BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

August 16, 1956

IN THE MATTER OF:

CASE NO. 1130

TRANSCRIPT OF PROCEEDINGS

DEARNLEY-MEIER AND ASSOCIATES
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ALBUQUERQUE, NEW MEXICO

INDEX

Case No. 1130

APPLICANT'S CASE

PROTESTANT'S CASE

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
MABRY HALL - STATE CAPITOL
SANTA FE, NEW MEXICO
AUGUST 16, 1956

R E G I S T E R

NAME	REPRESENTING	LOCATION
Leroy Wise	Velma Petroleum Corp.	Hobbs, N. M.
Ira A. Herbert	Southwest Potash Corp.	Carlsbad, N. M.
Charles W. Hicks	Farm Chemical Resources Development Corp.	Carlsbad, N. M.
W. Aubrey Smith	Southwest Potash Corp.	Carlsbad, N. M.
R. H. Lane	International Minerals & Chemical Corp.	Carlsbad, N. M.
E. C. Jourdan	Potash Co. of America	Carlsbad, N. M.
G. E. Atwood	Duval Sulphur & Potash Co.	Carlsbad, N. M.
G. C. Weaver	Duval Sulphur & Potash Co.	Carlsbad, N. M.
D. L. Libbey	U. S. Potash	Carlsbad, N. M.
R. J. Reeder	National Potash.	Carlsbad, N. M.
R. H. Blackman	Potash Co. of America	Carlsbad, N. M.
R. S. Fulton	U. S. Geological Survey	Carlsbad, N. M.
J. A. Forest	U. S. Geological Survey	Artesia, N. M.
C. M. McConnell	U. S. Geological Survey	Carlsbad, N. M.
John A. Anderson	U. S. Geological Survey	Roswell, N. M.
J. W. Gurley	N. M. O. C. C.	Santa Fe, N. M.

IN THE MATTER OF:

CASE 1130: Application of the New Mexico Oil Conservation Commission on its own motion at the request of Velma Petroleum Corporation for approval of four proposed wildcat oil well drilling sites located in the potash area of Eddy County, New Mexico, in compliance with Paragraph VII of Commission Order R-111-A. Applicant, in the above-styled cause, seeks an order approving four proposed wildcat oil well drilling sites to be located in the center of each 40 acre sub-division of the SE/4 of Section 28, Township 19 South, Range 30 East, Eddy County, New Mexico. The Potash Company of America entered an objection to the administrative approval of the subject application whereupon the matter was referred to the Secretary-Director of the Oil Conservation Commission for arbitration. No satisfactory settlement could be reached through arbitration and the matter is hereby set for hearing.

BEFORE:

A. S. (Johnny) Walker
A. L. Porter, Jr.

TRANSCRIPT OF PROCEEDINGS

MR. WALKER: The hearing will come to order. The first case on the Docket is Case 1130.

MR. GURLEY: Application of the New Mexico Oil Conservation Commission on its own motion at the request of Velma Petroleum Corporation for approval of four proposed wildcat oil well drilling sites located in the potash area of Eddy County, New Mexico, in compliance with Paragraph VII of Commission Order R-111-A.

MR. GIRAND: I would like for the record to show Neal Girand appearing on behalf of the Applicant.

MR. WALKER: How many witnesses do you have?

MR. GIRAND: I have one witness.

MR. BLACKMAN: I would like the record to show R. H. Blackman, Jr., Carlsbad, New Mexico, appearing on behalf of The Potash Company of America.

MR. WALKER: How many witnesses do you have?

MR. BLACKMAN: I am planning on four witnesses.

MR. WALKER: I would like to swear them all in at one time. Of course, it is understood that if either side has any further witnesses, we can swear them in at that time.

MR. GIRAND: If it please the Commission, at this time I believe that the Applicant and the Protestant, Potash Company of America, have agreed on certain stipulations which will shorten the hearing to some extent.

MR. BLACKMAN: That is right.

MR. GIRAND: And, if we may, we will just dictate the stipulations into the record.

MR. WALKER: That will be fine.

MR. GIRAND: It is stipulated that W. C. Neal is the owner of record of U. S. Oil and Gas Lease No. NM06770 covering the SE/4 of Section 28, Township 19 South, Range 30 East, NMPM; it is further stipulated that the property covered by Lease No. NM06770 is located within the area known as the oil-potash area in Lea and Eddy Counties, New Mexico; it is further stipulated that Velma Petroleum Corporation of Hobbs, New Mexico, is the operator designated by the owners of

the working interest on said lease in charge of the operations of the lease; it is further stipulated that Potash Company of America is the owner of the potassium lease from the United States. Do you want to give the number?

MR. BLACKMAN: Being Lease No. Las Cruces 046729 A, C and D, and 050063 B, E and F, originally dated the 13th of January, 1933.

MR. GIRAND: It is further stipulated that W. C. Neal, the lessee under U. S. Oil and Gas Lease Serial Number NM06770 signed the stipulation required by the Department of Interior required of all successful bidders for leases within the potash area, the pertinent parts of the stipulation being set forth on this exhibit.

(Whereupon PCA Exhibit No. 3 was marked for identification.)

MR. GIRAND: It is further stipulated that the Velma Petroleum Corporation, the operator under the Oil and Gas Lease NM06770, has complied with all of the procedural steps required under Orders of the Oil Conservation Commission of the State of New Mexico, being Order No. R-111-A, and the approval date of that Order is 13 October 1955; it is further stipulated that either party or any party to this proceeding will have the right to introduce such documentary evidence in support of the stipulated facts.

MR. BLACKMAN: Potash Company of America is agreeable to the stipulation as dictated by Mr. Girand.

MR. WALKER: The record will so show.

LEROY WISE

a witness, called on behalf of the Applicant, having been first duly sworn on oath, testified as follows:

D I R E C T E X A M I N A T I O N

BY MR. GIRAND:

Q State your name, please. A Leroy Wise.

Q Where do you live? A Hobbs, New Mexico.

Q Are you associated with the Velma Petroleum Corporation?

A Yes, sir.

Q In what capacity? A President.

Q Are you the operators designated by the owners of the working interests under U. S. Oil and Gas Lease NM06770?

A Yes, sir.

Q That covers the SE/4 of Section 28, Township 19 South, Range 30 East? A Right.

Q Mr. Wise, as operator, or designated operator, of that lease, have you filed application or notice of intention to drill with the USGS and with the Oil Conservation Commission?

A We have.

Q In that application did you set forth, or did your office set forth, the drilling program, submitting the program to be employed by the corporation in the drilling of any well?

A Yes, sir.

Q Now, Mr. Wise, you filed four applications, or four notices of intention to drill at one time? A That's right.

Q For the purpose of the record, will you tell the Commission

why you filed four notices at one time?

A Well, due to the fact that there was a question, after conference with Potash Company of America, knowing that they would have some objections or might have an objection, we didn't want to file for just one location until we knew that we would have all four locations approved, and instead of hearing on each separate location, we decided that it would be proper to have the hearing on all four locations at one time.

Q Under your letter acquiring your working interest of the U.S. Lease, as has been identified here, did you have any continuous drilling program in the event of discovery? A We did have.

Q Did you feel, or do you feel at this time that it is necessary that you be able to develope the entire property in the event of discovery?

A It would be, for economic reasons.

Q Mr. Wise, I hand you here what appears to be copies of your notices of intention to drill on the four proposed locations. Is that a correct copy of the notices filed by the Velma Petroleum Corporation, as operator? A It is.

Q Will you read into the record the casing program as set out and outlined therein?

A We propose to drill a hole eleven inches in diameter to 370 feet, cement with 150 sacks of cement, allow cement to set under pressure for twelve hours, and an additional 12 hours drying time, test casing by bailing dry; drilling a seven and seven/eighths hole

and setting five and a half casing, cementing with 400 sacks, cement allowed to set 48 hours, all cement to be circulated as set out in regulations; this well to test Yates Formation.

Q In your opinion, as an oil operator, is that program in full compliance with the requirements of Order R-111-A of the Oil Conservation Commission of New Mexico? A Yes, sir.

MR. GIRAND: Pass the witness.

MR. BLACKMAN: No questions.

MR. WALKER: Is there any further questions of the witness?

BY MR. MANKIN:

Q Mr. Wise, you indicated when you read the program there, you indicated five and a half, and you indicated the program which you intended to follow, but I didn't understand the depth where you intended --

A That is the Yates Formation at about seventeen hundred.

Q In other words, there is only an intermediate string and --

A Surface string.

Q -- surface string and production? A Yes, sir.

MR. WALKER: Any further questions?

BY MR. NUTTER:

Q Mr. Wise, in your indicated cement program you planned to cement the surface pipe with 150 sacks, and the other string with a given amount of cement. Would those cementing programs be subject to change if the calculated volume required of cement were such that more than 150 sacks would be required?

A That is stated in there that we would circulate the cement in accordance with the Commission Regulations.

Q In other words, you weren't bound by the 150 sacks?

A It states that in the application for the permit.

MR. NUTTER: That is all.

MR. GIRAND: For the purpose of the record, that is 175 sacks instead of 150.

A Of course, that is an arbitrary figure, and the other regulations as set out in that application for permit to drill states that we shall circulate the cement to the top in accordance with the Conservation's Rules and Regulations, so, consequently, those figures of sacks are completely arbitrary.

BY MR. GIRAND:

Q Just one further question. Mr. Wise, in filing these applications, and the manner in which they were prepared, there was no intent or attempt on the part of Velma Petroleum Corporation to disobey any of the Rules of the Oil Conservation Commission or the U. S. Geological Survey, was there? A No, sir.

MR. MANKIN: I didn't hear a program there as to salt solution.

A It will be drilled with cable tools.

MR. WALKER: Is there any further questions of this witness? If not, the witness may be excused.

(Witness excused.)

MR. WALKER: Is that your only witness?

MR. GIRAND: That is my only witness at this time.

(Whereupon, Applicant's Exhibit No. 1 was marked for Identification.)

MR. GIRAND: At this time we would like to offer a reproduced copy of a letter received by John A. Frost, District Engineer of the U.S.G.S., which shows and recites that in addition to complying with the stipulation that has been entered into between the lessee and the U.S.G.S., that the Velma Petroleum Corporation must do this: (Reading Applicant's Exhibit No. 1).

MR. WALKER: Is there any objections to this Exhibit?

MR. BLACKMAN: No objection.

MR. WALKER: It will be received.

(Whereupon Applicant's Exhibit No. 1 was received in Evidence.)

MR. GIRAND: That is the Applicant's case.

MR. WALKER: Call your first witness, Mr. Blackman.

MR. BLACKMAN: We call Mr. Jourdan. I wonder, Mr. Chairman, if I might have the indulgence of the Commission to conduct my examination sitting down.

MR. WALKER: Certainly.

E V E R E T T C. J O U R D A N

a witness, called on behalf of the Protestant, having been first duly sworn on oath, testified as follows:

D I R E C T E X A M I N A T I O N

BY MR. BLACKMAN:

Q Mr. Jourdan, please state your full name for the record.

A Everett C. Jourdan.

Q By whom are you employed? A Potash Company of America.

Q How long have you been employed by that company?

A Thirteen years.

Q What is your present capacity? A Mining Engineer.

Q What are your duties as Mining Engineer with Potash Company of America?

A In charge of the planning of future mining operations, the statistics and cost work, general engineering nature for the mine.

Q Mr. Jourdan, are you familiar with the general methods of mining potash, general locations of deposits of potash, quite generally in North America? A Yes, sir.

Q Will you describe for us, just generally, the locations where commercial deposits of potash are presently known to occur on the North American Continent?

A Of course, our biggest at the present time is Carlsbad, that is in production; there is a deposit of unknown quantity in Moab; there is a --

Q Moab where?

A Utah. There is a small production coming from California at the present time, and I think the largest future production will eventually come from Canada.

Q Do you know of the existence of any other deposits of potash in the North American Continent that is known to be of commercial location and quality at the present time? A No, sir, I don't.

Q Will you describe generally for us the method, or how this potash occurs in the Carlsbad area, how deep it is?

A Beg your pardon?

Q How deep is it?

A It varies anywhere from 550 to a little over 1,000 feet deep in our particular mine, and, of course, in that same general depth in the other mines in the area.

Q How are the deposits of potash laid down?

A They are laid in the salado or salt formation in flat deposits varying from four to twelve or fourteen feet in thickness.

Q Is Potash Company of America the lessee under a Federal lease of the SE/4 of Section 28, Township 19 South, Range 30 East of the New Mexico Principal Meridian? A Yes, sir.

Q Have you prepared, Mr. Jourdan, a plat of the SE/4 of Section 28, Township 19 South, Range 30 East, to show the present openings, the present workings of Potash Company of America's mine and also the projected future mining plans as it affects Section 28?

A Yes, sir, it is on the board right here behind me. This is --

Q Just one moment, please.

(whereupon, PCA Exhibit No. 1 was marked for Identification.)

Q Mr. Jourdan, referring to PCA Exhibit No. 1, would you designate for the Commission with a capital "A" the north boundary of the present workings, the present openings in the PCA mines.

A You mean the -- this is the north. You mean limits?

Q I mean the limits as shown on that sketch.

A That would be --

Q Indicate with a capital "A."

A That is this dash line around here where the present facies are, as of this month, at the present time.

Q Now, still referring to that plat, the heavy lined plan of the plat is indicated in heavy lines to show what?

A This shows the worked-out areas, this is done in light pencil. As we advance the line, we draw an advance in in ink, which, of course, makes the darker print, and this area back in here is already worked out at the present time, in behind this line of facies here.

Q Roughly speaking, then, the heavier marking on the plat is intended to show the present workings of the mine?

A Yes, sir.

Q Now, proceeding to the left side of the map, then, you have scaled in in lighter color similar plans. Will you explain what those represent?

A Yes, sir. That's where we are intending to extend these workings outward to the limits of the ore which are out in this area somewhere here.

Q When you say "out in this area somewhere here," you are referring to an area completely off the map?

A Yes. I would say yes, fourteen percent line.

Q Will you indicate on the map there by the letters "B," "C," "D" and "E" the corners, the four corners of the SE/4 of Section 28

if they are not already satisfactorily shown on that, and I do not believe they are, "B," "C," "D" and "E"?

A Yes, sir.

Q And upon the basis of the application filed by Velma Petroleum Corporation for orthodox locations in the four forty acre plots, would you indicate with the letters "F," "G," "H" and "I", the locations of those wells as shown on the plat? Indicate it right in the location, if you will, please, Mr. Jourdan.

A Yes, sir.

Q Now, you have shown those locations there surrounded by a circle; will you explain why those locations are surrounded by a circle?

A That is a pillar of 100 foot radius which we would be forced to leave around any well in that area if it was drilled. This one here, of course, would go right down in the middle of the workings, and we couldn't possibly leave a barrier there. I showed it there mainly to emphasize.

Q In respect to the locations which are labeled, the one labeled "I," your testimony is that that location would go right through the present workings of the mine, is that correct?

A Yes, sir.

