BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 17, 1957

TRANSCRIPT OF HEARING

Case No. 1275

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
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ALBUQUERQUE - SANTE FE
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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 17, 1957

AFTERNOON SESSION

IN THE MATTER OF:

Application of Shell Oil Company for an exception to Rule 309 of the Commission Rules and Regulations to permit the transportation of oil from the basic lease prior to measurement, and to produce more than eight wells into a central plant, and to commingle production from the participating area of the Carson Unit with production from other wells in the area. Applicant, in the above-styled cause, seeks an order authorizing off-lease measurement of oil produced from the Bisti-Lower Gallup Oil Pool and an undesignated Lower Gallup Oil Pool in Township 25 North, Range 11 West, and Township 25 North, Range 12 West, San Juan County, New Mexico, by means of an automatic custody transfer system; and to authorize the production of more than eight wells into a central testing and measuring plant and further, to authorize the commingling of non-participating area production with participating area production in the Carson Unit, with royalty payments to be calculated by means of periodic production rate tests.

Case 1275

BEFORE:

Honorable Edwin L. Mechem
Mr. A. L. Porter
Mr. Murray Morgan

TRANSCRIPT OF HEARING

MR. PORTER: The meeting will come to order. Before we continue with the next case on the docket, the Commission will announce that the normal unit allowable for August will remain at

thirty-eight barrels. We'll take up next, Case 1275.

MR. MANKIN: Application of Shell Oil Company for an exception to Rule 309 of the Commission Rules and Regulations to permit the transportation of oil from the basic lease prior to measurement, and to produce more than eight wells into a central plant, and to commingle production from the participating area of the Carson Unit with production from other wells in the area.

MR. SETH: If the Commission please, this is an application by Shell for approval of a system for producing, testing and metering oil and gas in the Carson Unit and adjoining lease. It contemplates the use of various items of automatic equipment meters to permit the use of a closed system. We believe that it is in the interest of conservation to adopt a system of this character, as the testimony will show.

The appearances for Shell are Mr. Leslie Kell and Oliver Seth. We have three witnesses, if the Commission please. They may be sworn now, if you like.

(Witnesses sworn.)

GEORGE HOLLIDAY

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. SETH:

Q Would you state your name please, and the position that you

hold?

A George Holliday, mechanical engineer with Shell Oil Company, Los Angeles, California.

Q You have not previously testified before this Commission, have you, Mr. Holliday? A I have not.

Q Will you state briefly your education and your experience in the mechanical engineering field?

A I have a Bachelor's Degree in mechanical engineering from the University of California at Berkeley, and ensuing nine years practical experience as mechanical engineer for Shell.

Q What sort of work have you been doing in recent months, or recent years?

A Primarily supervision, mechanical engineering, and operations for what was the Salt Lake Division in very recent times.

Q Are you familiar with the designing and operation of automatic custody equipment and related equipment?

A Yes.

Q Have you had experience in that?

A I have done a good portion of the design on this particular setup as well as helping supervise additional items.

MR. SETH: May he testify as an expert?

MR. PORTER: Yes, his qualifications are acceptable.

Q Will you state, Mr. Holliday, the general purpose of the application of Shell in this case?

A Briefly, we wish permission to install centralized field test facilities whereby we'll bring more than eight wells, eight units into a common metering or transfer point, and then transferring the oil from this common point to the pipeline by means of automatic custody transfer employing positive displacement meters. In addition, we request that we be allowed to account for crude from the non-participating area of the Carson Unit, and commingle that with non, or with participating area oil, and allocate the non-participating area oil on the basis of periodic production tests.

Q Does this system contemplate a measurement of oil by methods by measurement in tankage as contemplated by Rule 309?

A It does. We include no tankage by which we would do measurement by hand gauging or automatic tape gauging.

Q Would you indicate to the Commission, please, the area proposed to be covered by this system?

A The area included within this exception includes within Township 25 North, Range 11 West, that which is commonly known as the Bisti Field. The Carson Unit, which is outlined in green encompassing all of Sections 5 through 8, 17, through 20, 29, to 32; in Township 25 North, Range 12 West, all of Sections 1, all of 2, all 11 through 14, all of Sections 23 through 26, Sections 35 and 36. Those are this area in green. I trust there are no color-blind Commissioners.

The areas marked in yellow are not included within, or say are not a part of the unit, although they are within the unit boundaries.

Q That is uncommitted acreage?

A That is uncommitted acreage. I have a description if you are interested. In addition, we ask that the L. M. Phillips two leases, as a separate entity, be included, and this little piece over here described in Township 25 North, Range 12 West, as Section 4, lots 1, 2, South half of the Northeast Quarter, the Section 9, the North one-half, Section 10, the Southwest Quarter, and the East half, all of Section 15, Section 22, the North half in the Southeast Quarter Section 27 would be the West half. That is this area on the extreme west. The E. W. Mudge, one lease in Township 25 North and Range 11 West would be Section 26, the West half of Section 27, the South half of Section 34, all of it. This is the E. W. Mudge, one lease in the lower right-hand corner, in Township 25 North and Range 11 West. The E. W. Mudge two lease,, Section 4, the Southwest Quarter, Section 9, the West half, Section 16, all of it, that would be the E. W. Mudge 2. This portion here. In Township 25 North and Range 12 West, the E. W. Mudge four lease which includes all of Section 21, Section 28, 33, and 34. The E. W. Mudge four should be this section on the west side of the Carson Unit. In addition, in Township 25 North, Range 11 West, the J. R. Anderson lease, the Southeast Quarter of

Section 9, the Northwest Quarter of Section 15. This would be the Anderson lease on the east side of the Carson Unit. The Moore assignment in Township 25 North, Range 11 West, the Northwest Quarter of Section 22. Last, the Mims lease in Township 25 North, Range 12 West, Section 3, lots 1, 2, 3, 4, south half of the north half and the Southeast Quarter, which is the Mims lease. Right here, this one to the west of the Carson Unit. Those are the lands included within our petition.

Q Is Shell a working interest owner of the leases outside the unit area?

A We are. We have one hundred percent operation of those leases.

Q Would you carry us, next, through a very brief outline of the over-all facilities that are proposed? Perhaps refer to Exhibit C there.

A The same areas are shown on Exhibit C. We are proposing to angle the oil within each basic lease without crossing the lease boundaries, by means of centralized lease facilities consisting of a test station, a central plant, and automatic custody transfer.

Q You are referring, now, to the leases outside the unit area, is that correct.

A That is correct. This unit. The same general procedure is included within the Carson Unit whereby we will have individual

test stations located strategically throughout the field. The oil in general will go to the test station, then down the gathering system to the Central Plant for our automatic custody transfer.

Q I think that is sufficient. Would you go into some detail, now, on test stations, if you would, please?

A If I may use the Carson Unit as an example, I think that we find that all of the other surrounding leases are similar in their design, and we can simplify our discussions by simply using the Carson Unit as a model. As I mentioned a moment ago, we will have located strategically throughout the fields some test stations. The number of stations will vary as the number of wells vary.

