F. A. Dallyn, W. S. Lea, and Theo. J. Lafreniére, of Canada, whose testimony furnishes an invaluable record on the engineering side of the question. As a result of this conference certain broad fundamental principles were established, upon which any remedial action must be based. The services of Prof. Phelps were secured as consulting sanitary engineer to the commission, and under his direction a series of careful studies were made, with particular reference to the interception and treatment of riparian sewage on the Detroit and Niagara Rivers, the chief areas of pollution. Public hearings were held in the cities and towns along these waters in 1914, and

again in the present year, to afford every opportunity to the municipal and other authorities interested to put their views before the commission.

In March, 1916, the consulting sanitary engineer submitted to the commission his report upon remedial measures. Before closing the hearings the commission deemed it desirable to give those interested in health matters on the St. Lawrence an opportunity to come forward and present their views. With that object in view it was decided to hold a meeting in Ogdensburg to-day. Afterwards the commission will proceed to prepare for submission to the two Governments its final report, both as to the extent and causes of polution and as to the remedies best designed to safeguard the health of the Canadian and American communities along the boundary.

Not only are we here to confer with those interested in health matters, to find remedies for the removal of the causes of pollution, but to ascertain to what extent and by what methods, system, or lack of system are the boundary waters in this community being polluted in contravention of the terms of the treaty made between the British Empire and the United States, which provides that "These waters shall not be polluted on either side of the line to the injury of health or property on the other," and also to serve notice that the time is drawing near when no raw sewage will be allowed to flow into these waters, and all communities in the near future will be required to treat their sewage by some process of purification before being allowed to use the waters of the boundary as an avenue for its discharge. The commission therefore desires to hear from representatives of the cities and towns bordering on the St. Lawrence River as to what is being done at this time and what plans, if any, are being considered for the future to remove the causes of pollution in these boundary waters.

By direction of the chairman, Secretary Burpee then read the notice of the meeting to be held at Ogdensburg, which was sent to interested municipalities and officials in the United States and Canada, together with copies of the report of the consulting sanitary engineer of the commission, and also the list of the municipalities to whom the notice and report were sent.

The notice and list are as follows:

NOTICE.

JULY 7, 1916.

DEAR SIR: I am sending you a copy of the report of the consulting sanitary engineer upon remedial measures in connection with the pollution of boundary waters investigation. The commission intends to hold a hearing at Ogdensburg, N. Y., probably toward the end of August. I will advise you of the exact date as soon as it has been decided. Meanwhile the accompanying report is sent to you so that your engineers and other officers may be in a position to give the commission the benefit of their views at the hearing. If you require any additional copies of the report, please let me know.

Yours, very, truly,

——— ———, *Secretary.*

Municipalities to whom notice was sent:

Cape Vincent, N. Y.; Clayton, N. Y.; Thousand Island Park, N. Y.; Alexandria Bay, N. Y.; Morristown, N. Y.; Ogdensburg, N. Y.; Waddington, N. Y.; Kingston, Ontario; Gananoque, Ontario; Brockville, Ontario; Prescott, Ontario; Cardinac, Ontario; Morrisburgh, Ontario; Cornwall, Ontario.

The chairman, specifically mentioning each municipality in the above list, called for the names of persons appearing in their behalf, as well as the names of any others who desired to enter an appearance, and the following appearances were announced:

APPEARANCES.

Prof. Earle B. Phelps, of the United States Public Health Service, Washington, D. C., consulting sanitary engineer of the commission.
Dr. J. W. S. McCullough, of Toronto, Canada, medical health officer, provincial board of health of Ontario.
F. A. Dallyn, Toronto, Canada, sanitary engineer, provincial board of health of Ontario.
W. J. Stewart, Ottawa, Canada, representing the department of public works of Canada.
James White, Ottawa, Canada, assistant chairman of the conservation commission of Canada.
Francis S. King, representing the Dominion Marine Association.
George A. Wright, mayor of Brockville, Ontario.
W. H. Kyle, chairman of the public utilities of Brockville, Ontario.
G. H. Bryson, city engineer of Brockville, Ontario.
Dr. A. J. Macauley, medical health officer of Brockville, Ontario.
J. R. A. Lang, member of the council of Brockville, Ontario.
J. E. Chrysler, member of the council of Brockville, Ontario.
C. J. Sheriff, member of the council of Brockville, Ontario.
George K. Dewey, city clerk of Brockville, Ontario.
F. S. Evanson, mayor of Prescott, Ontario.
R. R. Dowsley, superintendent of the water and light system of Prescott, Ontario.
G. F. Darrow, chairman of the water board of Ogdensburg, N. Y.
Andrew Irving, chairman of the board of public works of Ogdensburg, N. Y.
Frank Chapman, member of the board of commissioners of Ogdensburg, N. Y.

Mr. GARDNER. We will first call on the mayor of Brockville.

STATEMENT OF MR. GEORGE A. WRIGHT, MAYOR OF BROCKVILLE, ONTARIO.

Mr. WRIGHT. Mr. Chairman and gentlemen, I shall have very little to say, personally. We have with us our city engineer and medical health officer, who will be able to give you whatever information you require and to ask for whatever information we ourselves desire. It is needless to say that we are very much interested in this question. Pure water has been a big problem with us in the town of Brockville. Within a year we have suffered severely from impure water. Therefore we are looking at the present time for ways and means to secure a supply of pure water. We have been dealing with the question of filtration, but the matter has not been definitely settled by us yet.

As to the disposal of our sewage, our civic officers will give you information regarding that. I do not think it is necessary for me to take up any more of your time than to introduce to you, first, our medical health officer, Dr. Macauley.

Mr. GARDNER. You obtain your water from the St. Lawrence River, do you?

Mr. WRIGHT. We take our drinking water from the St. Lawrence River and discharge our sewage into it.

Mr. MIGNAULT. Do you discharge your sewage into the St. Lawrence River treated or untreated?

Mr. WRIGHT. Untreated.

Mr. TAWNEY. You said that you had suffered severely from impure water within the last year. Will you kindly state what your experience was in that regard?

Mr. WRIGHT. We had a typhoid epidemic about a year ago.

Mr. TAWNEY. How large an epidemic did you have in your town?

Mr. WRIGHT. We had about 180 cases.

Mr. TAWNEY. What is the population of Brockville?

Mr. WRIGHT. About 10,000.

Mr. TAWNEY. How many deaths were there?

Mr. WRIGHT. Fourteen.

Mr. GARDNER. Was that the first instance of typhoid that you had?

Mr. WRIGHT. It was the first epidemic. We had a break in one of our pipes, which I think had something to do with the cause of it.

Mr. TAWNEY. Did you trace the source of the epidemic to the pollution in the river water?

Mr. WRIGHT. Yes.

Mr. POWELL. What is the cause of your pollution?

Mr. WRIGHT. We think the sewage is the cause.

Mr. POWELL. Sewage from where?

Mr. WRIGHT. From the town of Brockville. Of course, as I stated, there was a break in our sewage pipe which permitted the contamination.

Mr. POWELL. Is the source of your intake farther upstream?

Mr. WRIGHT. It is above our sewage outlet; yes, sir.

Mr. MIGNAULT. How far above?

Mr. WRIGHT. Not a great distance, but much farther out in the river. The town engineer will be able to give you that information.

Mr. POWELL. If your intake is farther upstream than the outlet of the sewage, how can the sewage be responsible for the trouble?

Mr. WRIGHT. We have a considerable eddy. On account of the eddy in the river we occasionally find sewage above the town.

Mr. POWELL. That is the town's own sewage?

Mr. WRIGHT. Yes. We find that the river there is contaminated, and we find a great deal of difficulty in obtaining any samples of pure water in the river anywhere in the neighborhood of the town.

Mr. POWELL. Are there many shoals in the river which cause a deflection of the current?

Mr. WRIGHT. Yes; there are a great many shoals.

Mr. POWELL. That leads to a mixture of the waters on both banks?

Mr. WRIGHT. Yes.

Mr. MIGNAULT. Is there any sewage in the river above Brockville?

Mr. WRIGHT. There are some small summer resorts above the town, and I understand that a limited amount of sewage goes in from them.

Mr. POWELL. How far is it from Brockville to Gananoque?

Mr. WRIGHT. A little over 30 miles. We do not feel that we are contaminated from Gananoque, though.

Mr. POWELL. I suppose you have never made an investigation to see whether you are or not?

Mr. WRIGHT. No.

Mr. MAGRATH. You would rather have those questions directed to your health officer, would you not?

Mr. WRIGHT. I think so. I will ask our health officer, Dr. Macauley, to take the floor now.

STATEMENT OF DR. A. J. MACAULEY, MEDICAL HEALTH OFFICER OF BROCKVILLE, ONTARIO.

Mr. GARDNER. What is your official position, Dr. Macauley?

Dr. MACAULEY. I am medical health officer of Brockville.

Mr. GARDNER. How long have you occupied that position?

Dr. MACAULEY. About 15 years.

Mr. GARDNER. What has been your observation in regard to the water supply for the city of Brockville?

Dr. MACAULEY. The water supply, the untreated water, for years has been found to be impure. It is much more impure now than it was some years ago, but we have always found colon bacilli in the water.

Mr. GARDNER. In your opinion, does it increase in amount as the time goes on?

Dr. MACAULEY. It certainly has increased.

Mr. POWELL. To what do you attribute the increase?

Dr. MACAULEY. I suppose it is the pollution. There is a constant emptying of sewers into the water all the way up. As you will find by investigation, the St. Lawrence River is polluted all the way up, even above the towns where the summer resorts are.

Mr. MIGNAULT. There are a large number of boats that ply on the river, are there not?

Dr. MACAULEY. There are a great many boats; I could not say as to the number.

Mr. MIGNAULT. I suppose the islands and the riparian communities are increasing in population, and the increase in sewage would be the logical result?

Dr. MACAULEY. Yes, sir.

Mr. TAWNEY. Have you ever made any independent examinations?

Dr. MACAULAY. Examinations have been made by our board. They are made every week. I think from four to six samples a week are analyzed, and the raw water is now found to be constantly polluted.

Mr. TAWNEY. Have you a water-filtration plant?

Mr. MACAULEY. We have not. We chlorinate our water by gas chlorination.

Mr. POWELL. What would be the average summer contamination, expressed in colon bacilli?

Dr. MACAULEY. We find colon bacilli practically constant in 5 to 10 cubic centimeters.

Mr. GARDNER. Do you notice any difference in the amount of pollution in winter and summer?

Dr. MACAULEY. I think it is practically the same; perhaps it may be a little higher in the summer season.

Mr. MIGNAULT. What have you done locally to remedy the situation, Dr. Macauley?

Dr. MACAULEY. Our epidemic was due to an accident. The intake pipe we have now extends 700 feet out into the St. Lawrence from the dock, but the one we had before extended only a little over 100 feet into the river. There is an eddy that flows down to Picketts Point right below Brockville, and it goes right straight up back along the shore; but our sewage pipe extends about 900 feet down and about 800 feet from the shore. In December about two years ago a boat anchor got a hold of the sewer pipe down below our intake pipe and opened it about 200 feet from shore. It made an opening in the joint of the pipe, and we got the pollution from the sewage into the intake pipe. That is undoubtedly what caused the epidemic. When that was remedied the epidemic stopped.

Our water is chlorinated. We use about 100 pounds of hypochloride to 3,000,000 gallons of water. It is put in as an equivalent, because we use gas instead of the chlorine.

Mr. GARDNER. Have you more than one outlet to your sewage discharge?

Dr. MACAULEY. Yes; we have. We have an outlet at the western end of the town. Our engineer will give you the capacity of that outlet. Our main outlet is below the town and also below our intake pipe.

Mr. POWELL. Your system of piping is a series of small pipes, is it not?

Dr. MACAULEY. Yes; but there is a trunk sewer.

Mr. POWELL. How large are those pipes?

Dr. MACAULEY. The engineer can give you that information.

Mr. POWELL. Dr. Macauley, on which side of the river is the riparian population increasing most rapidly, on the United States or the Canadian side?

Dr. MACAULEY. I think it is increasing most rapidly on the Canadian side; perhaps not in the summer resorts; there is quite a large population on the islands, but principally on the American side. The population is increasing very rapidly each year.

Mr. POWELL. When you say on the Canadian side do you mean exclusive of Brockville?

Dr. MACAULEY. Well, they are increasing every year.

Mr. POWELL. As rapidly as on the American side?

Dr. MACAULEY. I do not think so with respect to the summer resorts, because the majority of the islands are on the American side.

Mr. POWELL. What is the density of the population during the time that the summer residents are there?

Dr. MACAULEY. I could scarcely tell you that.

Mr. POWELL. I want to get the floating population passing from one side to the other.

