STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISON
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

3 June 1987

EXAMINER HEARING

IN THE MATTER OF:

Case 8190 being reopened pursuant to the provisions of Division Order No. R-7556, Union, Harding, and Quay Counties, New Mexico. CASE 8150

BEFORE: David R. Catanach, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Division: Jeff Taylor
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For Amoco Production Co.: William F. Carr
Attorney at Law
CAMPBELL & BLACK P. A.
P. O. Box 2208
Santa Fe, New Mexico 87501

A P P E A R A N C E S

For Amoco Production Co.:	Daniel P. Currens Attorney at Law Amoco Production Company Post Office Box 3092 Houston, Texas 77253
For Cities Service:	W. Thomas Kellahin Attorney at Law KELLAHIN, KELLAHIN, & AUBREY P. O. Box 2265 Santa Fe, New Mexico 87051
For Amerigas, Inc.:	James G. Bruce Attorney at Law HINKLE LAW FIRM P. O. Box 2068 Santa Fe, New Mexico 87504
For Ross Carbonic:	Kurt Sommers
For Amerada Hess:	Jim Hefley

I N D E X

E X H I B I T S

E X H I B I T S CONT'D

MR. CATANACH: Call next Case 8190.

MR. TAYLOR: In the matter of Case 8190 being reopened pursuant to the provisions of Division Order R-7556, which order established special rules and regulations for the Bravo Dome 640-acre area in Union, Harding, and Quay Counties, including a provision for 640-acre spacing units.

Interested parties may appear and show cause why the Bravo Dome 640-acre area should not be developed on less than 640-acre spacing and proration units.

MR. CATANACH: Are there appearances in this case?

MR. CARR: May it please the Examiner, my name is William F. Carr, with the law firm Campbell & Black, P. A., of Santa Fe. We represent Amoco Production Company.

I'm appearing in association with Daniel R. Currens, attorney for Amoco Production Company from Houston, who will present Amoco's case.

MR. CATANACH: Are there other appearances?

MR. CURRENS: Daniel Currens,

Mr. Examiner.

MR. CATANACH: Thank you, Mr. Currens.

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of Santa Fe, New Mexico, appearing on behalf of Cities Service Oil and Gas Corporation.

MR. BRUCE: Mr. Examiner, my name is Jim Bruce from the Hinkle Law Firm in Santa Fe, representing Amerigas, Inc.

MR. SOMMER: Mr. Examiner, my name is Kurt Sommer. I appear on behalf of Ross Carbonics, Inc.

MR. HEFLEY: My name is Jim Hefley. I appear on behalf of Amerada Hess Corporation, Tulsa, Oklahoma.

MR. CATANACH: I'm sorry, I didn't get your name, sir.

MR. HEFLEY: Hefley, H-E-F-L-E-Y.

MR. CATANACH: Anybody else? How many witnesses are we going to have?

MR. CURRENS: I've got one witness, Mr. Examiner.

MR. CATANACH: One witness.

Does anybody else have any witnesses?

Will the witness please stand and be sworn?

(Witness sworn.)

MR. CATANACH: Do you want to put the map on the wall?

MR. CURRENS: I don't think it's necessary, Mr. Examiner. I think the people that are interested in them have some copies available.

This is merely an orientation map, this first particular map. The exhibits that we will be using are all easily lap size beyond -- besides this one.

MR. CATANACH: Okay.

MR. CURRENS: And perhaps while people are looking at those exhibits, Mr. Examiner, I might jsut go ahead and restate, as you said, this is a reopening of Case 8190, which was heard in May -- on May 15th, 1984, concerning rules for the Bravo Dome Carbon Dioxide Area.

From that case Order No. R-7556 issued and established on a temporary basis a Bravo Dome 160-acre area and a Bravo Dome 640-acre area, and set this matter to be reopened at this time.

Since the engineering analysis

of drainage at the time of that earlier hearing in 1984 was primarily based on calculations and modeling, the order included a requirement that a plan be furnished the Division for field testing to demonstrate the drainage efficiency of wells located on 640-acre spacing units.

Now plans to accomplish this were submitted and approved. Tests have been run, the information analyzed, and we're here today to present you the results.

Those tests will conclusively demonstrate 640-acre spacing is proper. Our recommendation is that the temporary rules that were previously issued in this cause be adopted for the 640-acre area and be made permanent.

JAMES W. COLLIER, JR.,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CURRENS:

Q Will you state your name, by whom you're employed, at what location, and in what capacity?

A My name is James W. Collier, Junior. I'm employed by Amoco Production Company in Houston, Texas, as a

Senior Petroleum Engineering Associate.

Q Mr. Collier, have you ever testified before this body before?

A No, I have not.

Q Will you briefly summarize for us your educational and work background in the field of petroleum engineering ?

A Yes. I graduated from Texas A & M University in 1972 with a Bachelor of Science degree in petroleum engineering.