Taking for example on Section 14, these various wells would be directed to a test station. That test station would consist as such of a skid shop fabricated unit where the well fluid would enter a manifold, that well which is in test would be directed through a test header into a test separator, from a test separator through a positive displacement meter, and a sampler, and be commingled with the oil to the central plant. The other oil which is being grouped from the remaining wells not in test would go through the group header into a group separator, from the group separator through a totalizing meter, and then to the central plant. The gas, in the case of the test separator, would be

separated, go through a positive displacement meter, be commingled from the gas from the group separator, and go to sales.

Q Does this permit the ready testing of individual wells? Would you discuss that briefly, and how it does? You are referring, now, for the record, to Exhibit D?

A Yes, this is correct, Exhibit D. A particular well would be placed in test; during that interval of test we would determine the rate of production by means of a positive displacement meter. Cut and gravity determination would be obtained from manually testing the sample obtained in conjunction with the meter. The sampling, or the testing procedure, will be done manually by switching a valve on the header. We can vary the duration or the sequence of testing so that we can get most any combination within the limits of the unit. By random sampling of this production we can then determine a reliable test for each well entering the unit.

Q While that individual test is being conducted, the balance of the production is routed through the group separator, is that right?

A That is correct.

Q And provides for a continuous operation, is that right?

A We have continuous operations, we know how much oil goes through the test as well as what goes through the group separator. We have continuous operation.

Q Is there any lease tankage or well tankage ahead of this unit shown on Exhibit D?

A There is no tankage, the flow line goes directly from the well to the header without any tankage, and is a closed system as a result.

Q Proceed with your next discussion.

A The meter, which is located downstream of the test separator, will be maintained in accuracy by a routine replacement, and recalibration program. We will determine this from history, we have sufficient history in other operations presently in use that we can make a conservative estimate as to the first when this unit begins to become operative.

From there, as history indicates, we will vary the routine replacement and calibration program. As I mentioned a moment ago, the oil which is going through the test circuit will be variable, normally the duration and sequence will amount to probably approximately once per month, and a twenty-four hour test taken each time. As the oil, or after the oil has been tested, it will go down to the central plant by way of a gathering system. This gathering system is indicated on Exhibit C by the dark line running through the center of the area.

As you will notice on Exhibit C, the area in the center will be classified as the participating area. Those areas surrounding that would fall into the non-participating area. You will notice that in some cases non-participating area wells will be, fluid from non-participating wells will be handled by facilities on the

participating area. As mentioned, originally, part of our request is to allow for the accounting of the oil from the non-participating area on the basis of periodic production tests. This will be accomplished by random sampling and random testing of those wells which do fall outside of the participating area. We believe this to be an accurate and correct method of accounting since random sampling tends to be statistically correct, and provide us with a considerably more advantageous method of handling our oil in accounting form.

Q Can you indicate the participating area, if the present participating area is a lesser area, that the area indicated in purple on C?

A This is correct. There has been a revision to this first proposed participating area, but substantially this is the correct area.

Q Your system contemplates a further expansion of the participating area?

A As the wells become, or as we grow, wells outside of the participating area, they will then be non-participating area wells. We must be in some position to test these wells so we can determine whether they are participating or non-participating wells before we can make the recommendation for the inclusion of the wells within the participating area.

In order to facilitate such testing, we propose to run those

wells which ultimately may be within the participating area, but presently are in the non-participating area, into the test facilities located nearest that particular well. Those wells, then, which are determined to be participating or should be recommended for participating area inclusion will be tested, and while approval is being obtained of the U.S.G.S. and the working interest partners and the Oil Conservation Commission, we can continue to produce these wells into the various test stations.

Q Are their facilities designed so that upon request of the Commission or other regulatory agency, that you can make special tests on requests, various types that may be required?

A We can make tests on special requests. We have ample facilities, normally the testing will consist of going through all of the wells within the system one day at a time and then immediately starting out on a second cycle.

This, will then provide us with a method of handling random sampling. Because on the first of every month the same well being tested, the wells will fall at different periods of the month. There is ample stuff there so we can detail and test at any time on the special order.

Q It is possible that there may be marginal wells which will not become participating wells in the Carson Unit. Has that tendency been taken care of? A Yes.

Q Are there wells that are presently marginal?

A There are wells which we believe to be presently marginal. I think, using as an example Carson Unit 2, will probably never be included, but this I'm not qualified to discuss all this detail, but presently is not included nor considered for inclusion.

Q But the equipment of the testing program is such that you can test separately and account for the non-participating area?

A We can account for the non-participating area marginal wells by the method previously mentioned, the accounting procedure, the actual calculation of this oil which is directed to each one of these test stations can be accomplished as indicated on our Exhibit J, which is a calculation sheet showing the method by which we propose obtaining the accurate amount of oil which has been directed to the test station.

Q Do you want to discuss the accounting sheet now or at a later period?

A I think I can go over it briefly right now. In effect, we will account, on periodic production tests, for each one of the wells within the test station. After obtaining the amount of oil that has been tested, we can correlate that with the amount of oil that has been directed to the test station, that which has gone from the test station to the central plant, and our proposal briefly is to allocate back to each test station, and then to each well, its proportion of the oil that has left the central plant through the automatic custody transfer equipment.

Q Do you have an opinion as to the accuracy of the measurement by the use of this system as compared to the manual gauging of tanks?

A We believe this to be as accurate as the best tank gauging methods. We can show this by our random sampling of the well and by the calibration of the test meter and the calibration of the central plant meter.

Q Have you advised the other working interest owners within the Carson Unit of the proposed system?

A We have sent a detailed letter outlining the facilities approximately as shown to each one of our working interest owners. We have received from them their agreement to the use of this system, and these letters of agreement are our Exhibits E, F, G and H from the Phillips Petroleum Company, from the Humble Oil Company, the El Paso Natural Gas, and the Skelly Oil Company.

Q Do you have anything further, Mr. Holliday, on this aspect of the matter?

A I believe that I have covered this sufficiently. If no further questions, I can pursue the oil from the test station on through to the central plant. The central plant is shown on Exhibit J. The oil from the various test stations will be directed through this line, if dehydration is necessary to make this oil merchantable, it will be directed through dehydration facilities back and into the system.

We're proposing some surge tankage so that in the event we have some minor difficulties, we will not have to shut down immediately; the oil therefore would be directed into one of the surge tanks, from that surge tank be directed to the second surge tank, and then from that point on into the system. This connection between the first surge tank and the second surge tank will probably constitute top filling, whereas the oil entering the first surge tank will probably be bottom filling. The oil, then from these tanks, will go through the automatic custody transfer equipment.

It will first go through a pump, if this pump is required, and further discussion will bring out why it may or may not be required. Through a cut monitor, through a strainer, through a gas eliminator, through the meters, and then to the pump and out to the pipeline. In the event that this cut monitor recognizes non-merchantable oil, a valve will be shut such that, this motor-operated valve, will be shut so that the oil then will be directed through this line by the opening of the second valve on the re-circulating line, the oil will be recirculated and directed to the dehydration facilities.

In the event that we continue to have non-merchantable oil, the oil will build up in these tanks until the oil either becomes merchantable or the tanks are full where the field will be shut down. The cleanliness of this oil should be rather vastly improved by the installation of a continuous bottom circulating pump

which will continue to pull tank bottoms off of these tanks so there is no chance for them to build up and affect the quality of the oil going through the pipeline.