Dr. MACAULEY. I could not give you that information. There is a great deal of pollution undoubtedly from the boats.

Mr. MIGNAULT. There is quite a large summer population on the islands?

Dr. MACAULEY. There is, particularly this summer.

Mr. MIGNAULT. You do not make provision for letting the surface water of the city pass into your sewerage system, do you?

Dr. MACAULEY. Partially it does; but it enters the St. Lawrence by a separate pipe.

Mr. GARDNER. How many cases of typhoid fever do you think developed in consequence of the sewage pollution in your water supply?

Dr. MACAULEY. At that time?

Mr. GARDNER. Yes; that is approximately how many cases?

Dr. MACAULEY. There is no doubt that the breaking of the intake pipe was practically the cause of the epidemic. We have had too high a typhoid content always until the water was heavily chlorinated. We have chlorinated our water since 1910.

Mr. GARDNER. Previous to that time did you have an epidemic of typhoid?

Dr. MACAULEY. We had in 1909 a slight epidemic. There were, perhaps, 25 or 30 cases. I could not give you the exact number now. We had none in 1910. The dredging that was being done along the river front was practically the cause of the epidemic. We have never been as free from typhoid as we were this last summer. We have never had any cases that we could trace to the water since it has been highly chlorinated. Still our water is always suspicious, and if anything went wrong with the chlorination plant we would surely have typhoid.

Mr. MIGNAULT. At the time of the last epidemic the water was chlorinated?

Dr. MACAULEY. Yes; but it was not chlorinated highly enough. We practically got sewage into our water pipe.

Mr. POWELL. I suppose there was too great a burden thrown on your chlorinating system?

Dr. MACAULEY. Yes.

Mr. POWELL. In the official circles of your city has the question of purification of your sewage ever been mooted or discussed?

Dr. MACAULEY. Not of our sewage. We have been for some time agitating very seriously the question of putting in a filtration plant.

Mr. POWELL. That is for your water for consumption?

Dr. MACAULEY. Yes.

Mr. POWELL. But what about the sewage?

Dr. MACAULEY. The sewage is never treated.

Mr. MAGRATH. Have any demands been made upon you by the public-health service of Ontario to improve your system?

Dr. MACAULEY. We have been notified that the time would come when we would have to do that. We are trying to get our filtration plant in. We thought last year that we practically had it.

Mr. POWELL. You would look after your water and let the other fellow look after the sewage?

Dr. MACAULEY. Self-preservation first, always.

Mr. MAGRATH. Have you any complaints against the pollution of water from this side crossing over to the Canadian side?

Dr. MACAULEY. I do not know that we have. Examinations made by our local board have shown that for several miles up the river the pollution is practically constant in the raw water.

Mr. POWELL. Across the whole river?

Dr. MACAULEY. Right across the channel. We examined all the way across.

Mr. POWELL. But you have had no independent examination?

Dr. MACAULEY. Yes; we have.

Mr. POWELL. And that independent examination showed the same results as our examinations?

Dr. MACAULEY. Practically the same.

Mr. POWELL. Showing that contamination extends across the whole channel?

Dr. MACAULEY. Across the whole channel and all the way up.

Mr. POWELL. Has any opposition on the part of the citizens to purification of the sewage, or sterilization of it, ever manifested itself?

Dr. MACAULEY. I think not. It has been mooted, but no definite action has been taken.

Mr. POWELL. Why was not definite action taken in compliance with the request of the provincial board?

Dr. MACAULEY. I think the lack of funds was the main thing.

Mr. MIGNAULT. Did you ever have studies made as to sewage treatment in Brockville?

Dr. MACAULEY. No; I think not; not for Brockville especially.

Mr. MAGRATH. It is just your water supply that you are contemplating improving?

Dr. MACAULEY. At the present time that is all. We know that we shall have to improve the other in time. No doubt it is dangerous.

Mr. MIGNAULT. But you have not seriously considered it so far?

Dr. MACAULEY. I can not say that we have. It has not been brought to my notice if it has been.

Mr. POWELL. The engineer can probably answer this question, but his experience may not go far enough back. Has any investigation ever been made as to the natural facilities that are afforded for sedimentation beds and things of that kind on the other side of the boundary?

Dr. MACAULEY. I think not.

Mr. POWELL. Have you ever heard of any complaints owing to sewage from vessels passing up and down the river?

Dr. MACAULEY. Yes; we have heard complaints. During the year 1909 one of our wharves was in bad condition, and many of the large boats stopped at a point that was practically over the end of our intake pipe. That was doubtless the cause of our epidemic. There is no doubt that the year the boats were there there was an epidemic. We went so far as to prohibit the boats staying there. We prohibited the large liners or passenger boats tying up to that wharf. For some months, however, they did tie up to the wharf.

Mr. POWELL. As a man having to do with sanitary matters, what is your opinion regarding the effect of the boats discharging the sewage into the river? Is the discharging of that sewage into the river detrimental to health on your side?

Dr. MACAULEY. Undoubtedly.

Mr. MAGRATH. I would like to say, Mr. Chairman, that if Dr. Macauley as the health officer of a great town along the river here wishes to make any statement to the commission he may do so. He may have gotten the idea that he is here to ask questions. If he has anything to say on the subject, this is the time to say it.

Dr. MACAULEY. I do not know of anything special at this time. Something may later suggest itself to my mind.

Mr. TAWNEY. Can anyone here give us information as to the number of vessels passing up and down this river in front of Brockville? Is there any record that would give such information?

Dr. MACAULEY. I do not think we have any such record.

Mr. GARDNER. I suppose, Dr. Macauley, that you are willing to say that the tonnage passing up and down the river here is very large?

Dr. MACAULEY. Certainly there are a great many people passing up and down the river on the line of boats, the *Kingston* and the *Toronto*, especially this season. Owing to the fact that the season has been a very hot one, the boats have been crowded all summer.

Mr. POWELL. I suppose the reports of the lock masters of the canals would give us some idea of the number of boats passing up and down.

Dr. MACAULEY. I do not think so, because a large portion of the travel comes from the train or from Brockville; but a large number of passengers would go only as far as Prescott. I think it would be only a fractional part would go to Montreal.

STATEMENT OF MR. G. H. BRYSON, CITY ENGINEER OF BROCKVILLE, ONTARIO.

Mr. GARDNER. Mr. Bryson, you are the city engineer of Brockville, are you?

Mr. BRYSON. I am.

Mr. GARDNER. How long have you held that position?

Mr. BRYSON. Four and a half years.

Mr. GARDNER. Have you with you plans of your sewerage system?

Mr. BRYSON. No; I did not bring any. They are on file with the commission's original report of 1914.

Mr. GARDNER. Can you give us a general outline of the character of your sewerage system?

Mr. BRYSON. The town is divided into two systems. One system discharges into what is called the west-end division. The main sewerage area takes about three-fourths of the area of the town and discharges about 820 feet from the intake pipe. It starts with a 16-inch outlet and then follows up with an 8-inch outlet in the river. The original system was laid out to take only sanitary sewage, but for some reason that was abandoned. The west-end system is a 9-inch pipe, except the small piece of 8-inch cast-iron pipe running into the river. That discharges about half a mile above the intake pipe. It is practically all sanitary sewage.

Mr. GARDNER. What is the nature of the surface of the country there? Is it flat?

Mr. BRYSON. No; it is very hilly. We have really three watersheds in the town.

Mr. GARDNER. As an engineer, would it, in your judgment, be very difficult to put an intercepting sewer in there for the purpose of purifying the sewage?

Mr. BRYSON. Plans have been gotten out for intercepting all the west end sewage and bringing it into the main system.

Mr. MAGRATH. Have those plans been approved by the public health service?

Mr. BRYSON. No; they have never gone to them, but it is a recommendation from them that the sewage from the west end be pumped into the main sewerage system. That was one of the conditions contained in the original order, that the west end sewage be passed into the main sewerage system.

Mr. POWELL. What is the estimated cost of that work?

Mr. BRYSON. About $10,000.

Mr. GARDNER. That was a suggestion for the purification of your sewage?

Mr. BRYSON. It was just simply to divert the sewage so it would go out below the intake.

Mr. GARDNER. You have never taken into consideration the purification of your sewage before it is discharged?

Mr. BRYSON. No; nothing has been done about that.

Mr. POWELL. What is the axis of this rotary area where you have the back flow?

Mr. BRYSON. I beg your pardon?

Mr. POWELL. There is a back flow on the Brockville side. What is the major axis, and what is the minor axis?

Mr. BRYSON. It flows west to about the Canadian Pacific Railway dock and then turns down the river.

Mr. POWELL. About how far is it from where it starts to flow up to the end of the curve?

Mr. BRYSON. It starts about half a mile below the town. I should think it is out about 800 feet. The intake is supposed to be across the present eddy.

Mr. POWELL. Just beyond it, near the margin.

Mr. BRYSON. Yes.

Mr. POWELL. During your time has the pollution increased very much?

Mr. BRYSON. It has increased with the population in the western end of the town.

Mr. POWELL. Have you ever made any estimate as to what the cost would be of sterilization by sedimentation or otherwise of the sewage?

Mr. BRYSON. No, sir.

Mr. MAGRATH. So far as I can gather, you have been the chief offender against yourself in the past.

Mr. BRYSON. I think so, Mr. Magrath.

Mr. GARDNER. Your concern has been chiefly in regard to your water supply?

Mr. BRYSON. It has been to protect ourselves.

Mr. GARDNER. And you have no complaint to make about the water being polluted in the stream above you?

Mr. BRYSON. No.

Mr. MIGNAULT. Are there any large towns below Brockville that would be polluted by your sewage?

Mr. BRYSON. Prescott is the only possible place that could be affected by it, I think.

Mr. POWELL. There is no surface sewage that passes into your western system?

Mr. BRYSON. There is very little; nothing to speak of.

Mr. POWELL. Does all the surface sewage in the lower system pass into your pipes?

Mr. BRYSON. It passes into other pipes now; but for the last four years we have been taking out such surface sewage as we could because we have been having very heavy floods in the lower pipes of the town.

Mr. POWELL. Could you avoid a pumping system in disposing of your sewage?

Mr. BRYSON. No; we have to pump. The location of a plant would be very difficult from the present point of discharge.

Mr. POWELL. Have you any idea from what elevation you would have to pump the sewage in order to dispose of it.

Mr. BRYSON. I think to get land we would have to go outside of the town limits entirely.

Mr. POWELL. But how high would you have to go?

Mr. BRYSON. About 90 feet.

Mr. POWELL. That would be quite expensive?

Mr. BRYSON. Yes. There is no available land in sight.

Mr. MAGRATH. You have no general statement that you wish to make regarding this situation, have you?

Mr. BRYSON. Dr. Macauley was asked about the pollution in the river. Last year I went out all over the lake taking samples and sent them to the provincial board of health. Everyone showed contamination. We crossed the main channel and right over to the American side. We went up the river to Big Island.

Mr. GARDNER. Did that investigation cover the whole surface of the river from shore to shore?

Mr. BRYSON. We took samples every 400 feet right across.

Mr. POWELL. Have there ever been any complaints made by the lower communities on your side against the sewage?

Mr. BRYSON. No.

Mr. POWELL. You have never been threatened with any lawsuits?

Mr. BRYSON. No.

Mr. EVANSON. May I ask Mr. Bryson a question?

Mr. GARDNER. Certainly.

Mr. EVANSON. Mr. Bryson, in speaking of purifying the sewage of the town of Brockville you said it would have to be pumped for a considerable distance. Do not the sewers go down some of the principal streets of Brockville?

Mr. BRYSON. Yes.

Mr. EVANSON. Is it not possible that a plant could be built under ground beneath those streets to take care of the sewage?

Mr. BRYSON. I do not think so. I think we would have to spend too much money in rock excavation.

Mr. EVANSON. I know that Mr. Murray, of Toronto, suggested that system to me some years ago. He said it could be taken care of without pumping at all.

Mr. BRYSON. Our outlet is in rock now and it is below the level of the St. Lawrence.

Mr. POWELL. There is not much rise and fall of the St. Lawrence River here, is there?

Mr. BRYSON. No; not very much.

Mr. POWELL. About what is the range?

Mr. BRYSON. About 4 feet at Brockville.

Mr. POWELL. Is there much shallow water on the Brockville side?

Mr. BRYSON. Not along the main water front. It is only along

the west end that it begins to get shallow. There is a shoal over there.

Mr. POWELL. Is there an area there of some acres of shallow water?

Mr. BRYSON. Yes.

Mr. POWELL. Could you not dike it off? Or would that be too expensive?

Mr. BRYSON. Yes; it would be too expensive.

Mr. GARDNER. Is there anyone else from Brockville who wishes to be heard?

Mr. WRIGHT. Possibly we might hear from the chairman of the water commission, if the question of filtration is of any interest to this commission.

