The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

and

IN THE MATTER OF an application by Canadian Delhi Oil, Limited, for a permit authorizing the removal of Natural Gas from the Province of Alberta.

I. N. McKINNON, ESQ. (*Chairman*)
D. P. GOODALL, ESQ.
DR. G. W. GOVIER

DATE 10th May 1951.

VOLUME III.

THE COURT HOUSE,
EDMONTON, ALBERTA.

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SITTINGS OF THE BOARD AT THE COURT HOUSE, EDMONTON, ALBERTA, AT 10:10 O'CLOCK IN THE MORNING, MAY 10TH, A.D.1951

MR. PORTER: Mr. Chairman, it would facilitate matters for some of those who have been here for some time and are rather anxious to get away, if Mr. Dougherty could stand down this morning and Mr. Warterfield could give his testimony with respect to the engineering and Mr. Natelson could speak with respect to financing. If there is no objection I would suggest we proceed that way.

FLOYD E. WARTERFIELD, Dallas, Texas, having first been duly sworn, examined by Mr. Porter for the applicant, testified as follows:

Q Mr. Warterfield, I believe that you are an Engineer by profession?

A Yes sir.

Q And that you have spent most of your professional career in the pipe line engineering and construction business?

A That is correct.

Q In order that the Board may have some appreciation of your experience and ability to undertake to make this report, would you mind telling them about some of the work that you have done, describing as you go, the type of country in which the work was carried out?

A Yes sir, I was graduated from the University of Oklahoma in 1920 with a degree of Mechanical Engineering. Practically all of my time from 1920 to date has been spent in the design, location, construction and operation of pipe line systems. Prior to the formation of the Engineering Company I was employed by a subsidiary pipe

A (Cont'd) line company wholly owned by the Standard Oil Company of New Jersey. During that 23-year term of employment I was given the responsible authority for the construction and supervision of a substantial amount of pipe line construction. One of the principal projects was the Plantation Pipe Line, and to use a pipe line term, I was the first Indian on the ground, and did all the location work myself and supervised the engineering design and construction, and later operated the system for five years. The system begins at Baton Rouge, Lousiana, and extends to Greensboro, North Carolina. The total pipe line mileage is 1,261. It traverses the States of Lousiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina and Tennessee. Later during the war the system was extended into Richmond, Virginia, which includes Virginia as one of the States served. To a degree this pipe line system is representative of a wide variety of pipe line construction problems and conditions.

I have also had the pleasure to work with the Civilian Pipe Line Committee during the war and as the Work-Horse Chairman I designed seven pipe line projects in the China-Burma-India theatre. These projects represent perhaps some of the most difficult pipe line construction that could be conceived. The one line which extends some 800 miles from Calcutta to Darbhangah presented very difficult construction conditions and further had the disadvantage that the men made nice targets for the Japs who were in the Naga Hills. The second important project of these

A (Cont'd) seven was from Rangoon to Mandalay. The line then extended to the Ledo Road and on into Kunming, China. The other five projects are relatively short and relatively unimportant.

MR. SMITH: Would you mind shouting a little, Mr. Warterfield.

A I beg your pardon, sir?

MR. SMITH: Would you mind shouting a little, it is very hard to hear in here.

A Yes. During this period I designed a line from Amyot to Fairbanks, which was to serve Petroleum Reserve No. 4. Can you hear me now?

MR. SMITH: Yes.

A This line, originating in the Colefield River valley traverses the Brooks Range of mountains and crosses through the Nitkit Pass and goes down the Johns River valley, across the Yukon and thence to Fairbanks. Those who are familiar with this territory will immediately realize the very difficult construction which would be encountered over the very barren areas in the Brooks Range, yet it is a perfectly feasible and practical pipe line route.

I have also done work in Colombia, South America, and this involved the design and construction of a line which parallels the Magdalena River and extends from Varranca to Cantamblora. The route goes through very dense jungle and crosses innumerable swamps which are subject to two turn-arounds per year from flooding from the Magdalena. A second line now in progress extends from Port Sellbar to Bogota. This line is about 84 miles in length and beginning at an

A (Cont'd) elevation of about 600 feet rises to 8600 feet in some 60 miles. It goes directly up the eastern slopes, or the western slopes, pardon me, of the Eastern Corderas, and in my opinion is a more difficult construction route than anything I have observed on the presently proposed Trans-Canada route.

I have also done work in France from L'Havre to Paris. It is not particularly difficult in construction except where the line goes into Suburban Paris.

At the present time I am engaged in the design, location and supervisory construction of a line some 430 miles in total length which traverses the State of New Jersey, Northern Pennsylvania, through the Pokano Mountains into Upstate New York. I have also had the pleasure of doing a considerable amount of work in Canada, and was retained by Imperial Oil in the initial design and location phases of the Interprovincial and Lake Head systems. I have done further work in the location of the line in Canada from Gretna to Woodstock and also from Sarnia to Toronto.

Q Mr. Warterfield, there is a substantial part of this line which pretty well parallels the type of job you had in Interprovincial?

A Yes sir.

Q That is from Princess to just east of Winnipeg?

A Yes, the Prairie Provinces are very typical of a large amount of pipe line construction in the States through similar flat terrain.

Q The balance of the line presents some difficulties?

A Very definitely.

Q Yes, now I would like at this stage, Mr. Chairman,

Q (Cont'd) to tender an engineering report made by Mr. Warterfield, and then to examine the parts of it as he has set the line up and he could then describe the physical difficulties that he has to meet.

THE CHAIRMAN: That will be Exhibit No. 6.

"TRANS-CANADA PIPE LINES LTD., ENGINEERING REPORT, APRIL, 1951", MARKED AS EXHIBIT 6.

Q MR. PORTER: I show you Exhibit 6, Mr. Warterfield; That report was prepared by you personally?

A Yes sir.

Q Going along to page 4, "Main line -- Section (1)"about which I spoke a moment ago, that is the line from Princess to a point 60 miles west of Kenora; it is your experience that Interprovincial pretty well parallels the problem of that line?

A Yes, it does.

Q Now, coming to "Main line -- Section (2)" which is from Gunne Station, from Kenora to Gunne Station; in your experience have you had anything of the nature of the country to deal with similar to that and if so where?

A The closest parallel to the construction to the east and to the west of Kenora can be found in Pennsylvania and in West Virginia, the exception being that the granite outcrops and the number of rocks which were involved present a slightly different problem. The construction is also made more difficult by having to route the line around these lakes and find a point of junction by connecting stream where it can be bridged or spanned because in my opinion it is impractical to cross any of those lakes in

A (Cont'd) the customary manner because the approaches would have to be dug through solid rock and granite.

Q Now, you are speaking, I take it, of the Kenora section to the Gunne Station?

A Yes sir.

Q Or does that include as well the piece from Gunne Station to Port Arthur?

A I think it would include, sir, all those areas throughout the route from the point east of Kenora to a point south of Sudbury, it is scattered.

Q Oh, is that generally?

A It is scattered but if you collect it, it would aggregate some 500 miles and there would be sections of 20, 40, 80 or 100 miles where the general description that I just gave you would be applicable.

Q Now, you speak of lakes and rock which you have already encountered and dealt with elsewhere; have you had any experience with anything paralleling a muskeg condition?

A Yes sir, a very similar type of construction is encountered in Mississippi where we have peat bogs and what would be classed as muskeg, I presume; and also I might point out the very difficult construction that is encountered through the Seneca in the jungle sections in the Magdalena Valley in South America and I think one would present no greater construction problem than the other.

Q Are you familiar with the construction down through the Jersey Meadows?

A Yes sir, I was just going to make this comment sir; the line right across the Jersey Meadows is subject

A (Cont'd) to a very pronounced tidal action which would not be the case in passing through a peat bog and muskeg section, and some of the soundings which were made through the Jersey Meadows did not encounter any firm base in some 60 or 80 feet.

Q Now, Mr. Warterfield, in approaching this problem when you were asked to make a survey of this line to locate it and give some estimate of its costs, give us an idea of how you went at it?

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A Well, knowing that the point of origin was somewhere in Alberta Province, and being very familiar with the general topography, there wasn't much question in my mind what one route would be substantially as good as another up to a point somewheres near Winnipeg. Having flown across - - .

Q MR. PORTER: That was based on your recent experience in Inter-Provincial?

A Yes. Having flown across the sections of Northern Ontario and into Toronto, along the St. Lawrence, I realize that a great amount of very careful work would have to be done in selecting a route which at times in the past I had thought would be impossible, but that conclusion was based upon the fact that airlines fly point to point and not along places where a pipe line route could be selected. So beginning at Toronto an aerial reconnaissance was made along the St. Lawrence up to Montreal and thence to Ottawa and up the Ottawa River through the Clay Belt, through Nakina, Superior Junction and into Winnipeg. Careful observations and notes were made of this route with respect to the difficulties which might be encountered in construction, as well as the accessibility of the line for maintenance and repairs after construction. A turn around was made at Winnipeg and the line was flown as is indicated on this map. Several doubling operations were made in order to more definitely define the route. Construction will be extremely difficult and very expensive in the area around Nipigon and Schreiber and Mobert. There is about 136 miles as stated on

A (Cont.) the exhibit, which will be extremely expensive, in fact, the cost is almost fantastic. Yet there is no question in my mind but what the route is practical and the line can be constructed.

Q MR. SMITH: What does your witness mean by "fantastic"?

MR. PORTER: I think you will find that section separately dealt with, perhaps we can get that section in the exhibit? Section 5, that exact area is dealt with in Section 5.

Q MR. PORTER: When you talk about "fantastic", you are talking about the figures in Section 5 on page 8?

A Yes, when I say it is fantastic, that's a relative term when thinking of a normal pipe line construction, the cost goes so high, that you just wonder.

Q What about the balance of it?

A From Mobert or a point about White River through to Sudbury, or a point some thirty miles to the west of Sudbury, it transverses a very dense timbered section which is laced with lakes and muskeg and swamps and other difficult construction. However, it is close to a railroad, and the route seldom gets more than ten or fifteen miles from this railroad. A considerable number of ingress roads have to be constructed to the right-of-way. The line can be laid through this section in very much the same manner as lines have been constructed across the Jersey Meadows and through the Seneca's in South America.