I was employed by Amoco Production Company in 1972 and have worked for this firm for the past fifteen years.

I have worked in various reservoir engineering positions, handling primary, secondary, and tertiary oil recovery engineering projects. I've also been assigned to various engineering supervisory positions over the past ten years in West Texas and in Houston.

Also I have been accepted as an expert witness by the Texas Railroad Commission in the past.

Q Mr. Collier, let me further ask you with respect to the matter that's before this hearing today, have you had occasion to make studies of individual well performance histories and tests that were run in conjunction with the Commission order having to do with 640-acre drainage?

A Yes, sir.

MR. CURRENS: I submit Mr. Collier is --

MR. CATANACH: Mr. Collier is so qualified.

Q Mr. Collier, let me direct your attention to what's marked as Amoco's Exhibit One, and that's our only large exhibit, a map, and ask you what that depicts.

A Okay. This map depicts the Bravo Dome CO2 Gas Area in New Mexico. The map includes both the Amoco operated Bravo Dome CO2 Gas Unit and the Cities Service operated West Bravo Dome CO2 Gas Unit.

The Amoco unit is outlined with the heavy, bold, solid border. The Cities Service West Bravo Dome CO2 Gas Unit is in the cross hatched area in the southwestern part of this map.

Q Okay. I also see a dashed line on this map. What does that depict?

A That depicts the outline of the 640-acre area as defined by the NMOCD following two hearings in 1984.

Q Those being the hearings that Amoco had on 640-acres and the one that Cities Service subsequently had for 640-acre spacing.

A Yes, sir, that's correct.

Q Okay. Just generally would you describe

for us that outline that covers the eastern side and the south and the north a little more?

A Okay. Essentially, the entire Amoco operated Bravo Dome CO2 Gas Unit is spaced on the 640 acres.

Following the hearing 8190 in May of 1984, the order subsequent to that hearing established temporary 640-acre spacing rules for a period of three years for the entire Bravo Dome Unit Area, with the exception of twelve townships in the southwest part of this map.

If one were to draw a line north/south between Ranges 31 East and 32 East, traversing across Townships 18 North and 19 North, then you would have a picture of what the 640-acre area was subsequent to the Case 8190.

Q Okay, and then the changes that were made beyond that were as a result of the second hearing held by Cities Service having to do with that area.

A Yes, sir.

Q All right, sir. I further notice on this map you have some colored symbols. Do they have significance?

A Yes. There are two symbols on this map. There are three orange dots. Those are the locations of Amoco's long term flow tests which were run to help validate 640-acre spacing was proper , and there are four green triangles. Those are the locations of shut-in pressure mon-

itor wells that have not produced and the purpose is to see interference from the offset producing wells in the form of pressure response.

Q Okay, anything further with respect to this map?

A No, sir.

Q Let me recall that back at the hearing in 1984 we showed some long term flow tests and those were tests where production had taken place for some period of time, and that production had been analyzed and I believe in two of those instances a projection had been made as to what performance would be expected if 160 acres or 640 acres was being drained.

Is my memory correct?

A Yes, sir. Those are the two -- two southernmost orange dots on Exhibit One.

Q Okay, let's look at Exhibit Two and tell me what that is, please.

A All right, Exhibit Two is a reproduction of the old Exhibit Thirteen from Case 8190 held in May of 1984.

Q And that's the exhibit that was entered at that time and has to do with one of these orange dots?

A Yes. Exhibit Two is the long term flow test data and the predictions therefrom for Well 1934-201G,

which is the westernmost of the two orange symbols on Exhibit One.

Q The southern orange symbol.

A Yes, sir.

Q Okay, now there was another long term flow test that had predictions made at that time. Do you have a copy of the exhibit that we entered at that time?

A Yes, sir, Exhibit Three for this case is a reproduction of the old Exhibit Fourteen from the original Case 8190.

Q Now which orange dot is that?

A That is the easternmost of the two southern orange dots, or Well 1935-221G.

Q And it similarly made a projection as to the results that would be expected if 160 acres was being drained or if 640 acres was being drained.

A That's correct.

Q Okay. That's been three years ago. Were those two tests continued?

A Yes, sir. We continued the monitoring flowing tubing pressure and rate performance on both of these wells in order to validate our predictions.

Q Okay, well, let's look and see what additional data we've obtained in the interim.

I believe Exhibit Four has to do with

Well 1934-201G.

A Yes.

Q Let's look at that exhibit.

A Yes, sir. This Exhibit Four is again back on Well 1934-201G, which corresponds to Exhibit Two, whcih I just discussed.

What I've shown here is an updated performance. If you look at the middle third of this graph you can see that we have updated the flowing tubing pressure performance out to a total test period of about 1000 days.

Likewise, we've updated the gas production rates for this well the same time period of 1000 days.

Q Okay, now you show on there the old rate prediction you had down in the bottom third of that exhibit, I believe. Is that what the dashed line is?