Q Were these exhibits that you have testified from, were they prepared under your direction or your supervision, Mr. Holliday?

A All of the exhibits shown here, as well as the ones mentioned, were prepared under my supervision, and these large drawings are photostatic copies of the ones which appear in the supporting data which we forwarded to the Commission.

Q You have prepared reduced sizes of these exhibits to be submitted as the formal exhibits in the case?

A This is correct.

Q Are they exact copies of these?

A They are exact copies of these.

Q Do you have anything further you would like to discuss?

A I believe that covers the general outline of the equipment and its use.

MR. SETH: That is all of our direct questioning. We have further witnesses.

MR. PORTER: Does anyone have a question of Mr. Holliday? Mr. Mankin.

MR. MANKIN: Warren Mankin with the Oil Conservation Commission.

CROSS EXAMINATION

By MR. MANKIN:

Q Mr. Holliday, isn't one of the extremely important phases of this installation and closed system a factor in regard to maintaining gravity of the oil in this system? In other words, maintaining higher gravity than you would normally be able to maintain if it was tanked?

A Yes, this is true. I think our next witness will be able to cover that in rather complete detail, including some facts and figures on that.

Q I have one question. On your Exhibit D, I notice that there is an automatic oil sampler and oil meter shown in the test line. There is shown as an oil meter on the main flow line, coming through the group separator. Does this oil meter that passes from the group separator, after the group separator, does it also have some kind of a sampler as well?

A It was not designed to have a sampler. We would know the cut and the gravity of each individual well by its test when it went through the test system.

Q So far as merchantable oil, there would be no segregation of merchantable or unmerchantable from such a time as it passed from the test stations going into the larger collections installation, is that right?

A Yes, the central plant would be the first time of recognizing merchantable oil, because it would contain the only

dehydration facilities on the Carson Unit, or the other leases outside, and excluded from this; at the central plant there would also be dehydration facilities if required.

Q Referring to Exhibit C, I notice that there is a participating area of approximately two and a half sections shown on that exhibit. Is that the original first participating area?

A This was our first proposed revision to the participating area.

Q Does the five and a half sections which are shown in deep purple, is that a new proposed participating area?

A No, this represents what we believe to be the participating area at the time that the pipeline is ready to take oil. We think this may be true. This is more schematic than it is true.

Q So it is a possible future participating area based upon development at some future date? A Yes.

Q Prior to the time the pipeline goes into effect?

A We believe this to be true.

Q Is it also true that you expect to produce in some detail this production later this fall to fill the pipeline from these participating areas and other areas?

A We understand there is a good possibility that the pipeline will be in a position to take oil, probably the first of October or thereabouts. The oil from the Carson Unit probably would be included in the oil to fill that line.

Q My next and last question is that this future possible participating area approximately five and a half sections in the Carson Unit, would you envision that to be at a period around in October or when the pipeline is finished in March of 1958?

A I would be more inclined to say that this would probably represent the possible participating area at the time the pipeline is ready to take oil, which presently is estimated about January 1.

MR. MANKIN: Thank you.

RE-DIRECT EXAMINATION

By MR. SETH:

Q I don't know whether I understood your answer about the recognition of merchantable oil. Isn't it correct that at the regular test station the regular and periodic testing will determine whether the oil is merchantable by determining the basic sediment, water and cut and the other sampling practices?

A The oil coming from the well may not be merchantable. It may have a cut in excess of the pipeline minimum. Therefore we could tell what that amount of water and basic sediment was within the system, but the oil may not be merchantable, after passing through the sampler it still could be contaminated with water.

Q You could determine that in the test station?

A We could determine the extent of the BS&W content.

MR. SETH: That is all.

MR. PORTER: Anyone else? Mr. Nutter.

RE-CROSS EXAMINATION

By MR. NUTTER:

Q Mr. Holliday, I think you mentioned that previous experiments or comparative tests had indicated that the use of the positive displacement meters was as accurate as manually measuring oil in tanks? A Yes.

Q Would you tell how you could determine that those meters are accurate?

MR. SETH: I believe the next witness can tell you more about that.

A We have a man who has complete knowledge and more facts and figures than I am able to do right now.

Q Mr. Holliday, the wells that are outside the participating area, I think your ultimate participating area shaded in purple includes all the wells on the plat except possibly four or five or six. What will happen to those wells in a period of time? Is there any segregation clause in the unit agreement that would cause those wells to be kicked out of the unit itself if they are not within a participating area within a certain time?

A I believe there is a clause within the agreement for retraction of the unit. That retraction apparently, is apparently not too well defined as to what the smallest area would be, the smallest subdivision of area. However, it's conceivable that it

could be retracted to the participating area.

Q All of those wells, that I was just referring to that are outside the participating area as depicted on the exhibit, are on Shell acreage, is that correct?

A In this particular case that is true. It may not be true when the final participating area is approved.

Q Is that purple participating area on that exhibit all Shell acreage? A Oh, no.

Q Is there other working interest?

A No, there is Phillips' working interest as well as Skelly shown in the shaded portion in the purple.

Q In other words, the wells that are outside the participating area will have one owner, and the wells that are in the participating area will have another owner, being a combining of several companies?

A The participating area, of course, as the oil in there and the royalties are divided among a group of people on the outside, that oil is allocated to people other than the working interest owners within the participating area.

Q In other words, the two oils have separate ownership?

A I think this, in this case, could be said to be true.

Q Is the royalty ownership common under the entire acreage or is there a diversity of royalty ownership also?

A There is a diversity of ownership within the Carson Unit.

Q In other words, we will have the commingling of oil which has separate working interest ownership and separate royalty ownership?

A This is true at the time that the unit is retracted to the participating area size.

Q Well, actually prior to that time even, isn't it, Mr. Holliday? Shell owns this Well No. 2 down here, for instance?

A Yes, it falls --

Q (Interrupting) Whereas the other wells in the participating area are owned by the participating area which is a combining of several companies?

A That is true where the present participating area which apparently was just approved several days ago has working interest owners other than Shell.

Q And the method of assignment of royalties and credits in the accounting of this central plant to these individual wells that are outside the participating area will be on the basis of a periodic test, is that correct? A This is correct.

Q How often will those tests be taken, Mr. Holliday?

A We had planned a minimum of once a month for a twenty-four hour duration, and where we have sufficient capacity for testing, we would then start through the cycle again so that in some cases there could be more than one. It would be one and a fraction, probably.

Q Do you think there is any possibility of a well's producing characteristics changing enough within the period of one month or between tests that the allocation of the production from that well on the previous test would only be accurate?

A We have data on Carson Unit 2 over a period of several months which indicates that there is less than a one barrel deviation in the production characteristics of that well. This is gauged in a tank approximately every day or maybe every couple days.

Q Do you anticipate that these marginal wells outside the participating area will probably be flowing wells or pumping wells?

A We expect these wells to be pumping and pumped off during their productive life.

Q Do you think such an occasion as maybe the pump motor, the prime mover on the pumping rig going down and possibly being down for a day or so or maybe even overnight might result in that well not making the production it could be making, whereas the other wells might be flowing wells?