Q From Sudbury on into Toronto, what have you to say about that? That is dealt with in your section 7 on page 10 of the exhibit?

A That's right.

Q The section you have been speaking of is Section 6, dealt with on page 9 of the exhibit?

A Yes.

Q From Sudbury to Toronto?

A You encounter again granite construction over barren areas which will require a very close selection of route, but it isn't as difficult as the one referred to around Nipigon and Schreiber.

Q Section 7 actually takes in a small parcel thirty miles north-west of Sudbury to Sudbury?

A Yes.

Q And it is that parcel you are talking about now?

A Yes. Construction is made a little complicated through this Section 8 by the developments which are there in the way of summer resorts, some towns and cities, which would require an irregular line to get around those places satisfactorily.

This next section, from a point about 72 miles north of Toronto and on into Toronto is average or normal construction and doesn't present any problems.

Section 10 from Toronto to Montreal parallels the St. Lawrence River, and while it is largely agricultural, it also passes through a highly developed section of the country, but it in turn doesn't present any unusual or extraordinary construction conditions. The same thing may be stated of Section 11 which is the extension from Toronto to Morrisburg. The construction as a whole is just normal, I mean into Ottawa, and also the lateral to the City of Stratford from Toronto comes within that same classification.

Q In addition to flying this line, Mr. Warterfield, I understand that you have made a study of aerial pictures of it?

A That's correct, sir.

Q Have you used that method before as a useful means of assisting in locating and estimating of a line?

A It is one which has become almost a standard in the location of pipe line routes. Fortunately there is extensive coverage in Canada by the Dominion and Provincial Governments. These prints are available and by means of them a route can be plotted once it is known within limits. It is customary to use these photographs, or, if not available, to have similar photographs made on a commercial scale, but their use is the same in either case. The line is plotted, and these aerial prints with the line printed thereon is taken directly to the field and an examination made on the ground for a matter of refinement of location.

Q Have you used this system in other lines that you have built?

A It was used on plantations, it has been used by all major pipe line companies in the United States for the past twenty years and is being used at the present time on the project in New Jersey, Pennsylvania and New York.

Q I understand that you have also consulted with some engineers experienced in this territory, with regard to ground conditions. Tell us about that.

A Yes, while I was in Toronto we had the pleasure of meeting the Chief Engineer of the Department of

A (Cont.) Highways of the Province, and he called in his Chief Location Engineer who was very helpful in providing us with information, topographical data, soil conditions that they had observed over years of roadway location in the Province.

Q Now, turning to the exhibit, each section contains a set of figures prepared by you showing a breakdown in five items of the cost of that section?

A Yes.

Q Do these represent the figure at which in your opinion in present conditions each of these sections can be built?

A May I answer your question, sir, by saying that the estimate of cost for each of these sections was determined first by my own knowledge and judgment and experience as to pipe line costs in similar locations. After these had been prepared I submitted them to my associates Oklahoma Contracting Company for their opinion and judgment. During the past twenty years that company has constructed large diameter pipe lines for some 21 companies, totalling 4900 miles and better in twenty-two states and one foreign country.

Q Any of these lines encounter country as bad as some of this?

A In my opinion it is worse, particularly with respect to West Virginia and a certain part of the Allegheny Mountains in Pennsylvania. I doubt if there would be a dissenting vote among the contractors in the United States who have worked in Virginia, if Virginia wasn't the most difficult pipe line construction section that they had ever worked in.

Q You reported your examination to the contractor, with your estimate and discussed your views with him?

A There was concurrence in practically all instances.

Q How do you do that? How does he know what the country is like?

A About all that was necessary for me to do was to describe, for example, the section between White River and Sudbury, and immediately he realizes two similar conditions where he has constructed pipe lines. It is only by taking the known and relating it to the unknown that you can get an appraisal of what the unknown might perhaps cost.

Q Based on that method you have arrived at the figures that are set out in the Exhibit 6 for each of the sections?

A Yes.

Q As being in your opinion the sum cost of this line?

A I would go further than that and state that the figures are outside estimates, and machinery is in motion at the present time to further revise the line location, which is always done, and in so doing, if this follows, I would expect it to follow, as has been the case with other lines, there will not only be a re-allocation and redistribution of costs, but there will be a reduction in cost.

MR. PORTER: Mr. Chairman, unless the Board so desires, it isn't my intention to take the witness through each of these sections in detail, they pretty well speak for themselves and relate to the map. Just another item, Mr. Warterfield, your instructions are to continue to examine this line with a view to

MR. PORTER: (Cont.) ascertaining in more detail the problems to be dealt with?

A Yes, that work is going forward and will continue throughout the summer months when conditions are good throughout the area for that purpose. In addition there is an alternate route which is to be examined. It could not be examined at the time the original reconnaissance was made because weather conditions closed in and made it impossible for us to do any further work, and I speak of the Canadian National Railway Route running from Sudbury north of the present plant location.

Q You want to examine that?

A We want to examine that route because it may be that, although somewhat longer, it could be justified through a lower construction cost.

Q Based on the background and experience which you have, in your examination of this project, is it your opinion feasible, physically feasible?

A It is not only feasible, but it is practical.

MR. McDONALD EXAMINES THE WITNESS:

Q With regards to the price of the pipe, Mr. Warterfield, this figure of $125.00 is based on what shipping point?

A That's based on Milwaukee as a shipping point.

Q Your five points as set out in your summary of each section, do they include duties?

A They don't.

Q Duties and sales tax?

A They don't.

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Q So that these figures would have to be amplified by including these items as and when they are --.

A Unless these are obtained -- it may be wishful thinking but it isn't impossible for a pipe mill to be constructed in Canada and all the fabrication done in Canada, and that is why duties and excise taxes were omitted from the estimate.

Q MR. MAHAFFY: Are these in Canadian or United States funds?

A These are U.S. funds.

Q MR. MARTLAND: I take it there will be a further report with respect to the route, and I would prefer to cross-examine when the complete data is available.

MR. PORTER: Oh, yes, Mr. Warterfield will no doubt be back with us in September, but we wanted to get this evidence before the Board.

MR. SMITH: Will he bring the mill back with him?

MR. PORTER: I wanted to make it clear that he is continuing this study.

MR. SMITH EXAMINES THE WITNESS: Just before Mr. Warterfield goes: I wonder if very briefly you could give us any description of what you called the Kenora area and the work you have done with respect to your ability to put a pipeline through. You know what I am getting at. We call it No Man's Land.

A The most difficulty will occur in the first three miles west of the city and the first two miles east of the city and in traversing the city itself.

Q And how do you get by all those lakes and rivers and so on that drop down just like that?

A There are three or four possibilities in the Kenora area: bridges are there, both on the railroad and on the highway and it isn't unusual at all to suspend a gas pipeline over anything like that from a highway or railroad bridge.

Q Well, you aren't allowed to do that from railroad bridges, are you, Mr. Warterfield?

A If that cannot be accomplished, then an aerial crossing can be made in the same way as a railroad or highway.

Q Now, that is the district in which you mentioned the cost as being fantastic, and I take it that is the one place you would have the greatest difficulty?

A No, sir; Kenora doesn't bother me; it's the area between Nipigon and Schreiber, and that is the one I had reference to when I said it was fantastic as to cost, to me.

Q The reason you would go through there is because you can drop down to Port Arthur and Fort William which are fairly good cities?

A That is correct.

THE WITNESS RETIRES.

MORRIS NATELSON, 1 Williams Street, New York, New York, having first been duly sworn, examined by Mr. Porter, testified as follows:

Q Mr. Natelson, I understand you are a partner of Lehman Brothers of New York City?

A Yes, sir.

Q And Lehman Brothers are a banking institution?

A Lehman Brothers is an investment banking house which specializes in the sale of securities to the public or privately to finance companies, corporations, projects, whatever is worthy of the finances.

Q Has your firm done any pipeline financing in its history?

A Yes, we have been major participants in the financing of practically every one of the large American pipelines.

Q By the way, how long have Lehman Brothers been in business?

A Well, we have been in business for a hundred years, although for the first fifty it didn't look much like the present firm. As far as our present type of operations are concerned I would say about fifty years.

Q And you say you have had a part in financing most of the major linesin the United States?

A I would say all of the major lines.

Q Do you maintain a staff of people who are able to study and examine and report upon these lines as contemplated and as built?

A Yes, we have at the present time three major people in addition to the three or four partners who specialize in natural resources including petroleum and gas and pipelines; and in addition to that we are affiliated with the Investment Trust which has assets of over a hundred million dollars, which is also interested from an investment point of view in natural resources.

MR. SMITH: I wonder if you could tell us who the

MR. SMITH(Cont'd) three people are, those three main people.

A As individuals?

MR. SMITH: I don't care.

MR. PORTER: The people in his firm?

MR. SMITH: Oh, well, I will let it go.

Q MR. PORTER: Mr. Smith was just wondering if you could tell him the people in your firm who devote their particular attention to those phases of your business.

A Well, there are quite a few who devote themselves --.

MR. SMITH: I meant the names of the people he depends upon.

A I would say, first, Mr. Whittemore, who was for many years with the Chase National Bank as vice-president in charge of loans for natural gas pipelines, and oil, and Mr. Kennedy who is an expert in the values of oil securities and who knows a great deal about the oil and natural gas business from every point of view; and Mr. Callary who has been engaged in the oil and gas business for many years and who is a partner in the firm. These are the three main ones and there are many others assisting in that phase of the business.

MR. SMITH: I'm sorry, Mr. Porter; that wasn't quite what I had in mind.

Q MR. PORTER: Now, in this project with respect to gas in the province of Alberta, you have been watching its progress for some time?

A We have been interested in this project since it was originally conceived by Canadian-Delhi and we

A (Cont'd) are familiar with the work that has been done so far in determining the amount of reserves available for export in Alberta. Of course we have considered as well the practicability of the business, the over-all economic status of the venture and things of that nature.