Q When mining plans proceed, Mr. Jourdan, will this plan of mining be followed?

A Within reasonable limits, yes, sir. We might run into salt, a salt horse, and have to turn, but in general this would be the

plan that we would follow.

Q Now, Mr. Jourdan, you will also note on there a line which occurs in two segments which goes through, one segment of which goes through the SE/4 of Section 28. Will you please identify that line with the letters "J," "K" and "L." "J" at one end, "K" in the middle, and "L" at the other end. A Yes, sir.

Q Tell us what that represents.

A In planning our mine, we have attempted to lay out our working lines and working schedule. At the end of five years, this is probably the limits where the workings will be at that time.

Q The five-year line that you have drawn on there is the same line as is shown on the official maps presented, or rather filed with the Oil Conservation Commission in compliance with Order R-111-A, is that true, Mr. Jourdan? A Yes, sir.

Q Now, Mr. Jourdan, will you describe generally the method of mining which I believe is called the room-pillar method of mining which is illustrated by that sketch?

A Our haulage ways for either belt conveyer or track would be in this entry, we would proceed down here leaving these pillars on each side. We would go out and take approximately sixty-five per cent of it in the first mining.

Q What is the designation of that entry?

A NW323. We would proceed out in these panel areas, and remove approximately sixty-five percent of the ore, then we would intend to come back and take out a remaining twenty-five percent by removing

these pillars.

Q When you say a "remaining twenty-five percent," do you mean twenty-five percent of what is left, or twenty-five percent of the original hundred percent?

A Twenty-five percent of the original one hundred percent.

Q So the total amount which would be removed under the plan which you have outlined would be sixty-five percent on the first mining and twenty-five percent, or a total of ninety percent of the potash present in that area, is that right?

A Yes, sir. Yes, sir.

Q Have there been any pillar-pulling operations performed at the Potash Company of America?

A No, sir, there haven't been at the present time.

Q I might clarify that question a little bit. Is the operation of the second mining which you have stated that twenty-five percent of the ore would be removed commonly referred to as pillar pulling?

A Yes, sir.

Q How much of the potash is left in a pillar-pulling operation and why is it left?

A Approximately ten percent of the overall total would be left mainly as protective pillars and to protect your haulage way when you moved out.

Q That is a variable figure, is it not, depending on circumstances?

A Yes, sir. That is theoretical. I think some of the other

companies could probably answer that question better than I could. They have had more experience.

Q Mr. Jourdan, have you ever conducted or participated in any plugging operations on wells, oil and gas test wells in this particular area, and, by particular area, I mean within the vicinity of five or ten miles from Potash Company of America's minesite in Eddy County, New Mexico?

A Yes, sir. I supervised the plugging of Mr. Neal Wills' wells in the Barber Pool; we plugged them under our supervision so we were sure they were plugged as close as we could get to what we thought was reasonable for protection.

Q Do you recall the plugging of the State 1-B in the Barber Pool, Mr. Jourdan? A Yes, sir.

Q Would you describe that for the record, please?

A The well was abandoned by Mr. Wills and he notified us that we could take over the plugging of these wells, and this one particular well, at the time we went out there to examine it, it had a gate valve which was shut on the top of the, I believe, seven inch casing. I opened the valve and it blew gas for about forty-five minutes and never did stop up until that time, so I shut the valve and went back to the laboratory and had a chemist come out and get some samples out of the well, and --

Q What did you do after that?

A Then we put a gauge on the well and left it, and --

Q Did you allow the well to blow for a while before putting the

gauge on?

A Yes, sir. We let it blow for two days.

Q Then after you shut it in with the gauge, what did you discover?

A Four pounds per square inch reading on the gauge. We opened it and left it for about a week, then.

Q What was the analysis of the gas?

A Sixty percent methane, and forty percent nitrogen and with a trace of hydrogensulfide.

Q Now, Mr. Jourdan, in what formation was that well drilled to?

A The Yates formation.

Q Are you familiar with whether or not there is any gas produced in any other wells in this vicinity from the Yates formation?

A I know the best evidence is to drive down through the pool and you can have a very --

Q What pool?

A Barber Pool, or the Getty Pool, any of the pools out in that general area have a very definite odor of hydrogensulfide.

Q But there is some gas being produced?

A I would say yes.

Q That, however, is not in the nature of commercial gas as generally known, is that true?

A No, sir. I do know, in, I believe it's the Hale, I'm not sure of the pool designation, but in that general area, there is two gas wells that have been plugged by Mr. Wills, that I think at

one time were commercial.

MR. BLACKMAN: I believe that is all for now, Mr. Jourdan.

MR. WALKER: Just a moment, Mr. Jourdan, you haven't been excused, yet. Is there any further questions of this witness?

MR. GIRAND: Yes, sir.

C R O S S E X A M I N A T I O N

BY MR. GIRAND:

Q Mr. Jourdan, can you show, from Exhibit No. 1, the approximate outer boundaries of your mining on or about April the 19th, 1955?

A Same location.

Q Same location? A Yes, sir.

Q There has been no development within the SE/4 of Section 28 since April 19th? A No, sir.

Q Now, for the purpose of the record, the small squares shown on the exhibits, what is the dimension of those squares?

A This, the small pillar?

Q Yes, sir.

A They are sixty-five feet, under this plan, from center to center of the rooms, and the rooms are thirty feet wide; that would be thirty feet off sixty-five, or thirty-five feet square.

Q Thirty-five feet square? A Yes, sir.

Q Now, as you have shown there by your circles marked "F," "G," "H" and "I," what is the diameter of the circle?

A One hundred feet in radius.

Q Now, in relation to the proposed mining area, or the mined

area upon your obtaining the ninety percent depletion, in relation to that ninety percent of production from each forty acre subdivision, what is the ratio of the area that would be required to be left as a pillar around a well, as to the total production on your ninety percent basis?

A Will you restate your question, sir?

Q What I am driving at, Mr. Jourdan, what is your potential production from each forty-acre subdivision?

A That would vary withthe height of the ore in the area.

Q Well, have you made any estimate?

A In this particular area, I would say the ore is approximately four and a half feet high. I would have to figure it out. I don't have them in my head, I would have --

Q Now, that would be true of the area that you would leave for a pillar; around an oil well bore hole, is that right? In other words, it would be static throughout the entire forty acres?

A You mean we would leave this one hundred foot barrier around every well?

Q Yes, sir. A Yes, sir.

Q All right. Now, have you calculated the amount of ore remaining that would be recoverable to you as to the amount of ore that you have to leave during the life of an oil and gas well?

A I don't think we would recover any more than sixty-five percent if we had these wells in this area.

Q You feel that sixty-five percent would be your maximum recovery?

A I would be very hesitant to pull pillars where there is an oil well.

Q But you would be able to go along and produce your sixty-five percent of the ore?

A Minus the barriers.

Q I beg your pardon?

A Minus the barriers that we would leave around here, the one hundred foot pillars.

Q Well, percentage wise, have you arrived at any figure?

A It would probably be, I would say, two or three percent. I haven't figured it. It's something like that.

Q In other words, then, during the life of oil and gas production within the area there, you would be able to realize at least sixty-two or three percent of your ore body during the life of the production of oil and gas?

A I would say reasonably, yes, sir.

Q Now, on your exhibit there, do you have any area where you have gone back and made your additional recovery of twenty-five percent of one hundred percent?

A No, sir. We have not pulled pillars anywhere in our mine at the present time.

Q And, at the present time, how long have you been in operation there, Mr. Jourdan?

A Since 1935.

Q And, since that time, you have been operating your mine on

a recovery of approximately sixty-five percent of your ore in place?

A Yes, sir.

Q Mr. Jourdan, is there any particular reason why the outer boundaries to the north and east -- I beg your pardon, west, of your properties have not been extended since April 19th?

A Yes, sir. When we converted over to continuous mining, we took our conventional equipment out of here and plan to come back in with conveyer belts. What we mean by conventional equipment is joy loaders and shuttle cars.

Q Now, you have been in that process since April 19th, is that correct? A Since before then.

Q Since before then. Has that been over your entire mining operations, or do you have facies on the other side of your mine, for instance, east, north, south sides?

A Yes, sir, and we work only a small area of our mine at one time.

Q On what basis do you arrive at your protracted line, or five-year extended recovery?

A By our production, estimated production figures and tons or number of cubic feet and the tons in each area, and how much we will need to extract and where we will move our equipment, the power, the haulageway tract installation is taken into consideration.

Q Then would you say your protracted line there is correct within a radius of reasonable error? A It is an estimation.

Q Now, I notice on the map you have an area here undesignated,

that seems to be approximately 150 feet wide and extending over quite an area there. Will you mark that, oh, either 1 or 2, anything to identify it?

A I will make it a 2 there.

Q Now, what does that area represent?

A That is a barrier pillar to protect the different panels. This is what we refer to as a panel there; we will have another one here, and we have these barriers in here to keep the weight from coming down too much in one section.

Q I see. Now, would a bore hole of some eleven or twelve inches, we will say, in diameter down to a depth of approximately 375 feet, from there on about seven and a half inches in diameter affect the strength of that barrier?

A It would to a very small extent. I couldn't answer that question exactly.

Q It would be within a tolerance of why you had the barrier, say, 150 feet rather than 150 feet and two inches?

A Yes, sir.

Q Then there would be areas within your proposed mining where a well bore could be located where the operators of both the oil and gas lease and you, in the operation of the potash mines, could both live under and operate under?

A If we wanted to settle on an overall sixty-five extraction, yes.

Q The location of a well bore in your barrier area would deprive

you of going back to your twenty-five percent?

A I would say it would. I would be hesitant to pull pillars with an oil well in the area.

Q Of course, in your mining operations to date, you have had no occasion to go back for that twenty-five percent recovery --

A I think we --

Q -- around any particular well bore or old well bore in your mine -- I mean in your potash area? A No, sir, we haven't.

Q Now, in that area, there are numerous core holes, are there not, drilled to determine the amount of --

A Yes, sir.

Q -- the potash, or if potash exists? Now, those core holes are not of quite the same diameter of an oil well, but then they are what size, if you know?

A Oh, I would say the actual open hole would probably be about four inches in diameter. That's just a rough estimate.

Q Now, in relation to the core holes, what size pillow do you leave around core holes?

A One hundred foot radius.

Q One hundred foot radius. Now, the existence of those core holes in your mine, do they deprive you of your going back into your mine for your second mining operation to recover your additional twenty-five percent?

A No, for the reason that the core holes usually end about six feet below the potash bed, they do not go down into the oil or gas

formations.

Q The penetration of the oil and gas formations, does that weaken the hole to any extent?

A I would not say that they would, no, sir.

Q I mean after all is said and done, the only thing that can happen would be from your mined area upward, and not downward on a recovery basis, isn't that right?

A I'm not sure of that, sir. I think there would be a great deal of concentrated weight on the bottom in certain areas.

Q But it would be weight from above, where you had extracted your ore?

A It would be a squeeze, I would assume, down on the bottom.

Q And any hole that extended down below the ore body would be the same, whether it were a core hole or oil well?

A If it went below into the, through the salt, I would say it would be affected in the same way.

Q As I understand your testimony, the majority of the core holes go through the ore?

A That's right. We have a marker bed below the ore. That's the end of the hole.

Q That particular hole does not necessarily weaken your overhang, or your over burden, is that correct, in your opinion?

A I don't believe it does, no, sir.

Q But then one that penetrated deeper would, is that your testimony?

A No, sir, I'm not saying it would make it weaker; I'm saying it would be dangerous for us to pull pillars because of the fact of any movement in the bottom. There is a possibility of gas or salt water coming from below.

Q You have been in that area for some twenty-five or twenty-six years?

A The mine has been, yes, sir.

Q I didn't mean you, personally, I meant the company. You have been there thirteen? A Yes, sir.

Q During that time you have had no occasion to go in and effect this secondary recovery of twenty-five percent in any part of your workings, is that correct?

A We have managed to stall it off. We are going to have to in the near future.

Q When would you anticipate that, Mr. Jourdan?

A That would be a pretty difficult question to answer. It depends on our production schedules.

Q Can you proximate it in a tolerance, say, of two or three years?

A I would say within three years, if not sooner.

Q You, yet, have designed there only a portion of the area that you will be able to penetrate within the next five years on your primary recovery?

A We are going to be pulling, probably, pulling pillars in some area of the mine. It takes a lot of experimenting. I think the

International Minerals or U. S. Potash can probably tell you how much trouble they went through in pulling pillars. Of course, we are rather secretive with our information. We are going to have to learn the hard way, to a great extent.

Q Maybe we will learn something about it today, I don't know.

MR. BLACKMAN: I might state that I am going to put on, later, a witness from both United States Potash and International Minerals, both of whom are familiar with their pillar-pulling operations, and may be able to give you the information you wish.

Q I just want to ask one other question. Should practice in the field, or methods be developed, that would satisfy you engineering wise, that the leaving of the pillar as you have designated there, with a one hundred foot radius, being sufficient to protect you and your miners in the extraction of your additional twenty-five percent, assuming that you were able to mine the area out before the production of oil and gas had been depleted, would only be approximately two or three percent, which would be within the tolerance of your base figure of ten percent you intended to leave anyhow, isn't that correct, sir?

A That would be possible, but I don't think the oil industry could devise a casing that would withstand any of the stresses of moving ground.

Q This is only a hypothetical --

A Yes. I think if they could prove to us, and guarantee it -- I would almost want a written guarantee, because our whole mine is

at stake, it is not just one area, because if we ever got gas in there, it would be pretty serious.

MR. GIRAND: I believe that is all.

R E D I R E C T E X A M I N A T I O N

BY MR. BLACKMAN:

Q Mr. Jourdan, I would like to ask another question or two. PCA Exhibit No. 1 represents a rather large scale of the SE/4 of Section 28; would you tell the Commission the approximate length of the PCA mine from north to south?

A It would be approximately six and a half miles from north to south.

Q And the approximate width from east to west?

A About three miles east and west.

Q And are all of these areas, mining areas, interconnected with the rooms the way this plat shows on the right hand side?

A Yes, sir. Every area in the mine, 475 miles of tunnels, approximately, are connected.

Q In your opinion, is there any feasible or practicable way in whic any particular area of the mine could be isolated?

A Practically, no. It could be done, but from an economic standpoint it would be disastrous to us, I think.

Q I forgot in my first examination, Mr. Jourdan, to question you on one other exhibit.

(Whereupon, PCA Exhibit No. 2 was marked for identification.)

Q Mr. Jourdan, will you please refer to PCA Exhibit No. 2 placed on the chart board and explain just what that is?

A This is a highly theoretical diagram. Actually it is backed up by information we have gotten from the other companies, but this is the area in the mine, these are pillars where they are being removed, and this was made to show the slumping action of the salt and disturbance of the floor when the pillars are removed.

Q May I interrupt you just a moment and ask you if that is a theoretical cross section shown diagrammatically of a subsidance area, an area from which the underlying support has been removed?

A Yes, sir.

Q And will you point out on the diagram and show the pillars that remain in place as they are shown on that diagram?