Mr. GARDNER. This commission is not so much concerned about the purification of your water supply as about the purification of your sewage.

Mr. WRIGHT. I understand that. The point we wish to establish is that so far as our experience goes we have not been able to find pure water in the river irrespective of any pollution that comes from the town of Brockville. While no doubt there is pollution from the sewage in the town of Brockville, at the same time in all our experience with the river we have been unable to find pure water in the neighborhood of the town, either above or below the sewage outlet. Therefore, we have come to the conclusion that the river is polluted irrespective of our sewage.

Mr. MAGRATH. Do you know of any community treating the sewage above you?

Mr. WRIGHT. No, sir.

Mr. GARDNER. The commission would be glad to hear from the chairman of the water commission.

STATEMENT OF MR. W. H. KYLE, CHAIRMAN OF THE PUBLIC UTILITIES COMMISSION OF BROCKVILLE, ONTARIO.

Mr. KYLE. Mr. Chairman and gentlemen: We had tests made of the water above the town, away above any contamination from our sewage, and I believe to-day if we could get pure water above Brockville we could put a pumping plant up there.

Mr. MAGRATH. And treat your sewage so as to leave the people below you in the same position?

Mr. KYLE. We are in the position that we take that as an international question, and there would be no use of their treating it unless it is made general. The water is polluted also from the big insane asylum there. That will have to be taken into consideration when the question of the town of Brockville is considered.

Mr. GARDNER. Where is that located, in reference to your city?

Mr. KYLE. It is about a mile below our city. I believe we can not get any pure water in the river at the present time and that we shall have to treat our sewage and also put in a filtration plant. I believe that the trouble in our water is caused by shipping. I remember passing one of those big liners in a motor boat one day. I do not know what sort of an apparatus they had, but they dumped the material, and everybody immediately grabbed their handkerchiefs and held their noses until they got by. I believe that has a great

deal to do with the contamination of the water. Many of the summer residents also wrap their garbage in paper and throw it in the river.

Mr. GARDNER. That is increasing in amount?

Mr. KYLE. Every year.

Mr. MIGNAULT. Have you any idea as to the summer population above Brockville?

Mr. KYLE. Practically all the islands are occupied now, as well as the shores, by summer residents, and at Alexandria Bay there are thousands and thousands of people every day. I think we are getting more contamination from the vicinity of Alexandria Bay than we are perhaps from Gananoque.

Mr. MIGNAULT. How far are you from Alexandria Bay?

Mr. KYLE. About 22 miles.

Mr. MIGNAULT. How far are you from Gananoque?

Mr. KYLE. About 30 miles. I think probably in another year we will filter our water. I think the water should be filtered, no matter whether the sewage is treated or not.

Mr. MIGNAULT. I suppose the point you make, Mr. Kyle, is that unless all communities treat their sewage, the treatment of sewage at Brockville would not help you?

Mr. KYLE. It would not affect us and would not affect the other towns. They would still have to chlorinate.

Mr. MIGNAULT. In other words, the water as it comes down from Brockville is already polluted.

Mr. KYLE. Yes.

Mr. MIGNAULT. And I suppose, inasmuch as the summer population on the islands is increasing, you could hardly expect that any system of treatment of sewage or garbage going into the river could be ever attempted?

Mr. KYLE. I do not know just how they would get after them. But they would have to burn the garbage and treat their sewage. It is a serious question for the municipalities. They have all issued debentures for putting in plants for the disposal of the sewage, I suppose with the permission of the Government. Some towns can do it very easily, but in our town it would be a very serious question.

Mr. MIGNAULT. I understand that no studies have been made as to sewage treatment in Brockville.

Mr. KYLE. Well, not to any great extent. The engineers have informed us that it would be a very expensive undertaking on account of the rocky formation and the hilly ground on which we are located.

Mr. POWELL. As I understand you, your personal view is that there should be a general prevention of the deposit into the river of raw sewage?

Mr. KYLE. Yes; it is my view that it should be prevented by both the United States and Canada.

Mr. POWELL. You think it should be prevented by all concerned?

Mr. KYLE. Yes; by all concerned.

Mr. POWELL. All communities should be prohibited from depositing raw sewage into the river.

Mr. KYLE. Yes, sir.

Mr. MIGNAULT. You would still have trouble from the campers on the islands, even if the communities treated their sewage?

Mr. KYLE. Yes.

Mr. GARDNER. And from navigation also?

Mr. KYLE. Yes, sir; also from navigation.

Mr. POWELL. You are in favor of that as applying to the whole community, but you think that it would be of no avail for any particular community to attempt purification because of the communities above?

Mr. KYLE. Yes, sir; because the boats would still contaminate the water.

Mr. POWELL. Have you ever brought to the notice of the steamboat association the pollution of the waters of the river through the boats?

Mr. KYLE. Only by ordering them away from our docks. We have a dock at the pumping station where the boats sometimes land, and we have refused to allow them to land; but that applies more to our old intake pipe than to the present one.

Mr. POWELL. But the fact remains that their presence there has the effect of polluting the water?

Mr. KYLE. We simply ordered them away as a precaution.

Mr. POWELL. Was it a mere precautionary measure or was it because they were a source of pollution?

Mr. KYLE. At that time we believed they were stirring up the water, and the diver told us that the bottom was all soft stuff and it would be naturally stirred up and go into the intake pipe. They can not do that now. There is no question but what our water with the new intake pipe is very much better than we got before.

Mr. POWELL. Then, what is the ground of your complaint? Is it against the steamboats in that they stir up the deposit at the bottom of the river, or that they add to the pollution?

Mr. KYLE. At the present time they add to the pollution. I do not think they stir it up to any great extent.

Mr. POWELL. And you believe that is a real source of danger?

Mr. KYLE. Yes.

Mr. MAGRATH. Do you think that the passenger traffic is of sufficient size to be a danger?

Mr. KYLE. I do. I think a thousand people coming out on a boat would produce pollution in the river.

Mr. GARDNER. Have you any idea of the number of people that passed up and down the river in boats during a season within the past two years?

Mr. KYLE. The excursion steamer *Thousand Islander* goes out with a thousand people. It very seldom goes farther than Alexandria Bay, which is about 28 miles from Brockville.

Mr. POWELL. How many trips does she make a week?

Mr. KYLE. She makes a trip every day, practically; but that is only one of the boats.

Mr. GARDNER. Do you think that on an average a thousand people a day pass up and down the river during the period of navigation?

Mr. KYLE. For the total number of boats; yes, sir; very many more. I think that around Alexandria Bay there are two or three thousand people, or more, perhaps, every day, because the boats from Kingston run in there.

Mr. Dewey has just informed me that he thinks there would be 30,000 people during the day within 30 miles of Brockville on passenger steamers.

Mr. GARDNER. That would have reference to the whole navigation season?

Mr. DEWEY. Yes; and during July and August I think it would be a very conservative estimate to say that there would be 35,000 people on steamers every day.

Mr. POWELL. About how many freight steamers pass up and down daily?

Mr. DEWEY. I could not say. There is a continuous line of them. The majority of the boats that go through the Welland Canal, freight boats, that pass down the river, pass by here.

Mr. GARDNER. I do not suppose you have any means of knowing what the average river population would be during the entire navigation season?

Mr. DEWEY. No, sir.

Mr. GARDNER. It would fall off greatly, of course, after what you might term the vacation season?

Mr. DEWEY. My estimate of the number of people, tourists, would be from the regular line of boats and the excursion steamers passing.

Mr. GARDNER. How late do these steamers run on the river here?

Mr. DEWEY. Until the middle of September.

Mr. MIGNAULT. Can you give us an idea as to the population on the islands?

Mr. DEWEY. On the islands in the immediate vicinity of Brockville there are about 1,500 people.

Mr. MAGRATH. You say Brockville people?

Mr. DEWEY. Probably Brockville people.

Mr. MIGNAULT. But from elsewhere than Brockville, what would the total be?

Mr. DEWEY. The number of nonresidents of Brockville that would be in the vicinity of Brockville would not be very large.

Mr. MIGNAULT. I am referring to the population that might affect the water flowing past Brockville.

Mr. DEWEY. There would not be any substantial increase there, but I should think it would be safe to say that there would be anywhere from 5,000 to 10,000 people in the immediate vicinity of Alexandria Bay and Clayton during the summer months.

Mr. POWELL. I was told that on one island alone there were pretty nearly 10,000 people as a floating population.

Mr. DEWEY. Yes; that is on Thousand Island Park.

Mr. POWELL. You will find the floating population of Thousand Islands and Alexandria Bay to be pretty close to 50,000.

Mr. DEWEY. Yes; but these would be permanent for the summer. There is practically none in the immediate vicinity of Brockville occupied by summer cottages.

Mr. POWELL. Taking the region that we have loosely called the Thousand Island region, what would be the floating population of thoes islands and the vicinity on the main land?

Mr. KYLE. That is difficult to say because they are coming in by the thousand every day and staying a day and then leaving. I believe

100,000 a day would be a conservative estimate for the islands and the immediate shores.

Mr. POWELL. Mr. Dallyn, did the bacteriological examinations that were made on the river here cover the season when the floating population was present?

Mr. DALLYN. There were two examinations made. We were on the river with a laboratory from about the middle of April until the end of May, and from about the 10th of August, to the 20th of August. It is reported in the progress report.

Mr. POWELL. Have you any data, exact or otherwise, as to the summer population of the district?

Mr. DALLYN. No; but I think there is something in Dr. McLaughlin's report as to that. We made no calculations ourselves. I know the populations of Cape Vincent and Clayton double themselves in the summer; but what the island population and the excursion population were I have not any idea.

Mr. MIGNAULT. Is there any record available to show what that summer population amounts to?

Mr. DALLYN. I am not sure.

Mr. MIGNAULT. It is rather important to know because that is a feature, that and the pollution, and it strikes me at the present moment that even if the communities treat their sewage and the boats sterilize theirs, there will be still a danger from this summer population camping on the islands.

Mr. DALLYN. Yes; that is true. They will come, of course, under township regulations. I do not know just how they handle them on the American side. In the Muskoka Lakes we make them treat their sewage properly.

Mr. MIGNAULT. How do they accomplish that?

Mr. DALLYN. They have various methods of getting at it. Some use the chemical process, and store it and pump it out in a nocuous form into beds. Some lay piles through the sand.

Mr. MIGNAULT. What is your opinion as to the danger of pollution from your summer population?

Mr. DALLYN. It is very serious. We were very much amazed in making a minute survey on some of the islands to find that their sewage outlet and their intakes would be only 40 feet away from each other, making it practically certain that the two would mingle.

Mr. TAWNEY. Mr. Dallyn, I have here a report which you and Dr. McLaughlin and Dr. McCullough made, a portion of which I wish to read into the record. From page 50 of the progress report I read as follows:

"While examination below Wolfe Island among the Thousand Islands did not show an average gross pollution, its intermittent character presents a menace to the summer residents in this section who take their supply of water from the river without purification.

Examinations made in the vicinity of Brockville showed that the shore samples collected from the cross section above Brockville carried considerable pollution. Toward midstream, where dilution and mixing had taken place, the samples showed constant pollution of lesser degree. Below Brockville the major pollution remained near the banks of the river. Samples collected in midstream showed very little pollution in the early work before navigation opened. The latter work in August showed a very general serious pollution, due probably to summer resort population and to boat traffic. The condition of the river

between Brockville and Cornwall is very bad in the summer months, as evidenced by midstream samples Nos. 266–273.

Unquestionably, the water from this portion of the St. Lawrence River should not be used as a water supply without adequate purification.

Mr. POWELL. It is a fact, is it not, that the pollution at these summer resorts is steadily and rapidly increasing?

Mr. DALLYN. Undoubtedly so.

Mr. TAWNEY. There has been more this year than ever before, on account of the long period of hot weather, and also the fact that many people who have formerly gone abroad on their vacations have remained here.

Mr. DALLYN. The education of the people has improved very materially during the last few years, and they demand better conditions at the summer resorts.

Mr. POWELL. You are quite familiar with the Thousand Island region, are you not?

Mr. DALLYN. We spent about a month there in small boats.

Mr. POWELL. Passing in and out among the islands?

Mr. DALLYN. Yes, sir.

Mr. POWELL. Bearing in mind what Mr. Tawney read from the progress report to the effect that there was a greater admixture of water above Brockville than below, that would be due, would it not, to the various channels and rapids among these islands?

Mr. DALLYN. Yes, sir; and the channel is very tortuous just at that point.

Mr. POWELL. And there are jetties in all directions, which result in a general churning and admixture of the water.

Mr. DALLYN. We discovered that the Cataraqui Bay at Kingston periodically discharged itself completely into the St. Lawrence. That would give us a very high pollution. It is simply a tidal effect. The river seems to flow in both directions opposite Kingston.