Q I suppose in all of these you must depend on the professional opinion of the experts with respect to reserves, feasibility in costs and operating efficiences?

A Yes, we don't pretend to be engineers or petroleum geologists.

Q You are acquainted with the people who are doing the work in this project, DeGolyer and MacNaughton, dealing with reserves; the Oklahoma Pipeline Company surveying the construction with Mr. Warterfield; and the H. K. Ferguson Company who are doing the market study?

A We have been particularly impressed in this case by the calibre of the people who are starting the project and we are familiar with the development of the projects of the Delhi Oil Company because we have known them for a great many years and we have a substantial amount of stock in the company -- at least we and our clients have. We have a very high regard for their ability to find gas and oil and their ability to develop a property of this kind.

We are also very much impressed with the experts they have chosen to advise them on each phase of operation.

Q Suppose I put it this way: when these experts have

Q (Cont'd) made their final examination and their reports, are they people of the calibre upon whose judgment you would be prepared to rely in investing and advising investment?

A In the last analysis we don't have to be particularly satisfied as to who the experts are, because those who must be satisfied are those who put their money up. We expect a substantial part of these costs would come from institutions, and they consider DeGolyer and MacNaughton as absolutely a by-word -- at least American institutions do: I am not acquainted with Canadian business in that connection. The Oklahoma Pipeline Company is also extremely well considered.

In that same connection, their reports have also been considered by major institutional investors in determining their interests in buying large blocks of bonds in a project.

Q Against that background you have examined the work to date that is being done by these several people?

A I have discussed it with them but I am not too well qualified to look at a geological report and have any opinion as to whether it is right or not. I have to rely on the people who made it, and the same with the engineering reports.

Q What do you say, in the light of the progress thus far and the opinions and estimates they have given, assuming these opinions to be firmed by ultimate examination -- what do you say as to your ability to finance this line?

A We believe the geological report indicates adequate

A (Cont'd) reserves to support the line; we believe that the line cost, while it is high in some spots, on the over-all basis is not unreasonably high; and we believe that the market it will serve will absorb enough of the gas at a proper price to support the line and make it economically feasible; and since it is economically feasible, it is bankable and the securities can be sold.

Q MR. MARTLAND: I just wondered if you were suggesting that there is no other geological firm relied upon by American investment institutions other than DeGolyer and MacNaughton.

A I am not implying that at all. I am merely indicating that DeGolyer and MacNaughton is one that is accepted by more institutions than, probably, any other house. However, there are some other very fine firms, obviously.

Q MR. SMITH: Mr. Natelson, a Mr. Davis is one man who was heard from at least in other hearings, and he is rather well thought of?

A He is a very excellent geologist; we have used him ourselves on occasion for our own investments.

Q Without saying anything against anybody, supposing your firm found out that on checking the Viking-Kinsella field his estimated reserves were less than those of Mr. Dougherty of DeGolyer and MacNaughton, what would your firm think about how you should operate? On Davis' estimates or DeGolyer and MacNaughton's? That is, if you are going to give some of your money -- I take it that is what you are thinking about.

A Our interest would be in the availability of adequate reserves for the line, not in the actual numbers of billion or trillions of cubic feet.

Q You have probably read what Mr. Dougherty said about Viking-Kinsella and Mr. Davis too. Primarily the distinction is that there is a tremendous difference in the two estimates now -- you are lending money yourselves, I take it?

A We probably will make an investment.

Q Well, which one would you choose?

A I don't think it comes to a question of choosing one or the other. The question is whether there are adequate reserves. This line needs a certain number of trillion feet,and if they are there and if they are released, that is all we are interested in. It doesn't matter whether DeGolyer finds there are ten times more than Davis.

Q Well, now, I am giving you one of the biggest fields, and if we are considering the needs of the province first --.

A That's what we are most interested in: the over-all needs of the province and if there is enough gas to service the line.

Q I'll give it to you this way: let's assume Davis says there's only half as much as Dougherty -- if they don't mind me omitting the"Misters". You people as bankers would figure you had better act on what advice?

A If we were going to buy the property we would try to make a trade on the geologist who estimates the smaller amount of gas, which isn't what we are

A (Cont'd) trying to do here. (General laughter) We are trying to find two or three trillion feet of gas surplus in the province that the province is willing to export to the east. Once we have found that it doesn't matter much, doesn't make much difference if there's thirteen trillion or ten trillion. All we want to know is: is there enough surplus to service the line -- enough gas to service the line and the province of Alberta.

Q Suppose I come to you with these two volumes in my hand and say I want to borrow two or three hundred dollars and here is the reason for it. You wouldn't even say hello, would you?

A I would be delighted to see anybody who has a three hundred million dollar deal. (General laughter)

Q Forgetting your interest in Delhi, supposing they just came to you with these two exhibits and said, "We are starting this project and we want to borrow three hundred million dollars and here is our idea." How would you receive that idea?

A If the over-all estimates of Mr. Davis or anyone else indicated that there was enough gas to supply the line, it doesn't make much difference from the standpoint of the lender where the gas is, as long as it is available to the line. I am not enough of a geologist to decide whether Mr. DeGolyer or Mr. Davis is right for a particular field, but if they think they have evidence that for the over-all picture of Alberta reserves there is enough gas to service the line, we aren't too concerned about the amount of gas.

Q But if Davis says there's two and DeGolyer says four, which estimate would you take for a basis for lending money?

A If there is a difference between the two experts --.

Q As you know, there always is.

A Yes, there always is. (General laughter) If there is a difference between the two experts, in the first place it is very likely -- or, possible -- not necessarily likely -- that the experts may get together and determine their differences and why their estimates are wrong, and they would then come up with a figure which they feel they can both agree on as being sure, and that figure you are sure of can be used.

The other possibility is that the amount of line that is involved can be just as well covered by your two units as four -- if that is so, then it doesn't make much difference to us whether it is two units or four, if the two are enough to support the line.

Q Have you read this Board's interim report issued last January?

A I struggled through it, yes, sir.

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Q You struggled through it, and you must remember something about it, let us take their four trillion something, you will remember that?

A Yes.

Q Which would, as I understand it, compare with Mr. Dougherty's about 8 trillion something figure; if you had first Exhibit 4 and 4(a) and the Board's report and you were lending other people's money, which would you operate on?

A If I had the Board's report as to the four, in the last analysis I think the Board here will decide whether gas can be exported from Alberta. Now, if they are convinced that they cannot export gas from Alberta the problem is completely academic. If they tell us we can export gas from Alberta then we will be perfectly willing to finance this line.

Q O.K., I will go one step further, supposing the Board said to Mr. Porter's clients, the Delhi Oil Company, supposing they said "Here is a permit, there is our report, I don't know where you are going to get the gas but if bankers want to build a big line like that, you see if you can get the money.", would you give me the money to do it?

A We would review the reports, we would have a much more detailed discussion that we have had to date, we certainly would take Mr. Davis, who has had some disagreement with Mr. DeGolyer, testimony into our opinion based upon experts' advice that there is adequate gas.

Q Don't get me wrong, I only mention Mr. Davis because I think, generally speaking, he was about the lowest

Q (Cont'd) one of the various people, do you know what I mean, Mr. Natelson?

A Pardon me?

Q The only reason I mention Mr. Davis is that he is probably, generally speaking, about the lowest one of the various experts we have had?

A He is a very good expert.

Q Pardon?

A He is a very good expert, an acceptable expert.

Q I think he is more or less low and I think Mr. Dougherty's maybe -- no, I should not say that, strikes me as high.

A Of course.

Q What I am trying to get at is your opinion, Mr. Natelson, as a financial house that has got to lend the money, and other people's money usually, what kind of evidence would you depend on before you let your money go?

A In this case the kind of evidence we could have, but it is all we could have, because the pipe line cannot be built before the money is available as we know, evidence from reliable geologists that there is enough gas in excess of the Province's needs to supply a pipeline; we would need evidence from engineers that the pipe line is feasible and it would cost a certain amount of money. We could use our own judgment as to the mechanics of its operation.

Q All right, now it is Lehman Brothers, is it?

A Yes.

Q If some one approached them with this report Exhibit 4 and 4(a) and they also had this Board's report as of

Q (Cont'd) January, you are talking about evidence which you presently have?

A Yes, that's right.

Q Plus all of the evidence obtained here, you would be more inclined to go along with the Board and play it a little safe than you would be with Mr. Dougherty and be a little optimistic, wouldn't you, as bankers now?

A I think we would be inclined to follow Mr. DeGolyer's report.

Q Well, I will come to your country and see if I can borrow some money.

(THE WITNESS STEPS DOWN.)

THE CHAIRMAN: I think we might adjourn for a few minutes.

MR. PORTER: Mr. Dougherty will be recalled and that will be all we have to tender.

(At this point, 11:15 A.M., the Hearing stood adjourned until 11:30 A.M.)

J. F. DOUGHERTY, having been recalled on his former oath, cross-examined by Mr. Smith, testified as follows:

THE CHAIRMAN: Does anyone wish to question Mr. Dougherty?

MR. STEER: I am going to suggest to the Board that Mr. Dougherty's cross-examination should be deferred, I would prefer to cross-examine him when he comes back again.

MR. MARTLAND: I am in the same position, sir.

MR. NOLAN: And I am taking the same position too, sir.

Q MR. SMITH: Probably I will have to prevent that. Mr. Dougherty, if you will answer a couple of questions for me -- were you present when Mr. Natelson gave

Q (Cont'd) his evidence?

A Yes sir.

Q Now, answers which might tend to throw a reflection on the Board's thinking, don't hesitate to say it, they want information, Mr. Dougherty, do you follow me?

A Yes sir.

Q Now, I don't know why I keep mentioning Davis, but you have read the Board's interim report?

A Yes sir.

Q And generally speaking am I right that where their 4 trillion something appears it compares to your 8 trillion something?

A That is correct.

Q That is generally so, and I wondered if you have in your mind any general reason why there is the great difference, whether it is new discoveries, different thicknesses, or anything generally, could you tell us? Do not hesitate to criticize the Board.

A I have no criticism at all of the Board.

Q They want information.