A These are the pillars.

Q Will you designate those pillars, one of them, please, with an "A," and the area slightly to the right of center, where the pillars are not shown heavily, are where the pillars have been removed?

A Yes, sir. This indicates the fall from the back, and fall of the pillars that fall to the side when the ground begins to take weight.

Q Was that diagram prepared under your supervision, Mr. Jourdan?

A Yes, sir.

MR. BLACKMAN: I believe that is all. I will have my other witnesses testify as to what that chart shows, in detail, and how

it relates to the other exhibits that we have, Mr. Commissioner.

MR. GIRAND: If the Commission please, there is a couple of matters I left out in my cross examination which I would like to bring out, if I may, as well as cross examine a little bit on this exhibit.

MR. WALKER: Proceed.

RECROSS EXAMINATION

BY MR. GIRAND:

Q Mr. Jourdan, you referred to a term 'salt horse,' or 'salt horses.' For my enlightenment, and that of the Commission and everybody else, what is a 'salt horse'?

A That is an area of salt that is encountered in mining, a small area, and there is no way of telling it in core holes, or anything, it is something you run into and you have to move to one side and go around it, or if it is in a haulage entry, you have to go through and mine the salt anyway.

Q Are they found at frequent intervals, or are they more the exception, just an occasional encounter?

A Well, it is a known fact that they increase near the edge of your ore body to approximately, oh, I would say as much in the extreme limits to ten percent of the area near the fringe, what we call the fringe of the ore is in salt horses.

Q Is there any of the fringe area within the SE/4 of Section 23?

A It is rather difficult to say. It depends on the nature of

the ore, the characteristics of the ore, the thing varies from mine to mine, so far. Here are the salt horses straight in here, if you can see those dotted lines, they are very small in area, but we usually get through with -- sometimes they are so small that we go ahead and mine them anyway, and stack the salt, or haul it out, but there is no large salt horses indicated in this area.

Q You have a map of your entire mine, or property, up there above your Exhibit No. 1, do you not?

A No, sir. That belongs to Mr. Libbey.

MR. BLACKMAN: That is an area of United States Potash.

MR. GIRAND: I beg your pardon.

Q You do own potash leases covering Section 32 in 19 - 30, do you not?

A Right off-hand, I would -- I believe we do. I would hesitate to say.

Q For your information, that is the area in which W. H. Black has two wells, one the State Lowe No. 1 and State Lowe No. 2.

A Yes, sir.

Q Now, the State Lowe No. 2 is outside of the potash area, and the State Lowe No. 1 is within the potash area?

A Yes, sir. Right on the bare fringe, I would say, sir.

Q Then there is the W. H. Black Federal Yates No. 1, located in the SW SW of Section 28, which is within the potash area.

A That would put it out here?

Q No, right down off the corner of your map on the bottom.

A Yes, sir.

Q I believe that PCA consented to the drilling of the W. H. Black Federal Yates No. 1, as well as the W. H. Black State Lowe No. 1, is that correct?

A To the best of my knowledge it is. I do not approve the applications.

Q You do know the existence of the wells?

A Yes, sir.

Q Now, Mr. Jourdan, you never attempt a secondary recovery until you have completed your primary recovery of sixty-five percent of the ore volume, is that right?

A That is the practice at the present time in a mine, sir. There are other ways of mining it, but we do not intend, at the present time, to take it all at once.

Q I understand that under your present planning, as far as you know, that would be the planning and has been for the past several years, that you will take out sixty-five percent?

A Yes, sir, that has been the practice in the past.

Q So the two operations will not be conducted simultaneously in any given area?

A I wouldn't say that right off, Mr. Girand. We have a plan on the drawing board now of taking quite a bit and leaving very small pillars, taking eighty-five to ninety percent on the first time. It is only theoretical at the time.

Q That particular process is not being employed, nor is it

considered in your planning for the development of the ore body under the SE/4 of Section 23?

A At the present time it is not, sir.

Q I see. Now, this subsidance that you have diagramed, and in which you portray the subsidance or what would happen upon removal of the pillars, what effect if any did you calculate would happen here on the pillar immediately next to the one that was removed?

A I would prefer to leave those questions to Mr. Lane or Mr. Libbey, who can actually back them up with facts. All I can give is theory.

Q Did they assist you in the preparation of this?

A No, sir. That is theoretical.

Q You have, though, calculations as to the effect it would have on the pillar immediately adjacent to the removal?

A The only thing we got from them is in the actual bottom in there and this line here of forty-five degrees. We verified that from their information.

Q That the line would be a forty-five degree angle, is that correct?

A Yes, sir. They have proof of that, sir.

Q I see. Now, that forty-five degree line, was that established on any particular depth or thickness of ore body? Was that from a four-foot ore body, or a twelve-foot ore body?

A I can't answer that question at the present time. I would rather leave that to the people who know. I don't want to stick my

neck out.

MR. GIRAND: Thank you very much, sir.

MR. WALKER: Any further questions of this witness?

BY MR. GURLEY:

Q Mr. Jourdan, you testified, I believe, that you figure that it will take, oh, a hundred foot barrier, that is, a radius of a hundred feet, on each side of the bore hole, is that correct?

A Yes, sir.

Q What do you base that on?

A Past -- I believe there is a Government Regulation with regard to pillars and oil wells. I think Order R-111-A has the same information in it.

Q But have you had any experience with that sort of thing in your own mine?

A You mean leaving pillars? Yes, sir, we leave them all over the mine wherever we have a drill hole.

Q You do leave a hundred feet, is that correct?

A Yes, sir. Here's one right here, for example. That is our PCA Drill Hole No. 54. The barrier has been left around that.

Q Now, according to your chart up there, the proposed well, marked, I think, "I", would be right over what is presently your operational area, is that correct?

A Yes, sir. It is right in the center of this room here, and it is almost dead center.

Q It would be a physical impossibility to leave a hundred foot

barrier if that well is drilled there?

A Yes. I would say yes, you might force concrete in there, or some physical method.

MR. WALKER: Any further questions of the witness?

BY MR. NUTTER:

Q Mr. Jourdan, I didn't understand you when you stated what the extent of your five-year plan was as indicated on the map.

A You mean how we obtain this line?

Q No, sir. I didn't know where the line was. Is it that diagonal line?

A It's this line here. It is rather difficult to see. It comes right down this way and then it drops down here. Again I would like to point out that is only theoretical, it depends on our sales and equipment and production for the next three or four years.

Q Over what range of time would the mining operations, as indicated by the little rooms throughout the entire 160 acres in the SE/4 of that section, be completely mined out?

A Probably six or seven years.

Q In other words, the five-year plan is the dotted line, and the balance outside of that would be another year or two?

A I would like to point out that this area out here is not definite yet, these edges are more or less feathered out. There is no limit there. That is not the limit of the ore, either, it is just lying out of our mining plans through that area.

Q Where do you estimate the limit to the ore is to the west?

A It depends on the limit of what ore, what percent and what height. That is kind of a hard thing to say, because I think one of the other mines is mining stuff that we would throw away.

Q What is the approximate thickness of the ore bed in this area that you have mined as indicated by the heavy lines?

A In here?

Q Yes.

A About four and three/quarters feet, I would estimate; it is about four and a half out here.

Q And is the thickness of the deposit thinning?

A Yes, theoretically, we assume it does. Sometimes we hit on the edge of the salt, it will be six feet on one round, and five the other, and you will be in solid salt.

Q In the area such as this, where the average thickness is probably four and a half feet, unless we are giving away a secret here, what rate of advance would you make as you mine that out?

A I would have to calculate that. We would have to know what kind of equipment we have in here, continuous miners, or joy equipment. If you had joy equipment in there, you would probably run around sixteen feet per heading per day.

Q What does that mean?

A In each of these, say you were coming in this tunnel here, you would probably get sixteen feet in a day here, this way. It depends on the number of tunnels and how much you are working in the panel at a time. It is a hard question to answer. It would

actually depend on the equipment available, number of men you had.

Q Rate of production?

A Yes, for that panel.

Q If and when you decide you are going to pull some pillars -- Now, I understand you take sixty-five percent out in your first or primary operation? A That's right.

Q When you go in and pull your pillars, you recover another twenty-five percent? A Yes.

Q What happens with the remaining ten percent.

A Stuff we can't possibly get, fall off the side of the pillars, clean up, and a certain number of small pillars that you have to leave. As I say, on that pillar pulling, I would rather leave that to the experts.

Q When you do pull pillars, though, you do leave some pillars?

A Yes, sir.

Q When you go in and recover your secondary ore, and pull pillars, do you pull those barriers like that big barrier you marked as No. 2, I believe, on your Exhibit?

A At the present time I cannot answer that question, because I think we would pull a portion of it. We have no experience in that, we would have to sit down and figure what we are going to do, we might have to take a chance on losing some equipment in learning.

Q How long has it been since your operations were in this area indicated by the heavy lines?

A Approximately two and a half years down in here.

Q I see. One other question, Mr. Jourdan -- or two more, rather. You said as you drive down through those oil fields in that area, you can smell hydrogensulfide gas, is that correct?

A Yes, sir.

Q Do you know the percentage of hydrogensulfide in the gas produced in that area?

A No. We had only a trace in the test. Of course, you can smell it a long way. I think the actual wells are some five hundred or a thousand feet from the road, and you can get a very definite odor of gas.

Q By 'a trace,' how many parts per million were in that?

A You will have to ask a chemist.

Q Do you know what the United States Department of Labor specifies as the amount of hydrogensulfide in the area to be dangerous?

A I know it is a very, very small percentage.

Q Would it be a trace or less or more?

A Probably a little more than a trace, I would say. I think they would get excited if we said we had a trace in the mine area.

Q You are not sure if that gas you had analyzed was dangerous or not?

A No. The laboratory reported it to me as 'a trace.'

Q Has PCA ever engaged in drilling any wells for oil and gas?

A I think we have, yes, sir, but not in our own mining area.

Q Not in this particular area? A That's right.

Q Where have they engaged in that business?

A I believe we had some up at Aztec, and I think we had some in Kansas, if I'm not mistaken. That's the Exploration Department. Mr. Blackman probably could answer that question.

MR. NUTTER: That's all I have.

MR. WALKER: Mr. Mankin.

BY MR. MANKIN:

Q Awhile ago Mr. Girand was leading you on a question in regards to the possible drilling of wells in these barriers, which I believe you have indicated as "1" or "2" on your Exhibit?

A Yes, sir.

Q He was apparently indicating by suggestion that maybe wells could be drilled in that area without leaving any great amount of potash under the ground. Is it not true that a big portion of that barrier would be mined in that other twenty-five percent operation?

A I would assume that it would be.

Q And, as a result, the danger would be just as great then as it would be out in open mine workings?

A I would say yes, that any movement in there at all, if you sheared your casing, and believe me, there is some great pressures involved, and the gas did migrate up into the mine, that would be all as far as we are concerned. I know of no way we could handle it.

Q Referring, again, to the exhibit where you showed the forty-five degrees, that is actually a component, is it not, which was

both vertical subsidance and horizontal which gives you a forty-five degree component?

A Yes, sir. You would have probably something like this, this dashed line here would indicate it is not perfect, it might break through this section, through this section it might be absolutely vertical and then go over, but the evidence here indicates that it is forty-five from the point of pillar pulling.

Q Again some questions were brought up regarding core test holes where you leave a hundred foot radius, the same as you would suggest for the oil wells. The great danger is from oil or gas below, with the casing sheared, that is your great problem, is it not?

A I would say that is our main problem. We are not overly worried about anything from the top, it is the things down below in an oil well causing our concern.

Q There is, or has been, some seepage in mines in Eddy County, has there not been?

A We had some oil in our mine that migrated from somewhere. We don't know where it came from.

Q As a result of that, were not those workings disbanded and you went around?

A Yes, sir. We backed up some five hundred feet and took off in a forty-five degree angle, hit it again, took a chance and went through it, and it seeped for about three months. Apparently it has stopped now, there is no more evidence of oil. We have never found out where it came from.

Q But it is a very great danger?

A I would say it is, yes, sir.

Q That seepage which you were mentioning there is now more of an asphaltic nature in the salt section there, is it not?

A Yes, sir.

Q In other words, it is a very heavy, viscous oil?

A It is a heavy oil, and it doesn't have too much of a petroleum odor.

BY MR. HUTTER:

Q Mr. Jourdan, is there any evidence that that came from any oil and gas drilling operations in the area?

A Fourteen hundred feet from the location of the oil there is an abandoned well plugged as a dry hole, I believe the Chase No. 1.

Q Did it recover any oil or gas?

A No, it wasn't recorded. It was recorded as a dry hole. I think their plugging procedures were probably poor.

Q Did they report any oil or gas before plugging?

A Not to my knowledge.

Q So there is no evidence that this oil came from any oil or gas well?

A I don't think we can prove it, but we believe that's where it came from.

MR. WALKER: Any further questions of this witness?

MR. GIRAND: Has it been established whether that was refined or crude oil, the seepage?

A There is no pipelines around there that I know of at that depth.

MR. GIRAND: I see. All right. (Laughter.)

REDIRECT EXAMINATION

BY MR. BLACKMAN:

Q A couple of more questions. The area that is designated on PCA Exhibit No. 1 indicates two main haulage entries; I think it is in W223, is that right?

A 326. Up here it is 226.

Q Now, I would like an estimate, Mr. Jourdan, of the number or other working places in the PCA Mine, not those that are working, but the number of other working places that are in the mine, similar to this, if you can make an estimate of that number just to give us an idea of the size of the overall operations.

A We probably have -- you mean that have been worked out, or where we are going?

Q That's right.

A Oh, probably three or four hundred.

Q How many do you usually work at one time?

A About four or five.

MR. BLACKMAN: That is all.

MR. WALKER: Are there any further questions of this witness? If not, the witness may be excused.

(Witness excused.)

MR. BLACKMAN: I would like to call Mr. Libbey.

MR. WALKER: Before you start with your next witness, let's take a five-minute recess.

(Short recess.)

MR. WALKER: The hearing will come to order.

D O N A L D L. L I B B E Y

a witness, called on behalf of the Protestant, having been first duly sworn on oath, testified as follows:

D I R E C T E X A M I N A T I O N

BY MR. BLACKMAN:

Q Mr. Libbey, will you state your full name for the record, please?

A Donald L. Libbey.

Q Your profession, Mr. Libbey?

A Geologist.

Q By whom are you employed?

A United States Potash Company Division of United States Borax and Chemical Corporation.

Q What is your position with the United States Potash Company?

A Assistant to the Resident Manager.

Q How long have you been with the United States Potash Company?

A Approximately seven years.

Q Are you familiar, generally, with the geology in and around the potash producing section in Carlsbad? A Yes, sir.

Q Would you compare the geology of the area with which you are particularly familiar, the United States Potash Mine, with the other areas, particularly the Potash Company of America section?