Mr. MAGRATH. How far is it from Kingston to Charlotte?

Mr. DALLYN. I am really not aware. I imagine it would be about 130 miles.

STATEMENT OF F. S. EVANSON, MAYOR OF PRESCOTT, ONTARIO.

Mr. EVANSON. Prescott lies opposite Ogdensburg on the Canadian side of the St. Lawrence River, and the river at this point is about 1¼ miles in width. We have a splendid water system in Prescott for a town of its size. We obtain the water in the St. Lawrence River. We have three outlets for our sewers. We discharge our sewage into the river in a raw condition.

Mr. GARDNER. Have you ever contemplated the purification of your sewage in any way?

Mr. EVANSON. We have never considered it.

Mr. GARDNER. You have never had it under consilderation?

Mr. EVANSON. No.

Mr. GARDNER. In your opinion, would it be a difficult thing to do?

Mr. EVANSON. No; I think we could treat it all right. Prescott has been most fortunate in that we have not had any experience of an epidemic of any kind. Brockville has been troubled with typhoid for some years, but we have been free from it. We never attempted to chlorinate the water until Brockville had an epidemic a few years

ago, and we chlorinated the water as a precaution. At present we have not a case of fever in Prescott. You will find that the fever cases in Prescott are much below the average.

Mr. MAGRATH. You are satisfied?

Mr. EVANSON. We are satisfied with the conditions as they exist at present.

Mr. GARDNER. How long have you been treating your water?

Mr. EVANSON. Since the epidemic in Brockville we have been treating it most of the time. I regret that the medical health officer of the municipality could not come here to-day. I may state that the quantity of chlorine we put into the water is lowered at certain seasons of the year.

Mr. GARDNER. Did you have anything of the nature of an epidemic in your town before you commenced to treat the water?

Mr. EVANSON. We never had. I was mayor of the town in 1910 and 1911 and during that time I asked the medical health officer frequently to send in samples of our water, and he did so. He took the water from the taps in the town, and not from the river, and it was rarely shown that it was contaminated in any way. I can only remember one occasion on which there was slight contamination.

Mr. GARDNER. At what point in the river is your intake?

Mr. EVANSON. The intake pipe is at the most westerly point in the town and it runs into the river for 400 feet.

Mr. GARDNER. Do you find the channel within that distance?

Mr. EVANSON. No; we would not be out in the channel at that distance. The nearest sewer pipe is 1,500 feet from the intake pipe.

Mr. GARDNER. That would be down the river.

Mr. EVANSON. Yes. Of course I think the current of the river at Prescott improves the conditions there. It is said that the water flows by there at about 4 miles an hour. We have no eddys at all such as they have at Brockville. At Brockville there is a point that juts out and obstructs the flow of the river at the west side, and that is the cause of the eddy there, but we have no eddy whatever at Prescott.

Mr. GARDNER. Is the river narrower opposite Prescott than it is opposite Brockville?

Mr. EVANSON. I think it is about the same width as at Brockville; we are about a mile and a quarter across here.

Dr. MCCULLOUGH. The river is one mile and three-quarters wide at Brockville.

Mr. GARDNER. What is the average depth of the river here from shore to shore?

Mr. EVANSON. I can not say as to that. Of course, along our docks at Prescott, the river is 14 or 15 feet, and the two Richelieu boats are in there every morning, the one from the west coming in at 7 o'clock, and it remains there until 10 o'clock or half past 10, and the boat from the west comes in at 10 o'clock and remains there until noon. The sewage would not contaminate our water because the sewage outlets are at least half a mile east of our intake pipe.

Mr. GARDNER. Did you notice any disturbance of the river bottom when these steamboats are leaving or arriving at the wharf?

Mr. EVANSON. No. Of course the town owns the western wharf where our water system is and no boats tie up there at all; the only boat that comes there is an occasional boat with coal.

Mr. POWELL. Have the town authorities at Prescott ever considered the advisability of purifying or sterilizing the sewage?

Mr. EVANSON. In 1911 we put in a further sewerage extension in the east end of the town. We had two outlets then. We extended the sewer in the east end of the town, and in order to get an outlet for that extension we had to put the east one farther west, and the question was considered then, but it was decided that it was useless to purify the sewage at one small outlet and let the two larger outlets go without purification. The question received some consideration then. It was suggested that we could put in a plant which would take care of the purification of the sewage.

Mr. POWELL. Have you the same rock formation at Prescott as at Brockville?

Mr. EVANSON. I do not know of any harder rock than we have at Prescott; you are liable to run into it at any place in the town.

Mr. MAGRATH. What is the assessed value of the property in your municipality?

Mr. EVANSON. A little over $2,000,000.

Mr. MAGRATH. What is your rate of taxation?

Mr. EVANSON. The rate of taxation varies from 25 to 27 mills.

Mr. MAGRATH. Is the water supply of your town satisfactory to the public health authorities of Ontario?

Mr. EVANSON. I think so.

Mr. GARDNER. What is the basis of taxation; is it the full value of the property?

Mr. EVANSON. No; I think it is about 75 per cent of the value of the property, I think that is the way the assessor places it.

Mr. POWELL. What is the rate of taxation?

Mr. EVANSON. Twenty-seven mills on the dollar last year; that is $27 on the thousand.

Mr. POWELL. Does that cover everything?

Mr. EVANSON. Yes; of course it does not cover the water and light rate; it covers the general taxes of the town and the school rate; the school rate is about 11 mills.

Mr. POWELL. The individuals who consume the water pay for it?

Mr. EVANSON. Yes; and the municipality owns it.

Mr. GARDNER. What is your indebtedness?

Mr. EVANSON. Our indebtedness would run about $170,000. I should say that in the neighborhood of $100,000 of that covers the water and light system. Of course, the water and the light take care of their own departments. We own the water and the light plants.

Mr. GARDNER. And a proportion of your indebtedness is because of your ownership of these utilities?

Mr. EVANSON. Yes. When we put in the water and light systems in 1900 we issued debentures for $120,000 at that time to take care of it. We have extended the sewerage system since at a cost of $25,000 or $30,000.

Mr. POWELL. If the purification of sewage is made obligatory along the river here I suppose that your town would have no objection to comply with the general rule?

Mr. EVANSON. Certainly not.

Mr. POWELL. But you would have objection to be singled out and compelled to do that if other people were allowed to go free?

Mr. EVANSON. Yes. Prescott is most fortunate in having first-class water in the river here, and that has been the condition for a number of years. I think it proves that flowing water will purify itself in a distance of 12 miles, because there must be a great amount of sewage flowing into the river at Brockville, which is 12 miles above us.

Mr. GARDNER. Unless you have some general statement to make to the commission I think that is all we want to hear from you, Mr. Evanson.

Mr. EVANSON. I have nothing further to say. I say that the municipality of Prescott will be glad to carry out the wishes of this commission and of the United States and Canada if a means can be devised to purify sewage.

STATEMENT AS TO ASSESSED VALUE OF BROCKVILLE.

Mr. GARDNER. I wish to ask the mayor of Brockville what the assessed valuation of the town is.

Mr. DEWEY (city clerk, Brockville). The assessed valuation of the town is about $5,000,000, and the population 9,500.

Mr. GARDNER. What is your rate of taxation?

Mr. DEWEY. Thirty mills this year.

Mr. GARDNER. What is your basis of value; is it full value?

Mr. DEWEY. No. Under the law it is supposed to be.

Mr. POWELL. Is that a supposition contrary to the fact?

Mr. DEWEY. Taking it on the whole, I presume it would be 75 or 80 per cent of the value.

Mr. GARDNER. It is high enough at that rate, I should think. What is your indebtedness?

Mr. DEWEY. The net debt, including public utilities, is $600,000.

Mr. MAGRATH. What do your public utilities cover?

Mr. DEWEY. Electricity, gas, and water.

Mr. POWELL. Is there any surplus from the supply of electricity, gas, and water?

Mr. DEWEY. There is a slight surplus over the operating charges and the amount necessary to take care of the debt.

Mr. GARDNER. How are you paying that? Is it by a sinking fund?

Mr. DEWEY. Some of it. Some of it is payable in annual installments. We issue debentures both ways.

Mr. POWELL. Is your debt diminishing or increasing?

Mr. DEWEY. I think it is diminishing. Our local improvement debt constitutes the bulk of the debt.

Mr. POWELL. And these public utilities carry themselves?

Mr. DEWEY. Yes. The local improvement indebtedness is paid largely by the property owners.

Mr. MAGRATH. It might be well to state for the information of those gentlemen who have come here from a distance that we are to hear this afternoon Mr. Paterson, an expert in the matter, in reference to methods of treating pollution. It might be interesting to these gentlemen to stay here to hear Mr. Paterson.

Mr. POWELL. It may interest these gentlemen, because Mr. Paterson claims that the municipalities could make a large profit out of the treatment of this sewage.

Mr. GARDNER. You would be able to pay off your indebtedness, perhaps, if you took Mr. Paterson's advice.

(The commission took recess for luncheon.

After the luncheon recess.)

STATEMENT OF MR. EDWARD A. PATERSON.

EDWARD A. PATERSON, chemical engineer, London, England, appeared before the commission and said:

After I received the telegram from the secretary of the Canadian section of the commission asking me to come here I cabled to London for certain plans and models and additional samples, as I only had a few samples on this side and a few notes. These samples and reports have not yet got here, I suppose owing to the war conditions. I therefore have to rely upon rough laboratory notes, which I hope to augment with further information as soon as the data arrive here. I hope you will excuse me for not having the short report which I have made in fuller detail. I shall be glad to give you more interesting information later.

I may state, first, that my remarks are purely from the British point of view; I am not at all familiar with the conditions on this side, except as to a few of the plants, such as the Baltimore plant and others, where they have erected up-to-date plants for the collection of the solids. I have been investigating this matter for about six years purely from the point of view of the disposal of the solids, and I have looked upon it from the utilization point of converting waste products into a commercial enterprise. Our difficulty in Great Britain is that we have an enormous accumulation of what we call sludge cake or sewage cake, which comes mostly from the filter press, and in some cases it is taken out to sea and in others it is disposed of on the land and in other cases they burn it. In England alone we have enormous quantities of this material, which costs from 1 shilling to 5 shillings—that is, from 25 cents to $1.25—per ton of wet sludge. When I refer to "wet sludge," I mean sludge that contains from 50 to 60 per cent of water.

As to the raw material, the process to which I will refer deals with the raw sewage which has been precipitated or agglomerated by means of lime, "ferro-alumina," or other agent, and rendered solid either by filter pressing or "lagooning" at the sewage-disposal works. This solid material contains on an average 50 to 55 per cent moisture and must, owing to its nature, be quickly disposed of, because for about six months in the year it becomes extremely offensive, and they have in England a very small area in which to dispose of it. It has to be taken away by railway trains and in boats and such like conveyances. In Great Britain the amount of solid material—containing 50 per cent moisture—produced by each 1,000 inhabitants is approximately 100 tons per annum, and, for the purposes of this report, those towns in the United Kingdom having a population of over 100,000 people produce annually 1,800,000 tons.

In disposing of it we look upon it from the commercial point of view, and, therefore, the composition of the sewage is very important.

The composition of raw sewage, of course, must vary very considerably, depending on the time of year and the district which it is

derived from—trades waste, and so forth, e. g., paper factories, iron works, dye works, render it very complex and an ever-varying mixture, but the following analysis will give a very general idea of its character and composition in great Britain:

Analysis of raw sewage per 100,000 parts as solids.

In solution, 125.4 In suspension, 62.9	188.3
Chlorine	8.9
Free ammonia	2.1
Organic (albuminoid). Ammonia	76

I have a sample here of the material that is generally produced at the sewage works.

(Sample produced and shown to the commissioners.)

That sample contains from 55 to 60 per cent of water and is as it comes from the filter press, and it is called filter-press cake.

Mr. GARDNER. That is not in commercial form?

Mr. PATERSON. No; that is in the form as it comes from the sewage works, and it is material that gives us much trouble to dispose of. The analysis of that material, not air dried, is approximately—by "approximately" I mean the general analysis of that class of material over the United Kingdom—as follows:

Analysis of press cake (not air dried).

	London.	Leeds.	Wimbledon.
	Per cent.	*Per cent.*	*Per cent.*
Water	50.00	58.05	56.15
Organic matter	15.40	16.69	11.36
Silica	6.40	8.08	7.10
Carbonate of lime	10.30	7.94	11.14
Nitrogen in sewage sludge (dry)	1.63	.....	.....
To ammonia	1.95	.....	.....
To ammonia sulphate	[1] 7.67	.....	.....

[1] Or per ton sludge, 171.8 pounds.