A There is always the possibility of the prime mover failing. We would anticipate that, the prime mover being electricity, but that isn't a proven fact. It conceivably could be the well could go down overnight, this is correct, but we would know in the afternoon of the day that it was still on; the next morning we would again know that it was either on or possibly off.

Q Mr. Holliday, one more question. What is the criterion

for determining whether a well ought to be in the participating area or not?

A I believe it is outlined within the agreement as a well which produces sufficient oil to pay out its drilling costs, operating costs and indicate a reasonable profit.

Q And how do you determine that in advance, by analysis of the sand thickness and other reservoir data when you drill the well, or is it based on the I.P. when you complete it?

A I am not qualified to discuss that point to any great extent. This is handled by someone else and I have never made a study of it. I don't think I am in a position to discuss that intelligently with you.

MR. NUTTER: Thank you, Mr. Holliday.

MR. PORTER: Are there other questions of Mr. Holliday?

By MR. PORTER:

Q Mr. Holliday, you may have given this information, but what is the maximum number of wells that you propose to produce through the test station, or have you set a maximum?

A We have not determined the participating area, and therefore, it is difficult to say what the extent is. I believe here we are picturing something like seventy-eight wells. This can vary one way or the other depending on the development program.

Q How many of these wells through one particular test station?

A Oh, how many through one particular test station. Right

now it is set up so that we can test at least once a month, which would mean that we could go through as many as thirty perhaps.

MR. PORTER: Mr. Mankin.

MR. MANKIN: I have one other question.

By MR. MANKIN:

Q You indicated that there was approximately fifteen wells at the present time in each of the test stations on the present development plan. Would it not be possible if certain areas of forty-acre development was decided upon that you might have as much as these thirty wells that you mentioned in each test station, which would still give you one test per month?

A That's correct. We would probably increase the number of test stations as needed so that we could have a little extra capacity.

MR. PORTER: Mr. Murray Morgan.

By MR. MORGAN:

Q What factor in this system could possibly inhibit the normal production of a well in the system?

A By inhibit, what do you mean?

Q In other words, preventing that well from operating to its best --

A There is built into this system which should keep a well from producing?

Q I mean erroneously so. In other words, by manually

controlled valve or jet, would the pressure that this well, there might be a weak well would have to buck in the system that is controlled by a jet, is it not, or a jet opening?

A You are thinking of a choke or something like that?

Q Sir? A A choke you mean?

Q Yes.

A There would conceivably be a choke installed on the well heads.

Q If it were erroneously closed, or otherwise, they were not sized for that well's production, it could inhibit that well's full production?

A If that choke size were changed without our knowledge, it could change the production. However, if that choke size is maintained, or our pumpers who would normally take care of that would adjust that, the subsequent tests would indicate that the well was producing more or less than its former test.

Q In case the characteristics of the fluid should change from a month's time, how would that be taken care of?

A By characteristics you think of an increase in BSW content?

Q Water.

A This field, as I understand it, is a solution drive field. We anticipate no erratic changes in production characteristics of the oil. There would be, if such a thing did occur, there would be a change in the production, we would have to pick that up on the

next production test.

Q It might be thirty days behind on that.

A Probably not thirty days. We would see if the total fluid changed and if it changed appreciably we would be able to pick that up by our group separator meter. It would show that it did not fall in line with the production for the day before because that reading will be taken each day.

Q You would know there is trouble in some well?

A As soon as we know there is difficulty we would make a short duration test to see which one is giving us difficulty.

MR. PORTER: Mr. Nutter.

By MR. NUTTER:

Q Along the same lines of thought that Mr. Morgan was entertaining there about what would happen to inhibit the well's production, what about pipeline failure, would that inhibit the production or do you have storage facilities in the area?

A You are thinking of the pipeline itself, the Four Corners Pipeline?

Q Yes, sir.

A If that pipeline was shut down, the only storage that we would have available would be the two surge tanks at the central plant.

Q What is the capacity of those plants?

A As yet they have not been determined definitely. They would

probably be less than one day, however.

MR. NUTTER: Thank you.

MR. PORTER: Does anyone else have a question of Mr. Holliday? The witness may be excused.

(Witness excused.)

W. A. HARTHORN

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. SETH:

Q Would you state your name, please?

A W. A. Harthorn, with Shell Oil Company, Los Angeles.

Q Would you state your educational qualifications, your experience?

A I have a Bachelor's Degree and a Master's Degree in chemistry from Occidental College in Los Angeles. I also attended San Jose State College. I have worked for Shell for eight years, during which time I have held various jobs in the drilling and production departments. My work has been concerned with drilling of wells, designing of oil handling collecting equipment, treating equipment and various other measurement and control activities.

Q You are familiar with the ordinary manual tank gauging methods as generally practiced? A Yes.

Q Are you also familiar and had some experience with

automatic custody equipment? A I have.

Q Have you had occasion to supervise or examine similar facilities in operation elsewhere? A I have.

MR. SETH: May he testify as an expert witness?

MR. PORTER: His line of testimony will be as to the operation of such an installation as this?

MR. SETH: He will testify as to the design, flow and operation of the automatic custody equipment.

MR. PORTER: Yes, sir, we accept his qualifications.

Q Mr. Holliday left the flow of the oil roughly at the surge tanks at the central plant. Would you discuss the equipment and the flow from that point to the point where its transferred to the pipeline company?

A I believe Mr. Holliday discussed the operation of the surge tanks and the recirculation equipment for non-merchantable oil, and so forth. The delivery point to the pipeline gathering company will be here; beyond this point, the equipment will belong to the pipeline company.

Q You're referring to Exhibit J? A Yes.

Q And what point on Exhibit J, for the record?

A The point between the motor-operated valve and the manual valve at the head of their pump.

The oil, after it has been gathered from the various test stations and passed through the surge tanks, will first pass

through a pump, a charging pump, to maintain a pressure on the meters, will then pass through a cut monitor which will continuously determine whether the BS&W content is more or less than one percent. It then passes past a mechanical sampler where an incremental sample is taken directly proportional to the amount of oil going through the system. It passes through a strainer which will take out any foreign objects which might damage the meter, then to a gas eliminator and to the positive displacement meters through a back pressure valve which will maintain a back pressure on the system, and motor operating control valve. This motor-operated valve is the main operating control for the system.

There are high and low level switches in the surge tanks which will operate the motor-operated valve. When the oil reaches an intermediate level in a tank it will open this valve and start the charging pump and start the pipeline pump and delivery will feed into the pipeline. This will continue until a low level switch is tripped which will shut this valve and turn off this pump and turn off this pump.

I might go into more detail on each of these points now. The pump, the charging pump, which Mr. Holliday mentioned, would be optional, is put there to maintain pressure on the meters. We have determined, from vapor pressure measurements in the Bisti Field, that about seven pounds pressure will be required to assure that no gas can escape from the oil as it's passing through the system.