A The location of the United States Potash Company Mine is

approximately eight miles southeast of the mining area of Potash Company of America. As far as the geology is concerned, the Salado Formation is present in approximately the same degree of conformity that you gentlemen have over at Potash Company of America, very similar in every respect.

Q You heard Mr. Jourdan testify this morning concerning the method of producing potash which is employed at Potash Company of America; what method is employed at United States Potash Company?

A Very similar to what Mr. Jourdan presented, very similar.

Q Do you proceed with mining plans in somewhat the same way at United States Potash as Mr. Jourdan testified as to Potash Company of America?

A Yes, sir.

Q Is the potash producing zone from which potash is now being produced at the United States Potash Mine the same zone from which potash is now being produced from the Potash Company of America Mine?

A Yes, sir.

Q Do the same structural beds exist from the potash producing zones upwards as they do at the Potash Company of America Mine?

A Yes, sir.

Q Would you generally outline those beds, beginning at the potash producing bed, with particular reference, if you would, Mr. Libbey, to PCA Exhibit No. 2, which is posted on the chart board, marking on that Exhibit a letter indicating where the potash is and the generalized zones above that by other letters?

A Yes, sir.

Q Beginning with the letter "B," if you please.

A As you know -- can you gentlemen see me?

MR. WALKER: Yes.

A As you know, this is the producing bed, this area here.

Q You are referring, now, to the bed which has been designated by Mr. Jourdan with the letter "A"?

A That's correct. That is the producing potash bed. It is in the upper one-third of the Salado Formation, and you have a salt series starting, just for the purpose of the question, from this point here on up to your top salt.

Q Will you place the letter "B" to indicate where the top of the salt is? A large one, if you please.

A Yes, sir.

Q Now, carry it on upward to your next general zone.

A On top of your top salt, going on up in the next section, you have, oh, six feet to eighty-five feet of unconsolidated material, sandy clay, silt, and heterogenous mixtures of gypsums. Above that, you have approximately 220 to 240 feet of anhydrite gypsum in which you have two dolomite beds, known locally as the magentadolomite and calabradolomite, with the latter being the lower member. Above your anhydrite gypsum, you have approximately 200 to 300 feet of red silt zone triacic red beds, and in certain scattered areas you have caliche outcrops. Sometimes you don't have caliche, although your caliche is --

Q All right, Mr. Libbey, would you take your seat, again, if

you please. Have you performed any pillar-pulling operations at the United States Potash Mine? A Yes, sir.

Q And approximately when did you commence the pillar-pulling operations in secondary mining at the United States Potash Mine, if you know the answer to that?

A December the 15th, 1953.

Q And approximately when did you cease the operation, the pillar-pulling operations, in that same area?

A April the 17th, 1956.

Q Have all of those pillar-pulling operations of United States Potash been in one area, one general area?

A Yes, sir.

(Whereupon, PCA Exhibit No. 4 was marked for identification.)

Q Mr. Libbey, are you familiar with the geological and engineering work that was performed at United States Potash Company in connection with the pillar-pulling operation?

A Yes, sir.

Q Will you describe, generally, the geological work and engineering work that was done by your company in connection with that operation, what control points did you set up, what observation techniques you utilized?

A In preparation to final mining, or second mining procedure, we very carefully studied every technical consideration we could think of regarding this situation. First, we established a survey

over a large area of our property, indicating the exact survey points in respect to the exact elevations, and also as to location, which would take into consideration subsidance and displacement.

Q Mr. Libbey, would you kindly refer to PCA Exhibit No. 4, and locate thereon, in the first instance, what area is delineated in dark pink, the area that is delineated in dark pink represents what?

A The area delineated in dark pink is our present final mined area.

Q That is as of the present time? A That's correct, sir.

Q You have mined out the maximum amount of potash that it is possible to get out of that area, is that true?

A Possibly not. There is approximately ten percent of the ore still in there that was necessary to remain in there. Due to economic need, at some later date, we may go in after that ten percent.

Q I wonder if you would state what has happened underground when you removed this ninety percent of the potash in this area? What happens to the roof?

A Generally within two or three days after final mining has been conducted, we notice the roof to start coming down, it begins to heave and heave from the floor, or fault; the corners of the pillars, or fenders, start taking weight and falling off. Those are the first symptoms.

Q Will you, now, please indicate what you intend to show by the

area that is delineated on the PCA Exhibit No. 4 in light pink?

A In light pink, we have shown here the area where vertical subsidance has taken place. I would like to point out, again, this is the area where actual final mining operations have been conducted, and this is the area where overall vertical subsidance has taken place.

Q Now, the latter item which you referred to is the area delineated in light pink? A Yes, sir.

Q And where is that, in the mine, or on the surface?

A On the surface, from a surface survey.

Q The light pink is surface and the dark is underground?

A That's correct.

Q How deep is the light pink with respect to the surface?

A Approximately a hundred feet below.

Q If you can give us an overall picture, approximately what was the thickness of the potash that was removed from this underground area?

A From nine to eleven feet, approximately.

Q Now, Mr. Libbey, in the area which you have delineated in light pink, at a large number of locations you have small figures; in the dark pink area, they are enclosed in a white circle. What do those represent?

A All the figures on this map show the degree of vertical subsidance.

Q When you say 'the degree,' do you mean in terms of what?

A Feet and tenths of feet.

Q Feet and tenths of feet? A That's correct.

Q Does that apply, Mr. Libbey, both to the figures which appear in the dark pink area and those which appear in the light pink area?

A Yes, sir, they are both of a surface consideration.

Q Now, will you tell us what the exterior boundaries of the light pink area represents in terms of date of latest survey?

A The latest survey, as of July 26, 1956, your extent of vertical subsidance.

Q Will you also explain how you have shown on that plat the boundary at an earlier survey, the survey boundary of subsidance area?

A The extent of an edge, or the boundary, of vertical subsidance on 4-23-56, was at this point here, as indicated on this map, and also at this point here; as you can see, the movement is progressive, even though final mining activity has not been conducted since the 17th of April, 1956.

Q Will you tell the Commission just when the last pillar-mining operation was conducted in this area?

A Seventeenth of April, 1956.

Q And where, with respect to your coordinate shown on the side of the map, is the approximate area from which that material was removed?

A Right in this area here.

Q Will you state, for the record, the coordinates of that area?

A Yes, sir. It would be 65 North, 90 East on our coordinance.

Q Then, to explain that further, the coordinance to which you refer are the coordinances which appear on the edges of the cross hatched section of Exhibit No. 4? A Yes, sir.

Q Will you, then, explain the area that you have designated on that plat with a dashed line consisting of large and small dashes, a combination of dot-dash line, which is a square area?

A Well, this dot-dash line is divided up into forty-acre plots. It may be a little difficult for you to see from afar, but those of you who have maps can see, in the bottom right hand corner, forty acre blocks, and so forth, right across this area.

Q The overall dimension, then, of the area which you have included in the outside boundaries of the combination dot-dash delineation on your sketch is 640 acres, is that correct, a section?

A That's correct.

Q Now, Mr. Libbey, will you point out where the boundary on the top side of that plat showed the area of subsidance to have extended at the time the last pillar-removing operations were conducted?

A This point right here on this, and this point right here, 1250 feet.

Q I am not sure you understood my question correctly. The plat shows, does it not, the edge, boundary, of your surface movement on April the 23rd, 1956? A Yes.

Q Now, it also shows the boundary on July 26, 1956?

A Yes, sir.

Q Now, both of those boundaries were established under your supervision, were they not? A Yes, sir.

Q And will you state, for the record, the character of the survey by which those boundaries were established?

A Our survey is one/hundredths of a foot on the vertical survey, and one/thousandths of a foot on a horizontal survey, the point and figuration established by giving each one of these locations a number and the outside figuration was located by interpolation.

Q Now, Mr. Libbey, you have also established the vertical and horizontal movements of a number of these checkpoints that you have shown on this plat, have you not? A Yes, sir.

Q Have you prepared, Mr. Libbey, exhibits showing the vertical and horizontal movement of two of those checkpoints?

A Yes, sir, I have.

(Whereupon PCA Exhibits Nos. 5 and 6 were marked for identification.)

Q Mr. Libbey, I hand you a document which has been marked for identification as PCA Exhibit No. 5, and ask you if you can identify this exhibit, please.

A Yes, sir, I am familiar with it.

Q What is it?

A This is a graph, or plat, showing horizontal displacement and vertical subsidance at Station 65 North, 95 East.

Q Will you state what the upper half of that exhibit represents,

Mr. Libbey?

A Surface horizontal displacement.

Q And how was that established?

A By survey on nine different dates, when the vertical subsidance was also surveyed.

Q So you established, by your survey, the exact location of one of these checkpoints on several different dates as shown on the exhibit itself, and then platted, on the exhibit, the movement that that checkpoint went through, is that correct?

A That's correct.

Q What is the first date shown on that, Mr. Libbey?

A September 15th, 1955.

Q What is the last date? A June 26, 1956.

Q What is the coordination between PCA Exhibit 5 and PCA Exhibit No. 4?

A This station we have here, 65 North, 95 East, was located right at this point.

Q It is located at North Coordinate 65 and East Coordinate 95 on PCA Exhibit No. 4, correct? A Yes, sir.

Q And what is the extent of the horizontal movement of that checkpoint during the time between the first survey and the last survey? A Slightly over four feet.

Q What is the vertical distance in subsidance between the first and last survey?

A In this case, approximately four point five feet.

Q Now, that is in vertical subsidance?

A Yes, sir.

Q Now, Mr. Libbey, I would like for you to state whether, between the first and second survey dates, that checkpoint moved up or down.

A Between a first and second survey date, in respect to vertical subsidance, our point moved up.

Q And between the sixth survey date and the seventh survey date, with respect to -- strike that. Now, Mr. Libbey, I hand you a document marked PCA Exhibit No. 6, and ask you if you will identify this document?

A Yes, sir. I am familiar with it.

Q Will you identify it, please?

A Yes, sir. I am familiar with it.

Q What is it?

A This will show a graph, or plat, of Station 50 North, 95 East, showing surface horizontal displacement and vertical subsidance.

Q Will you locate that particular checkpoint on Exhibit No. 4?

A 50 North, 95 East, right at this point.

Q Now, Mr. Libbey, you also stated, before, that you surveyed a number of other check points; will you state, for the record, what the largest amount of horizontal displacement you found to occur between your first and last survey dates in any of your checkpoints?

A Three point eight feet horizontal displacement.

Q What checkpoint was that?

A Right at this point right here.

Q Will you identify that,please, by coordinates?

A 65 North, 125 East.

Q That is in terms of horizontal displacement?

A Surface horizontal displacement.

Q Would you also state what, in terms of vertical subsidance, the greatest vertical subsidance you found and encountered between your first and last survey dates?

A Eight point twenty-six feet.

Q Please locate the checkpoint with respect to the coordinates on PCA Exhibit No. 4.

A That would be 50 North, 90 East.

Q Now, Mr. Libbey, would you kindly describe PCA Exhibit No. 2, and explain just how PCA Exhibit No. 2 would coordinate with PCA Exhibit No. 4?

A Yes, sir. Area "A," bed, is comparable to the mined-out area of this plat here. In detail, it would be, this zone right here, comparing to the mined out area.

Q Will you please place a letter on PCA Exhibit No. 2 at the boundaries which would represent the boundaries of the dark pink area of PCA Exhibit No. 4? Please use the letters "C" and "D" to represent those exterior boundaries. A Yes, sir.

Q Now, will you also place on PCA Exhibit No. 2 the letter "E" to indicate the exterior boundary of the light pink area on PCA

Exhibit No. 4? A Yes, sir.

Q Now, Mr. Libbey, would you kindly detail, for us, just what occurred in your mine, explaining, if you can, and in as much detail as possible, just what movements were noted, and show us, if you can, on Exhibit No. 2, just what happened from a purely physical standpoint of the things that you observed?

A Yes, sir. In the beginning of the second mining operations, we have noted that your back, or roof, conditions become incompetent very shortly after the final mining, or second mining, has begun, there is an arching effect from your ninety percent extraction and extending six, ten, twelve, sometimes greater, feet into your roof or back. We find the arch, or salt, which makes up your arch, to fall. Now, this becomes progressive as you go up through the sections, your area is taking the weight, and it is reflected on up to the surface with vertical subsidance. At the bed depths, at the sides of your final mining operations, we note differential punching from the extreme loads, the fantastic loads, that are being put on certain materials in this area and also the remnant pillars left in the bed area. Generally speaking, your subsidance is dominant in this general area through your bed depth. Due to your differential punching from these -- your sides of your mined-out area and also inside your mined-out area, we have what we call floor heaves with the salt section punching back up. That is true inside your final mined area and also on the flanks.

Q What you have stated, to make the record clear, is if you

have removed the pillar support from the area between point C and D, on Exhibit 2, that -- and correct me if I don't state it correctly -- the weight is then transferred, must be carried some place, the increase, it increases the weight on the areas outside points C and D, increasing the pressure there, is that correct?

A That's correct. In our fault section, we visualize a flowing effect, and also a slumping effect as a result of our vertical subsidance; in the overburdened section above the salt, we visualize possibly, a flowage effect, a slumping effect, and also a bending effect.

Q Mr. Libbey, would you comment, please, upon the approximate forty-five degree angle that is shown there on Exhibit No. 2, with respect to your experience, your actual experience in the angle that developed at the mine at United States Potash Company?

A The angle, the forty-five degrees of vertical subsidance angle is a good average figure from the results that we have obtained at our mine.

Q What is the greatest angle that you have sofar calculated from the vertical at the United States Potash operations?

A It would be fifty-two degrees and twenty minutes with a 1250 degree.

Q Is that along the north side of the property shown on Exhibit No. 4? A Yes, sir.

Q Will you comment, Mr. Libbey, upon the variations in the degree of plasticity in the several formations from the salt up to

the surface?

A As we all know, due to the salt domes, European potash activities or Carlsbad potash activities, salt is quite plastic, and will flow to some degree; the area above the salt, your silting sand, your clays, your unconsolidated gypsums, well, it is not well cemented at all, and there we would somewhat feel you would have a slumping effect, and possibly some flowing; in your Rustler Formation, your anhydrited gypsum formations where you have your two dolomite members, we visualize certain bending and flexing. As far as your silt stone, or your redbed formations above, on to the surface, we visualize some slumping, bending.

Q Is it fair to state, then, Mr. Libbey, that in the event, or when vertical supports are removed from an area such as have been removed here, the various formations will react differently?

A Yes, sir, with differentials.

Q Now, Mr. Libbey, will you point out on the chart, Exhibit No. 2, and indicate with a letter, or a line, if you prefer, the area in which you feel the greatest vertical pressures would be exerted?

A The centerpoint of your final mining activity.

Q Might we identify that by saying between points C and D?

A Yes, sir.

Q Where, Mr. Libbey, do you think the points of greatest sheer pressure would be exerted?

A Along our forty-five degree subsidance angle.

Q Would you say, Mr. Libbey, that the material within the angles, within the funnel-shaped pocket, you might say, is material that might be said to be in motion of some type, depending upon its characteristic, and material outside of that point would not be in motion to the degree that the material inside is?