The ordinary air-dried sewage—we do not have very much of it in England—mostly comes from the small towns, in which the sludge is pumped up into lagoons and allowed to dry there, and the composition of that material is, generally speaking, as follows:

Air dry.	London.	Leeds.
	Per cent.	*Per cent.*
Water	11.86	16.40
Organic matter	24.61	27.92
Phosphoric acid (P_2O_5	1.04	.75
Sulphuric acid	1.12	1.02
Carbonic acid	10.98	13.11
Lime	14.33	17.51
Magnesia	2.34	7.67
Oxide of iron	3.02	2.32
Alumina	4.13	6.33
Nitrogen	.86	.70

These analyses will give a general idea of the composition of filter-pressed sewage cake, which we treat in Great Britain, and of which we have 1,800,000 tons per annum.

The object of the process under consideration is to dry the solids so that they may be available either for a fertilizer or, secondly, to be in a condition that by-products of commercial value can be recovered. The greatest difficulty with which we have had to contend was to provide a way of liberating the moisture, of which the pressed cake contained from 55 to 60 per cent, without volatilizing valuable material, and at the same time achieve the object in a short space of time and at low cost. One of the difficulties that has caused a great deal of time and trouble to solve is how to get rid of that moisture and dry the material at a moderate cost without losing any of the valuable constituents, because the valuable products are volatilized at a very low temperature. A very large amount of money and time has been spent in Great Britain in trying to dry sewage pressed cake, or sewage sludge, economically, and many ingenious mechanical appliances have been invented to try and solve the difficulty, but they have not been a success, as they have been costly to operate and required high temperature, with consequent loss of some of the valuable constituents of the sewage. This is due to the water in the sewage being in so many different forms, namely, hydroscopic water, water of combination, and water of crystallization; the first being easy to drive off and the two latter extremely difficult. So it is recognized now that the problem is one of chemistry and mechanics applied, and I can safely say that there is now a satisfactory solution of these difficulties on a practical scale.

Further on in this report I will give you some figures as to the cost of plant and cost per ton of drying pressed cake.

Having dried the material, it is in a condition to be treated by destructive distillation, whereby ammonia, oil, gas, fat, phenols, and other materals suitable for drugs and dye making may be extracted.

I show you a sample of the material as dried. It appears in that form [specimen exhibited], and it contains 50 to 55 and 60 per cent of water. After it is dried it becomes absolutely innocuous, as you see it there. That specimen is practically free from water; it contains only about 2 per cent of water. That material is valuable as a fertilizer, and it is sold in the form of a butter. [Butter specimen exhibited.]

The value of the material, as any chemist knows, is in its fertilizing contents for particular purposes. For certain purposes, the merchants who deal in the product add the necessary quantities of phosphoric acid that the material is deficient in, to bring it up to Government standard. That material is worth to-day on the English markets from $12 to $15 a ton.

Mr. GARDNER. What is the relative proportion of potash to phosphoric acid in that sample?

Mr. PATERSON. It varies very much, indeed. In small towns where it does not pay to extract—where there is not sufficient tonnage to pay for extracting the oil and the fat from these other products—they are either put into this form, or, if the towns are sufficiently near a large center, it is shipped on the railway to central works where it is treated for these products. But in isolated cases they simply dry the material by a special process, and they have local sale for it, and it is cheap to operate, so that where a man is usually

employed in these plants the man can do the whole thing, and you can practically make a small number of people the limit of cost. Taking about 1,000 as being about the limit, or 500 persons, they can put it into this form and use it for manure purposes.

Oils are interesting to the British people, because we have no oil in England outside of the oils which are obtained in very small quantities from the Scottish shale deposits, so that when you are dealing with several million tons of material which will produce a very large quantity of oil per ton it becomes a matter of extreme interest to the Admiralty.

Sir Boverton Redwood, Bart., D. Sc., F. I. C., and Alfred Gordon Salamon, A. R. S. M., F. I. C., the former of whom is one of the consulting chemists of the British Government, state in a report on this process, made two years ago:

1. That the process is capable of furnishing valuable commercial products for which there is a practically unlimited market. In this connection, we may state that the sample of crude oil distillate which was subjected to test remained fluid until cooled to 20° F., had a specific gravity of 0.971 at 60° F., and a flash point of 256° F. A sample of the redistilled oil previously tested by us contained only 0.24 per cent of sulphur, and had a calorific value of 10,230 calories per gram, or 18,415 British thermal units. It is evident that a product similar to the crude oil examined would be a fuel oil complying with the contract requirements of the Admiralty.

2. That very large supplies of the raw material, viz, sewage-sludge press cake, would be available in this country as soon as it became recognized that such press cake could be disposed of.

3. That it may be reasonably anticipated that a substantial profit would result from the general application of the process.

The yields of valuable products, of course, vary within very wide limits, depending upon the composition of the sewage, but, speaking broadly, the amount of ammonia as sulphate ranges between 60 and 130 pounds per ton of sewage containing 5 to 10 per cent of moisture. Oil, from 18 to 40 gallons per ton; fat, from 5 to 10 per ton; gas, from 14,000 to 17,000 cubic feet per ton. The rare products, it is difficult to give any reasonable figures. Then, after these products have been extracted, there is a residue which has a commercial value as a fertilizer base, as it contains products valuable for agricultural purposes. It is an inodorous grayish-black friable substance having the following general composition.

Siliceous matter	66.30
Iron oxide and alumina	7.30
Calcium carbonate	3.44
Carbon	20.40
Magnesia	.07
Phospheric acid	1.14
Moisture	
Sulphur	1.09
	99.74

The commercial value of sulphate of ammonia may be usually taken at 2 cents a pound, in Great Britain. It is difficult to say what the commercial value of these products is to-day, in war time. We obtain from 5 to 10 per cent of fat, and under special conditions, such as they have at Bradford, which is a wool-washing place, the amount of fat runs up to 20 per cent. It is difficult to give any definite figures as to the value of other products, because they vary in

different localities, but there is a fair amount of substances which are used in drug making.

That butter, or residue, after these other products are taken out, is absolutely inocuous, and quite a deodorizer because of the amount of carbon it contains.

That material is used by the fertilizing companies and they add to it the requisite amount of ammonia or phosphoric acid, or potash, or what is required for particular kinds of agriculture.

One of the chief products is oil, and the analysis of the crude oil obtained from the process is as follows:

	By volume.
Specific gravity at 15° C.....per cent..	9.931
Light oil boiling under 170° C.....do....	5.0
Light oil boiling between 170–230°.....do....	19.6
Light oil boiling between 230–270°.....do....	18.7
Light oil boiling between 270–350°.....do....	29.9
Residue, a soft pitchy substance, valuable for many purposes....do....	26.8
	100.0

The crude oil is a very dark thick-looking substance, very much like what you would see lubricating any bearing of engines, and very much like the crude oil that is obtained from the oil wells of this country. It can be split up and fractionated into different parts. It has not a very pleasant smell or a very unpleasant smell; it is quite different from the ordinary crude oil you get from the earth, but several different spirits can be obtained, which are useful for driving motor cars, internal combustion engines, and so on.

After that black crude oil has been split up into these various grades, and various other compounds taken out, there remains in the still a pitch which is practically animal pitch, and which is useful for all kinds of things for which bone pitch is used. [Sample produced.]

The extraordinary thing is to think that that comes through a human being, but it does.

I have no sulphate of ammonia with me; it is such a common thing, you will see it in any drug store, it is used in most households, and it is known to everybody. The mean calorific value of the gases after the extraction of all condensible oils in the process was found to be 130 British thermal units. It will be noted that all the products mentioned in this analysis are easily salable, and always in demand.

These products are extracted in this way: The chief process is drying material, which has been one of the greatest difficulties in solving the sewage problem.

Mr. TAWNEY. What is the device used?

Mr. PATERSON. They have revolving cylinders, they have chambers, they have glass houses, they have towers that it is worked down through; all these sorts of things. In this process they take the gases which are coming from the garbage plant, and pass them through a brick chamber in which there is an endless belt made of wire-woven mesh. That travels a distance of about 120 feet in 20 minutes, and the carbonic-acid gas from the furnace, in conjunction with certain other material, creates a chemical reaction which breaks up these various forms of water, and in 20 minutes the material is dry, and in that condition in which you now see it. Having obtained it in that condition, if it is not used for fertilizing, it is put into a gas plant,

which consists of retorts, in which the coal is thrown, the door closed, and heat applied. The volatile matter, gas and tar and so on, goes over in the condensers and the gas passes on and leaves behind it a tar and ammonia and liquor, etc. This process is very similar to the ordinary gas process, with this exception, that the ordinary gas retorts are not suitable, owing to the extremely low heat-conducting properties of dry sewage. So, special retorts have had to be constructed, and they are mostly vertical and in benches of 4 or 8 or 12 or 16. The material is taken along an automatic feed and pumped into these retorts and the top closed, and then the oil goes through a condenser and is thrown down in that form in which you see it. Steam is introduced and the ammonia runs over, the steam is condensed, and the ammonia is in that ammoniacal liquid. The ammonia is extracted from that liquid and the oil floats on the top and flows into these fractionating stills. Then the gas which passes on, 14,000 to 17,000 cubic feet, comes around again and is used for doing the distillation, so that practically the amount of gas in the sewage will complete the operation. In other words, it costs practically nothing for heat for doing the distillation.

The cost of one of these plants will depend on several factors, the chief of which is the population of the place. To deal with a small tonnage costs more per ton than to deal with a very large one, the overhead charges have to be taken into account, so that one is limited to a certain population for extracting the by-products.

As to whether a drying plant is installed alone or in conjunction with a distillation plant, this of course could only be decided by the careful examination of local conditions. Broadly speaking, a drying plant to treat 30 tons of sewage, containing 55 to 60 per cent of water, would cost approximately for the machinery $2,500.

Mr. McGRATH. For what population?

Mr. PATERSON. For 1,000 people making 100 tons a year. Usually, around a municipality, they have buildings and garbage plants and structures of different kinds, so that practically in most of the towns I have visited in England that is about the total expense for machinery, after putting the material into the condition you see it, without practically any extra labor. The cost of drying in England, for the plant at Wimbledon is $1.50 per ton. A larger plant would cost relatively less, as certain mechanical parts that would be necessary for a small plant would serve a much larger one. In London, as I have said, it is costing us for drying per ton of sewage about $1.50, and the value of the product as a fertilizer, which naturally depends on its chemical composition, is from $12 to $15 per ton, and as a matter of fact on its chemical contents it is worth more than that. That is a very conservative figure to put upon it, because the fertilizer people want profits.

The cost of the distillation plant will, of course, vary in different towns and different localities. It is extremely difficult to give estimates on the cost of a distillation plant on this continent as the conditions vary to a large extent, but to generalize, a plant is not expensive and we consider in England a unit for treating, say, 40 tons a day of dried sewage would be in the neighborhood of $40,000, most of which plant would be suitable for treating 100 tons per day with only the addition of retorts, which is the least expensive part of the plant.

I have gone into the subject in this report in a quite general and untechnical way, and I shall be pleased to answer any further questions which you wish to ask me.

Mr. TAWNEY. Where are the plants, which you speak of, situated?

Mr. PATERSON. At Wimbledon, which is part of London.

Mr. TAWNEY. Are they operated by the municipality or by private interests?

Mr. PATERSON. They are operated by private interests.

Mr. TAWNEY. Do these private interests buy the sewage?

Mr. PATERSON. The sewage is delivered to the works free of charge. Speaking from memory, the cost at Wimbledon is about 75 cents a ton. They are getting rid of it for nothing, and, in addition to that, they give the land necessary for the treatment.

Mr. TAWNEY. How long has that plant been in operation?

Mr. PATERSON. About a year. On account of the war it has been shut down two or three times by the Government taking the men away; but now it is practically under Government control, for it comes under the Munitions Department. It is now looked upon by the Government as a necessary national project, and comes under the munitions department.

Mr. POWELL. Because of the gasoline they get?

Mr. PATERSON. Yes.

Mr. TAWNEY. From your knowledge, what do you estimate the cost of a plant would be for a city of, say, from 50,000 to 100,000 people?

Mr. PATERSON. I should say from about $40,000 to $50,000.

Mr. TAWNEY. That would be about $1 per capita.

Mr. PATERSON. About that; but less per capita for a population of over 50,000.

Prof. PHELPS. What is the cost of operation?

Mr. PATERSON. From 35 cents to 50 cents a ton; that, of course, depends on circumstances and conditions.

Mr. TAWNEY. What are the elements of cost?

Mr. PATERSON. The elements of cost, after the material is dried, are simply the cost of distillation, which is the principal cost, and there is also the cost of the maintenance of the plant.

Mr. TAWNEY. What labor cost is involved?