Gas, of course, it is necessary, I should say, that gas does not pass through the meters. For that same reason that the gas eliminator is just ahead of the meters. The cut monitor is operated on a dielectric constant principle. This monitor is in wide use throughout the industry. The pipeline gathering company will probably set a limit of one percent BS&W on the oil, which is transferred to them for delivery. Therefore, this monitor will be set so that if the cut exceeds one percent BS&W, it will cause the motor-operated control valve to shut, the pipeline pump will shut down and another motor-operated valve will open and the oil will be recirculated through dehydration equipment until such time as the cut is reduced below one percent, at which time the controls will reach that and shipment will continue.

It is necessary, of course, in the sale of oil, to determine the quality and for that reason we have included an automatic sampler which will take a small sample from the stream for each one-half barrel that goes through the system. This sample will be taken into the laboratory and the gravity and BS&W will be determined from that. The strainer, of course, is just to eliminate rocks or rags or foreign objects from getting into and damaging the meters.

The gas eliminator, as I mentioned before, is to remove any gas or air that should happen to get into the system, so that it will not go through the meter. The gas eliminator is equipped so

that if an excessive amount of gas comes through, it will shut down the system. The meters will be positive displacement vein type meters. They will be equipped with a register and a ticket printer and electric pulses from the meter register will control the operation of the sampler.

Q Would you describe a little in detail on the ticket printer and the procedure on that in the meter?

A Yes. Each time the gauger, the pipeline gauger and the Shell gauger come to collect a ticket, they will print on the ticket the amount of oil which has been shipped during the previous shipping period. They will insert a new ticket and print an opening measurement, and during that --

Q (Interrupting) That is printed automatically, is it, by the insertion of the ticket?

A They have to crank it down. As soon as they print the opening measurement, the ticket is automatically locked into the meter so that it can't be removed without tearing it. It can be jerked out forcibly, but it would mutilate it, and then, of course, the measurement continues until they return and pick up the ticket and put in a new one.

The meter is also equipped with a temperature compensator which will correct all the measurements to a base of sixty degrees Fahrenheit. Again, the back pressure valve is set manually to maintain a back pressure on the meter. This would be about no

more than seven pounds.

The matter of the optional nature of this pump, as in some locations it may be possible to locate the surge tanks on a small hill and maintain a hydrostatic head on the meters equal to the vapor pressure of this oil. The entire system is electrically controlled and contains several safeguard features to assure that mismeasurement or non-measurement will not occur. The various safeguards are these: Of course, if the cut monitor shows a cut in excess of one percent it will shut in the system. If the sampler fails to take a sample for a period of about one minute, the time delay relay will time out and shut in the system. The gas eliminator will shut in the system if an excessive amount of gas should get into the eliminator, an amount the eliminator will not handle. The meters, if the counter should stop functioning, another time delay relay will shut in the motor valve. If the suction pressure on the pipeline company's pump becomes too low, that will also shut in the system.

An excessively high level in this tank will likewise shut, an excessively high level in this surge tank will shut in the inlet control valve so that spillage from these tanks will be prevented and there would be two such switches in the surge tank. Should any malfunction occur which shuts in the system, a red light will be lighted on a pole near the central plant, also a horn or a siren will sound off to alert any personnel in the area that something

has gone wrong. A white light will burn continuously, white or yellow, whichever is the most visible, and to assure that the system is in proper operation and that we have a power supply.

Of course, if we have a power failure, these valves are set so that they are normally closed and only the continuous application of power will maintain them open so that if a power failure does occur, the field will shut in.

Q Is there equipment of this general type in use at the present time?

A There is. We have two such systems in Los Angeles County, a third one being built at present. Thereare a number of other such installations throughout the company in the United States and Canada. I have photographs of one of the systems in California.

Q Are you referring to Exhibit O?

A Yes. Exhibit O shows the metering equipment, the cut monitor, the samplers contained in the box, the strainer, the gas eliminator; the meter on this particular system has a remote register, it shows in this housing in Exhibit P. The motor-operated control valve and manual valve pumps are located in the rear there. Exhibit P shows the registers.

We have the gross counting register which is not temperature compensated, and we have a temperature compensated register. This particular system also has a recorder for the cut and a recorder for temperature. The panel lights here are for malfunctions.

If any malfunction occurs in the system, it shuts it down. These panel lights determine the exact location.

The system is also wired so that it can be operated manually as well as automatically. This system is controlled on a time basis. It starts up every morning at eight o'clock and shifts until the tank is empty and shuts down.

Q Is there substantial amount of oil at the present time being transferred on the basis of measurement through the facilities of this character?

A Throughout the industry I would venture there are several million barrels being transferred in this manner. The two systems we have here are transferring approximately ten thousand barrels a day. They have been in operation about a year, and each of the two systems has successfully shipped about a million barrels each with no significant trouble.

Q Are you in a position to discuss the accuracy of this positive displacement meter as against manual tank gauges?

A Yes, sir. In our experience, I believe it is accurate to say that the positive displacement meters which we are now using are at least as good as the most carefully controlled manual gauges. There are cases where they are better. This would be a case where wax and corrosion incrustations causes errors in the tanks. This particular feature, or this particular potential error can be sizeable. We have noted in some locations wax incrustations on

tanks as high as one inch thickness. The meter will be unaffected by any wax incrustation. A factor is determined for the meter every, well, in this case, every two weeks, and in others every month, and that factor is applied to the measurements through that meter during the period of measurement.

This use of a mechanical device such as a meter, practically eliminates possibilities of human error in measurement, and human error, in my experience, has been one of the largest sources of error. There are many potential sources of error in a gauging system. I mentioned the wax incrustation problem, and we have determined in the case of the Bisti crude that we anticipate such a problem. We have measured in Exhibit Q and determined that wax begins to agglomerate at the temperature of about sixty-two degrees, and this will cause precipitation on tank surfaces. We have, in the limited production experience which we have to date, seen some rather substantial waxing incrustations on tanks and lines and so forth. So we anticipate that will be a problem.

Another source of error in manual measurement is in determining the temperature. This is, at times, a very difficult thing to do to determine accurately. We have experienced errors in measurement in manual gauges by having a change in the sediment deposition under the gauge hatch during the shopping period. The sediment will either build up under the gauge hatch or decrease during the shipping period.

The API allows, in the case of one thousand barrel tank, which is a common size, a measurement to the nearest quarter inch. This too, is another source of sizeable error in measurement. The common practice in calculating temperature correction for oil is to use the abridged ASTM Table 7 and if the gravity of the oil being measured is close to the change in groups which are considered in ASTM Table 7, it can be a rather sizeable error. The meters, the temperature compensators which we'll use in our meters, will be corrected in accordance to ASTM Table 6, which is the unabridged table.

Of course, while there are other small errors possible in tank manuals, tank strapping errors, bottom flexor of the tank tilt out of roundness and so forth. Of course, there are also potential errors in positive displacement meters. The tolerance in proving is two one hundredths of a percent on measuring the volume of the prover tank. The tolerance in reproducability of proving measurements on the meter calibration of meter is five hundredths of a percent. There are potential errors because of slippage past the meter they have, of course, to be taken into consideration in your meter factor.

The temperature compensator can be in error. Changes of viscosity of the crude will have a slight effect on the meter factor. We have made a series of measurements.

Q Most of these factors can be eliminated or reduced or controlled by a system of calibration in the testing meters?