A Yes, sir.

Q The line C and D -- no, correction. The lines C and E, what do they represent?

A That represents a theoretical line, or subsidance from your underground bed going up to your surface. In that line you have several formational sections.

Q Now, Mr. Libbey, where do you feel the greatest point of sheer pressure would be exerted?

A Along your line, subsidance line, your forty-five degree line.

Q At what points on that line, with respect to the several zones involved, do you feel that the greatest sheer pressure would be exerted?

A Due to the fact that we have different formational plasticity and composition at our top soil, you would have one differential, the salt would behave one way, your sand and clay and heterogenous material above the salt would behave another way, your Rustler Formation, your anhydrite gypsums, your redbed and silt zones would behave another way, and, coupled with the evidence we have submitted, it would appear that you have repetition of direction with vertical

subsidance and horizontal displacement.

Q In other words, two formations having different degrees of plasticity, you feel that would be the greatest point of horizontal pressure? A Yes, sir.

Q Now, Mr. Libbey, will you assume that an oil or gas well were drilled in a particular area, and,at some later date,the vertical support represented by a potash member, were removed so that a subsidance occurred, and the oil or gas well were in the area of subsidance movement, so that the theoretical line you have drawn of forty-five degrees would, at some point below the surface, intersect the casing of the oil or gas well, what do you think would be the effect upon that oil or gas well casing?

A No casing I know of would be competent enough to withstand the pressures involved.

Q Suppose there were some low-pressure gas in that well, do you think it could be contained? A No.

Q What do you think would be the effect on a potash mine if any gas leaked into it?

A It would be most detrimental.

Q There has been some testimony here, Mr. Libbey, about the fact that one gas well in that area was analyzed at forty percent methane; are you familiar with the characteristics of methane?

A Yes, sir.

Q Do you feel that would be a dangerous gas to have in the mine? A Definitely.

Q Is it a very explosive gas? A Yes, sir.

Q Is it, in addition to being explosive, characterized as being a poisonous gas? A Yes, sir.

MR. BLACKMAN: I believe that is all.

MR. WALKER: Before we start the cross examination of this witness, I think it would be wise for us to recess for lunch until 1:00 o'clock, so that we will get service much faster.

We will recess until 1:00 p.m.

(Whereupon, the hearing in the above matter was recessed until 1:00 p.m. the same day.)

August 16, 1956, 1:00 P. M.:

MR. WALKER: The hearing will come to order. Have you finished with the witness, Mr. Blackman?

MR. BLACKMAN: I have a few more questions.

Continuing direct-examination of the witness, DONALD L. LIBBEY, by MR. BLACKMAN:

Q Mr. Libbey, you have testified concerning the number of various check points on Potash Company of American's Exhibit No. 4, and I wonder if you would point out along Exhibit 4, along the top margin of the dark pink area, the extent of the vertical subsidance that has occurred, as reflected by the several check points that you have discussed.

A Along the top--

Q (Interrupting) What is the vertical coordinate on that--I can't read it from here?

A We have a coordinate of 70 north.

Q That is what I want, along that line, will you comment on the extent of the verticle subsidance?

A We have 0.66 feet, and we have 0.39 feet (indicating); and 0.96 feet and 1.51 feet.

Q Now, Mr. Libbey, would you please point out in similar fashion the extent of verticle subsidance which occurs along the south side, approximately where the veins now rest?

A Along the coordinate line 40 north, we have two points indicated on this map, of 2.17 and 7.82 feet, and--excuse me, there is one further point here, 2.78 feet.

Q Now it appears from observing the map here, Mr. Libbey,

that the extent of the of the horizontal movement as shown on the surface is not as far from the mined out area underground on the south portion, along the south boundary, as along the north?

A That is correct.

Q In other words, where it appears you had a large amount of verticle subsidance, the horizontal movement did not extent out so far away?

A That is correct. The changes are very rapid in that respect and presently we have no way to predict them.

Q Would you comment somewhat on the time within which movement commences after removal of the sub-surface support?

A We have definitely noticed movement within one month after the operation originally started; in fact, it come on much faster than we thought it would.

Q What is the situation now with respect to the extent of movement?

A Well, we feel that the movement would extend out in respect to the vertical subsidance undoubtedly in all directions that we have indicated in light pink. We have attested that it has moved from April to July that much, and what is very much a possibility, after letting it rest longer, the vertical subsidance will extend in all directions to a greater degree.

Q Would you please comment on the forces and pressures involved in a movement of this sort, if you can?

A The forces that are in effect in a movement of this type are fantastic. They are particularly accentuated where you have formational change, or a difference in composition, or a foreign object that might be present there, and you get geometric increases

in your various earth pressures. The very intricate earth pressures pointing your downward effect, vertical subsidance, horizontal effect, are extremely intricate and I might say fantastic in just a month.

Q You have commented on Exhibits 5 and 6 and have shown the variation in movements of two check points. Are those representative check points?

A Yes, sir.

Q Do other check points which you have observed move around in such irratic fasion?

A Some of them move move; some of them move less. Those were more or less generalized points to complete the dimensional consideration.

MR. BLACKMAN: I believe that's all.

C R O S S E X A M I N A T I O N

By MR. GIRAND:

Q Mr. Libbey, as I understood your testimony, you stated that the U. S. mined area, which is exhibited in Exhibit No. 4, was comparable to the mined area now being operated by Potash Company of American, is that not correct?

A Generally correct.

Q The testimony here has been that the ore body was approximately four feet in thickness under the quarter section that is involved in the SE/4 of Section 28, 19, 30. As I recall your testimony, your ore body had a thickness of some 9.11 feet?

A That is correct, sir.

Q Would the difference there of some five to seven feet in

thickness of ore body affect your figures on the amount of subsidance or amount of movement, both vertically and horizontally?

A The situation is this: That once your earth pressures are triggered and start moving, your subsidance angle will remain the same as I have reported. As to the total vertical subsidance, naturally the figures will vary, but the subsidance angle will remain generally the same.

Q I see. But the extent of the subsidance will vary based on the amount of displaced dirt under the surface?

A On the vertical consideration you are correct. As far as the angle is concerned, from a theoretical point of view,--and that is all you can go on on that, it would appear absolutely that the 45° subsidance angle would be the same.

Q That 45° angle varies on your Exhibit 4, does it not?

A Yes, sir.

Q What is the minimum, or degree of variance there? In other words, I believe you stated to the north it ran as much as fifty degrees, twenty minutes.

A The minimum angle that we have reported is some twenty-seven degrees and I might add that ground is still working.

Q Then from your study of this movement, why the angle varies from twenty-seven degrees to fifty-two degrees, twenty minutes?

A Yes, sir.

Q That is at the present time?

A At the present time; the ground is still working.

Q All right. Now, if you know, when did the United States

start mining out the area, making their secondary recovery, so to speak, of the area covered by Exhibit 4?

A As I stated this morning, December 15, 1953.

Q December 15, 1953. That is when--

A (Interrupting) --they started second mining in this area.

Q In relation to the other mining property, the sections you have shown there in Exhibit 4 are on what side of your mining property, generally speaking?

A Generally, on the south side.

Q Is that to the extent of your lease-owned property--I mean does it go to the south extremity of your leased property?

A Would you clarify the question sir?

Q The area shown there--

A (Interrupting) May I ask a question?

Q Yes, sir.

A You may not own the lease-line of the ore limit--

Q (Interrupting) The ore limit or the development limit?

A To our ore limit.

Q In the area shown there, where there any existing well bores or old oil and gas wells?

A No, sir.

Q Were there any old core holes in the area?

A Yes, sir.

Q Was any check made in regard to the old core holes?

A They were watched very very carefully, yes, sir.

Q Was any of the information furnished here in your exhibits 4, 5 and 6 obtained from information obtained from watching those core holes?

A Yes, in general--there is one core hole, I might add.

Q One--can you identify it on Exhibit 4?

A It is approximately in this area right here (indicating).

Q That would be on your north coordinate?

A Approximately part of the 40 and 45 north coordinate, and approximately 95 east.

Q Now, Mr. Libbey, in the process of your secondary mining, did the company explore any other methods of recovering additional ore and still leaving sufficient pillar strength to alleviate any subsidance?

A Oh, yes.

Q What measures did the company take in that regard?

A We carried on long studies on a European subsidance problem where holes were drilled in pillars to try to establish equilibriums so that when the back came down and the floor would come up in the final mining position, that equilibriums would be established bringing the back or roof and the floor together with the greatest amount of ease and undisturbment.

Q Did you employ those methods in this operation?

A No, sir.

Q Now, have you made any study as to the extent, percentage-wise, of ore body that would be required to be left in the mined property in order to eliminate subsidance?

A Well, subsidance goes along with the mining industry.

Q We have established that you can take out 65% and not bother it--I think that is established.

A Yes, sir.

Q And we know when you take it down to 10%, she moves?

A That's right.

Q Somewhere in there, there is a point of recovery that would still leave your property free of any subsidance?

A That is a question which is not quite as clear-cut or simple as you have to say. Once you start your earth pressures moving, you have a triggering effect, and possibly the best solution is to leave your remnant pillars in place, which would allow ten per cent of your ore to be there to act as a cushion to bring it down in equilibrium. Actually, when you start going much higher than sixty-five or seventy per cent, you develop differentials or points of maximum pressures that disturb your equilibriums and make it much harder than bringing down your pillars on a ten per cent remaining basis.

Q What effect--getting back to the core hole you examined, what effect would it have on the core hole--what did your study reveal?

A Very little or none--very little or none. It subsided at the surface, I can't exactly quote the vertical subsidance figure consistent with the area I mentioned, but for the purposes of the question I will say around six feet. The casing friction which was at the very surface, the upper one hundred feet or so, behaved very well and went down uniformly.

Q Then, from your study of that core hole, would you say a well drilled in the potash area, and properly plugged, or could it be properly plugged so as to alleviate any seepage of gas or oil in the event of subsidance as you testified to under Exhibit 4?

A No, sir; your development casing is the big question there. I say no to the oil test, potash test is different in that respect.

Q It is your testimony that an oil well or oil well bore hole presents a different problem than a core bore hole?

A Yes, sir.

Q How far below the floor of your mine property do you estimate there would be any movement?

A That is a question that we would like to know, sir. We have thought about employing sonar and radar and geophysics all the way through, aside from drilling. We feel, aside from theory, though, that it would probably go down forty or fifty feet.

Q Then any well that was plugged from the bottom up to we will say within the--through the salt section, would in all probability not be affected from fifty feet below the depth of the floor on down to the bottom of the hole?

A I am saying that purely on our own experience. I understand there are some operators that probably have other considerations along that line. The subsidance and displacement possibly might not have to occur, although bear in mind that the activity we have done here is done on the basis that we were operating under the best technical premise possible. We have learned a lot from our second mining operations and continue to do so.

Q There is one question which I think I have asked you and I am not sure of the answer or that I got an answer, so I will ask it again: Should an area be penetrated with oil and gas well bore holes, and should--you had left your pillars, in connection with R-111-A, one hundred feet radius around the bore hole,

how far out from that pillar do you feel you would be unable to move your other square and/or other bodies of ore, that 25%--how much additional space do you think you would need?

A Mr. Girand, I believe you would find it the policy of United States Potash Company Division of United States Borax and Chemical Corporation, from a purely technical and operators' point of view, that we could not afford to conduct even first mining in and around mining operations due to the fact that we could not gamble on the life of our mine.

Q Well, that is a good answer, but it doesn't answer my question--you don't feel there is any safe position then?

A Somewhere between a mile or two miles from commercial ore.

Q You feel safe in that?

A Let's say two miles from commercial ore.

Q Do you have any old oil wells, that is wells which are plugged and abandoned, in your mining property at the present time?

A No, sir.

Q Mr. Libbey, in the event a section of your mine, or should your mine become gassed through a gas leak, it is not your statement that the gas cannot be removed or the leak repaired and the gas removed and the mine made safe?

A Well, one-tenth of one per cent of methane or CH_4 is out of the question as far as a mining operation is concerned. That is your limit. It would be most detrimental to your mining operation and could very possibly cause the loss of the entire mine under certain conditions due to the fact that your section in respect to where the gas probably would be coming in would be

around the bed where you have been conducting final mining operations and would be migrating from the gas-producing zone to where you are indicating the casing was breached or something. You would find the whole salt section in that immediate area and other areas would be completely honey-combed with foliage patterns, weakness planes, and separation units, and suddenly in other areas of operation--you are familiar with it, I am sure--you have a gas well blow out, and we would be picking up gas on all sides of us, in front and in back and there is great doubt whether our ventilation techniques could take care of that, and I think in all operations in the industry the protection of our personnel is the prime consideration.

MR. GIRAND: That's all.

MR. WALKER: Any further questions?

C R O S S E X A M I N A T I O N

BY MR. NUTTER:

Q First of all, I would like to establish where this area is where you have done the secondary mining indicated on your Exhibit No. 4?

A The south portion of our ore body, the extreme southern portion.

Q What section would that be in the map?

A It would be a portion of Section 13, Township 21 South, Range 29 East, N. M. P. M.

Q Is the area south of Shaft No. 2?

A Yes, sir.

Q Mr. Libbey, for one thing, when you mine this--carry out

your primary mining operation, you remove some 65% of the ore in place and leave pillars of 25%, is that correct?

A Well, you must bear in mind that various operators vary in detail as to extraction figure. Our figure presently is closer to sixty, maybe sixty-two, varying in some areas, although in some areas sixty-five is correct.

Q Your mining operation is much the same as P. C. A.'s, leaving a pillar and driving a long ~~broom~~ room through, is that right?

A Very similar.

Q Has any attempt ever been made to determine whether any subsidance takes place on the surface, before the pillars are closed, as a result of primary mining?

A In a few limited cases there were, but I think you will agree that the time that should have been done was in 1929 or so, before the mining operation came in to being, due to the fact that our operation was a pioneer development in respect to the North American continent. We are sorry that we did not have this type of grid over our operation and we don't have the proper information as to subsidance on primary mining.

Q Is your company or any other company engaged in first mining in the Carlsbad potash area at the present time?

A Yes, sir.

Q Are they taking any measurements that you know of to determine whether there is surface subsidance?

A I can't speak for others, but we have established a different grid over a large portion of our operations.

Q But you don't know whether they are measuring or not?

A I presume International has. They have done final mining and I can't say anymore--I don't know.

Q I wonder if you would turn to P.C.A. Exhibit No. 2 there which is a cross-section of the subsidance and draw a vertical line commencing at a point midway between C and D?

(Witness complied)

A Is that satisfactory?

Q Yes, sir, right down through there. Now, if you would mark on that vertical line the areas of either unconsolidated, conglomerance or salts, or any material that would either build or flow--could you do that? I believe you said at the top it was either unconsolidated or conglomerate?

A Your weave would be involved from, say, zero to twenty feet unconsolidated rotten caliche. From twenty feet to shall we say 200 feet, we would have red beds. From 200 feet--I'm not able to draw this to scale--

Q That's fine, I just want approximate figures.