Mr. PATERSON. The labor cost is about 2 shillings per ton.

Mr. DALLYN. Does the fertilizer possess a solid residue devoid of organic life; do the seeds germinate at all?

Mr. PATERSON. That is not our experience; of course, there is bound to be organic life.

Mr. DALLYN. I mean, as you deliver it from your plant?

Mr. PATERSON. Not so far as we have found.

Mr. DALLYN. I speak of disease germs.

Mr. PATERSON. We have not found it so. That dry piece of sewage which you see there has been in my bag for five months.

Mr. MAGRATH. This process deals entirely with the solids?

Mr. PATERSON. Yes; it deals entirely with the solids.

Mr. MAGRATH. And it does not include any treatment of the liquid sewage.

Mr. PATERSON. No.

Mr. MAGRATH. What would be the minimum population that you consider it would be feasible to erect a system for?

Mr. PATERSON. Do you mean commercially?

Mr. MAGRATH. Yes.

Mr. PATERSON. Well, on the dry process, I should think down to 1,000 people, or probably 500 people. In England, the War Office, at two of their camps,, have put in small plants for about 1,000 men. They call them field destructors, and they get sufficient oil to run the machines, but they do not save the products.

Mr. MCCULLOUGH. What process of sedimentation do you use?

Mr. PATERSON. They have a series of sedimentation tanks, and they use both lime and alumina to precipitate.

Mr. TAWNEY. Are the costs of the precipitants included in the cost you have mentioned?

Mr. PATERSON. No; this is purely for the treatment of the solids.

Mr. POWELL. It includes the drying?

Mr. PATERSON. Yes.

Mr. DALLYN. The use of chemicals for precipitating in your sedimentation tanks would make it cost more.

Mr. PATERSON. In certain cases they do not use a precipitant at all, but in other places they do. In places they use lime and alumina, and that is expensive: It does not affect the process at all if lime or any other agglomerant is not used, you still have the solids left. They are rather getting away from lime precipitation on account of its cost, but, on the other hand, where they have it for a fertilizer they are getting the value back that they paid for their lime to a very large degree, and possibly they are making a profit out of it. There is no doubt that lime does give more rapid precipitation, and it has its advantages, but it does not affect the solids for treatment or the by-products that you get from the solids.

Mr. MAGRATH. Do I understand that none of the important centers have yet taken this matter up?

Mr. PATERSON. They have signified their intention to take it up. Glasgow and Sheffield are contemplating putting in a plant, and Derby and Leeds. The plants would have been built this year, but the condition in England now is that no municipality can lend money without the sanction of the treasury. The plans are drawn for Glasgow, Leeds, and Sheffield.

Mr. TAWNEY. Is this a patented process?

Mr. PATERSON. In part; the distillation part is not patented.

Mr. MIGNAULT. Did you tell us what profit is realized out of the disposal of the sludge?

Mr. PATERSON. That could only be given in a general way, depending on the quantity which is treated. In London, which has 100,000 tons a year, you would naturally make a very large profit there in comparison to a city of 3,000 or 4,000 or 20,000 people.

Mr. MIGNAULT. Take a city of 100,000 people.

Mr. PATERSON. It leaves a fair margin of profit.

Mr. MIGNAULT. What do you mean by a fair margin of profit?

Mr. PATERSON. A fair margin of profit, and to pay for the depreciation of the plant, the redemption of the plant, the money that is necessary to keep it up, the cost that the city has gone to, and leave interest on the money plus decrease of capital, plus profit, I should think $1 a ton profit on 100,000 people, after paying all this, would be quite a good thing.

Mr. MAGRATH. I suppose, as a matter of fact, this process is in the experimental stage, or do you consider it is now sufficiently established?

Mr. PATERSON. It is sufficiently established, because the plant is paying. It went from the laboratory to a small plant at the rate of a ton a day, and now it has gone to a bigger one and a bigger one. We practically hope, and we are pretty sure, that we are going to take over the London sewage, which would be a very large plant.

Mr. MIGNAULT. How much money has been invested in these plants?

Mr. PATERSON. The one at Wimbledon is not a fair criterion, because it has been in operation for a long time, and it has gone through all the initial stages of a new process. Now, of course, it is in perfect order, and running smoothly, and giving good results, but it has come up from a smaller plant to a large degree, and there were lots of difficulties encountered which have been surmounted. I suppose it might be said to cost $300,000 now.

Mr. GARDNER. And, in the light of your experience, what do you estimate you could duplicate that plant for?

Mr. PATERSON. The same plant could be put in to-day easily for $40,000 or $50,000. Of course, in a new process we are continually putting in different things and trying different things, and also extracting things which we never dreamed of were in the material.

Mr. DALLYN. Is it not a fact that when the pressed sludge was first offered to the agricultural interests in England it was taken up and they paid a certain amount for it?

Mr. PATERSON. Yes.

Mr. DALLYN. And, after the system was generally adopted, is it not so that they could find no demand for it? Do you not think that if this process were generally adopted the value of the by-products would decrease on account of the large volume offering?

Mr. PATERSON. I do not think so, because of the nature of the by-products. Take this continent, and you import an enormous amount of sulphate of ammonia. The recovery of nitrogen is one of the problems which the United States Government has taken up within the last year. We have to have nitrogen, and you can not get it much cheaper than you can out of sewage, because you have to get rid of the sewage anyway. I do not think that nitrogen will ever depreciate in value. They are trying to take it from the air to-day, and have been fairly successful. Oil will always be valuable, gas will always be valuable, potash, phosphorus are all absolutely essential for the human race, and everybody is straining his brains and experimenting genius in trying to discover methods of getting oil and nitrogen. It seems to me to have been wicked that the English-speaking races should have been throwing this material away for so many years and looking upon it as a curse instead of a blessing. We can imitate the Germans in a great many respects, and that is one of them—to keep what is valuable instead of throwing it away.

Mr. MIGNAULT. Did you read the testimony of Mr. Hatton given before the commission?

Mr. PATERSON. Yes.

Mr. MIGNAULT. Comparing your process to the one he spoke of, what would you say?

Mr. PATERSON. I came to the conclusion, in reading Mr. Hatton's report, that he had the same difficulty which we had in Great Britain—that is, as to treating sewage. He complained that there was not sufficient sun. He said that after he had dried it that it was worth $20 a ton—I think he placed the minimum at $15 a ton. But his difficulty seemed to be with the process of drying and the difficulty of drying. In some of the plants I visited—in the plant at Baltimore—they have a drying plant there, and, perhaps I should not say it, but they have not got any further than we did four years ago. They had not discovered yet how to get over the difficulty in drying this material. If you have to wait in the summer time for the material to air dry, then you have the difficulty of bad smells, putrescent material lying about, and complaints. The material should be treated as soon as it is recovered.

Mr. MIGNAULT. According to your system, do you get rid of these difficulties?

Mr. PATERSON. Yes; we get over the difficulties. Formerly it used to take us two months to dry it, and if we tried to force the drying by most of the machines that have been invented we would lose most of the valuable constituents. Glasgow spent £6,000 on a drying machine, and then it had difficulty, and they were still in that difficulty five months ago. The difficulty about drying the material is that you must not drive off the valuable constituents, because if you do you lose money—you lose the volatile oils, you lose several things of value—and after it gets dry to a certain extent it becomes extremely inflammable. This material here that I have shown you could be used quite suitably as a fuel. It burns beautifully. That brick there, if you put a match to it, will burn quite easily and make an excellent fuel. If you want to augment the heating qualities of it, you can add coal or slack or anything like that to it, because it is a very excellent fuel.

Mr. MIGNAULT. Has this system any distinctive name?

Mr. PATERSON. I do not think it has. We have a company in England, we call it the S. O. S.; not the call for help—it is quite accidentally called that—but it means Sewage Oil Syndicate.

Mr. POWELL. I suppose the difficulty in drying is that if you use heat to expedite the drying you are apt to drive out the volatile constituents?

Mr. PATERSON. Yes.

Mr. POWELL. You must dry at a reduced heat?

Mr. PATERSON. Yes; it dries at a very low temperature. Another difficulty with the drying is that this sewage cake is so extremely nonconductive. You could heat it up to a temperature in the retort of 2,000 F., a piece the size of your fist, and the center will come out exactly as you put it in the retort. It will retain the moisture still, almost in the same condition as it went in, after receiving that high temperature for six hours.

Mr. TAWNEY. Has the development of this system proceeded beyond the experimental stage, or has it yet reached the commercial stage?

Mr. PATERSON. Yes, sir; it has reached the commercial stage. You have to take into consideration that the conditions in Canada and in the United States are considerably different from what they are in Great Britain. Great Britain is a smaller country, thickly

populated, and I would want to point out that isolated towns would not have the same facility of working that we have here. Take a town like Rochester, and Buffalo, the next town, is 70 or 80 miles away. A town like Indianapolis, with a population of 300,000, has around it many towns of 20,000 or 25,000 people which radiate out from that center, and it would mean an absolutely sure profitable proposition. In other towns, like in Ontario, where they are isolated, you could not expect to make as large profits as in these well-situated towns.

Mr. POWELL. What is the highest percentage of net profit on capital expenditure? Maybe you do not wish to disclose that.

Mr. PATERSON. I do not think that would be wise at the present stage. Before answering that, I would like to know the conditions in this country better. One might make a statement as to that and then fall down lamentably on it after he understood the conditions.

Mr. TAWNEY. Do you think that a city of 25,000 inhabitants could install a plant of this kind for the disposal of sewage at a profit, or without a loss?

Mr. PATERSON. And using the by-product as a fertilizer?

Mr. TAWNEY. Yes.

Mr. PATERSON. If a town is situated like Hamilton, in Ontario, with respect to a large city like Toronto, yes. But not to put up a by-product plant for itself. It certainly could make a profit. I think Mr. Hatton bears me out in that, that there is almost an unlimited demand for this material at about $15 or $20 a ton in America.

Mr. MIGNAULT. I think Mr. Hatton stated that there was a very small percentage of fat in the sewage of Milwaukee. I would like to know whether this system can be applied anywhere, or does it depend on the nature of the sewage?

Mr. PATERSON. In England we take out the fats first in any case, but where it is used for fertilizing alone, Mr. Hatton is quite correct in what he says. In England, where we are dealing with large tonnages and taking out the other by-products, yes, it pays. Generally speaking, small towns of 25,000 people, unless they are well situated with relation to larger towns, the only way they can make a profit, so far as I know, is by drying the product and selling it as fertilizer, and that they can do at a very moderate cost. A drying plant will not cost more than $2,500, and the operating expenses are practically all done with the staff they have; that is, for a small city.

Mr. GARDNER. I wish, Mr. Paterson, on behalf of the commission, to express to you their thanks, and to say how much we appreciate that you have come before us from Indianapolis on our invitation and given us the valuable information which you have.

Mr. PATERSON. We professional chemists look upon it that we should render your commission the most useful information which we have in our possession, and I am sure we are all glad to do so. If I can be of any further assistance to the commission, I shall be glad.

Mr. GARDNER. We appreciate that.

Mr. PATERSON. If I can give you further information, I shall be only too pleased to do so.

Mr. TAWNEY. Mr. Paterson stated at the beginning of his statement that he had a full report on this matter on its way from England, or that he expected one before long. I would suggest that when he receives that report he should forward it to the commission, with any additional data that he wishes to submit to us. I am sure we would appreciate it.

Mr. PATERSON. I shall be very pleased to do so.

STATEMENT OF DR. A. W. GOODALE, OF THOUSAND ISLAND PARK.

Mr. GARDNER. What is your position at Thousand Island Park, Dr. Goodale?

Dr. GOODALE. I am the secretary of the association and health officer. I have held those positions for several years. We received a notice from this commission from Washington to appear here. However, we have nothing to ask of you.

Mr. GARDNER. What are your particular duties as health officer?

Dr. GOODALE. I have had charge of putting down all the sewers, looking after our water, getting rid of our closets, and running them by water instead of having outdoor closets.

Mr. GARDNER. Have you a system of sewage disposal there?

Dr. GOODALE. We have.

Mr. GARDNER. What is your outlet?

Dr. GOODALE. Our outlet is the St. Lawrence River. We have a sewer that runs through the center of the park to the river. Then each street has a sewer that runs into the main sewer, and through that into the river below where we take our water.

Mr. GARDNER. What is your permanent population?

Dr. GOODALE. We haven't any. I suppose there are a dozen families living there; not over that.

Mr. GARDNER. What is the population during the vacation season?

Dr. GOODALE. We have a transient population there of about 10,000 tourists. They are there from the 1st of July until about the middle of September.

Mr. GARDNER. That would include those arriving and departing day by day?

Dr. GOODALE. Yes, sir; but we have about 500 cottages. About 105 cottages and our principal hotel and stores were burned about two years ago. They were owned by the association.