A Yes, there will be a precise factor applied to all the measurements which are made by the meter. There will be records, of course, maintained on all these factors. They will be plotted on a graph so that we can determine trends in the change of the meter factor and determine when service is, or replacement, is necessary.

Q You described this system as a closed system, I believe. Would you briefly tell us the advantages of a closed system as against the ordinary tankage?

A Yes. In several fields which are being operated by Shell we have had occasion to convert a collecting system from an open type system where manual gauges are taken and open tanks are located in the field. We have converted these to closed system where we use meters and other types of automatic custody, or automatic measuring devices.

Q When you say closed, you mean it is a system where the oil is not exposed to the air?

A That's correct. So that it minimizes loss of vapors from the, particularly from the tanks. In one field it was determined that the gravity increase as a result of closing the system and not allowing exposure of the oil to air at any time during its course from the well to the pipeline, the resulting increases in gravity ranged from about two or three tenths degree API to as high as one and one quarter degrees API. The average for this particular field

was about one-half degree API. According to some research done by the University of Texas, it was determined that for oil of this similar grade, one could expect a volume increase as a result of conserving these vapors of about two percent for each one degree increase in gravity.

In the case of the Bisti Field and the approximate, well, to retract slightly, using the average increase of a half degree which was experienced in one field where similar crude is being produced,and comparing that to the potential of savings in the Bisti Field, the amount of increased production during the life of the field could be in the neighborhood of 65,000 barrels. This is a conservative figure.

Q You wouldn't expect much difference between a closed and open?

A That has been our experience elsewhere, and we can see no reason why it wouldn't be the same here.

Q About 65,000 barrels? A Yes.

Q How does that affect the royalty and tax situation?

A Of course the added production, you will pay royalties on it and severance taxes and so forth, and a further possible advantage in this gravity conservation is the price of the oil should the resulting half degree increase changing the oil into a higher price bracket. Then, of course, the higher price applies to the entire production of the property.

Q Does this also have bearing on the life of the field, the economic life of the field?

A Yes, we have determined that operating the properties in this manner, by centralizing facilities and minimizing the distance between measuring stations and so forth will result in operating savings which it is estimated will reduce the economic limit from about three point four barrels per day per well to about two point nine, and the resulting, well, the net result will be that we expect on the basis of about a ten percent decline, that the life of the field can be extended something like two years.

During this two-year period we will be able to produce about 160, about 180,000 additional barrels of oil upon which, of course, royalties and so forth will be paid.

Q Is this system considered to be safe as far as the personnel is concerned rather than an open system?

A Yes. The gaugers will not have to climb tanks to take measurements. They will not have to be exposed to tank vapors during a measurement. Potential loss of crude as a result of fire will be reduced because of the smaller amount of crude oil storage above ground.

Q Are there any other comments you would like to make about this system?

A I left out the reference to Exhibit R here. A few months ago we installed a meter of the identical type which we plan to

use on the L. M. Phillips No. 2 and ran some extensive measurements with that meter for the purpose of crystalizing the design of our system here. It was during these measurements that the back pressure requirements and so forth was determined. We operated the system with three operating situations where the pump was located downstream of the meter, and the oil which was measured had been weathered for some four days in the tank to assure there was no gas breaking out. We moved the pump upstream of the meter and used the same crude.

The third condition was we had the pump upstream of the meter and took the oil directly from the separator through a surge tank into the meter, and the resulting curves which came from these measurements, there were some 150 separate measurements made, are shown here. Each horizontal line represents a one-tenth of one percent; the deviations of the individual points from these curves were well within acceptable accuracy. I don't think I have anything further.

MR. SETH: That's all.

MR. PORTER: Any questions of Mr. Harthorn? Mr. Hankin.

CROSS EXAMINATION

By MR. HANKIN:

Q Mr. Harthorn, you indicated in Exhibit J that you had two surge tanks. Do these two surge tanks not also serve an extremely useful purpose for a certain amount of weathering of the oil?

A The purpose in the surge tanks is to stabilize, one of the purposes is to stabilize the oil so that vapors which are coming out will have a chance to escape before the oil is run through the metering system.

Q Which amounts to a certain amount of weathering process?

A Correct.

Q You also mentioned there would be a considerable saving due to keeping a closed system in this particular field, you mentioned a half a degree rise in gravity which will give, one degree would be two percent, and for half a degree it would be one percent increase in volume?

A Roughly, it would be actually one point ninety-five.

Q With that, possibly, when the pipeline is completed, there will be say fifteen million barrels per day taken out of the Bisti that would be a saving of 150 barrels a day, would it not?

A Yes.

MR. MANKIN: I believe that's all.

MR. PORTER: Anyone else have a question? Mr. Nutter.

By MR. NUTTER:

Q Mr. Harthorn, has Shell Oil Company, in determining the accuracy of positive displacement meters, run any tests in which the production was being measured by meters and also in adjoining tanks?

A Yes, we have.

Q What has been the result of those tests?

A The systems, the pictures of which you see up there, is calibrated by means of comparison with regular stock tanks. The deviation between the meters and the stock tank measurements is, I forget whether it is plus or minus one-tenth, or plus or minus two-tenths of a percent. I have the data here. All the measurements fall in plus or minus two-tenths of one percent. We get a characteristic cumulative curve in this determination, and I'm inclined to believe that the deviation which we see is not meter error, but tank measuring error.

Q In other words, that deviation that you were just talking about is the average deviation, or that is the total range of deviation?

A That is the total range.

Q So there were no notable exceptions to the accuracy of the meters? A No.

Q You stated if your upper surge tank there on Exhibit J got full, that the inlet valve, which I believe you indicated to be on the far left side of the exhibit -- A Right here, yes.

Q (Continuing) Would be shut? A Yes.

Q What would that do?

A When this valve shuts the pressure in this line will build up and cause, well, the first thing that would happen, the group separator and test separator, the oil level will rise and the valve in here will shut, which stops the gas from being shipped.

As soon as that happens, the pressure in this system builds up and automatic valves on these inlet lines will shut. Then, well, then the oil, of course, will be unable to come into this system from the well. It will be unable to communicate from well to well through the header because we have check valves here.

Further down the line at the well itself, in case the pumping well, if the pressure on this line builds up it will shut in the pumping area.

Q How about a flowing well, will it shut in at the header?

A It will shut in here.

Q The only pressure you have on any system, in the event that the surge tank got full or over full, would be the pressure on the flow line from the well to the testing plant?

A That's right.

Q I presume you are taking care of that with high pressure flow lines?

A Yes, that's right. If any particular well has an excessively high pressure, then there will have to be a similar shutin device at the well head so that there won't be any chance of the flow line breaking.

Q You mentioned, I think you said that you would have a two-week calibration program on the meters?

A To begin with it will be about two weeks.

Q The normal calibration program through most of your

operations, though, is four weeks?

A Yes, and you find very little deviation during that period.

Q They are usually in pretty good shape when you take them to the shop?

A We take them to the shop when the factor increases from the original factor by an amount of about twenty-five hundredths of one percent, and we take them out of service regardless of the fact that they are still operating properly.

Q What facilities are made over there in your Exhibit J for a situation where you have had some kind of separator failure and you're getting too much gas in your oil? You probably went through that, but I missed it.