A Yes, sir. The dashed line is the prediction of gas flow rate from this well that was made back in 1984.

Q And has production from that well been substantially different than the amount that we had predicted at that time?

A Yes, sir, we have averaged -- actually, since 1984 we've averaged roughly 2-million cubic feet a day from this well as compared to the 1984 prediction, which was just under 1-million cubic feet per day.

Q Now what's the top third of this particular graph, cumulative production?

A The cumulative -- yes, sir, this is cumulative production with the actual being the solid, heavy line, and the 1984 prediction being the dashed line.

Q The two dashed lines just went together and the solid lines are what's actually occurring?

A Yes, sir.

Q All right, then using this additional data, were your old predictions still good?

A No, sir.

Q So was it necessary then to make a new prediction to match the actual production history that you have over this more extended period of time?

A Yes, sir, that's correct.

Q Do you have a prediction on this particular well?

A Yes. Exhibit Five is an updated prediction using the same modeling technique that was used for the '84 prediction.

Q Okay, let's just discuss that for us, please.

A Okay. Again, if you look at the lower third of this graph, the actual gas flow rate performance is shown in a light blue solid line. The model was updated --

well, let me move to the next curve, in the middle curve, you can see that I've also superimposed actual flowing tubing pressure performance and if you'll look closely, you'll see that the red line in the middle third of this graph overlies the blue line. The reason it does that is because I chose to input the actual flowing tubing pressure performance from this well into the model and instructed the model to predict flowing tubing -- excuse me, flowing gas rates from this well, and the match that resulted from this modeling work can be seen in the lower third; if you compare the solid red line to the solid blue line, you can see that we have a very acceptable and very valid match of producing rates.

Q I take it in the upper third the blue line is the actual cumulative production there, too.

A Yes, sir. The --

Q Okay, now in addition to those lines there are some black lines on this exhibit. What are they?

A Those black lines are the predictions that we obtained by inputing the same flowing tubing pressure performance but yet instructing the model to assume a 160-acre drainage area rather than a 640 area.

Q Okay, so you tell the model it can't reach out past 160 acres and the black line is the result you get.

A That's correct.

Q The bottom one is for the rate?

A That's correct.

Q And the top one would be the cumulative that was associated with that rate.

A Yes, sir.

Q Now, Mr. Collier, let me ask you if -- which one of those predictions most closely fits the actual data, the 160 or the 640?

A I think it's obvious that the 640-acre drainage prediction more closely fits actual performance.

If you look at the cumulative performance, the percent difference between the predicted cumulative on 640 acres and the actual cumulative is less than 4 percent.

Q All right, sir, let me ask you if based on this work, if you you have an opinion as to the drainage associated with the production from this well?

A Yes, sir. I believe this particular well is draining 640 acres.

Q Anything further with respect to this exhibit?

A No, sir.

Q Okay, we had two of those 1984 exhibits we were looking at awhile ago, and I assume you've done sim-

ilar work on the second of those wells?

A Yes, sir, I have.

Q Well, let's go ahead and look at Exhibit Six, then, and tell me about that.

A Again Exhibit Six corresponds to Exhibit Three, which, Exhibit Six provides an update of actual flowing tubing pressure performance and gas flow rate performance for Well 1935-221G, which is the easternmost of the two orange dots on Exhibit One.

Q And is the setup on this similar to what we just looked at before?

A Yes, sir. We are looking at actual gas flow rates in the solid blue curve in the bottom third of this graph, and you can see that the '84 prediction was about 1.2-million cubic feet a day, held constant, but the actual flow rate has been something on the average in excess of 2-million cubic feet per day in this well.

Q Okay, so again we have a situation where we were able to produce at a higher rate than we had used in the earlier predictions. I take it that again necessitated a new match and prediction system.

A Yes, sir.

Q Okay, let's turn to Exhibit Seven and look at those predictions that will appear on that one, sir.

A Exhibit Seven provides the updated pre-

diction. Again we have input the actual flowing tubing pressure into our predictive model. Again the solid blue curve in the middle third of this graph overlays the red curve. That is because we've input the actual flowing tubing pressure measured on this well and have instructed the predictive model to predict gas flow rates from this well, using that flowing tubing pressure performance, and that prediction is shown in the solid red line in the bottom third of this graph.

Q Okay, that's the 640-acre prediction?

A Yes, sir.

Q And there's a black line in the bottom third of that graph, as well. That's the 160-acre prediction?

A Yes, sir.

Q Let me ask you, Mr. Collier, which is the best match?

A I think it's obvious from looking at both rates, our history match performance as well as the cumulative performance in the upper third of this graph, that the 640-acre prediction more closely matches actual performance than the 160 does.

Q Okay, again let me ask you with respect to this particular well, if you have an opinion as to what area is being drained by production from it?

A Yes, sir, I conclude without a doubt that this well is draining 640 acres.