A I think they are excellent. The primary difference would be in the "proved" fields and areas which were estimated, we estimated 77 distinct prospects or fields, some of which were areas covering proved fields or prospects. For example, the Princess area, we attempted to do something in detail that the majority of estimators had, say, skimmed over for lack of time or data. In that respect we feel our efforts were directed to trying to dig out something in those which were not estimated, since they are a part of the reserves of the Province.

Q Probably the primary reason for it, if I understand it right, Mr. Dougherty, is that you spent a lot of time here with your seismic picture, your seismic picture?

A Seismic, yes, that was a very minor part of the whole study. You see, actually what we did was to build up a record for every single well drilled in the Province.

Q How did you handle that?

A We have a card file system in which we took Mr. Floyd Beach's and the Board's compilations as well as Dr. Hume's compilations and exhaustively set up every single well in the Province that had been drilled so far as we could tell. We obtained drill-stem test data, simple descriptive data, within the limits of time, and then proceeded to determine which of those wells drilled had a measurable volume of gas and which had small showings. Now, all of the areas colored in green or red on our wall map consisted of measurable volumes of gas. We missed quite a few we find in checking back just in the mechanical problem of developing them, we have another dozen or so that escaped our attention. In relation to all those wells which had showings we indicated those primarily by black crosses on that map. After we had compiled them we then began to bombard Mr. Raborn and Mr. Beach with inquiries for data from whomsoever they could obtain them. As our hearing date was post-poned we began to get more and more detailed data, originally we would necessarily have had to have skimmed over this but as the time began to work in our advantage we found there was a great deal of data

A (Cont'd) which we had correlated which could be obtained. Many of the field prospects which were not estimated we will have to find time to estimate. There should be some data on them on which someone could make an estimate or a guess.

Q Some of them used to say "Let us take a mile around a well"; I notice you do not adopt that at all in your report?

A That is true, we attempted to go back as far as the data will permit and form our own judgment, having in mind other people's work, because we did not have all the data which is available to the Board or perhaps to the Utilities at Viking-Kinsella or any other field. We hope some day to have that much.

Q Well, I take it one of the main factors with regard to the difference as you have just explained it, the fields, if you call them fields, which you included?

A That is correct.

Q You have done the work you described yesterday morning with respect to those fields?

A That is correct.

Q Now, is there anything else you would like to bring to the attention of the Board?

A We have attempted rather than treating, say, with respect to Viking-Kinsella as an area developed by a given number of wells, we tried to conceive the whole reservoir, the entire area of saturation, because we feel fundamentally that is going to have more influence upon the history of the reservoir than some random distribution of wells and some

A (Cont'd) arbitrary acreage assigned to those wells.

Q Your expression about "saturation" interests me a bit; I take it that what you said yesterday and what you are just now saying, that is probably one of the reasons why your acreage for Viking-Kinsella is, I have forgotten the amount, but almost double the Board's thinking of last January?

A That is correct.

Q You remember that being so?

A That is correct.

Q Now, in your map, generally speaking, did you not include some, to use the Deputy Chairman's word, "dud" wells in there?

A If they had saturation we included them as part of the reservoir.

Q Well, is that explanation you gave about -- what was it, Manville?

A The Manville well.

Q You remember that?

A Yes.

Q Does that apply to other wells within the Viking-Kinsella area as designated by you?

A Yes sir, they all had some indications of measurable gas volume which would indicate that Viking sand saturation was present.

Q Even though the North West, for instance, just called them "duds" to use my language?

A Yes sir, but I think a "dud" well depends largely on the economics in many cases, I am familiar with many fields in which wells were plugged and abandoned having five or ten million potential when the average was fifty a well being drilled at that time.

Q Do you remember of any well such as we have been talking about that may be included in your area, Dr. -- is it Doctor or Mr.?

A Just Mr. We could check through our records, let me have the Viking-Kinsella?

Q Maybe it could be made available later?

A Oh, I see, yes.

Q All I am getting at is to some one like me, to have a couple of "duds" down here in the south, for instance, and your contour line should go in instead of out, as they apparently do, does that mean anything to you, Mr. Dougherty?

A I think perhaps --

Q If we use this map here, supposing there are some "duds" here at the bottom shown at this point. My idea would be that your line should go in towards what I might call the "field" rather than outwards?

A You will note in our detailed map s-

Q I just want an explanation, not an argument.

A In Census Division 10 we have made a very great distinction between what we call "proved" area, "probable" area. Our "proved" area corresponds rather well to the areas chosen by some other estimators for the reservoir. The "possible" area which extends beyond the field we conceive as being the fringes of the reservoir, they will contribute gas either by a number of wells drilled there somewhere down the line when the gas supply is a little tighter in that field or by migration.

Q Well, Mr. Doughtery, your acreage with regard to Viking-Kinsella is what you used to get "proved"

Q (Cont'd) reserves, you call it "proved" and "probable", possibly equivalent to what the Board called "established", is that correct?

A The "proved" and "probable" is the, so far as I can determine, the equivalent of the Board's "established" reserves, that is less surface losses, that would be available for sale, that is the "proved" and "probable". We did not include "possible" in any of the computations involving the "available for sale" quantities or for pipe line purposes.

Q And that is so throughout your Exhibit?

A Yes sir.

Q Appears from your Exhibit.

A Yes.

Q Well, the "proved" and "probable" -- I hate to bring this up again, I think we have heard it so often -- I think you said on Monday morning or yesterday morning, something to the effect that you, probably it appears in the Exhibits, you do remember Mr. Leisemer's definition but I think if you read his whole submission again that there is a lot more to what he said about "proved" and "probable" than a definition meaning "capable of being proved"?

A That was the dictionary definition and that is the way we have conceived it also.

Q You remember he also said, I asked about some organization in the States, I cannot think of the name --

A The American Gas Association.

Q I suggested that they probably would be classified as "possible"?

A We are well acquainted with the A.G.A.'s work and we have ourselves completed a much more comprehensive and extensive survey of the gas reserves of the United States than the A.G.A. ever attempted, and again the difference is primarily that in many of the corporate estimates, they are built up in a conference usually of about two weeks at some place such as San Antonio or New Mexico, they may have a considerable back log of company data but many of them have never studied the entire field or groups of fields in a cohesive and coherent pattern. We think their estimates are very good but they tend to be strictly for the "proved" you will note.

Q They tend to be what?

A Strictly for "proved" gas, they make no prognostications as to the "proved undeveloped" even for example, or the "probable".

Q You have read the Act under which this Hearing takes place?

A Yes.

Q You will remember that the question primarily is, at least the first purpose of the Board is to deal with the protection of this Province, and that is why I am a little anxious about this that you have as "probable"; aside from Leisemer or anybody else, can you give us a little more assistance in the "proved" and "probable" according to your own ideas, for instance why do you bother distinguishing them in your Exhibit at all?

A Because the Province, in its present stage of development, one additional well in some of these one and

A (Cont'd) two-well fields may double or quadruple the reserves. If in looking, as you are, for a 30-year supply for the Province you restrict your thinking to one or two-well fields and do not try to conceive the extent of the reservoir that is behind those wells, I do not feel that we in our estimates would just be giving the Province its due.

Q Let me put it this way, never mind 30 years hence, take this moment, you would still think that what you call "proved" and what you call "probable" should be all put in the one basket, is that right?

xxxxxx

Q I wonder why you make any distinction? All the rest of them have done it, that may be the reason. They have all done the same as you, and chucked them all in one basket. I want to find out why.

A We made a rather careful distinction between the possible and the probable.

Q I am talking about the proved and probable, not possible.

A As I read into the record at the very first part of my testimony, the probable reserves are proved reserves just a little further removed from direct well control, and if we know from the Isobaric thickness maps, for example, that Picardville, we couldn't actually conceive of that sand pinching out there towards the outside almost within a mile or two. We set up what we felt would be the limit of the shrinkage area and the thickness which we felt would exist further out, based on seismic and structural evidence.

Q Would you tell us how you made that measurement?

A We have constructed structure maps behind most of the exhibits that are submitted here as Isobaric maps, and in the Morinville-Picardville area, for example, if I may use that as an illustration, we found that the locations of most of these prospects were all irregular nosings which almost became closures. By a little geological imagination they would be closures. So that there was more than just a random reason for these cumulations. We had some additional seismic data which would appear that some of them were quite close, for example, Calahoo, and perhaps Picardville itself.

Q I take it you got your seismic data from whoever owns and controls the area?

A That's right.

Q With regard to Delhi and Cessford, I suppose you got it yourself?

A That's right.

Q The only reason I mentioned that is because most of these people are pretty jealous of the seismic data?

A We didn't get very much seismic data volumes, we got some fairly complete data of a number of isolated fields, but most of it is not available and probably will never been available until such time as a particular operator is selling gas to a pipe line. We feel rather strongly that our probable classification is essentially proved of a slightly lower category. I'm not worried in the least about the probable.

Q Are there any other basic differences that you have in mind as between the Board's thinking of January and your thinking of today?

A I think those two reasons are probably basically the differences, as the number of wells considered, the time which we had available, being paid for by a client as compared with that of a regulatory Body whose staff has many other duties and the reservoir concept and perhaps since we are trying to look at it over a real broad scale, we are sticking our necks out further than some, but we feel that we have good geological and engineering basis for so doing.

Q Would you give us a little more of your consideration

Q (Cont.) with respect to service losses? My impression is that yours generally speaking are a bit lower.

A There are a number in which we are higher. The service losses on the non-associated reservoirs on the average would be between eight and ten percent to the recoverable gas to the terminal pressure.

Q Would you take any field that comes into your mind and give us a little detail about what your thinking is?

A The breakdown of most of them is rather uniform. Our experience has been that a 4% allocation for compression fuel, compressor fuel works very well for the Cretaceous Sand fields in north-western New Mexico. For example, they have approximately the same depth as these Cretacecus fields, approximately the same pressures and in general the same terminal pressures, the situation is the same, so that through their life the allocation of gas for compressor fuel would be very much the same. So we base that on direct analogy and direct comparison.

Q That's your experience?

A Yes. A shrinkage loss of two or three percent is theoretical.