Mr. GARDNER. How near the boundary line is Thousand Island Park?

Dr. GOODALE. It is about 6 miles across, and we are about in the center.

Mr. GARDNER. About how far is the border of the island from what you might term the ship canal—the channel where the navigation goes up and down the river?

Dr. GOODALE. About half a mile. The main channel, I think, is on the American side.

Mr. GARDNER. Where is the outlet of your sewers with respect to that ship channel?

Dr. GOODALE. It goes out pretty near the channel.

Mr. GARDNER. You do not treat your sewage at all, do you?

Dr. GOODALE. No, sir. If I may be allowed to say it without being asked, I would state that we have the healthiest people that I know

of anywhere around. We have no typhoid fever; we have no diphtheria, scarlet fever, or any of the contagious diseases. We are now suffering under the misfortune of having to quarantine people in order to keep out infantile paralysis from New York and other places south of us.

Mr. GARDNER. Do you think you contribute anything to the good health of those farther down the river?

Dr. GOODALE. No, sir; I do not think we do; that is, nothing except in the way of pure water.

Mr. GARDNER. You think you have the advantage of them in obtaining pure water.

Dr. GOODALE. Well, we have the same advantage that Detroit and Niagara Falls and those places above us have of us. We take their pollution, if there is any.

Mr. GARDNER. The two cases are hardly parallel. You are right at the mouth of a big lake.

Dr. GOODALE. Well, virtually we are. I think where the big lakes empty in is up about Cape Vincent and Kingston.

Mr. GARDNER. As a matter of fact, before getting up into the lake the only town above you of any considerable size that sends sewage down to you is Clayton, is it not?

Dr. GOODALE. Clayton and Cape Vincent.

Mr. GARDNER. Have you ever considered any plans or schemes for purification of sewage?

Dr. GOODSALE. We have had schemes suggested to us with which I am not familiar that we have considered not to be feasible, on account of our being situated in such a way that the water goes in both directions at Thousand Island Park. Part of it goes into the Canadian channel and part into the American channel. We have considered schemes of treating the sewage there, and it has always been so expensive that we could not afford to do it if it had been desirable.

Mr. GARDNER. That, then, has been the only reason why you have not formulated plans for the purification of sewage, the matter of expense?

Dr. GOODALE. The matter of expense and the fact that we have not considered that it was necessary so far as we are concerned.

Mr. GARDNER. But you have recognized it as a pending evil?

Dr. GOODALE. Yes, sir; we have not dodged that. It is an evil that has got to be done away with. However, we have not suffered with it at all. We have about 15 or 20 very good wells from which we obtain drinking water.

Mr. GARDNER. Are they artesian wells?

Dr. GOODALE. No, sir; we pump the water, and sometimes a hundred families get water from one well.

Mr. GARDNER. You do that, I suppose, because you think you get better water from your wells than you do from the river?

Dr. GOODALE. Well, many have had typhoid fever in Clayton and many of the residents there have felt afraid to use the St. Lawrence River water. But I do not think it is very bad. I talked with some boatmen coming down on the *Island Belle*. They have been running the *Island Belle* for 20 years. They say they do not want any better water. I asked them where they got their water, whether

they got it at Clayton or Thousand Island Park, and they said no; that they got it out in the center of the stream.

Mr. GARDNER. You have quite a good deal of navigation going to and from the island?

Dr. GOODALE. Yes, sir; there are a great many boats landing there every day.

Mr. POWELL. Have you any idea of how much of a floating population there is in the whole region, the mainland and the islands?

Dr. GOODALE. Well, it would be a guess. Do you mean during the summer while the tourists are there?

Mr. POWELL. Yes.

Dr. GOODALE. I should think 50,000.

Mr. POWELL. I was there before the big hotel was burned and on that one island alone for a week or so they had a population of over 10,000.

Dr. GOODALE. At Thousand Island Park we have a population of nearly 10,000 at this minute.

Mr. POWELL. You think a fair estimate of the total population would be 50,000?

Dr. GOODALE. Yes, sir. Of course, it is all guesswork. I have no means of knowing.

Mr. POWELL. You never took a poll or made a census?

Dr. GOODALE. No; I have been looking after sewers and sick people.

Mr. POWELL. What do you do with the excreta or raw sewage?

Dr. GOODALE. Do you mean our garbage?

Mr. POWELL. No; the excreta from the inhabitants.

Dr. GOODALE. From the water-closets or toilets?

Mr. POWELL. Yes.

Dr. GOODALE. We dump it into the river. It goes down through the main sewer.

Mr. POWELL. Do you burn your garbage?

Dr. GOODALE. Yes, sir.

Mr. POWELL. You burn the least nocuous?

Dr. GOODALE. Well, we could not very well burn the sewage. We burn the garbage; that is, it is emptied every day. We have a man remove it every day. It is taken away and each cottage pays a certain amount for its removal. We have nothing at Thousand Island Park to breed disease but what we dispose of.

I have no apology to make for anything that we do that injures our neighbors, because we really have not been looking out for that. We would be very glad to if we were able. The last fire we had damaged us about $250,000 to $300,000, so you will realize that we have not much money to spare. We have the healthiest place that I know of anywhere in the United States or Canada. Thousand Island Park is really an international park. We have a tabernacle in which we can seat about 3,000 people. We would be very glad to cooperate with this commission, or with anybody else, for the benefit of the St. Lawrence River, but we are too poor to do it just now. I did not come here to ask for anything, but to simply state to you that we are doing everything we can for the protection of the health of the people who visit us and of the people who go up and down the river. I would like to ask whether or not this commission is appointed from Washington?

Mr. GARDNER. It is appointed by both Governments. The commission was brought into existence by treaty between Great Britain and the United States, and, among other things, they agreed in that treaty that they would not permit the pollution of the boundary waters to the injury of property or health on either side. Now, the two Governments referred the question to this commission to ascertain whether or not the terms of the treaty were being violated, and if the waters were being polluted in contravention of the treaty. The commission put bacteriologists at work, and they have demonstrated beyond any question that the waters are being grossly polluted in places in violation of the treaty. The Governments then asked this commission to determine the remedy. That is what the commission is at work upon at the present time, to devise a remedy for this wholesale pollution that has been going on indiscriminately all up and down the boundary waters. The fact that any one community has been able to get pure water and avoid sickness does not change the matter at all; if they are dumping their sewage into the boundary water it is the duty of this commission to ascertain the facts and report them to the Governments. If the Governments accept the remedies that the commission finally submits to them for adoption there will not, I apprehend, be any discrimination between communities; they will all be treated alike.

Dr. GOODALE. As I understand it this commission has nothing to consider in regard to the purity or impurity of the St. Lawrence River.

Mr. GARDNER. Yes; the commission have to determine whether or not the waters are being polluted in contravention of the treaty; and, if so, what is the remedy. But the two countries have agreed that the waters shall not be polluted to the injury of health or property on the other side.

Dr. GOODALE. Well, what are they going to do if it is?

Mr. GARDNER. Well, we are ascertaining the facts now. We are trying to get at the actual conditions, and when we submit our report to the Governments it is for them to devise the administrative part of it. These two great Governments have joined in this movement, and I do not think there is any question but what they will be able to put a stop to what they regard as an unwarranted abuse.

Mr. KING. Mr. Chairman, I came here on instructions from the Dominion Marine Association and with no intention of saying anything unless called upon. I have an opportunity of going home on the 4 o'clock boat, which I would take if I had any assurance that the question of the steamers is not coming any more definitely before the commission than it has to-day.

Mr. GARDNER. The commission held a hearing in Detroit for the special purpose of hearing the navigation interests, and they appeared there. If you have anything to say we shall be glad to hear it.

Mr. KING. I am not pressing for the opportunity, but I wish to furnish the commission any information that they wish to obtain with regard to the boats, and I did not like to leave without asking the commission if they desired to ask any questions.

Mr. GARDNER. So far as my recollection goes the representatives of the navigation interests were very ready at the Detroit meeting

to adopt any methods or remedies that proved to be reliable and safe. So far as that feature of it is concerned we have regarded the matter as closed. We are in perfect accord with them and they with us.

Mr. KING. I understood from Prof. Phelps that the test is now being made on the Lakes.

Mr. GARDNER. It is, and in case there is any weakness I apprehend it will be remedied.

Mr. KING. I hope you will call upon us at any time you need information or assistance.

Mr. GARDNER. Mr. Irving, the commission is now ready to hear the representatives of the city of Ogdensburg.

STATEMENT OF MR. ANDREW IRVING, CHAIRMAN OF THE BOARD OF PUBLIC WORKS OF OGDENSBURG, N. Y.

Mr. IRVING. Mr. Chairman, the mayor of Ogdensburg was called away, and will not be back again until after the first of the month. The board of public works is represented, as is also the board of water commissioners. I am president of the board of public works and Mr. Darrow is president of the board of water commissioners. We are prepared to give you any information that you may desire with regard to the sewerage and water here. The city engineer is also present, as well as the superintendent of the waterworks.

Mr. GARDNER. Are you prepared to go on now?

Mr. IRVING. Yes; I would be glad to do so.

Mr. GARDNER. As president of the board of public works all the public utilities come under your supervision, do they?

Mr. IRVING. We have nothing to do with the water board. That is a separate and distinct commission. Mr. Darrow represents that commission. We have charge of the sewers, the building of the sewers, and the building of the streets and public works.

Mr. MAGRATH. What is the population of Odgensburg?

Mr. IRVING. About 18,000; that is, including the inmates of the State hospitals.

Mr. POWELL. You simply do the work of constructing the sewers and the manner and time of such construction is determined by the State authorities?

Mr. IRVING. Yes, sir. I might more fully answer your question by explaining our sewerage system. In 1872 Col. George E. Waring, jr., was employed by the city of Odgensburg to make a report upon a system of sewers, which he did. He also presented plans and gave a report as to the best method of sewering the city. Practically all sewers that have been built since that time have been built on what is called the Waring plan. The law provides that a sewer can not be built unless plans are submitted to the two State commissions, the State board of health and the State conservation commission. They have to approve the plans before the sewers are built. After those plans are adopted and approved by the two different commissions, then our board constructs the sewers. That, of course, is obligatory on the part of the city corporation.

Mr. GARDNER. That same condition applies all over the State?

Mr. IRVING. I believe it does. It certainly does so far as we are concerned. It applies to all cities of our class, at any rate. We are a city of the third class.

Mr. GARDNER. You discharge your raw sewage into the St. Lawrence River?

Mr. IRVING. It all gets in there ultimately.

Mr. GARDNER. Have you ever considered any plans for its purification and sterilization?

Mr. IRVING. Practically we have not; no, sir. We have in a sort of a desultory way spoken about it, because we can appreciate what a necessary thing it would be, but we have never seriously considered any plan.

Mr. POWELL. Have the State authorities ever urged any plan upon you?

Mr. IRVING. No. Of course there is a general proposition always floating about by the State authorities that the best way would be a sewage-disposal plant of some kind, but it has never been brought absolutely before us in concrete form. There has never been any mandate issued that we should do that. As a matter of fact, within the last year consent has been given to us to still empty the large sewer into what is practically the St. Lawrence River.

Mr. GARDNER. What is the assessed valuation of the city?

Mr. IRVING. I think it is about $6,000,000.

Mr. POWELL. What is the population?

Mr. IRVING. We consider it to be 18,000 people. That includes the State institution down here.

Mr. MAGRATH. Have you any complaint to make against the Canadian municipalities in the matter of pollution?

Mr. IRVING. No; we are all in the same boat.

Mr. MIGNAULT. Have you actually made any studies with regard to a sewage purification plant?

Mr. IRVING. We never have. It has never been contemplated. It is one of those questions that I presume we felt was a bridge that would have to be crossed some time.

Mr. MAGRATH. How is your sewerage system situated with regard to a purification plant? Have you one outlet or several?

Mr. IRVING. We have about 15 outlets altogether.

Mr. MIGNAULT. It would be necessary to have an interceptor?

Mr. IRVING. I may say that while Col. Waring suggested that at some time some different system of disposal would be necessary, he did not provide in the plan for any connection. You see we are lying right along the front of the St. Lawrence, and our outlets reach from up at one end of the city down to the other.

Mr. MIGNAULT. Where is your waterworks intake?

Mr. IRVING. The intake is well up above any local sewage. The water commissioners will explain all that to you and give you some valuable information regarding the contamination that they discovered when they put in the intake.

Mr. MIGNAULT. You have no idea, have you, as to what it would cost to install a purification plant?