Q Anything further with respect to this exhibit?

A No, sir.

Q Okay, I notice that up at the northern end of the map we have one more orange dot. Is that another long term flow test?

A Yes, sir, it is.

Q And do you have that one depicted on Exhibit Eight?

A Yes. Exhibit Eight is the flow test information gathered from Well 2233-321K.

Q Okay, and that test ran for a much shorter period of time than the ones we just looked at, which were, what, about 1000 days. This is how long?

A About six months, 180 days.

Q About six months, so this test was a relatively new but short term test.

A Yes, this test was initiated in late 1985 and concluded in early 1986.

Q Okay. You had from this the same data, rates, and flowing tubing pressures, and did they allow you to make a prediction?

A Yes, sir, using the measured rates over

this 180-day period, we input those rates into a model similar to the two we've previously spoken about, although using the actual reservoir parameters inherent to this well, and again have made predictions assuming a 160-acre drainage area and a 640-acre drainage area, and those predictions are shown as flowing tubing pressure performance in the upper part of this graph, the red line being the 640-acre prediction and the green line being the 160-acre prediction.

Q What's the relationship or the comparison between the actual performance and those predicted performances under different drainage radius?

A The prediction on 640 acres of flowing tubing pressure is a better match with actual than the 160-acre prediction is. In fact, the actual flowing tubing pressure performance is even above the 640-acre prediction for this particular well.

Q Indicating drainage greater than 640, probably, from that well?

A It indicates to me that in all likelihood this well is draining more than 640 acres.

Q Okay, let me ask you if there are any other characteristics having to do with your predictions on this 6-month test that you have seen on your 3-year tests that lend some validity to the work on this shorter term long-term flow test.

A Yes, sir, in all the modeling work that I have done and seen, the characteristic of these models is that the prediction for 160 acres and 640 acres is similar in a very early time period of the prediction, approximately at 60 to 70 to 80 days, you start seeing a divergence of the two predictions, and this has been a very common trait.

Q And you saw that divergence on the two long term flow tests that we looked at --

A Yes.

Q -- just prior to this one?

A Yes, sir.

Q All right, sir, anything further with respect ot this exhibit?

A No.

Q Okay, I believe that's all the long term flow tests that we had in this particular series. There were the green triangles on the map. Tell me again what those were denoting?

A Those four green triangles denote the locations of shut-in pressure monitor wells that have never produced since the unit went on production in 1984.

Q Okay, if I understand correctly, the green triangles are at the locations of wells that have been shut-in except for testing purposes on completion, or something of that nature, but when production started from

the unit they were not turned onto production even though all of their offsets and neighbors may have been.

A That's correct.

Q Okay. Since these were shut-in wells did you have a data gathering program to go with them?

A Yes, sir. We, well, first of all, we ran initial bottom hole pressure build-up tests on those four wells and then subsequent to the offset producers being put on production we have monitored the bottom hole pressure in all four of these shut-in wells on approximately a quarterly basis.

Q Do you have a tabulation of the results of that pressure monitoring?

A Yes, sir, Exhibit Nine is such a tabulation.

Q Okay, we have individual well analyses and work that's been done on each of these?

A Yes, sir.

Q So we may want to refer back to Exhibit Nine from time to time, but why don't we move on and look at the individual well tests or shut-in histories of these wells and see what they show us.

Let's look at Exhibit Ten, which I think is a three part exhibit?

A Yes. Exhibit Ten is actually is three

parts, labeled Ten-A, Ten-B, and Ten-C.

Q Okay, what well is that associated with?

A This is Well 1833-351C, which is the southwesternmost shut-in pressure monitor well.

Q Okay, what's the A part of this depict?

A This is a plot of pressure versus time for this particular well.

Q And is anything else shown on there except those actual points?

A We -- the actual points are shown with the blue X's. We have also constructed a 9-section model describing the producing system around this shut-in well and the prediction of pressure versus time is shown as a rust colored line this Exhibit Ten-A.

Q Okay. What's the B portion for orientation so that we kind of get all of these in mind?

A The B portion is a plot of bottom hole pressure measured in the shut-in monitor well versus the offset cumulative gas production volumes to the shut-in well.

Q Okay, you've got another rust colored line.

A Yes, that is a prediction from the same model as I showed you before on the Ten-A, just showing different parameters, those being pressure versus cumulative

production from the offsets.

Q Okay, what's the third part of this exhibit?

A The third part, Exhibit Ten-C, is a tabulation of the offset producer cumulative gas volumes on a well-by-well basis. This particular well only has two offsets and I've shown a tabulation of actual production in the model, cumulative production, and then the last column is the percentage difference between the two.

Q Okay. Now, if I understand correctly, what you've done is taken a model with the center of it being the shut-in well and modeled the -- that section that that's in and the eight surrounding sections, such that you have a nine section block being the offsets to that shut-in well, and then you have made pressure measurements on the shut-in well and you have model predictions of what should have happened.