A --from 200 to, say, 430 feet, you would have a Rustler formation with two beds known as the magentadolomite and the calabradolomite, and from 430 feet down to, say, just as a general figure, five hundred feet, you would have a rather unconsolidated sort of clay, silt and loosely consolidated gypsum, I would say 500 feet, going down through the soft section, say, to a depth of 1,000 feet, which is here, you have the upper one-third of Salado salt section of which there are numerous grade beds, to say nothing of the fact that there are some approximate twelve ore zones in that interval that are recognized in the area. Do you want me to go into the flowage?

Q I would like to know which would flow or slump.

A They all have indicated that we have subsidance; I think you will agree to that. Due to the fact that we have a change in composition as far as the formations are concerned themselves, I think you would also agree that there is a good possibility that we would have a change in subsidance aspects. After rather detailed studies, both in this country and abroad, it has been determined that your salt will flow under sufficient pressure. In some cases in the European mines at a little different depth than we have, your potash actually flows like beeswax between two bricks, so I think you can assume as far as the upper formation of the Salado formation, that the Salado will flow and bend or slump to a degree with the main thing being its flowing effect, due to the fact that the bed material has been removed. As to the unconsolidated zone right above the salt, we visualize due to the fact it is not too well knit together, that we will get a certain amount of slumping. There are clay seams and things of that nature. You can correct the flow if you want to--it is just to the coordinate. As far as the zone above it, we feel it will bend and slump as has beenattested, due to the fact that we have the vertical subsidance indicated. As far as the upper section is concerned, I look at it as more of a slumping situation. There are few red bed situations in that section. Back to the salt beds I mentioned, the dolomite and anhydrate beds, we are all familiar with them, those beds act as reinforcing steel does in cement, and help control the subsidance.

Q That bed of dolomite across there--in order to achieve this subsidance as indicated on the chart, it would probably have to shear in two and drop, wouldn't it?

A The dolomite bed in the present detail on the Calabra, is a dolomitic line from shaft-sinking operations. It appears to have a pretty heavy block effect and the theoretical consideration--I would tend to feel that it would possibly bend, although it could shear. I can't answer that question--very definitely it could shear, but we would feel possibly it would bend also, and it has a possibility of shearing also. We just don't know.

Q There is no bed across the theoretical funnel with enough rigidity to withstand the weight of the overburden in case of subsidance?

A No, sir.

Q I would like to find out just how you obtained--or after you had control already, just what steps you took to observe the vertical and horizontal movements?

A Each month--I had better say that we have established well control point designations and locations--and each month our surveying department checks most of the survey points mentioned in this area, or over a far greater area than mentioned. It is done on a regular basis each month.

Q And after they have laid out the grid, what do they do?

A After that they had all the various specifications checked for a permanent type marker, using steel stacks with cement footings along proper specifications approved by various organizations and the Government, and established the grid so that those points would remain stable. Some animals dug up some, and one was on a train right-of-way, and we lost one or two that way.

Q Those are permanently fixed however, and the only way

they would move would be if the ground moved?

A Yes, sir.

Q And they checked those movements on a transit, or what?

A Yes, we have a very competent survey monthly, each month.

Q Referring to your Exhibit No. 4, point 65 north, 95 east or west, whatever that is--what has been the general movement of that point in a horizontal direction?

A 65--95, we note that from Point 1 to Point 2 we went, shall we say, northeast. From point 2 to 3, we went southwest. From three to four we went northwest; from four to five, we went southeast; from five to six, we went southwest; from six to seven, we went northeast; from seven to eight, southwest, and to Point 9, well--we did go due north.

Q What has been the general movement from Point 1 to Point 9?

A What do you mean, I don't understand?

Q What is the over-all net movement?

A Well, it would be--

Q (Interrupting) In a southerly direction?

A Yes--yes. And with the very definite provision that the point has reversed its position back and forth many times.

Q Referring to control point 50, north 95, what has been the general trend of its movement?

A It has generally moved to the north from--as you can see, the location of Point 1 to Point 9, there has been much duplication of intersection or movement here as was in the other case briefly mentioned--generally north.

Q Referring to Exhibit 2, Point E on the top of the ground there, and Point F on the far right side--would the tendency of those two points be to move together also?

A Yes, sir. It is our very definite opinion that in the center of your final mined out areas, you have more vertical subsidance.

Q There would be a point where you wouldn't have any horizontal movement but you would have vertical subsidance?

A Well, yes, but on the flanks of your 45-degree subsidance angle you would have a greater horizontal movement than in the center. What I am trying to say is that this point here, you would have greater horizontal displacement here than here, and also greater horizontal displacement here on the surface than here.

Q Where would the greatest vertical displacement be?

A In the center, although as far as the displacement aspects are concerned, they change. When you think it is all figured out, something very definitely in reverse happens sometimes, but what I have said is generally true.

Q Mr. Libbey, how are mines ventilated?

A Well, under the State of New Mexico Mining Law, we have to have two shafts to operate, I believe, more than ten men, and most of the operators have a down-draft and an up-draft shaft. Extending over the areas of underground operation we use various fans and openings to push the air to the working face, and as it reaches the working face, it goes on to the up-draft shaft where we have a large fan that pumps the air out of the shaft with fresh air coming in.

Q These shafts, those are operator shafts that you have?

A Yes, sir, production shafts.

Q In other words, you don't have to bore them--there are some drilled in the mine?

A In some cases, I believe--but it is not true in respect to the operation I am most familiar with,--I believe in some cases in possibly service and supply, the main reason for sinking shafts would be due to the high cost. Naturally we try to keep the shafts at a minimum and no bore hole shafts for ventilation have been yet completed in the Carlsbad area.

Q In the event that pillar pulling becomes necessary to extract the final amount of ore, how close do you pull pillars near the shaft?

A That is an extremely difficult question to answer. We are evaluating that very carefully from the information we have developed, and along that line of thought, the theoretical figure we are considering is around 2,000 feet, possibly a little less, possibly a little bit more, but it very definitely is a theoretical figure and is under advisement.

MR. NUTTER: I believe that is all, thank you.

MR. PORTER: Any further questions of the witness? If not, the witness may be excused.

R. S. FULTON,

a witness, called on behalf of the Protestant, having been first duly sworn on oath, testified as follows:

D I R E C T E X A M I N A T I O N

By MR. BLACKMAN:

Q Kindly state your name.

A R. S. Fulton.

Q And your profession, Mr. Fulton?

A Mining engineer.

Q What is your present position?

A Regional Mining Supervisor, Geological Survey, Carlsbad, New Mexico.

Q And as such, are you in the immediate charge of the operations of the United States Geological Survey as it applies to potash operations in the Carlsbad area?

A As it applies to the Carlsbad operation, potash operation on Federal potash leases.

Q Mr. Fulton, in your capacity as Regional Supervisor, do you have access to all core drilling data and mining data from time to time submitted to you by all the potash companies?

A Yes.

Q And are you familiar with the methods generally in use in the potash mining industry for the estimating of the amount and character of ore in place?

A Yes, sir.

Q I will ask you, Mr. Fulton if at my request you addressed a letter to Potash Company of America, dated August 13, 1956, in which you set forth your calculations on the basis of information in the hands of the Geological Survey on the value of potash under the SE¼ of Section 28, Township 9 South, Range 30 East?

A Yes, sir.

(Whereupon PCA Exhibit No. 7 was marked for identification.)

Q I will hand you a document marked Potash Company of America's Exhibit No. 7 and ask you if that is a photostatic copy of that latter?

A Yes, it is.

Q Would you kindly read that letter into the record, Mr. Fulton, and explain to the Commission just how it is you have arrived at these evaluations, if you will, please, and make any explanation you think is necessary?

A The letter is addressed to Potash Company of America, Post Office Box 31, Carlsbad, New Mexico: "Gentlemen: This is in response to your recent verbal request that this office compile data relative to the potash orebody contained in the SE¼ of Section 28, T. 19 S., R. 30 E., N. M. P. M., New Mexico, which is embraced in your potash lease Las Cruces 046729-D, issued January 18, 1933. Potash values have been determined on the basis of total recoverable value and recoverable value per acre for the several extraction stages involved in the mining operation. The average grade and thickness of the orebody were obtained by taking the weighted average of the four potash core tests located at the four corners of the SE¼ Sec. 28. The recoverable values are obtained by using the following formula:

Recoverable value per acre = 2,722.5 x thickness of ore in feet x grade of ore in % K_2O x % mining extraction x % mill efficiency x units of K_2O per ton x price per unit of K_2O.

The constant, 2,722.5, represents the tons of ore contained in one acre-foot, using 16 cubic feet = 1 ton of ore. The price per unit of K_2O in muriate is 36 cents. Following are the values

determined:

	Recoverable Value per 160 Acres	Per Acre
1. First mining (extraction 65%, mill efficiency 90%)	$9,804,430	$61,278
2. Second mining (extraction 25%, mill efficiency 90%)	3,770,935	23,568
3. Total mining (extraction 90%, mill efficiency 90%)	13,575,365	84,846

The following values relate to a protective pillar with a minimum radius of 100 feet which would be required to protect a producing oil well drilled through the orebody, no part of which could be recovered:

Value of pillar (65% extraction, 90% mill efficiency) = $44,390

Value of pillar (90% extraction, 90% mill efficiency) = $61,464

The average depth of the orebody in the SE¼ Sec. 28 is approximately 750 feet. In the event that four producing oil wells existed in the tract at the time second mining was contemplated, the Survey would require observance of a subsidence angle of 45 degrees - pillars could not be removed closer than 750 feet to a producing well. As the proposed oil wells are to be located in the center of each 40-acre subdivision of the SE¼ Sec. 28, this means that all mine pillars within the 160-acre tract would be less than 750 feet from a producing oil well, hence no pillars could be removed."

Q Now, Mr. Fulton, in order to calculate the value of the potash which would be left in place in the event oil wells were drilled as stated in your letter, it would be necessary to add

together your 25% figure on page 1 of your letter, which is point 2 in your table of values, to the value of the pillar which you have shown on page 3, not part of which could be recovered--is that true?

A That is true.

Q Do you care to make any further comments upon what you have stated in this letter?

A No, I believe not.

Q Mr. Fulton, I hand you a document marked Potash Company's Exhibit No. 8 and ask you if you will kindly identify that for the record?

(Said Exhibit No. 8 of PCA had heretofore been marked for identification.)

A That is the copy of the Department of the Interior regulations which apply to the issuance of oil leases covering formerly withdrawn potash lands.

Q That is a copy of the Department of the Interior notice containing the regulations published prior to the issuance of the lease which is the subject matter of this hearing today, is it not?

A Yes.

MR. BLACKMAN: Thank you, that is all.

MR. PORTER: Any questions?

CROSS EXAMINATION

BY MR. GIRAND:

Q Mr. Fulton, I think there is a slight error there. I don't know how great it is, but it wouldn't be the sum of your value figure No. 2 on the 25% plus the value of the pillar because the pillar you would have in there, whether you would--other than

your well bore radius, because of the 100 foot radius--you wouldn't have quite the exact figure there, would you?

A Well, what is meant, Mr. Girand, is that in the event the 100 foot radius pillar had to be left around the producing well, the operation would lose is normal expected 65% from the area. In addition, I don't believe he would be able to remove anything in secondary mining--hence, the 25% plus that pillar area there.

Q Has it been determined that no pillars would be allowed to be removed from around a producing well from within 750 feet of the well bore?

A Such a case has never come up, Mr. Girand. However, my office is the power that is, you might say, in that respect. The only way our instructions could be overruled would be from the higher officials in the Department.

Q I was only inquiring whether that determination had been made. That being true, it would still allow the potash operator to recover at the present time and during the life of the production of the oil and gas well, at least 65% of his ore?

A That is correct.

Q A denial of the right to drill for oil and gas, in the event oil and gas exist in place, would deprive the lessee of the oil and gas of 100% of his oil?

MR. BLACKMAN: If the commission please, I think that is a bit of argument.

MR. GIRAND: All right, I will withdraw it. I will make my speech later.

Q Mr. Fulton, in the field the potash is now in, have there

been occasions where potash has been mined around producing oil and gas wells?

A I am not certain, Mr. Girand. I think the Potash Company of America either have been close or are getting close to some wells in their operation.

Q As a matter of fact, Mr. Fulton, there are two wells in--at the present time--producing within the limits of the Potash Company of America leases right at this time, aren't there? That is, the W. H. Black Federal Yates located in the Southwest, Southwest of Section 28 and the Black State Lowe No. 1 in the Northeast of the Northeast of 33, I believe, or 32?

A The thirty--two?

Q Both of those wells are located in what has been delineated as the potash area. Do your records disclose the estimated value of the potash on the SW¼ of Section 28?

A No, sir. We could compute it, if there is a need for it. However, my office was asked to compile the data for this particular case.

Q I wonder if you would make that information available to the Commission to show a comparable value between the SW¼ and the SE¼ of Section 28?

A The Southwest and the Southeast? It will take sometime, Mr. Girand, to prepare that. I have no facts or anything available to do it now.

Q There are no core holes, or there isn't the same information in regard to the SW¼ of Section 28 that exists as to the Southeast quarter?

A Oh, yes, but I don't have it here.

Q Well, I meant at a later time.

A Yes.

Q Just for the Commission's enlightenment.

MR. BLACKMAN: You have made a statement, Mr. Girand, in the course of your questions, that part of this area is within the PCA area, and I haven't challenged the statement because I don't know the facts. I don't have our lease line around there.

MR. PORTER: The map will show it, it is on file in our office.

MR. BLACKMAN: Will the Commission take judicial notice of the map on file to the extent of the PCA leases?

MR. WALKER: The Commission will take judicial notice and it will be in the record.

MR. BLACKMAN: Fine.

C R O S S E X A M I N A T I O N

By MR. NUTTER:

Q In making your calculatipns on the value of the potash reserve, what were the thicknesses of the beds in the four corners of the quarter section?

A Well, sir, those thicknesses and the actual information information is really not mine to divulge unless PCA would agree to it.

Q Well, I think it is just a matter of figuring it out backwards--would you say it was an average of 4½ feet?

A Does PCA have any objection?

MR. BLACKMAN: We have no objection.

A The average thickness was 4.52 feet.

Q Is that usually a pretty reliable method of determining the thickness--taking the core thickness? At the section line?

A Yes, it is a weighted average.

Q Has experience in the past revealed it to be pretty reliable?

A Yes,

Q One other question--the value of the K_2O is thirty-six cents in the unit. Is that the value of the ore in the mine or on the surface or at the mill, or where?

A That is the value of the product as sold.

Q In other words, from these figures we would have to deduct the cost of mining and processing the ore, is that correct?

A You would if you were calculating profits, but we are speaking of values here.

Q The stuff doesn't have any value until it is brought to the surface and processed though, does it?

A True, true.

Q Has your office constantly observed this 45 degree angle of subsidence?

A Yes, sir.

MR. NUTTER: That's all.

MR. WALKER: Any further questions?