A The gas eliminator will remove small amounts of gas. There is a low level float in the gas eliminator so that if the oil level in the eliminator drops too far, it will close the switch and shut in the system.

MR. NUTTER: I believe that's all, thank you.

MR. PORTER: Anyone else have a question? Mr. Utz.

By MR. UTZ:

Q Mr. Harthorn, in case the gas on the eliminator shuts in the system, does it have to be put back in operation manually?

A No, the gas eliminator will continue to dump the gas until the oil level eliminator opens the switch again, and it will reset and start shipping again. If there is gas slugging through there,

it will be opening and closing until the situation clears up.

Q The gas eliminator does do away with a certain amount of gas?

A Yes, it does.

Q How about failure of your sampler when it shuts in the system, does the system have to be put back in manually?

A It does.

Q Do you have any safety features on this system from the well head through the whole system to include the wastage of oil through line breakage at any point?

A No special features like that are incorporated here.

Q In other words, that would have to be picked up by your pumper or field man?

A That's correct, just as at present.

Q How often would you have personnel over this system to catch such an instant?

A They will be there daily. They would ride the entire lease or leases daily.

Q In the event of line breakage, then, you could have oil wastage for a twenty-four hour period?

A Sixteen, perhaps less.

Q I beg your pardon?

A Perhaps sixteen or overnight you might say. There will be people there every day and probably during the early life of the field, when the production rates are high and pressures are high,

they will probably be there on a continuous basis. Later in the life of the field it will probably be cut down to a daylight operation.

Q In the event of automatic shutin of this system, what would keep your surge tanks from running over?

A There are two switches, I have a cross section of the tank if you would like to look at it here. These are the float switches located in the tank. There is a low level float switch which operates the pump shutdown and the valve control on the main motor control valve, the median level float switch which starts the pump and opens the main control valve, the high level switch which will close the plant inlet valve, and a second switch, an emergency high level switch which will operate and take over in case this one fails.

Q That high level would shut your system in ahead of the tanks?

A Yes.

Q Are these tanks closed, undoubtedly they are not, they are vented a certain amount, aren't they?

A There will be some pressure maintained on them, probably four ounces on that order. If the vapor recovery system is installed, there will be no venting of any kind.

MR. UTZ: I believe that's all I have.

MR. PORTER: Any more questions of Mr. Harthorn? The witness may be excused. Will you call your next witness?

(Witness excused.)

ADIN H. HALL

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. SETH:

Q State your name and position, please.

A I am Adin Hall with Shell Pipeline, and currently Manager of the Plan Division and an engineer.

Q What education have you had and practical experience?

A Graduated from the University of Oklahoma in 1941 with a Bachelor of Science degree in mechanical engineering, and industry engineer from Houston. I was first employed by Shell Pipeline in 1941 and have been with them continuously ever since with the exception of four years out for military service. For nine years of the time with Shell Pipeline I have been a development engineer concerned with various and sundry facets of pipeline operation, oil measurements pumps, station design, and pretty much in charge of all the miscellaneous problems that arise on the pipeline. For the last couple of years I have been in the organization, or the division of our company, known as Operations Planning in which we are interested principally in the economics of the operation and also the application of the latest industry techniques, in an effort to minimize operating costs.

I'm also a member of the API Positive Displacement Metering Measurement Committee, and Vice Chairman of the Crude Oil PD Metering Subcommittee. A member of API Code 2500 Measuring and Testing of and Sampling of Crude Oil.

Q Your experience has been, in recent years, primarily with testing, sampling and gauging, is that correct?

A Yes.

MR. SETH: This witness will testify in regard to positive displacement meters and calibration.

MR. PORTER: We will accept his qualifications.

Q In your capacity with Shell Pipeline, will you relate to the Commission the connection between Shell Pipeline and the Four Corners Pipeline?

A Shell Pipeline is the contractor, constructor and operator of Four Corners Pipeline. They're designated as such by a formal contract, and in general under conditions of that contract, Shell Pipeline's policies and those of Four Corners are identical. Four Corners' policies, of course, are subject to approval by the Board of Directors, but we are designated as the, Shell Pipeline are designated as the constructor and operator of Four Corners Pipeline.

Q You have heard the testimony concerning this automatic custody transfer equipment. Is Four Corners prepared to accept the oil on the basis of this type of system and measuring?

A Yes, sir, we agree with the testimony which has been set

forth concerning automatic custody transfer equipment and the Exhibit N here is from the Four Corners Pipeline Engineer in which they agree to accept the custody of the crude oil on the basis of positive displacement meter measurement.

Q Has the type of production proposed been explained to the producers and are they in accordance with the accepted practices?

A Yes, sir, Shell Pipe Line, over the past fifteen years, has operated and conducted various tests with positive displacement meters. Since 1947, or beginning in 1947, we conducted extensive tests in metering sour crude oil service, and feel that even sour crude can be metered entirely satisfactorily.

Shell Pipe Line is currently -- I have the total number of barrels here, currently receives about 797,000 barrels per month on the basis of positive displacement meters. Under construction right now are facilities which will increase that by another million and a quarter barrels a month, and approximately 900,000 barrels of that will be on the basis of automatic custody transfer, using positive displacement meters.

Q On this proposed system, who will handle the calibration of the meters, and would you explain the procedures?

A Yes, sir. The pipe line will assume responsibility for the calibration of the meters. In assuming that responsibility, it is, of course, a joint witnessed calibration. The producer has the right to witness all of those calibrations, and if in his opinion

the calibration has changed, or some error is being made, can request a calibration at any particular period or any time he wants it. The calibration will be by the volumetric method in accordance with API standard 1101.

It might be well to say here that 1101 is being changed. It was formerly API ASME Code. So if you look right now for API standard 1101, that is still in draft form. So the current one is API ASME Code 1101. The calibration will be in accordance with the provision of that code, and the meters are calibrated by running a given quantity, or running oil through the meters into a calibration tank, the volume of which has been determined very accurately by utilizing Bureau of Standards' calibrated measures.

Therefore, the volume of the calibration tank is very accurately known, and by passing this quantity of fluid through the meter and into the tank, a comparison can be made between the meter reading and the accurately known volume contained in the calibration tank.

Exhibit S is a sketch of an approved calibration tank. Exhibit T is a Code form for positive displacement meter proving reports. This sets out the various factors, volumes, meter readings, all the data that is needed in order to accurately compare the volume contained in the tank with that registered by the meter.

Q In this connection, I assume you have a regular program of

calibration?

A We agree with what Mr. Harthorn said, out there initially the meters will be calibrated at least at two-week intervals, and of course, before they are initially set in operation there will be a thorough check made to insure that everything is in operating order.

It might be at some future date that we would want to extend that calibrating period to once each month, but never would we expect to go one month without a calibration. Also, if it is noted that there has been a great change, or a change which seems out of line experience-wise in calibration, several may be run at one time, and perhaps it will be watched every day for a few days to assure that something hasn't gone wrong. As experience builds up in the Bisti area we will know that each meter element could be expected to operate a given number of barrels. So, it would be intended that the meter elements would be replaced prior to expected failure.

Q Do you have any other comments about the over-all system, or any particular items?