Now is that generally the scheme we're going into here?

A Yes, sir, that's correct.

Q Okay. Let me ask you what you see from this first one.

A I see no -- no data on this test which can cause me to make any kind of engineering conclusion.

Q Why is that?

A Because the pressures measured bottom hole subsequent to the initial bottom hole pressure build-up test run in this well are slightly higher than the initial reservoir pressures.

Q Looks like we had a bad initial pressure on that well, then, is that right?

A Yes, sir, it does.

Q And that makes that one incapable of analysis, really.

A Yes, sir, I would not use this to make an analysis.

Q Well, let's see if we can find one that is capable.

Let's look at Exhibit Eleven and that series. Tell us which well that is.

A All right. Again, Exhibit Eleven has three parts, A, B, and C.

Exhibit Eleven-A is a plot of pressure versus time for Well 1835-161M, which is the southeastern-most shut-in pressure monitor well.

Exhibit Eleven-A again, as I mentioned, is a plot of pressure versus time.

Q Okay, and I notice that the pressure has declined with the passage of time. I take it that's been a period of production from the offsets.

A Yes, sir, it's about a 3-year period. This well has shown a definite decline in reservoir pressure.

Q Does that indicate to you a good match between your model and the actual pressure results that you have measured?

A Yes, sir, I think is a very valid match.

Q Okay, what about the B part of this?

A The B part again plots offset cumulative production versus pressure in the monitor well, the blue crosses being the actual points and the model prediction being the solid rust colored line.

Q How is your match there?

A Again I believe the match is very rigorous.

Q Okay, and the C part shows the production history. How many offsets does this one have?

A This well is offset all around so it's got eight offset wells.

Q Okay, and I believe on this you have the model predicted production and the actual production. How do those compare?

A They compare very closely. Actually the percent difference between the prediction and the actual cumulatives is about one percent out of a total of roughly 7

BCF.

Q Okay. Let me ask you, Mr. Collier, that when you analyze this one and you look at the pressure decline that's taken place at this well location, and the offset production, do you have a conclusion as to whether or not the shut-in well is being affected by the production from its neighbors?

A Yes, sir, I believe this well, because it has shown a definite drop in reservoir pressure, has to have been affected by offset production.

Q Okay, is it your opinion that production in this particular area is evidencing 640-acre, or greater, drainage?

A Yes, sir, I believe it is.

Q Okay, we've got two more of these shut-in tests. Let's look at them, or did you have anything further on that one?

A No, sir.

Q All right. Let's go to -- what's the next one, the northeastern green dot, triangle?

A Yes, the next series of exhibits is Twelve-A, Twelve-B, and Twelve-C. This depicts the shut-in performance of Well 2034-201G, which is the northeasternmost of the shut-in pressure monitor wells.

Q Okay, why don't you just run through the

A, B, and C parts in a similar manner? We all know the X's are the actual and that the --

A Correct.

Q -- rust color is the predicted, so what -- just tell us what we're seeing there.

A Okay. Again in this well, it is offset by eight producers and it has shown a definite decrease in reservoir pressure at the shut-in location, and that's depicted on Twelve-A.

Q Good match?

A Yes, I believe again this is a good match.

Q All right, sir.

A Exhibit Twelve-B is a plot of cumulative production from the offset eight producers versus pressure in the shut-in monitor well, and again we have a good match between the actual and the predicted.

Q Okay. How did our predicted and actual production compare?

A Okay, out of a total cumulative offset production of about 9 BCF our prediction was only one percent difference from the actual.

Q Let me ask you again with respect to this well, the analysis that you've made of it, as to any opinion you have with respect ot pressure interference from its off-

set wells and what drainage may be being recognized by the shut-in well.

A Since this area is spaced on 640-acre well spacing and yet we've seen a definite pressure decline in this well, I conclude that we are definitely affecting this well on this type of spacing.

Q All right, sir. Anything else with respect to this series?

A No, sir.

Q We have one more shut-in series of tests, I believe, and that would be the northwestern of these wells. That's Exhibit series Thirteen, A, B, and C?

A Yes, sir.

Q How about discussing those in a similar manner?

A Okay. This is the pressure performance for a shut-in monitor Well 2033-161G, which is the northwesternmost of the four shut-in pressure monitor wells.

Exhibit Thirteen A again is a plot of pressure versus time. This shows a decline again in reservoir pressure measured at the shut-in well over a period of three years.

Again we have constructed a nine-section model and that is -- again the prediction is shown in the rust colored line and again we have a very valid match.

Q Okay, B part?

A The B part again is the cumulative production versus pressure plotting the offset cumulatives versus the pressure in the monitor well, and again we have a very valid match between the actual measured pressure versus cumulative and the predicted.

Q Okay. How many offset wells are there?

A This well is only offset on four sides.