Q That could vary?

A Could vary, but in general these gases are so dry, there are relatively few of these liquid hydrocarbons that the actual shrinkage may be a fraction of that. The miscellaneous losses are at 1%.

Q When you say "miscellaneous", you mean line meters?

A Line testing, blowing to the air, test procedures.

A (Cont.) We find that as the price of gas goes up, your test value is realized and much of the testing is done into the line. In southern Texas, for example, it is now illegal to test wells by using back pressure tests open to the air, except once to determine the in-flow or back pressure slope. Thereafter a test of deliverability then is taken which is into the line. That means that the volume of gas is previously wasted by numerous back pressure tests is conserved and placed in the line. We are a strong believer in value and price as having an influence on the manner in which you handle your wells and operate them. We have seen big changes take place. It would be difficult to sever the value of gases for producing the gas well from the wastage, because there has certainly been a direct relationship between that in the fields with which we are more or less intimately acquainted.

Q Let's take Pincher Creek, take a field of that type and give us a little bit further of what you have said about the service losses?

A We anticipate very/few service losses actually there other than the removal of the contaminating constituents, the acid gases, and again we utilize 30% as the total involved wastage and loss due to processing as based upon actual experience in a similar reservoir of almost exactly the same character under actual operating conditions.

Q What have you in mind?

A The Barker Creek field, Pennsylvanian limestone field in New Mexico. Their losses are 27%, service

A (Cont.) losses including compressor fuel and drilling wells and the extraction of the acid gases, so we use 30%.

Q In other words, by analogy you are going to be safe and use 30%?

A Yes, there should be more shrinkage because of the higher volume of liquid hydrocarbons in the Pincher Creek gas than in our analyzed fields.

Q What is your terminal pressure at Pincher Creek?

A 700 pounds.

Q I think you explained in one case, Leduc, about your terminal of 381. How did you arrive at that? If I remember, 700 is somewhat lower than the Board's figure in January for Pincher Creek.

A No, I think it is the other way around, 400 was the Board's.

Q That's what I mean, I got lower and higher all mixed up. Your terminal is still a higher pressure than the Board's?

A Yes. We look at an 85% recovery as being a nice working figure at most gas reservoirs.

Q I don't want to bother you much longer, but have you anything further to say about the Jumping Pound field than you have said about the Pincher Creek?

A We didn't estimate Jumping Pound due to the limitation of time, but rather took the Board's figure.

Q I noticed that.

A In this particular instance we had a considerable amount of data to make a rough check. I think we would have come up with approximately the same answer.

Q As contained in the Board's report?

A Yes, as contained in the Board's estimates.

Q I think while we are at Pincher Creek, I might be interested with respect to the method at which you arrive at your porosities in Pincher? You will notice there you are about half again over the Board.

A Yes, the Gulf people made some very elaborate studies of the two wells that were drilled, that was No. 1 Pincher Creek and No. 1 Marr, in which they had a plug core analyses and some hole core analyses, and then their geologists examined the plugs and cuttings and visually eliminated certain portions of that porosity as being too low to produce gas.

Q Is that because of what you call the "plugs" are a little too small to suit your - - ?

A I don't know, I haven't been able to find out exactly how they do that. I have never been able to do that or know anyone who could see any permeability, particularly in a reservoir which will undoubtedly in its high pressure condition have surprisingly different differential across that reservoir log, so I was very dubious in my own mind.

Q Were you able to examine any of these?

A No, sir, I have seen many limestone cores down in Leduc of the Madison Gas Company and other limestone fields, but the elimination of porosity or permeability by visual examination to me is a fallacy.

Q You refer to that in your report?

A Yes.

Q How do you arrive at your figure?

A What we did was this: each of the porosities they determined have some merit, therefore, we took the weighted averages of those three for zones within two wells. Gave them each an equal weight, I think that's probably on the low side, actually some of the core analyses showed porosities up to 6 and 8%, for which geological examination reduced it to 1½ or 2, and that I couldn't follow in my own thinking.

Q How do you arrive at your weighted average? I don't quite follow you.

A We took the average porosity determined by the plug cores times the thickness represented in the No. 1 core and the No. 1 Pincher Creek. The same thickness for which the whole core porosity determinations had been made and the geological examination of porosities had been made. Projects of those, that's the thickness times the porosity for each total, divided by the total thickness would give the weighted average porosity for that thickness by the three methods, giving each, in effect, equal weight. We did that for both of the zones. We did subdivide the reservoir into the upper half and the lower half.

Q Have you discussed this with any of the Gulf people, Mr. Dougherty?

A No, I am well acquainted with one of the engineers who worked with me in the Pan Handle, Mr. Wilkins, I believe he has testified for the Board, although the engineering, I didn't have any opportunity to discuss the geological examination.

Q Did you consider at all what has been mentioned, I think before the Board, a suggested faulty structure

Q (Cont.) in this Pincher Creek field?

A Yes.

Q Can you give us your thoughts on that?

A Based on the Gulf seismic and structural map which we were provided with, we put in only as probable and possible the faulted area on the south end of the structure and the north extension of the structure as being in the possible category. The balance of the field we considered as proved, on the basis of the seismic and structural data available to date.

Q I take it then you did consider these faulty structures and put them into the proved?

A Possible and some probable, I believe.

Q Did you have any opportunity in your studies of finding anything more than we have heard about this question of faulted, whether or not the seismic picture is likely to show true?

A So far the seismic picture on the wells drilled to date has panned out very well.

Q On the Jumping Pound too?

A Yes, so far as I know, it will take more wells to be able to fully determine the validity of the seismic picture.

Q It always does that?

A Actually we are not going to know any of these answers, except as a post mortem when they won't do any of us any good, I am afraid.

Q Were you in here when I was examining Mr. Natelson?

A Yes.

Q Do you remember I asked some questions I thought were leading towards what banking concerns would do

Q (Cont.) in connection with lending money. You have had some considerable experience with the Federal Power Commission personally?

A Yes.

Q Can you give us an idea of how they might accept proved reserves?

A I am afraid I don't follow you there.

Q Well, let's take your own Exhibit 4 and 4 (a), having regard with your experience with the F.P.C., would they accept your exhibit which shows 8 trillion as proven reserves?

A I am afraid I don't know, I haven't been turned down there yet. Your problem here is somewhat different than any that the Federal Power Commission has ever tackled, it is a much bigger one.

Q They would be kind of tough?

A I think they would be as tough as you are. The thing that is different is this respect, that their work has always been restricted to dedicated acreage, developments of a specific field or group of fields rather than the entire province or an unknown number of fields of which none of it is dedicated to any pipe line.

Q Well then, Mr. Dougherty, let's take your Cessford area and take your exhibit 4 and 4(a)?

A Yes.

Q With regard to Cessford, you deal with it very carefully by wells, supposing you had that same material before the F.P.C. and you had to advise the F.P.C. about what weight they should give to it. Now, tell me what advice you would give to the F.P.C.?

xxxxxxxxxx

A I think we would recommend that we think there is considerable validity to the estimates, but --.

Q I'm not saying that there isn't.

A -- But more wells should be drilled to prove up those areas which are shown as probable and possible. That would hold for any of the one or two-well fields.

Q Well, that is a good frank answer.

A If we had dedicated acreage and we were dealing with a small number of fields, it is a little bit different problem -- it is a little bit different problem than anything we believe the Federal Power Commission has dealt with. I don't believe that they have dealt with anything on this scale or approaching it.

I particularly applied to the probable and possible some of the ideas I gained in reading the testimony previously given here. I remember Dr. Govier asked Mr. Leisemer why some "guesstimate" -- or estimate couldn't be made for Normandville, for example; there was some core data and some drill-stem testing. That made an impression on me that we should give whatever impression we could.

Q Well, at least you haven't taken a well here and one 80 miles away and drawn a big circle around them.

A No, I hope we haven't.

Q Then, one further question: have you had an opportunity to examine what we call the Foothills area in so far as your clients are concerned.

A Yes, the Brazeau area shown in Census Division 9.

A (Cont'd) I contacted the Home Oil Company and they gave me considerable information on testing and production of Home No. 1 Well and Shell-Home No. 1 Syndicate, and I almost put in a figure for some probable gas reserves in the Brazeau, but I never could find the original reservoir pressure. I had a reservoir pressure after the production of about 265 million cubic feet of gas over a period of about a month or two,but I wasn't sure what the reservoir pressure was so I didn't have any starting point.

There is a considerable liklihood of some commercial gas in the Brazeau structure, particularly if some porous sands can be located by the drill and the data accumulated to back up the estimates. Actually it was very similar to the Jumping Pound in depth and core.

Q How deep is that?

A About 9,600 feet, that Home-Brazeau Syndicate. After acidizing the well produced at a rate of 5 or 6 million feet a day for a month, producing something like a total of 250 million feet, and then it was shut off for four or five months and built up to a higher pressure than on the original tests. However, I don't know if that was the original pressure or not.

Q Having regard to Mr. Slipper's statement -- you probably read that?

A Yes, sir.

Q He was quite hot -- if you will forgive the expression on this whole area. Did you have any opportunity to study any seismic data on this?

A No, sir; I know there are a number of them in existence made recently; they cover partly the Foothills area and I understand they are trying to form some groups of --.

Q I don't suppose that Delhi thinks it is worth while to go into that area rather than two or three hundred others?

A Yes, I think that has been very much discussed. As I remember Mr. Shultz' testimony the first day, some suggestion was made that they move from the plains province into the Foothills and Peace River, in an attempt to prove up these reserves.

Q I take it you agree to a certain extent to what Mr. Slipper said?

A The province does need another Pincher Creek or two.

Q And from what you have learned, I take it, from Pincher Creek and Jumping Pound, you might find something on north?

A It is quite possible, in fact quite likely.

Q That is from what you have learned?

A That's right.

MR. MCDONALD EXAMINES THE WITNESS:

Q Mr. Dougherty, would you just refer to this item: "Trans-Canada Availability" in Exhibit 4(a)?

A Yes, sir.

Q As I read the Exhibit,you have set up here availability for 25 years. Is that what you have in mind?