C R O S S E X A M I N A T I O N

By MR. GURLEY:

Q One question: I don't understand what you mean when you

say on the second page of your letter that "pillars could not be removed closer than 750 feet to a producing well." I am not quite clear on that. You mean there would have to be a solid piece of ground there, I mean ore, of 750 feet, surrounding the well, or in that area the pillars that were there, mined around them and left them, they could not be removed--which would be the case?

A What I mean is, Mr. Gurley, observing the 45-degree subsidence angle with the average depth being 750 feet vertically, your 45-degree angle would indicate a 750-foot distance horizontally, so if the well was 750 feet out, we wouldn't dare take any pillars closer than that because it would affect the well itself.

Q Then, actually, it effect, it would be--you mine 65% within the area of the well, and leave the pillars for 750 feet, is that correct?

A Yes, they would get 65% extraction over the entire tract except for the pillar around the well, but when it came time to take the 25% normally expected in the pillars, if there were four producing oil wells in the center of each 40-acres tract, all the mine pillars in that 160-acre tract would be less than 750 feet from a producing well, and you could not take them.

(Mr. Gurley indicated he had finished his cross-examination.)

MR. BLACKMAN: May I clarify that last statement: I thought you intended to say if there were one producing oil well in the center of each 40-acre tract within the 160-acre tract, in that case all of the potash ore-producing zone would be within 750 feet of an oil-well, is that correct?

A That is correct, all the pillars within the area.

RE-CROSS EXAMINATION

By MR. NUTTER:

Q Referring to Exhibit No. 8, Mr. Fulton, this copy of the rules and regulations put out by the Department of the Interior, in here do they say how close a well can be drilled to the potash reserves, or anything about 750 feet?

A No, sir, they don't.

Q They don't mention any angle of subsidence or anything on that, do they? That's all.

MR. WALKER: Any further questions of this witness. You may be excussed, Mr. Fulton.

ROBERT H. LANE,

a witness, called on behalf of the Protestant, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. BLACKMAN:

Q Mr. Lane, will you state your name, please?

A Robert H. Lane.

Q And your address?

A Carlsbad, New Mexico.

Q By whom are you employed?

A International Minerals and Chemical Corporation.

Q What is your capacity at International?

A I am a mine engineer?

Q Mine engineer? A Yes, sir.

Q Are you in charge of the mining engineering department at International?

A Yes, sir.

Q And how long have you been with International Minerals and Chemical Corporation?

A Six and a half years.

Q Mr. Lane, you just heard Mr. Fulton testify on the methods of estimating amounts of potash or ore. Would you give your comment upon the general use of methods familiar to those in the industry?

A Our company estimates reserves the same way as Mr. Fulton.

Q Have you generally found those methods to be accurate?

A Yes, in most cases.

Q Mr. Lane, do you consider the general averages we have been talking about with several witnesses, of 65% on first mining and 25% on second mining, to be fair averages of the type of mining that would be performed in an area such as is under consideration here in the Southeast quarter of Section 28?

A Yes.

Q Have you had any experience in removing the pillars and observing the resultant subsidence in International Minerals and Chemicals?

A We have robbed them three different times; first, in 1948, second time in 1952 and 1953, and we have just finished a small area this spring. On the surface we have very little in the way of check points compared to U. S. Potash. Underground we have observed it very closely.

Q Before passing that, have you had an occasion to measure

the movement of the potash members, or the general ground, after first mining?

A No. We have one case, not on the surface. This is underground and the back and the bottom will come together at a uniform rate immediately upon first mining.

Q Can you tell us what that rate is?

A An average rate of 1/100 of a foot per month.

Q Will you explain to us, Mr. Lane, the pillar-pulling operations which you engaged in and what you observed to have taken place at that time, and when it was, if you please?

A I will try to go over the area we just finished. It is a small area compared to what we call a sub-panel; an area approximately 800 feet wide and 1,000 feet long. After you mine to the edge of the sub-panel, you start to retrend, by pillar mining. Movement started within forty-eight feet. The first movement is that the floor heaves, this is caused by a mud seam underneath the potash bed and happens after the first pillar is split by additional weight being placed on it, and that weight, theoretically, is 375% on first mining and 1200% on second mining--the additional weight on a pillar. Movement occurs when there is a four-inch mud seam four feet underneath the mining bottom. This mud seam is compressed and tends to flow away from the fender causing the floor to heave or buckle in the center.

Q What is the fender?

A The fender is the remaining portion of the original pillar. After the floor heave takes place, it has been noticed in many instances where the pillar itself will move up to six inches

and then slide down to the tip of the bed. After that movement, usually the back will cave out.

Q Approximately what was the extent of your over-all recovery in the area from which you pulled those pillars?

A 93%.

Q Mr. Lane, would you comment on the lapse of time that should be expected between first mining and second mining operations? Is there any rule you can go by that you know of?

A I can't say there is a rule, but it varies from week to week, even in our own property.

Q In other words, if too much time is allowed to elapse before commencing second mining operations, your area might get in the condition that you can't perform second mining operations?

A Yes, sir, we have a small area of that nature.

Q Explain any direct experience you have had in that area?

A In 1952 we opened a new section in the mine, practicing the same standards as in the older section.

Q By that what do you mean?

A The same standards for width in first mine extraction--identical standards, with no rough salts or protection of that sort. In the new area, it wasn't very long before we found out our mistake. Then new standards had to be adopted and the original area was lost.

Q What do you mean when you say the original area was lost?

A The new orebody we went to.

Q When you say it was lost, what do you mean?

A It was lost to second mining. Safety-wise we can't rob

pillars.

Q How long a time was it between the time you finished mining in there and the area became what you considered to be unsafe for second mining?

A Seven to nine months.

Q Mr. Lane, would you care to comment on the pressures involved in a subsidence situation such as this, such as we have been talking about here? Can you illustrate it, if possible, by referrals to Exhibit 2 and state just what you observed with reference to Exhibit 2?

A Theoretically, on the pillars, you have an increase of 375% more pressure on the pillar on first mining than on the area before first mining. In the center area between C and B, the fenders remaining have an increased pressure of around 1200%.

Q You stated in your testimony, I believe, that you had had some floor heaves?

A Yes.

Q Will you state where they have occurred in there with reference to points C and D?

A It would be in the dark portion, taking Pillar A, the remaining portion, you take and drive pocket cuts through the center and this would be the remaining fender on each side. There is a normal pillar on this side with a fender in here and a mud seam four feet underneath. The increased pressure on the fender also would get it down through the mud seam; the mud seam being the weakest component, it will tend to flow out in both directions under the pillars, and the original mining bottom will boil off by push-

ing the additional mud.

MR. BLACKMAN: May the record show that the witness sketched on the bottom of Potash Company of America's Exhibit No. 2 a little sketch showing the method of removing pillars, which constitutes removing the center of the pillar and leaving two small portions of the pillar which he has denominated fenders.

(Whereupon PCA Exhibits No's. 9, 10 and 11 were marked for Identification.)

Q Mr. Lane, I hand you a document marked Potash Company's Exhibit No. 9 and ask you if you will identify that picture, please?

A Exhibit 9 was taken in the International Mine in a robbed-out area. It shows a typical floor heave.

Q Can you state approximately how far that heave occurred from the area where the pillars were actually removed?

A This is right in the area, this Exhibit 9.

Q Right in the area where the forms were removed?

A Yes, as in the diagram marked Exhibit 2.

Q I hand you another picture and ask you to identify that, please?---and this has been marked Potash Company's Exhibit No. 10.

A Exhibit 10 is a picture taken in International's mine. It is located about 300 feet from a mined-out area, and shows a floor heave in one of our main-line tracts. The large pillar you see on the righthand side was the barrier pillar and the floor heaving action came through that long pillar.

Q Mr. Lane, I hand you a document marked Potash Company's Exhibit 11, and ask you if you will identify that, please?

A Exhibit 11 is a picture which was taken in International's

mine on the 850-foot level, fifty feet above the level which has been in question all day.

Q I think you might explain, if you will, the number of levels on which mining is conducted at International Mine and Chemical?

A At the present time, we are on two levels--at one time, we were on three, but one has been abandoned for the time being.

Q It is not conducted on only one level as other mines are, is that true?

A To my knowledge.

Q Will you explain just what occurred on Exhibit 11?

A The pictures shows a corner of a pillar on an upper level. Subsidence occurred between this pillar and the one below, and the pillar is separating from the actual mining back which is a mud slip on this leve.

Q What had occurred on the lower level prior to the time that subsidence occurred?

A In Exhibit 11?

Q Yes.

A Pillar mining was completed with a normal floor heave and normal spreading of the pillars, and fenders.

Q Mr. Lane, are you generally familiar with deposits of potash in New Mexico?

A Yes.

Q I would like to have you comment on the extent of those deposits--and be as specific as you can. If you have to, you may look at any information you have about them.

A The deposits are generally the same in International's

mine as with the other mines, the difference being that we have two of the upper levels out of the reconized twelve mineralized zones. But in general all features are the same, mud slips, and the different compositions and beds.

Q Does International--I don't wish to ask you for confidential information so please feel free not to answer--I would like to know if International's over-all percentage of ore, of potash contained in the ore, is less now than it was previously.

A Would you re-word that?

Q Does International--I would like to know if International is mining a lower grade of ore than a few years ago?

A Yes, by 25%.

Q From your knowledge of the situation, is that the general situation in Carlsbad?

A It will be.

Q What is your reason for stating that, would you explain that?

A I think we can bear it out--all the shaft logs were placed in a higher grade of ore, and they are working to the fringe area now.

Q Would it be fair to state that New Mexico deposits do not constitute an inexhaustible source, but are definitely limited.

A They are.

Q Mr. Lane, would it be fair to compare the action and the pressures which are involved in a subsidence funnel of the type shown here with the method of underground mining which is in use in a good many mines throughout the world, known as block-caving?

A To a limited extent, yes.

Q Is the first action occurring in this subsidence funnel similar to the first action occurring in a block-caving situation?

A Yes.

Q In block-caving, then, you simply remove the material on the bottom between Position C and D on Exhibit 2, and keep on doing it and the material keeps on falling in?

A As long as an open area remains, it will keep crushing.

Q And if that is continued and there is a sufficient overburden for the weight upon your ore body, it is possible to crush the entire orebody and bring it out through the bottom as they have done in Butte, Montana?

A I don't think we can control the grade in our type of mining.

Q Not in potash, but if you were to do it, it could be done?

A Yes.

Q Mr. Lane, in the event oil or gas wells were drilled in an area and at some later time the Potash Mine came in and removed the sub-surface support by removing the pillars on second mining, would you care to comment on the effect it would have on a well?

A I don't think our mine would extract the pillars if there would be existing oil.

Q Assume for the moment that you did extract the pillars--what would be the effect on the oil and gas well?

A Through evidence of movement underground, it should be sheered, more likely the loss of the well or leakage into the mine.

MR. BLACKMAN: I believe that is all.

(Whereupon there was a recess, following which the hearing continued.)

MR. BLACKMAN: I have just one more question.

Q Mr. Lane, would you kindly explain to the Commission just why it is that International Minerals and Chemical, in line with some of the other potash mine operators in Carlsbad and throughout the area, are now beginning to pull pillars?

A As stated before, the shaft sites are generally put down in higher grade sections and when the high grade is really gone, or tending to be, you approach the fringe area and the grade of ore is less. It becomes necessary then that the pillars be pulled before any of your power cables or haulage ways are taken out. It is just economy. The grade of ore is so low, the decrease in the grade makes it necessary to pull pillars sooner after first mining on an economic basis, and also in certain areas a long period of time might destroy the chance of robbing the pillars due to first mining subsidence.

Q You think there may be a difference in the element of time that might be safely spent between first and second mining in some areas you might consider to be rich in the grade of potash and high in volume, as compared to what we call the fringe area on the edges of the orebody?

A I think the time element is mostly in the nature of the beds. Where there is a heavy mud seam underneath, the time element might make a different in the extraction of pillars.

Q And also it might be, if you had a rich body of ore that

was quite thick that you might hold your pillars in reserve for sometime and still be able to go in at a later date and recover them, whereas on a fringe area you would probably have to recover the pillars very soon after first mining, as a part of the same operation, is that not true?

A Yes, sir.

Q Do you care to make any further comments on the general situation here, is there anything you care to add?

A No.

C R O S S - E X A M I N A T I O N

By MR. GIRAND:

Q Mr. Lane, you have been in the hearing room all day, have you not?

A Yes.

Q You were here when Mr. Fulton gave his testimony in regard to valuations on the SE¼ of Section 28, Township 19 south, Range 30 East?

A Yes, sir.

Q That is the quarter section being involved and being the Potash Company's Exhibit 7. In looking at that report, would you say that Exhibit 7, that that area involved is what you would call a fringe area?

A I couldn't answer that question.

Q If the record showed the potash at approximately an average of four-foot orebody, averaging out four feet in thickness, of commercial ore, would you consider that a fringe area?

A Not necessarily.

Q Now, a mining operation that had been engaged in one mining area for a period of some twenty-one years, and during that twenty-one years had not seen fit to go in and conduct any secondary mining program--would you consider there was any subsidence of any significance in that area?

A I couldn't say in that mine.

Q When you remove or pull a pillar and leave fenders as you testified, what are the dimensions of those fenders?

A That would depend on the original size of the pillar.

Q Assuming it has been testified, I believe it has been, that the pillars left by PCA are 35 x 35 feet--is that right?

MR. BLACKMAN: I believe so.

Q What would be the dimensions of a fender left from that size pillar in a secondary mining operation?

A That will be controlled by--just the structural member of the bed--it could be any size.

Q I believe you testified your mine operation is similar to PCA's?

A I also testified it varies from section to section due to the type of ground.

Q Yes--but on the part of the mine similar to PCA's, bearing that in mind as a preface, would you mind testifying what size fenders you would leave on pillars of 35 feet by 35 feet?

A I think if I would be laying it out on the board, I would leave a fender of about 8 x 26 -- it would be 8 by 24.

Q Eight by twenty-four?

A Yes.

Q Now, in the area that you removed the pillars in 1948, did you make any test or checks on the subsidence that existed there?

A Yes, sir--very limited checks.

Q What was the result of those checks?

A We have surface subsidence to 4½'.

Q Vertical or horizontal?

A Vertical.

Q Now, in your pillar removal program you had in 1952 and 1953, did you make any check on subsidence there?

A No, sir.

Q In your 1956 operation, have you noted any there?

A No, sir, not on the surface.

Q I will ask you, referring back to your Exhibits 9, 10 and 11, the photographs here, these pictures were taken from the area from which the pillars were removed in 1948?

A Exhibit 9 was taken in the area of the 1952-1953 mining.

Q All right. And what about Exhibit 10?

A Exhibit 10, the picture was taken approximately 700 feet from Exhibit 9.

Q And was that in the area that the pillars were removed in 1952 and 1953?

A Outside the area that was robbed in 1952 and 1953.

Q Now, Exhibit 11?