Q And how did the production and the prediction from those compare?

A Well, as shown on Exhibit Thirteen C, offset cumulative has been about 1.3 BCF from the four offset cumulatives total and our prediction is less than 1 percent in there or off of that actual.

Q All right, deviation.

A Deviation.

Q Let me ask you again your opinion with respect to your analysis of the data on the 2033-161G test location as to whether or not you believe 640 acres is being effectively and efficiently drained as evidenced by a decline in shut-in pressure in that well.

A I believe since the wells again in this location are on 640-acre spacing, and that we've seen a pressure decline in a shut-in well, that we are effectively draining an area of 640 acres.

Q Okay, you've mentioned a time or two here that wells are on 640-acre spacing in here and I take it by that you mean that there's one well per section.

A Yes.

Q Is the geometry of the well locations absolutely uniform and in a grid so that each one's exactly in the same spot in all of the sections that we've been looking at?

A No, geometrically there are slight variations for various reasons. The wells are not exactly one section apart.

Q Okay. Let's look at Exhibit Fourteen and see if we can get a little better understanding of that particular aspect here. Tell me what Exhibit Fourteen shows, please.

A Exhibit Fourteen is a schematic showing the first shut-in pressure monitor well and its offset situation. This is the first one I discussed earlier, this being Well 1833-351G.

The shut-in pressure monitor well is shown with the -- again with the triangle, and I've shown arrows with distances from that well to the offset producers.

Q Okay, I notice you have some concentric rings there. It looks like the center of the circles is the

shut-in well. Is that correct, and what are those rings?

A Okay, on this graph -- on this plot I've superimposed the radius that corresponds to a drainage area of 640 acres, that being the inside concentric ring.

Also, the middle concentric ring is a drainage radius depicting a 960-acre area.

And the outside ring is the radius depicting a 1280-acre area.

Q Okay, so if I understand correctly, you're saying that what is seen at the triangle there, if it -- if -- the wells are located a certain distance away are being affected by what has happened over that distance, in withdrawal.

A That's correct.

Q Okay. Is there anything -- if I recall, you said you didn't really see anything significant about this particular test.

A Yes, sir. I made no conclusions from this test.

Q Okay. Is there anything further with respect to Exhibit Fourteen?

A No, sir.

Q Let's look at Exhibit Fifteen. I believe that's the southwestern shut-in well. Do you have a similar exhibit there?

A Yes, sir. Exhibit Fifteen again shows -- is a schematic showing the shut-in pressure monitor well and the offsetting eight wells in this case.

Again I've shown the straight line distances from the shut-in pressure monitor well to each of the offset eight producers.

Q Okay, in looking at that particular exhibit, the location of the wells and associating that with the performance and performance predictions that you had previously shown, do you have a conclusion as to whether or not that shut-in well is being affected and whether or not 640-acre drainage is being demonstrated there?

A Yes, sir, I sure do. The -- if you look at the bottom righthand corner of this exhibit, I've shown the original reservoir pressure measured in the shut-in monitor well and the Delta p or the pressure drop since we started production from the eight offset wells has been 35 pounds.

Looking at the distances from the shut-in pressure monitor well to the offset producers, the closest well is near, very near the 640-acre radius of a -- a radius of a 640-acre drainage area.

The second closest well is actually even outside a 960-acre drainage radius.

The remaining six offset producers are

well even outside a 1280-acre radius of drainage.

Q Okay, so if I understand correctly, you're saying that because you see in this shut-in well, which has never produced, a decline in pressure of 35 psi, while the eight offset wells were on production, and all of those offset wells are at a distance that is equal to or greater than a 640-acre drainage area, and radius, that you believe that that definitely shows that they're in pressure communication and interference --

A Yes, sir.

Q -- to that shut-in well. Couldn't have come from anywhere else except the production --

A That's correct.

Q -- of those wells. All right, sir. Anything else with respect to this one?

A No, sir.

Q Well, let's look at the next one of those, please.

A All right. Exhibit Sixteen is a schematic of the shut-in pressure monitor Well 2034-201G, which is the northeasternmost shut-in pressure monitor well.

Q Let me just ask you if that leads you to a conclusion having to do with the area affected by production in the vicinity of this well.

A Yes. Yes, sir, it does. Again we've

seen a substantial pressure drop in this well of 22 psi from the original of 385 psi.

The nearest offset producing well to this pressure monitor well is off to the east, southeast a little bit, at a distance of 2,952 feet, which is right on or very near the radius depicting a 640-acre area of drainage.

Q Okay, so it's your conclusion that 22 pound pressure drop, I believe you said, --

A Yes, sir.

Q -- and the location of all these wells currently supports your prior conclusion.

A Yes, sir. With one well at 640-acre distance and the other seven offsets well outside of the 1280 acres, I conclude that we're draining 640 acres as a minimum area.

Q Let's look at the last shut-in test. We'll mark that Exhibit Seventeen. I believe it's the one with four offsets.