A I would like to add that in this drawing of the automatic custody transfer facilities that we cooperated with Shell Oil Company in the design of that, so we would subscribe to this same general design and had a hand in cooperating or compromising with them on that particular design. I believe that's all.

We might add that we agree also in general with Mr. Harthorn's statement as to the accuracy of positive displacement meters as compared to manual gauging. One great advantage in positive displacement meters is the fact that should anyone question the accuracy of the measurement, it takes only a few minutes to run a calibration and settle that question right at the moment. Whereas, in restrapping tanks and checking out a tank, if there is some suspicion of mismeasurement, the time involved in restrapping and preparing tank tables, there's a great delay and it's not so easily arrived at. If an error is made there with a meter it can be calibrated on the spot, so to speak.

Q This calibration equipment, is that portable or trailer mounted?

A We would expect to begin with it would be mounted as a portable tank and moved to each location where meter calibration is to be made. As production increases and we can more accurately check the properties of the oil, the viscosity, gravity and so forth, it would be possible that we might go to a master meter method of calibration in which a meter is carefully calibrated at one location and placed in series with a meter being calibrated, and the readings of the two registers compared; that is something that I think can't be determined until some experience is gained with the oil which is being produced there.

If it is essentially the same, then that system is feasible.

If there is some variation in the crude oil, there is no alternative but to using the volumetric calibration.

Q Do you have any opinion or estimate on the time when the line may first receive oil from the Carson Unit area?

A My information is really hearsay. I can essentially agree with what has been stated before, it will be around October. I believe at this point—the projected line, of course, it is still under construction, so that can vary, but the usual method is as soon as the section of line is completed and hydrostaticly tested, that it is made available to producers to run oil into that line. Obviously no oil can be received at the other end until the line is completely full. So it goes into operation that much sooner if section by section is filled with oil as soon as it is completed.

MR. SETH: I believe that is all, unless you have something further.

MR. PORTER: Mr. Mankin.

CROSS EXAMINATION

By MR. MANKIN: You indicated there would possibly be some deliveries into Four Corners Pipe Line in October of this year for testing purposes. Would the positive displacement meter and other automatic custody equipment be used at that time in the initial phases of filling the line?

A I would say that would depend on whether or not the producing companies could have them installed. If they can, we would

have no objection to using them. However, I would say that would not delay production out there, in the event they were not placed, some arrangement would be made to measure in the meantime. I think that is a matter of which comes first.

Q I have one other question, on the Four Corners Pipe Line is there any proposal for emergency tankage or standby tankage other than possibly the first station in Utah?

A The initial station will have accumulator tankage of sufficient capacity to keep the line's operation stable at all times. At this point I believe the only extra tankage will be at relief stations at two points along the line.

Q That particular point would probably be somewhere in Utah?

A Right. That is the originating station. I would like to add another thing on the conservation angle. In comparison to tankage, it costs the pipe line money to run the tankage the same as it does the production company. So our general policy in Shell Pipe Line is that we would like to use tankage only where we have to. If we can stay out of tankage, then we've reduced our losses that much. So we would like to operate with a minimum of tankage with the idea that the line will be a continuous operation rather than a put and take operation.

Q Then on the pipe line, it would be a question of saving of steel tankage and also a gravity and aboveground storage problem?

A Right. We would operate with a minimum tankage.

MR. MANKIN: In order to operate with a minimum tankage. That is all.

MR. PORTER: Mr. Nutter.

MR. NUTTER: Two brief questions.

Q Does the Bisti oil have any particular corrosive qualities that would tend to interfere with the operation of this system?

A I can't answer that. Perhaps some of the other witnesses could give you some indication along that line. Let me say this, that in our tests, as far as corrosive oil is concerned, the only difference it makes is with meters that more maintenance is needed. We would not be concerned if it were particularly corrosive we would have to watch the maintenance more closely, which you have to do with the sour oil.

Q You would get just as good results?

A Yes, as far as accuracy is concerned, it costs more per barrel to meter, but it would not deter us from using the meter.

Q Later on you mentioned that you would use a carefully calibrated meter which would be put in series with the regularly installed meters? A Yes.

Q After one of the meters is calibrated, can it be used with reasonable care without interfering with the accuracy of the meter?

A Yes, sir. That, your term reasonable care there is the secret of the thing. Obviously you can't bang the meter on a portable prover around and expect reasonably good accuracy out of it. In this new code which will be published soon, that would be

an accepted method of calibration providing the oil properties are close enough to the meter with which the oil was calibrated. In other words, you wouldn't calibrate an oil of high gravity and low viscosity and expect to get a good calibration with API standards.

Q Calibrating your meters up in the San Juan, you will use Bisti oil to calibrate?

A If it is a close enough to the same quality, if it is different oil in gravity and viscosity we will have to use our portable prover at each location.

MR. PORTER: Any other questions of the witness? You may be excused, Mr. Hall.

(Witness excused.)

MR. SETH: We have no further testimony. There is one thing that has bothered me a little bit. There was a little discussion about Exhibit C in the participating area. I would like to say that is the mechanical engineering department's opinion as to the participating area and not what would be necessarily the case. That was projected necessarily to plan the location of the test station and the general setup. We don't need to be necessarily bound by it if the facts prove otherwise. We would like to urge the Commission's approval of the petition and its early consideration of the matter in view of the time that is required to install the equipment.

MR. PORTER: Does anyone else have any comment in this case?

MR. WADE: I have a statement. H. N. Wade with the Texas Company. Texas Company, although not directly affected by the application of Shell, is very interested in the outcome as it affects the Texas Company's future operation in the State of New Mexico. We feel that automatic custody transfer as proposed here by Shell is officially an accurate means of handling crude oil production. A favorable decision with the Commission in this case will act as an incentive to all the operators to employ the advanced means of field operation.

Therefore, the Texas Company respectfully urges the Oil Conservation Commission to approve the application of Shell covered by Case 1275.

MR. PORTER: Any other comments?

MR. BUELL: May it please the Commission, my name is Guy Buell, representing Pan American Petroleum Corporation. Although we are not directly involved from an operating standpoint in this application, we would like to, based on the evidence presented here today, recommend to the Commission that favorable consideration be given Shell's application.

MR. PORTER: Mr. Christie.

MR. CHRISTIE: R. S. Christie, Amerada Petroleum. We have some production in this general area, but are not particularly

concerned about this particular application. We feel that some day we are going to have automatic gauging in the State of New Mexico and that this is probably a good time to start. We have it in other states where we operate and it seems to be satisfactory. It still needs more information and testing, I think, and speaking of the operator in the area, we have no objection and urge the Commission to approve this application.

MR. PORTER: Anyone else have anything further in the case?

MR. SETH: If the Commission please, as we indicated during the course of the case, we have reduced the size of the exhibits and we would like to move the admission of Exhibit X which contains reduced copies of all the exhibits with supporting data.

MR. PORTER: Without objection, Exhibit X will be admitted to the record.

Anything further in the case? We will take the case under advisement and take a short recess.

(Recess.)

C E R T I F I C A T E

STATE OF NEW MEXICO)
: SS
COUNTY OF BERNALILLO)

I, Ada Dearnley, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 30th day of July, 1957.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1959.