MR. SMITH: Where is that?

MR. MCDONALD: The third tab in the first volume.

MR. SMITH: In 4?

MR. MCDONALD: Yes.

A Yes, that is true; our performance was -- runs about 25 years plus. Actually that is the average. Some averages which we have attempted would go 10, 11, 12, 15 some 20 and some 25. This in effect is the composite picture.

Q Your totals that you have used here are derived from the availability schedules that you have set out for individual fields throughout the whole of the expected gas supply field?

A Yes, we have -- this is a broad sketch of what the composite looks like.

Q And your net annual gas deliveries are related to the total of the net annual gas deliveries on your individual exhibits?

A That's correct.

Q And this "estimated required annual gross gas production", what does "required" apply to?

A That is the "required" to yield the net annual delivery shown in the second column, since there are compressor uses and service losses and shrinkage -- in other words, from the gross gas at the well-head to the net pipeline gas.

Q As I read this Exhibit and Exhibit 6 where you show the capacity of your line, roughly 380 million feet per day, you have a maximum here, and this would mean you would have your availability in the fifth year and then it isn't available from then on?

A On the assumptions made in making those performance curves this is the situation: we don't know what the drilling rate is going to be in these fields and we have taken what we feel to be a kind of

A (Cont'd)minimum practical drilling rate.

We could have, and perhaps should have put in a maximum, assuming we could drill the fields up just like that, but that would be very impractical and entirely theoretical.

Furthermore, the assumption that no other field would be discovered or added into this line obviously limits the discussion to the line capacity, because that would be something that would be subject to conditions throughout the province in the future. This represents what we feel to be minimum practical availability.

Q From the viewpoint you refer to in this Exhibit?

A Yes.

Q In other words, you don't --.

A In other words, we don't tie ourselves to the pipeline we tie ourselves to what we feel the fields could do, and in compiling this, we didn't know what the answer was going to be until we added that up. We could have juggled them around and come up with 365, but we didn't do that. More than likely we will have some new fields and production from capped gas wells and so on which will alter our concept, but this is all the fields proposed in the gas supply field.

MR. PORTER: That is, initial gas supply field?

A Yes.

Q MR. MCDONALD: In other words, for the first five years, what you have here would be adequate?

A Yes.

Q Now, this daily average net gas delivery for the

Q (Cont'd) fifth year, 388 million cubic feet -- have you done any calculation as to the maximum daily?

A No, not having the load factors I can't. However, looking at the individual performance curves and our estimated total delivery capacity column, column 9, in all cases we have very ample delivery capacity for the working pressures.

In most cases those working pressures are on the order of 5, 6 or 7 hundred pounds wellhead; therefore we have ample availability for the peak day months by reducing our working pressures and throwing the load on the compressor facilities.

Q Let me put it this way: if this is your average, then,the 80% load factor, your minimum peak day would be somewhere in the neighbourhood of 500?

A If our load factor were 50% --.But I understand that the plans of Trans-Canada include gas storage, and gas storage is going to be a consideration at the terminal end of the line in order to attempt to minimize the peaks and the low rate factor which has been experienced on your pipelines within the province and elsewhere, because some fields, particularly Pincher, would require rather a uniform and higher rate factor on their extraction plant, and that forms a very substantial part of the availability.

Q I take it generally you are convinced and your firm is convinced that the proposal made by your clients is feasible and based on this preliminary information you have now collected?

A That's correct.

Q So that you have actually set up in here, in your Exhibit as a gross supply for the line, something in the neighbourhood of 4.2 trillion cubic feet of Trans-Canada reserves?

A Yes.

Q And you have set up an availability for the first five years?

A No, this is an availability, for the assumptions we have made, for the fields for 25 years. In other words, we have taken out in column 4, on that availability page, 3.2 trillion out of 4.2 trillion as a cumulative.Faster drilling rates and higher productions can be involved at any time depending on the pipeline situation. In other words, it is quite possible to deplete the reserves in much shorter time.

Q You are convinced, then, that there is adequate gas -- supplies will be discovered by additional drilling to fill in the deficiency that occurs from the fifth to the twenty-fifth year in your availability schedule?

A That's correct.

Q That is a matter of development throughout the system covered by your gathering lines?

A That's correct.

Q Have you done a great deal in the way of general geology of the province in this investigation?

A That's correct.

Q Have you any doubt whatsoever in your mind that there is adequate gas for the purposes of your client

Q (Cont'd) and the purposes of the people of Alberta?

A I have no doubt whatsoever. The number of wells is extremely low, their density is extremely low, and I believe as Mr. Shultz said the number of gas and oil wells for the number drilled is very unusual. That is my view also.

Q And you feel that new gas, additional gas reserves will be discovered throughout the whole of the province?

A Yes, sir; there are many, many virgin acres remaining. The area between the Peace River country and the Morinville area and the entire Alberta syncline between the Foothills and the plains is a prospect. A number of wells indicate cretaceous sands at 5,000 feet carry showings -- are going to be productive of gas. There have been very few tests in that whole area as noted by the crosses on our map there.

You note the dearth of fields running through the centre of the province, northwest, southeast, between the Foothills and the plains, and there are very, very few dry holes or wells there of any sort in that area.

Q Now, in your Census Division No. 5 you take more than half a trillion cubic feet?

A That's right.

Q And then again in the Edmonton area, in Census Division No. 11 you have included practically another half a trillion cubic feet?

A That's correct.

Q And I take it you exclude the Leduc gas from this

Q (Cont'd) Edmonton area?

A Except for the lower cretaceous.

Q And you exclude Viking-Kinsella?

A That's right.

Q And you are still satisfied that in this area of Edmonton there is half a trillion cubic feet as of this date.

A That's right.

Q And you referred yesterday to the new well discovered in the Acheson area which gives promise of additional gas?

A Yes. There is one area in the Halfway Lake area north of Morinville, we included the northernmost well as being within our possible limits, as having a possible gas reserve in the lower cretaceous sand. About two weeks ago we were able to get a drill-stem test which showed 5 million in that sand. That is now proved but there wasn't time to change our maps.

Many of these wells, the records that we have been able to obtain are incomplete. A number of drillstem tests carried out at latter intervals are bringing to our attention sizable volumes of gas in wells ordinarily considered as duds or having no commercial gas showings. There have been several instances of that, but we have not been able to correct our maps. We expect to run on to more of those.

Q Does it sum up to this, Mr. Dougherty, with continued drilling in the Edmonton area you look forward to continued increase in reserves?

A Yes.

MR. SMITH: Which division is that?

A Eleven or 14 would cover that.

Q MR. MCDONALD: You look forward within a year or so to having a large increase in the possible, proved and probable in the area -- in those two areas?

A Yes, if the drilling go forward, and I am sure it will in the search for oil if not in the search for gas.

Q Drilling, of course, requires a market for the gas and a market for the oil.

MR. SMITH: Did Westcoast's Greenlight include those areas?

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Q No, they didn't, no, they didn't. You did mention yesterday or the first day you were on the stand with regard to the Peace River area, have you studied the general geology of the Peace River area?

A Yes, the data presently available is not complete or adequate. We looked at the actual Peace River field or "prospect", you might say, which lies on the division line between 16 and 15 and 17, at that junction, the northernmost red spot.

Q Yes?

A And found evidence. Many of the wells are still blowing open into the air geysering. Undoubtedly there is gas saturation there.

Q Yes?

A But there is no way of estimating it.

Q Would it be your judgment that an extensive drilling campaign in that area would establish adequate or --

A It should establish more gas, it should.

Q I notice in your submission here you have not included the detail for your estimates of the Whitelaw field, you have given gross figures but you do not give the details?

A I rather think we put in all the detail that we had.

Q Yes?

A That is in 16, there are the calculation sheets and the isopachous maps on the Triasic, that is pages 7, 8, 9 in Census Division 16.

Q You made your calculations in this field subsequent to January, did you not?

A Oh, yes.

Q So that the data that you have available here was

Q (Cont'd) obtained after the report of the Board, the interim report of the Board?

A Yes, actually our names contain a slight misnomer. The reserves are as of January 1st, 1951, where the production was deducted from producing fields, and we have taken discoveries, other data and so on, up to approximately around May, I would say about May 1st, about Saturday. There is one map and one tabulation we got out at noon Saturday so that we just got it as close to date as we could mechanically.

Q Now, Mr. Dougherty, you mentioned your experience with the Federal Power Commission; what have you to say as to the amount of gross reserves required by the Federal Power Commission, have they any specific measure, amount, of deliverability in terms of years; for instance, if you have a 25-year program do you have to have 25 years gross reserves or how much?

A There has been quite a little variation in the way they have treated those particular problems, my recollection is from some Federal Power Hearings that the demonstration of a 12 to 15-year supply and availability has been pretty well accepted, that is based on firm, dedicated reserves. We have a little different situation here and I don't know what there reaction would be. It has been rather that no one has ever demonstrated 25 years of availability or reserves to my knowledge. Most of the financing problems have been related to a 15 to 20-year amortization and our work with a number of the national houses has been based upon that concept since any estimate is in effect a static estimate. We estimate

A (cont'd) conditions, we assume, that the conditions under the estimate won't change, there is not going to be another foot of gas developed, not another field, but every line that has been constructed that we have had anything to do with, within 6 months or a year after the certificate has been back adding new facilities, adding new reserves, so that the consideration of these things as being fixed as at your initial certificate is an erroneous concept.

Q Thank you very much, Mr. Dougherty.

MR. PORTER EXAMINES THE WITNESS:

Q Mr. Dougherty, you had the opportunity while you were preparing this material to read all of the material that was submitted to the Board, the transcript of the evidence and the opinions of the others who have given estimates?

A That is correct.

Q And as you worked along you had that available to you and came to your conclusion I understand having weighed the evidence?

A Yes sir.

Q Now, Mr. McDonald I think perhaps left, certainly with me, the impression that you looked to the development within the initial area, that is Census Divisions 2, 3, 5, 7, 11 and 14 as being adequate for the long time life of this line, and perhaps its load growth; now, as I understand, this is the initial source that is contemplated in the initial gathering system, but it does not exclude others?