A Yes, this is Well 2033-161G. Again I've placed on this plat the shut-in pressure monitor well in the center and shown the straight line distances to the offset four producing wells.

Q Are any of those offset wells within the 640-acre circle?

A No, sir.

Q Are any of them within the 960-acre circle?

A No, sir.

Q Are any of them within the 1280 circle?

A No, sir, they're all outside the 1280 circle.

Q They're all even more remote than that.

A Yes, sir.

Q Did you see a pressure drop in the shut-in well?

A Yes, sir, a 10 pound pressure drop.

Q Do you believe that that -- well, do you reach a conclusion based on these things?

A In this particular location we're draining an area probably even larger than 640 acres.

Q Anything else with respect to this exhibit, sir?

A No, sir.

Q Mr. Collier, in the data that you've looked at in the long term flow tests and the shut-in tests, I believe there were seven wells involved. I believe that in one of them you said the data was not subject to interpretation, and I believe you said the other six were.

In the analysis of that data, have you a conclusion as to whether or not drainage, efficient drainage

is achieved on 640-acre spacing as demonstrated by these tests?

A Yes, sir, I believe 640 acres is demonstrated.

Q Okay. Do you have anything else, sir?

A No, sir.

Q Were Exhibits One through Seventeen, including all of their lettered parts, prepared by you or under your direction and supervision?

A Yes, they were.

MR. CURRENS: I'd offer Exhibits One through Seventeen and all their numbered parts.

MR. CATANACH: Exhibits One through Seventeen will be admitted into evidence.

MR. CURRENS: That's all I have.

CROSS EXAMINATION

BY MR. CATANACH:

Q Your performance curves, I was wondering what factors go into the construction of a model for the drainage areas, what type of information you used?

A Well, we input actual pay characteristics, porosity measured from a log, a density log. We input permeability measured from a bottom hole pressure build-up

or calculated from a bottom hole pressure build-up.

We then put, of course, pay height, water saturation, gas saturation, relative permeability data for two-phase flow, and we have predicted the performance of that well be giving it a no flow boundary at either 640 acres or 160 acres.

Q On your Exhibit Number Seven, I'm a little curious, on your flowing tubing pressure you get a substantial drop and at the same time you get a corresponding increase in producing rates. How does that -- how do you explain that?

A I believe at that time that we performed a fracture stimulation on this well and actually improved its productivity. I believe that was a foam CO2 frac.

Q The actual production data on the lower third of that Exhibit Number Seven --

A Yes.

Q -- the first part of that, up to about 400, or so, that's actual, and then does that go to what?

A Well, the entire blue curve is actual.

Q That's all actual.

A The only -- the reason it's different is the first 400 plus days is presented as daily, daily rates, and then the data from 400 to the end of the actual data is just smooth, but it's still reflective of actual measured

flowing rates. Just for ease of presentation and for ease of inputing into the model we smoothed the data, and that's what that represents.

Q Mr. Collier, how uniform are your reservoir characteristics in the area of all the test wells? Are they pretty uniform as far as --

A I can --

Q -- pay thickness, and porosity, permeability?

A They're -- I guess they're uniform. They're whatever we measured at that location. I think pay thickness is thicker from the two southern flow test wells and thinner for the northernmost well, but I know porosity is very comparable, within the range of 18 to 22 percent for the three flow test wells. There is some difference in pay thickness going from the northern wells to the southern wells.

Q But not exceedingly -- well, how substantial would the difference be?

A Well, if you look at Exhibit Seven, I've got the actual model parameters. Pay height there being 163 feet. The pay height, if you look at Exhibit Five for the other southernmost flow test well was 104 feet, and the pay height for the northernmost well was in the order of 50 to 60 feet.

Q Mr. Collier, are there areas within the unit where the -- where these characteristics are substantially different from the ones in this area here?

A Well, I've really only studied the area of production, which is the east central part of the unit.

I personally have not done a geological study to determine any differences in pay heights or permeability. The area of my study has been confined just to where we have production and I can only speak to the numbers that I've just given you. I don't know how varied the pay is in the rest of the unit.

Q So you can't really say for sure that this area is totally representative of the whole unit.

A Well, I can say that it is representative of the area that is currently spaced on 640 acres. We, by necessity, had to limit our data collection to areas where we had production; where we had a collection system; where we had a way to measure it; and where we could produce the gas and collect it and measure those rates.

So obviously, it had to be limited to that area in the east central part of the unit, but from that data I think there's enough of a widespread data in that area to make the conclusions that I've made; that the 640-acre temporary spacing area is spaced correctly.

Q Mr. Collier, how accurate are the bottom

hole pressure gauges? You've got some pretty small differences in pressure, 10 pounds, are those gauges accurate enough to -- so that they're --

A Yes, the stated accuracy of those bombs is one-half of a psi per 1000 psi.