A Exhibit 11 lies in the bed fifty feet above Exhibit 9.

Q Fifty feet above Exhibit 9?

A Yes, sir.

Q You testified that in your opinion, and of course we all

know that the orebody, is limited from the standpoint of productivity--in other words, there is just so much potash in place. In years, do you have any estimate as to the number of years of potash production available in the past?

A No, sir.

Q Do you have any estimate from the standpoint of tons?

A No, sir.

Q Do you anticipate an immediate exhaustion of the potash fields within the next five or ten years?

A No, sir.

Q Do you anticipate an exhaustion of the potash fields around Carlsbad area in the next fifteen to twenty years?

A It is possible from my information.

RE-DIRECT EXAMINATION

By: MR. BLACKMAN:

Q Mr. Lane, when you used the word "fringe" in response to a question I asked, were you thinking of fringe in terms of margins or being near the edge of an orebody?

A Both--as you approach the edge of the orebody, it would be a fringe, it would be marginal.

MR. WALKER: Does anyone else have any further questions?

CROSS EXAMINATION

By MR. GURLEY:

Q Mr. Lane, in your opinion, is an extensive practice of secondary recovery in the industry or in the mining area down there near at hand?

A I think it is.

Q How long, in your opinion, would it take to produce all the potash possible by secondary recovery methods in the area?

A That depends on production schedules.

Q Well, assuming that you ceased new operations and that you went into the secondary recovery angle, for your production, can you give me some idea in years how long it would take--for instance, in your own mine at International--to recover all the potash available there?

A No, sir; we don't know what the schedules would be next year or the year following.

Q Would you say it would take a matter of ten years?

A No, sir; it would be less than ten years if production schedules remain at today's levels.

Q Would you say it would be nearer five years?

A It would be nearer five, yes.

Q Then, in your opinion, it would be somewhere between five and ten years, is that correct?

A Well I wouldn't say which side.

Q You're a hard man to get an answer out of. Thank you, that's all.

MR. WALKER: Any further questions?

CROSS EXAMINATION

By MR. NUTTER:

Q Mr. Lane, the area of the floor buckling in Exhibit 9, is that between a couple of fenders?

A Yes.

Q The area in Exhibit 10 shows the railroad track buckling.

You say that is a distance of some seven hundred feet from the place where you robbed the pillars--I am learning the language.

A No, it's approximately two- or three hundred feet, and seven hundred from where the other picture was taken.

Q But it is about two-, two-fifty or three hundred feet from the area in which the pillars were pulled?

A Yes.

Q In which direction from the buckling were the pillars pulled?

A To the right.

Q On the other side of this pillar?

A On the right side of the buckling.

Q How long is the pillar there?

A The pillar in the picture is 400 feet wide and 150 feet long.

Q Exhibit 11, that was taken in the room immediately above the room where the pillars were pulled, is that correct?

A Yes.

Q Has the floor in this room subsided yet?

A As indicated in the picture, it has.

Q Has the ceiling subsided?

A We don't know.

Q If the ceiling has subsided, the floor has subsided faster, is that correct?

A Yes.

Q And yet the ceiling is the one with the weight of the overburden on it?

A Yes.

Q I think you made some mention, didn't you, that there is a time limit within which it is feasible to go in and pull pillars after primary mining?

A There is for a given area.

Q Is there a time in which those operations could be performed in any area in Eddy County?

A What do you mean?

Q I mean, would every area have a time limit?

A In a sense, yes.

Q What would be the maximum time limit?

A I wouldn't say.

Q In your own operation I think you mentioned eight to ten months?

A In eight or nine months we lost the pillars in one small area.

Q What is the determining factor on whether the time limit is short or length before you can pull pillars safely?

A The underlying and overlying beds--the mud seams are the main thing.

Q Are mud seams pretty prevalent in the Carlsbad area?

A Yes, to a lesser or greater extent, either pure mud or contaminated with salt.

Q Would you estimate the time limit of pulling pillars would exceed five years or be less than five years?

A In some cases over five years.

Q How much more than five years?

A The longest we have left any was eight years.

Q And were you able to pull those pillars?

A Yes.

MR. NUTTER: That is all.

MR. WALKER: Any further questions? If not, the witness will be excused.

MR. BLACKMAN: We offer in evidence exhibits numbered Potash Company's Exhibits one to eleven (1 - 11), inclusive.

MR. WALKER: Any objection to the admittance of these exhibits? (No objection) They will be received.

MR. BLACKMAN: We would like to request that the Commission take judicial notice of the oil records in its files, of the several oil pools in the general vicinity of the SE¼ of Section 28, Township 19 South, Range 30 East.

MR. WALKER: The record will so show.

MR. BLACKMAN: I would also like to ask the Commission to note what its files may show of the work done by Mr. Stanley who was at that time--Mr. S. J. Stanley--an engineer for the Oil Conservation Commission, on April 20, 1955, and who did some engineering work for the Commission at that time on the proposition of subsidence and oil and gas well casings in the event of subsidence. I am not sure of what the record will show on that, but there was some testimony in regard to that in Case No. 862.

MR. WALKER: The Commission will take judicial notice of that.

MR. BLACKMAN: The Potash Company of America has no further evidence to offer at this time.

MR. GIRAND: I am not sure that the applicant offered their one exhibit.

MR. WALKER: You did, and it was received. There are no further witnesses? Are there any further comments in this case, or statements?

MR. BLACKMAN: I would like to make a statement. What is the method of procedure?

MR. WALKER: Who wants to go first?

MR. GIRAND: Being the applicant, I should have the right of opening and closing.

MR. WALKER: We wouldn't cut you off anyway.

MR. GIRAND: The only remarks I have to make in regard to this matter are that we have applied here to the Commission for authority, or rather consent or approval of our notice of intention to drill, as to this location. This is required under Rule R-111-A as well as under the restrictions placed on us in filing our notice of intention with the U. S. G. S. How far the jurisdiction of this Commission goes in a matter of this kind, as to passing on whether we have the right to drill or not drill, I am really not prepared to argue at this time. There is serious doubt in my mind that it is a matter within the jurisdiction of this Commission because it is Federal land and the lease was acquired under a Federal Stipulation which required consent of the Director before the drilling would be allowed. There has been no opposition or protest made as to the location of the well as not being within the rules prescribed by the Commission. Each of the well locations is a regular 660 location--a 660 location free of the potash

area. All it would require would be the filing with the Commission because it had complied with the rules. Now, the evidence here clearly shows that a 660-660 location on the SE¼ of the SE¼--however, putting my eagle eye on it, it would seem to me a 330-330 out of the NE corner of the SE¼ of the SE¼ would be or could be permissible under the rules. We just think that the Commission is confronted here with you might say co-tenants. We own one floor and they own the other floor, and they can get 65% of their orebody out while we get ours out under the testimony, without interference, but in order for them to get the remaining 25%, in the event of 90% recovery, they can't tolerate us as a tenant. The facts are a little hazy and have a lot of elasticity to them as to how much potash we have and how long it will last and when they will get to it. I don't know the rights and wrongs on the matter, but I know the Federal code gives a lease on potash and also oil and gas. I don't know who is going to be the hen or the egg. I don't know that we should be put in that position, but surely if they are entitled to recover at least 65% of their orebody at this time, and can do that and live with us in the production of our product, if there is any there, it seems equitable and just that we might be entitled to enjoy some of the fruits of our estate, but to say that we are entitled to it as a matter of law I think there are other matters to be considered. There has been quite a bit of testimony as to the hazard involved and we do not want to be a party to anything that is ultimately, directly or indirectly, dangerous to human lives and values. I am in this position on the matter: If we can get to our estate and test it and see whether

or not we have oil and gas, and do it safely, and they can in turn enjoy production at the present time, and during our production, of 65% of their orebody, without assurance that they will need to get the other 25% during the life of our production, I think we would be entitled to go ahead with our operation.

MR. BLACKMAN: Mr. Chairman, and gentlemen, I would like to say in the first instance here, that the Potash Company of America approaches this problem a little more in the light and line of a problem in conservation, rather than a problem of the relative rights of the two parties. I think the engineering evidence is quite clear here that a producing oil and gas well will most certainly deny to somebody the production of the potash on second mining. Let's look at it a minute and see to whom it is denied. It is quite true that that denial is a denial to PCA of the amount of profit it can make from operatings its mine in this particular section. But let's take a look at the letter Mr. Fulton has put in evidence, as to the value of the potash to the people. The value of the potash to the State of New Mexico, how much will be lost if this oil well or these four oil wells are drilled. The testimony is uncontroverted, both the engineers' testimony and the statement of Mr. Fulton, that it will not be possible to mine this potash on second mining if oil and gas are discovered and produced here. The testimony of Mr. Lane is very very strong on the proposition that second mining--that we cannot wait for a large number of years before going in on second mining. Let's look at the economic situation in which all of the potash companies now find themselves. All of the old companies who have been participating

here--U. S. Potash, International Minerals and Chemical, and Potash Company of America--who have operated in this area for a good many years, and are approaching the limits of their orebodies, and beginning with the retrending operation of pillar pulling, and getting out final mining, they are in competition not only with the new companies coming in, but there is the strong possibility that the New Mexico operation is going to be in competition with the potash deposit now being developed by Delhi Taylor in Moab, Utah, and extensive operations in Canada, in which all potash companies are interested to the extent of taking out prospecting permits in Canada. The effect of these things is in all probability, permission to drill the wells at this time will mean a practical denial of second mining recovery of the SE¼ of Section 28 to the State. And what is the value of that? It is in the general area of Four Million Dollars. That is the value of the property which will be brought to the surface, loaded as a salable product. That isn't the value of it to PCA--their profit is a great deal less than that. But it is the value of the estate because it is made up of the wages and other expenses, but all the wages and other expenses going into that are funneled into the economy of the State. It all goes to the ultimate benefit of the State. I don't know the actual figures, or how many times you can turn over a dollar, but this certainly goes into the economy of the State of New Mexico. Now, what is the value of these wells? That, of course, is the sixty-four dollar question. They are a drug on the market if there is nothing there. But I ask you gentlemen to take notice of the records in your files on the values in terms of total production

in oil in other of the small pools around there and I think you will find a figure of something in the general neighborhood of Four Thousand Dollars, from Two Thousand to Four Thousand Dollars per acre is very very generous. The particular wells that have been drilled which are closeby the Black Yates well, look pretty bad to me, but I will not presume to tell you how good they are because I don't know anything about anything in the oil business, except the dry holes. I would like to state here and ask you to look carefully at this situation: We do not have here the situation Mr. Girand mentioned, of co-tenants; where two people, one owns the property on one level and one the other, and both have equal rights. That is not the situation at all. I refer specifically to Exhibit 3. Potash Company's Exhibit No. 3 is the oil and gas stipulation. This oil and gas lease of which Velma is assignee was issued under specific regulations by the Department of the Interior--our printed Exhibit No. 8--and I want to read to you one paragraph taken from the regulations which appears in the Velma lease:

"No wells will be drilled for oil or gas in formations above the base of the Delaware sand, or above a depth of 5,000 feet, whiever is the lesser, except upon approval of the Director of the Geological Survey, it being understood that drilling for production to these formations will be permitted only in the event that it is satisfactorily established that such drilling will not interfere with the mining and recovery of potash deposits or the interest of the United States would best be subserved thereby."

This oil and gas lessee is not in the position of a co-tenant,

but is the owner of a serving estate. It is up to them to prove that the mining and recovery of potash will not be interfered with. That is their obligation. And who is the beneficiary? The beneficiary is the State. And the loss, one set against the other, it seems to be a ridiculous comparison to me. A value of approximately four million dollars on second mining as against the valuation of the type of wells we may think we would get in this particular area. The question of jurisdiction has been raised by Mr. Girand. It is our feeling with respect to that problem, that the Oil Conservation Commission of the State of New Mexico does have jurisdiction, over-all conservation jurisdiction, which under the circumstances of this case they are entitled to exercise at this point. The question of jurisdiction between the State and Federal Governments is one of complexity. The law is very meager on the subject. And I think you are safe in saying that orders of this Commission conserving the natural resources of the State will be observed by the Federal Government, if they are reasonable. The so-called right which Velma has here is not a right which Potash Company of America is seeking to destroy. PCA had an original lease in this area, long before it was ever released by the United States Government for oil and gas leasing. Our mine was constructed and operations were conducted. The oil and gas lessee is charged with complete notice of everything that has gone forth, complete notice of the Department of Interior regulations affecting this. The State of New Mexico, in addition to direct benefits through economy, still is interested directly. As you all know, the royalties which are paid on both potash and oil to the Federal Govern-

ment come back to the State of New Mexico; 37½% of those royalties, under the Mineral Leasing Act, are returned directly to the State of New Mexico in the form of a direct cash grant for use in education or in public roads; 52½% of those royalties for both oil and gas are paid to the Bureau of Reclamation and the Bureau has already expended them in the State in which granted so the Federal Government only gets 10% back of the royalties. It doesn't take too much to calculate the relative values as far as direct cash benefits to the State of New Mexico on each of these propositions, whether we use the oil or whether we refer to the potash.

I believe, Gentlemen, that we are here looking at, I am afraid, the beginnings of probably several propositions similar to this, and with mention only of the proposition here, we would like you to check your land carefully through your records, and the testimony here, with respect to the amount of gas you find in the Yates formation. It is quite true there is only a small amount of commercial gas in this area, but there is still a good deal of gas available down there, and we are concerned with the contamination of our entire mine. You may say, "What are you thinking of here when you say you can't figure on second mining? Maybe you can figure a way to get in there." The plain fact of the matter is that this section is only a small portion of our mine, but it extends over a very large area all of which is connected together, and we simply couldn't take a chance on injuring our entire mine. The risk is very much too great, even if it were possible to conduct our operations by removing the pillars, which if you will refer to Mr. Fulton's letter, you will see it is not. Thank you.

MR. WALKER: Does anyone have anything further? If not, we will take the case under advise. The hearing is adjourned.

C E R T I F I C A T E

STATE OF NEW MEXICO)
: ss
COUNTY OF BERNALILLO)

I, THURMAN J. MOODY, Notary Public in and for theCCounty of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings, Pages 1 through 60, inclusive, were reported by me in Stenotype at the time and place hereinbefore set forth; that same was later reduced to typewritten transcript by me and/or under my personal supervision, and that same is a true and correct transcript to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal, this, the 27th day of August, 1956, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Thurman J. Moody
Notary Public

My Commission Expires:
April 3, 1960.

STATE OF NEW MEXICO)
: ss
COUNTY OF SANTA FE)

I, DOROTHY B. MYERS, Notary Public in and for the County of Santa Fe, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings, Pages 61 through ///, inclusive, were reported by me in shorthand at the time and place hereinbefore set forth; that same was later reduced to typewritten transcript by me and/or under my personal supervision, and that same is a true and correct transcript to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal, this, the 8th day of September, 1956, in the City of Santa Fe, County of Santa Fe, State of New Mexico.

Dorothy B. Myers
Notary Public

My Commission Expires:
8-3-60