A That is correct.

Q And on that account you have been looking and as Mr. Schultz has said, that the Company early contemplates entering into Peace River?

A That is correct.

Q To broaden the field of reserves available?

A That is correct.

Q Now, coming for the moment to the assumption, if you like, that you have made and that Mr. Smith was questioning you about. You have taken some areas,as I see it, in which you have said that you regard them as "proven" although it has not been drilled densely or perhaps drilled at all; now you have told us how you arrived at that, make that assumption based on thickness and production behavior and so on. Your client has been doing some drilling all over this Province on the basis of those forecasts of yours, is that correct?

A In part, yes.

Q And the areas that you have shown as "proven" and "probable" are areas, as I understand it, that your opinion is the one on which they are undertaking that drilling in an effort to support your judgment?

A That is correct.

Q And they are paying you for the opinion and it is your reputation, and it is on that advice that that work is being done.

A That is correct.

Q I simply wanted Mr. Smith to --

MR. SMITH: I was afraid that he was going to get into figures.

Q MR. PORTER: No, they are spending their money on that

Q (Cont'd) opinion and that is as far as we can go. Speaking of the Foothills into which Mr. Smith took you for a little while this morning?

MR. SMITH: I was trying to help you.

Q MR. PORTER: I appreciate that, I was just going to say to Mr. Dougherty though that you know something of the cost that is involved up there?

A Yes sir.

Q It is a very high cost, and when you discover oil or gas the only way to get the money back would be to market?

MR. SMITH: Oh, I haven't any doubt after Mr. Natelson --

Q MR. PORTER: I think I will go along with you if you will show me how to get it back. But your costs are high in those areas?

A Yes, it wont be an easy matter by any manner of means, and, unfortunately, it is going to take a very considerable number of holes. However, I think seismic data well spent as has been proved at Jumping Pound and Pincher Creek, will lighten the burden although there is no predicting the extent or even the presence of porosity until the drill is in the limestone.

DR. GOVIER: Mr. Dougherty, I have two or three questions I would like to ask you following along the line of Mr. McDonald's question, I wonder if you could indicate to the Board where, if you were in the Board's position, you would consider your "proven" gas or your "proven" plus your "probable" gas in considering the protection of the Province of Alberta?

A Not knowing exactly the basis of the Board's distinc-

A (Cont'd) tions I do in my own mind conceive our "proved" and "probable" as being approximately the same.

Q Well, why did you distinguish between them?

A Because, as I have said, the control is a little less definite than the minimum well control and as such it is subject to a little more uncertaintly, but the major distinction is between "proved" and "probable" as a group and the "possible".

DR. GOVIER: In other words, in the use of any of these figures you would not distinguish between "proven" gas and what you call "probable" gas?

A That is correct, we have applied that reserve in all cases of the availability studies because we feel that on the average the "probable" areas are essentially proven and will be proved by the drill without near the uncertainty of the "possible" areas. In effect they would give a slight margin of what needs to be done with respect to additional drilling because isolating our reserve concepts, which is the minimum location of one or two wells, is going to be wrong inevitably, it will be too small, and we know we are looking at it at this time and at the same time we are trying to picture it for 25 years.

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Q Mr. Dougherty, are there any of the fields for which you have given either proved or probable or both figures, which in your opinion either because of the volume of gas available, or the pressure or the permeability which can be developed, or the geographic location might not actually be available to a pipe line? You will recognize that I am referring to what the Board referred to as beyond economic reach?

A That's correct.

Q You dian't use that category? Are there any fields that you think really belong in that category?

A As of this instant, I would say that perhaps such areas or fields as Sibbald and Oyen might not be immediately available for pipe line use, but that's only a matter of a little change in the economics and a little drilling before, in our minds, that trend will have sufficient gas developed to warrant a spur line. I don't believe I have expressed it to the Delhi people yet, although, I may say that we visualize a spur line in effect from the general Hanna-Cessford area to the Youngstown, Oyen-Cessford area of Lower Cretaceous gas, but those fields couldn't stand by themselves for any distance of pipe line construction. So that I could have been a little bit at sea in understanding completely the Board's use of the term "beyond economic use or reach" when we are looking at a long time picture. The fields we have visualized as being proposed gas supply fields are close to the line on the average, the proposed line, we so chose them, except Pincher

A (Cont.) Creek. Towards the Whitelaw-Peace River area the virgin territory is geologically so similar to the Morinville developed area and the Whitelaw area that the almost certainty is that there will be a number of wells developed within that area which will support a 250, 300 million pipe line construction with the reserves along the way and the reserves at the terminus. A number of small fields which we haven't estimated, well away from the line, should be considered as for the local uses, but a number of fields, for example, the Dunmore field, that is being beyond economic use or economic reach. It is on the fringe of the Medicine Hat area and we feel that the development of that area is going to be very wide and large, and that, in effect, it is within their sphere of influence so far as utilization is concerned. The Pendant d'Oreille field, I don't believe that can be considered as not being within economic reach when we are looking at the provincial problem for 20 or 25 years. Today, I would agree that today one couldn't go and prove them, that's why we didn't attempt to make that distinction until such time as we became involved in a detailed allocation of market within Census divisions. At that time some arbitrary distinction will have to be made.

Q I take it then that you would then suggest a reserve less this so and so, or a pressure less this so and so should not be considered an economic reserve?

A That's true.

Q You wouldn't go that far?

A No, because again we are dealing with that as an

A (Cont.) isolated entity. In our program it is going to be considered with a group of other fields.

MR. GOODALL EXAMINES THE WITNESS:

Q Mr. Dougherty, take for instance, that you consider a well that had produced a measurable amount of gas, has proven the presence of gas saturation, puts that area in your proved or probable category?

A That's right.

Q I was thinking, for instance, of a large area in Southern Alberta which produces gas in measurable quantities from the Milk River Sand, but never produces volumes sufficient to make it economical for more than farm use. You would have to have practically one well per installation. Would you consider that as within economic reach?

A Well, you notice we haven't signed any reserves to the Milk River area, except in the case of Brooks, I believe, where it is a town supply. We stayed away from it for that reason, that there wasn't sufficient data at the present time to know whether that saturation could be utilized for anything except local usages. But we feel that the Medicine Hat Sand, for example, it has wide extent, would indicate that that area can be developed on a large scale, and economically. Our clients have considered getting into that area, and it is my understanding that a farm has been taken not too far from the Medicine Hat area. If sufficient volume were developed, that could well tie into the Princess area supply fields, or as an alternate area in

A (Cont.) supplying the Provincial needs. If some trillions of feet, and I am speaking now of generalities, can be developed in the general area, there is no reason why pipe lines can not be constructed to take care of the somewhat more distant Provincial needs. This is the immediate Medicine Hat-Redcliff area. We are looking at a long time picture.

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Q MR. GOODALL: How about the very low permeability on the edges of the fields which you have included in your probable category and considered as a reserve? Do you think that area on the edge of the field where the permeability is real low will ultimately produce economically or as economically as the main part of the field? Have you made any deduction for reserve loss by slow migration, on account of slow migration or uneconomical places on the edge of the field where it woulan't be economical to drill for it but it is included in your reserve? Have you made any extra deduction for reserve loss - - I mean, reservoir loss on account of that?

A I would make this qualification, that I would hope we would not have included such areas in the probable area. As in the Viking-Kinsella area we don't expect the recovery on that possible area is going to be a very high percentage over a short period of time. We expect terminal pressures on the fringes to be higher than - - considerably - - than the average generally on the fields. In the more permeable portions of the field it would be lower. In fields where a definite gas water contact exists, or can be inferred, the permeabilities are not necessarily going to decrease. They may remain fairly average right up to the last of it, pretty well - - limited to the consideration of connate water, of course.

All those are a little beyond calculation except on an average basis. We hope our choice of factors and judgment are good for doing these things

A (Cont.) as shown here. I don't think there is any more concrete way to get at them at this stage.

DOCTOR GOVIER EXAMINES THE WITNESS:

Q I wonder if we could look at the performance chart for Pincher Creek again? It's back on page 5, in Census Division 2.

A On the back of page 4.

Q Yes. I would like first of all, Mr. Dougherty, to make sure that the Board understands not only the use of this tabulation but the way in which you prepared it. Am I right in assuming that the starting point was actually Column 7? That is, you said, "Oh, well, it would be reasonable to have ten wells." Is that the starting point?

A That's correct.

Q The next thing is Column 8 and Column 9. If you have ten wells and have the pressure shown, 3203, you would have a certain open flow on the basis of that well-head pressure with ten wells?

A That's correct.

Q Then Column 6 is derived by taking some reasonable percentage of 9? Is that your method?

A In this case we took 10 million a day for ten wells: 100 million of gross gas.

Q That was equivalent to 15 or 20% of Column 9?

A We would keep that in mind, possibly, and check back.

Q In this case it was 16.4, or something like that?

A 17, or something like that, that's right.

Q And having obtained Column 6, you calculated Column 5?

A That's correct.

Q And Columns 4, 3 and 2 are just simple arithmetic from Column 5?

A That's right.

Q Then, as far as Column 7 is concerned, the acreage is one of the important factors, because it will indicate at least the maximum number of wells that could be drilled?

A That's right.

Q But you have also taken into account what would be reasonable in the first year, assuming that the first year would be 1953?

A That's right.

Q Column 9 hinges on open flow test data?

A Or our interpretation of it.

Q Now, I believe you described the back pressure test data you were able to get from Gulf and you also expressed your general dissatisfaction that the data weren't better?

A That's right.

Q I believe that is the data presented earlier to the Board, is that so?

A I believe so.

Q Is my recollection right that when the Marr well after acidization, there was only one point determined?

A No, sir; we have four or five points.

Q I guess that's the other well.

A Yes, Pincher Creek. They utilized one point that is the high flow rate. There were a number of various tests taken over quite a period of time, and this test after acidization was at a maximum

A (Cont.) slow rate, in other words, to attempt to get the greatest draw-down on the working pressure.

Q Let us talk about the Marr well then. The M was unusually small?

A .68.