Mr. IRVING. I have not the slightest idea. While Mr. Paterson was telling you what could be done I was interested in reading a

few remarks that were made by Col. Waring in 1872, when he suggested our sewerage system. He said:

> Many of the objections that hold against the system of water sewerage in most towns are inoperative in Ogdensburg. Not only can the whole city (except a small district near the river) be completely drained by natural fall, but the foul drainage will flow directly into a river that will carry it at once away—a river so large that there is no danger of action ever being taken by cities farther down the stream to prevent the contamination of the water. Indeed the only considerable objection that I can think of against carrying out a properly executed system of sewerage in Ogdensburg is the one item of its wastefulness. Properly deodorized and applied to good agricultural land, the night soil of a town of 10,000 inhabitants would be worth at least $50,000 annually. This shows that the item of wastefulness is worthy of the consideration of all thoughtful persons, and there is no doubt that at some not very distant day its force will be realized and the wasting of sewage will be stopped.

Mr. MIGNAULT. What is the name of this local river that enters here?

Mr. IRVING. The Oswegatchie.

Mr. MIGNAULT. What is your indebtedness?

Mr. IRVING. In 1914 it was $515,000, including the water board debt. The water board debt at that time was $68,250. In computing the bonded indebtedness of a town the water bonds are always excluded.

Mr. MIGNAULT. Has there been any material change since then in your financial situation?

Mr. IRVING. I presume that the issues would be about at a standoff. There have been some few small local bonds issued.

Mr. POWELL. Does your water system pay its way?

Mr. IRVING. These other gentlemen present can tell you about that.

Mr. GARDNER. What is your tax rate?

Mr. IRVING. One dollar and ninety-eight cents this year. That does not include our town tax; that is just the municipal tax.

Mr. GARDNER. Do you have a State tax in New York?

Mr. IRVING. Yes, sir.

Mr. POWELL. Do you tax real property, personal property, and income?

Mr. IRVING. Not income.

Mr. POWELL. That is exempted?

Mr. IRVING. We tax personal property and real estate. Of course, there is a national income tax.

Mr. GARDNER. Do you have a county tax?

Mr. IRVING. Yes; this $1.98 tax includes school and municipal taxes. Then we also have what is called a county tax.

Is there anything else in the way of information that I can give you about this matter? We have our sewer plans here, but I do not suppose they would interest you. The fact is that what sewage we have we empty into the St. Lawrence River.

Mr. GARDNER. You are not an engineer, are you?

Mr. IRVING. No, sir.

Mr. GARDNER. Is your engineer present?

Mr. IRVING. Yes, sir. Would you like to have some information from him?

Mr. GARDNER. Just a few questions bearing upon the sewage.

Mr. MIGNAULT. Did you state what distance from the shore the different outlets are?

Mr. IRVING. Do you mean where they are situated?

Mr. MIGNAULT. Yes.

Mr. IRVING. No. We have the plans here. Part of them go into the Oswegatchie River, which empties into the St. Lawrence, but the others are at different places along the shore; all under the permission given to us by the two State boards and all practically following this particular plan.

Mr. MAGRATH. You do not contemplate installing any water-purification plant?

Mr. IRVING. Yes; we have a splendid one which the board of water commissioners would be glad to tell you about. They are very proud of it.

STATEMENT OF MR. JOSEPH E. TATE, CITY ENGINEER OF OGDENSBURG.

Mr. TAWNEY. You are the city engineer of Ogdensburg?

Mr. TATE. Yes, sir.

Mr. TAWNEY. You have acted in that capacity how long?

Mr. TATE. For about 10 years.

Mr. TAWNEY. Does the city of Ogdensburg discharge its raw sewage into the St. Lawrence River?

Mr. TATE. Most of it directly and some of it indirectly into the Oswegatchie.

Mr. TAWNEY. You have no plant in which you first treat your sewage?

Mr. TATE. No, sir.

Mr. TAWNEY. What kind of a water plant have you?

Mr. TATE. A filtration plant.

Mr. TAWNEY. A sand filtration plant?

Mr. TATE. Yes, sir.

Mr. TAWNEY. Have you suffered in Ogdensburg in recent years in consequence of the pollution of the water that you drew from the St. Lawrence River?

Mr. IRVING. Mr. Commissioner, will you allow me to suggest that the water board is in a much better position to give you information on those points than the city engineer, as those matters are under the separate and distinct management of the board?

Mr. TAWNEY. What cities are there on the St. Lawrence below Ogdensburg?

Mr. TATE. I believe Montreal is the first large city below Ogdensburg.

Mr. TAWNEY. Are there any small cities or towns?

Mr. TATE. Yes; there are several. There is Edwardsburg, or Cardinal.

Mr. TAWNEY. How near is the nearest one to Ogdensburg?

Mr. TATE. About 8 miles. That is on the Canadian side of the river. Then Waddington is 18 miles below. Morrisburg is nearly directly opposite Waddington. Cornwall is farther down, about 40 miles.

Mr. POWELL. Mr. Tate, is Ogdensburg a difficult country in which to cut trenches?

Mr. TATE. Not generally speaking; no. It is clay and sand. Of course there are some streaks of hardpan here.

Mr. POWELL. There is much rock?

Mr. TATE. Well, there is on the west side.

Mr. POWELL. So it would be very expensive work to construct a series of intercepting sewers to connect all the existing sewers, would it not?

Mr. TATE. If we put in filtration plants, we would have to have two plants, one on each side of the river.

Mr. POWELL. I am not speaking about your intake of water and the filtration; I am speaking about connecting with the sewers.

Mr. TATE. Of course if you treat the sewage, you would have to have two separate plants.

Mr. POWELL. Yes; but you would have only one place where the sewage debauched into the river.

Mr. TATE. I think we would have to have two—one on the west and one on the east side.

Mr. POWELL. Well, it would not be very expensive to make these intercepting sewers, would it?

Mr. TATE. I rather think it would be quite expensive.

Mr. POWELL. There is nothing in the character of the soil that would make it expensive.

Mr. TATE. No; there is nothing in the character of the soil that would do so.

Mr. POWELL. How far from the edge of the river do your sewers discharge?

Mr. TATE. Generally right at the face of the bank.

Mr. POWELL. Have you contemplated the making of sedimentation beds or other means of purification of the sewage?

Mr. TATE. No, sir.

Mr. POWELL. You have never made any calculations in regard to that?

Mr. TATE. Our system is a combined one. We take in the sewage and all surface flows.

Mr. POWELL. Does the insane asylum down here connect with your sewerage system?

Mr. TATE. No, sir.

Mr. POWELL. Is their sewage thrown into the river in a raw state?

Mr. TATE. Yes, sir.

Prof. PHELPS. Could you intercept all the sewage without pumping, Mr. Tate?

Mr. TATE. I hardly think we could. I think very likely we would have to pump.

STATEMENT OF MR. GEORGE F. DARROW, PRESIDENT OF THE WATER BOARD OF OGDENSBURG.

Mr. TAWNEY. Mr. Darrow, you are the president of the water commissioners?

Mr. DARROW. Yes, sir.

Mr. TAWNEY. What have you to say in regard to the disposal of your sewage in the city of Ogdensburg?

Mr. DARROW. Well, we have never suffered from any pollution of the water supply, because we have filtered all of our water that has been taken from the St. Lawrence. Our water supply up to four or five years ago was the local river, the Oswegatchie, but we suf-

fered from typhoid there, and we changed over into the St. Lawrence and put in a slow sand filtration plant. We have been almost completely free from any typhoid or any other water-borne disease since then.

Mr. TAWNEY. Do you chlorinate your water?

Mr. DARROW. No; we never have, except at one time, when we had a little break in our intake pipe.

Mr. TAWNEY. You discharge all your sewage directly into the river, do you?

Mr. DARROW. Yes, sir. The intake pipe is above the city and there is nothing that would cause contamination nearer than the village of Morristown, which is 12 miles away on this side of the river.

Mr. TAWNEY. How is it with respect to the towns below you?

Mr. DARROW. The State hospital formerly got their water supply from the St. Lawrence, and they suffered so severely from typhoid, owing to the pollution by the city, that they changed their water supply to the city supply.

Mr. TAWNEY. How far is the hospital from the city of Ogdensburg?

Mr. DARROW. It is a part of the city of Ogdensburg, but it is probably 2 or 3 miles below the center of the city.

Mr. TAWNEY. How many people are there in that institution?

Mr. DARROW. Two thousand, or a little over.

Mr. TAWNEY. What is the width of the St. Lawrence River here in this vicinity?

Mr. DARROW. It is about a mile and a quarter.

Mr. POWELL. Do you have daily examinations of the water in order to ascertain its purity?

Mr. DARROW. Yes; our superintendent can give you all details as to that.

Mr. POWELL. It is practically free from bacteria?

Mr. DARROW. Yes; practically so.

Mr. TAWNEY. What supervision is exercised by the State board of health over your water supply and the health conditions?

Mr. DARROW. It was put in entirely under their supervision and protection, and the health officer takes samples of water from the taps throughout the city at any place he desires, and those samples are submitted to test at Albany.

Mr. TAWNEY. Does the State board of health have any voice in the management or supervision of your plant?

Mr. DARROW. I can not say as to that. There has never been any interference on their part.

Mr. TAWNEY. Do you make reports to the State board of health with respect to the purification of your water?

Mr. DARROW. No, sir. I understand, however, that if the plant goes wrong they have the power to come in and see that matters are corrected.

Mr. TAWNEY. In other words, they have the power to lock the stable after the horse is stolen?

Mr. POWELL. You supply the material for the test and the State makes the test?

Mr. DARROW. We have our own laboratory that makes its own tests, and then the State board of health supplements those tests from time to time.

Mr. POWELL. They take their own samples?

Mr. DARROW. Yes, sir.

Mr. TAWNEY. Is there any State law in New York with respect to the discharge of raw sewage into rivers or running streams that you know of?

Mr. DARROW. Not that I am aware of.

Mr. TAWNEY. So every city or village or town is free to utilize the St. Lawrence River, or any other river on which it may be located, as an open sewer?

Mr. DARROW. That seems to be the case; at least, they practice it. I know that where shallow streams have been used and it has been a palpable nuisance that they have applied for injunctions and restraining orders on account of its being a nuisance.

Mr. TAWNEY. What is your opinion with respect to the wisdom of utilizing these running streams as open sewers? Do you think cities of some considerable size should be prohibited from discharging raw sewage into streams where cities below are dependent upon the same stream for their water for domestic and sanitary uses?

Mr. DARROW. I think they should be prohibited from doing so. I think that all pollution of all streams should be prohibited. I think that it is not only a menace to the public health, but it is a greate economic loss.

Mr. TAWNEY. That is the judgment of all the sanitary experts and engineers that we have had before us throughout this entire investigation, and I am very glad to know that you corroborate their views.

Mr. POWELL. You are opposed to depositing raw sewage into a stream entirely?

Mr. DARROW. I certainly am. Of course, I think it is an evil that has got to be overcome slowly.

Mr. TAWNEY. Yes; but ultimately it will have to come.

Mr. DARROW. Ultimately it will have to come; yes.

Mr. MIGNAULT. Then, your opinion is that cities should be forced to treat their sewage?

Mr. DARROW. Just as speedily as it can be accomplished. I think it is on a par with garbage collection; that it should be done, and that eventually cities will find that it is a source of income instead of a source of expense.

Mr. GARDNER. Is there any other gentleman from Ogdensburg who wishes to be heard now, or who has anything to offer on the subject?

(There was no response.)

Mr. GARDNER. If not, we will proceed to hear the representatives of the next town who appear before us.

(There was no response.)

Mr. TAWNEY. Is there anyone else from any other city or town on the St. Lawrence in this vicinity who desires to be heard on this subject?

(There was no response.)

Mr. TAWNEY. Dr. McCullough, have you or Mr. Dallyn anything to offer with respect to this St. Lawrence district?

Dr. MCCULLOUGH. For my own part, I do not think so. I think all we have to say about it is set out in the report.

Mr. TAWNEY. You are the head of the health service in the Province of Ontario?

Dr. MCCULLOUGH. Yes, sir.

Mr. TAWNEY. I want these gentlemen present to know that you are the head of the health service in the Province of Ontario, and that Mr. Dallyn is the sanitary engineer of the Province.

Mr. DARROW. I think something ought to be done with the State of New York, because all of these plans for sewerage in the boundary waters are approved by the State of New York. The institutions owned by the State of New York are running their sewage into the boundary waters.

Mr. TAWNEY. The State boards of health, I think all of them, have been very cordially in sympathy with the investigation into this matter which the commission has been conducting for the last three years, and I do not apprehend that any recommendations that the commission may finally make to the two Governments, with respect to it, will be opposed by the State, judging from the expressions we have had from them. If there is nothing further, the hearing will be considered closed, and the commission will go into executive session for the purpose of considering some other matters that we intend to take up at this time.

(The commission then went into executive session and the hearing adjourned.)

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