Q Have you ever experienced a curve of that type before?

A Yes.

Q Have you found in your experience that such curves can be reliable even at that low a slope?

A There are many curves accepted in the Pan Handle field from .5 up to 1. However, the company I was with, the Phillips Petroleum Company conducted a very extensive experimental program and they found that with very careful tests with respect to the and the condition of the fluid in the well stablization of points, and checking volumes and the mechanical features about the test, that the .85 slope was the average which occurred, and all of the curve tests were very close to that; and we felt that in all cases there was some, either lack of stablization or mechanical condition in the well bore which produced the slopes over one and those substantially below .85. The only influence that slope would have in this case would be for a common production and depletion our drop in open flow would be a little faster than on a .85 slope. To that extent it would be conservative from what we feel the actual reserve capacity to produce would be if we could test it directly.

Q It seems you have given more weight to your experience and knowledge of a similar field than

Q (Cont.) you have to the actual data obtained at this field?

A That's correct.

Q which is, in a sense, the reverse of what you did with porosity?

A Yes, porosity is a little bit different. In other words, the mechanics of the test themselves have as much to do with the answers - - I have made back pressure tests in which for the same well you got three or four points to make a nice straight line back pressure curve, and have the range of open flow indicating between 15 million a day and 115 million, depending on the conditions of the test. So we are not very sold on a measured test volume.

Q Would it have altered the figures in Column 9 very much if you had assumed a line of slope equals .85 through the line on the same well instead of that one - - would it have made much difference?

A No, it would have indicated that the open flow capacity or delivery capacity would decrease at a slower rate.

Q And it would start out at a lower figure?

A That would depend on the points. We usually attempt to take the rate having the highest differential in surface pressures.

Q As being the most reliable point?

A Provided we have some idea the stablization is not too far off, as giving indication of what the well will actually open up to do. In this case it would make a relatively small difference: a million feet or half a million feet. We are fairly well convinced

A (Cont.) this figure itself is not a true indication of the well's capacity to produce because at smaller pressure differentials the volumes recorded were larger. We would like very much to get additional information from Gulf; we would like very much to have the data because we know they have then undertaking tests. The Pincher Creek No. 1 and the Bonertz should be done by August, if not before. If that is done we should be in a better position to check on our estimates.

Q Another thing: on this chart you have made no reference to peak loads, and in answer to a question by Mr. McDonald you made mention of the fact that you expected the line would operate at a high load factor and you didn't actually consider peak days.

A I have no particular knowledge on which to base a peak day computation as it stands now. We were rather trying to get a working concept ourselves, irrespective of the line, as to what these fields would do on the assumptions we had made; then when the propositions are firmed up we can go back into availability data, and there will be additional well data.

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DR. GOVIER: One thing I noticed was, however, that your Pincher Creek performance chart that even though it was assumed on the average the withdrawal was, say, 18% of well-head open flow, that that could legally be opened to 25% on peak days; looking at it from that point of view, the load factors, the operating load factors, for the Pincher Creek Field seemed to come out about what one would expect for a field of that kind?

A That is correct.

DR. GOVIER: Had you made that approach or was that deliberate?

A We attempted to estimate what we thought would be the actual operating condition.

DR. GOVIER: And in this case you took into account the processing plant at the field and so on?

A That is correct, however our viewpoint on this business of the 25% of what may be fictitious open flows, I don't know what to think about that.

DR. GOVIER: I see, would you give us your views on that, Mr. Dougherty?

A We have had a great deal of difficulty with the Oil-Gas Division of the Railway Commission of Texas, I mean they have had difficulties and all the operators have had difficulties ever since they chose arbitrarily that 25% of open flow and their own rules have varied 100% in my opinion in the limitations in new fields. For many years the Panhandle fields, the sour gas wells, the allocation primarily gave them a daily allowable production far in excess of 25% of their open flow capacity and they

A (Cont'd) were able to produce gas without damage to the reservoir and without reservoir losses. In other fields the limitation was not based upon open flow capacity at all and more recently in the Panhandle field where a great deal of these back pressure tests have been done, and where the 25% problem has been an important one, they are now changing the method of calculating the open flows so that now a new standard of references has got to be set up which may have no relation to 25%. It has been our experience that the 25% did not seem to be related to anything except it being a convenient number, that many wells were able to produce without physical damage and without reservoir waste so far as any one could determine at rates considerably higher and for extended periods. It is a suggestion that there should be some individual field consideration rather than a blanket rule, individual field rules would be the most logical approach to reservoirs of quite diverse character. In some places a limitation of 25% of open flow capacity on a sand field with a thin gas column and an active gas-water interface might be disastrous, the water would cone rapidly at such rates. We often times expressed the opinion to the Railway Commission that it would be best based on field tests and field operating experience over a period of time rather than upon a flat percentage, particularly where under the allocation procedure whatever method is finally determined, that the assumed selling rate is balanced out over 6 months or a year due to the almost universal problem of peak deliveries and widely differing load

A (Cont'd) factors between pipe lines. Under the allocation formula in the Panhandle, for example, one line may have a high load factor and one may have a low load factor and yet they are allowed the same volume of gas and if he does not produce it it is drained from under him or it is tossed back in the common pool and can be added to the allocation of another producer. The problem of determining of quantities under those conditions goes back to the 25% or the standard allocation formula. I think it is going to take considerable experimentation at these new fields to find something consistent with operating conditions and consistent with the reservoir, but I hope it is not uniform. I think the administration problem of a non-uniform allocation factor becomes almost impossible also.

DR. GOVIER: Do you believe it should be uniform within a field?

A I would have liked in some controversies I have had to have been able to win that point, that it should not be uniform, because of differing spacing patterns and different reservoir thicknesses. Ideally a field should be unitized but most of them cannot be, but I think the edge wells should get a chance to produce their fair share of the production before time catches up with them and their gas is gone, but I don't know mechanically how that would be arrived at. I think the administration difficulties probably would defeat, would be just too complex.

DR. GOVIER : Perhaps if it necessary for administration reasons to have a uniform rule within a field, then

DR. GOVIER: (Cont'd) a good part of the argument for distinguishing between fields also disappears?

A Well, I am afraid I think that is a distinct possibility. I would say the saving grace would be that the types of field might not be too varied in that one could not come to a series of categories that might do some fair equity as between the difficulties of regulation and say the optimum rate of allocation or production in which we would hope the operators of pipe line companies would do the major share of the work except for the supervision of the Board in the ultimate decision, that should be a burden on the operator also.

DR. GOVIER: Mr. Dougherty, I have two other short questions. One is this, do you know whether it is the intent of Canadian Delhi to run more comprehensive back pressure or flow tests on their wells this summer?

A Yes sir.

DR. GOVIER: It is?

A There are some of the wells in which we know definitely the tests were inadequate due to the manner of testing in the winter time, most of them have been tested in the late Fall and Spring, and it is my understanding that it will be done in that fashion and I myself will request.it.

DR. GOVIER: My other question is this, you will recall the Chairman making reference to the deliverability schedules and the manner in which in your opinion the requirements of the Province could be met and at the same time provide gas which your client wishes

DR. GOVIER: (Cont'd) to export; do you recall that discussion yesterday?

A Yes sir.

DR. GOVIER: I was wondering, Mr. Dougherty, if you were in a position now to indicate to the Board just what form your schedule describing that would take, that is would it be very similar to those Pincher Creek sheets, you start out there with requirements and work forward?

A I would prefer to start with the field as we have done here in an attempt to make a reasonable estimate of what a field might do because that, generally speaking, that is going to be the limitation, and build up these individual sheets per field and then combine them to see what the total picture comes out at. The inherent difficulty there is that development rate and I see no way to get around it except to put in an additional computation based on hypothetical maximum development, whatever that is, as if one could instantaneously get it and say "Well, that is the capacity and it will function in that fashion.". Perhaps between the two, reading between the two, a reasonable answer could be obtained.

DR. GOVIER: Would it be your intention at that time to try to deal with the question of load factor and peak day requirements of the Province?

A To the extent we could it certainly should be part of the study, I am wondering about the time limitations now in view of the difficulties we have had to date. Between now and September I suspect that the program is, we would like to estimate more fields which we

A (Cont'd) haven't had an opportunity to, which would multiply the calculations. If we can obtain some averages for areas by weighting in fields and not destroy too much validity on the calculations for some of the scattered fields in census divisions it might facilitate the matter and it may serve all right as a crude index.

DR. GOVIER: You mean to draw up a single performance chart weighted according to pressure, reserves, etc.?

A Yes.

DR. GOVIER: For a group of fields?

A Yes.

DR. GOVIER: I think that would be perfectly acceptable to the Board, Mr. Dougherty?

A Well, I am very glad to hear that because I think on the census division basis or portions of that fairly decent answers would come out and it would not be mechanically too difficult to make.

DR. GOVIER: I assume you would only lump together fields that were generally similar?

A We might go as we did in the Princess areas and stay with reservoirs, say the Viking, Sunburst and Bow Island where the general porosity and conditions and so on would be analagous and in that fashion do it by sands and then have a composite of the chosen area . I expect that is going to be mechanically the only way some answer can be obtained and I am very much interested in your reaction that it would be acceptable to the Board.

DR. GOVIER: Do you see anything wrong with it yourself?

A No, not in view of all the other data, in view of

A (Cont'd) everything else it could not be much worse.

DR. GOVIER: Thank you very much.

A Thank you.

(THE WITNESS RETIRES.)

THE CHAIRMAN: Mr. Porter, we will adjourn this application to September the 4th, and some time we would like to meet with Counsel and deal with the various applications and priority and so on.

MR. PORTER: I think while we are here some mention should again be made, it is not for my benefit, it is for Mr. Dougherty's benefit, of the time --

THE CHAIRMAN: I was going to mention that to him, we would like to have the balance of the information early in August, at the very latest, to give our engineers a chance.

MR. DOUGHERTY: I appreciate that and we will do our very best and will attempt to plan it so that as the deadline approaches we will delineate the fields or areas.

(At this point, 1:20 P.M., the Hearings on this Application stood adjourned until September 4th, 1951.)

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