MR. CATANACH: Are there any other questions of Mr. Collier at this time?

If not, he may be excused.

MR. CARR: I'd like to close, if I may.

MR. CATANACH: Go ahead.

MR. CARR: May it please the Examiner, in 1984 Amoco came before the Commission requesting 640-acre spacing for the Bravo Dome Area.

By Order R-7556 the Commission approved temporary 640-acre spacing for a portion of the Bravo Dome Unit Area, and this approval was given after an extensive, opposed hearing, in which Amoco presented a large volume of engineering and geological data.

The order didn't only create a 640-acre area and provide for temporary spacing, but that order also required for Amoco to come back and submit a plan that was acceptable to the Director that would demonstrate the drainage efficiency of wells located on 640-acre spacing units, and it required that that plan shoud include exten-

sive shut-in periods for one or more wells within the unit area.

Amoco came forward with a plan. The plan was amended. The plan was approved by the Director and the data you have been given today is the result of the additional study and data collection that was performed by Amoco in response to the Commission's directive, and we believe now that the record is complete in this case. The data that we developed during the last three years, not only the long term flow tests, but also the information we've accumulated from pressure shut-in monitor wells, this data clearly and absolutely confirms with actual reservoir performance the calculations and modeling work we had done.

Now that the record is complete we think it is clear that the most efficient and effective way to produce the Bravo Dome 640-acre area is on 640-acre spacing.

The efficiencies that will result are consistent with conservation principles. They will prevent waste. They will protect the correlative rights of all interest owners in this portion of the Bravo Dome and we therefore ask that the temporary rules be made permanent.

The order that created temporary rules provided that they would be effective for a three year period of time from June 19, 1984; therefore, to avoid

any gap in the rules for the 640-acre spacing area, we request that your order be expedited and request that an order be entered on or before June 15 making permanent 640-acre spacing for the Bravo Dome 640-acre spacing area as defined by Order R-7556.

MR. CATANACH: Anything else in this case?

If not, it will be taken under advisement.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true, and correct record prepared by me to the best of my ability.

Sally W. Boyd CSR

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

14 July 1988

COMMISSION HEARING

IN THE MATTER OF:

In the matter of Case 9428 being called by the Oil Conservation Division on its own motion pursuant to the provisions of Division Order No.R-6446-B, as amended, which approved the Bravo Dome Carbon Dioxide Gas Unit Agreement in Harding, Union, and Quay Counties, New Mexico. CASE 9428

BEFORE: William J. Lemay, Chairman
Erling Brostuen, Commissioner
William M. Humphries, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Division: Robert G. Stovall
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico

A P P E A R A N C E S Cont'd

For Amoco:	William F. Carr Attorney at Law CAMPBELL and BLACK P. O. Box 2208 Santa Fe, New Mexico 87501 and Daniel R. Currens Attorney at Law Amoco Production Company Post Office Box 3092 Houston, Texas 77253
For Norman W. Libby:	W. Perry Pearce and Sara M. Singleton Attorneys at Law MONTGOMERY & ANDREWS Post Office Box 2307 Santa Fe, New Mexico 87504

I N D E X

E X H I B I T S

E X H I B I T S CONT'D

MR. LEMAY: We'll now call Case Number 9428.

MR. STOVALL: In the matter of Case Number 9428 being called by the Oil Conservation Division on its own motion pursuant to the provisions of Division Order Number R-6446-B, as amended, which approved the Bravo Dome Carbon Dioxide Gas Unit Agreement in Harding, Union, and Quay Counties, New Mexico, to permit Amoco Production Company, the operator of said unit, to review operations and demonstrate to the Commission that its operations within the unit are resulting in the prevention of waste and the protection of correlative rights on a continuing basis.

MR. LEMAY: Thank you, Mr. Stovall.

Appearances in Case Number 9428.

MR. CARR: May it please the Commission, my name is William F. Carr, with the law firm of Campbell & Black, P. A., of Santa Fe.

We represent Amoco Production Company.

I'm appearing in association with Daniel R. Curren, Attorney for Amoco Production Company from Houston, who will present our three witnesses.

MR. LEMAY: May I ask if Mr. Currens is appearing as an engineer or as a lawyer>

MR. CURRENS: As an attorney, Mr. Chairman.

MR. CARR: We will try to keep him on track and in that role. Remember that lawyers are incompetent. We're having a hard time forgetting that.

MR. PEARCE: May it please the Commission, I am W. Perry Pearce of the law firm of Montgomery and Andrews, P. A..

I'm appearing in this matter in association with Sara M. Singleton, who is also with our firm.

We are appearing representing Mr. Norman W. Libby, L-I-B-B-Y.

We do not expect to have a witness, Mr. Chairman.

MR. LEMAY: Thank you, Mr. Pearce.

Additional appearances in the case?

If not, we shall begin.

Yes, sir.

MR. HOCKER: May I make a statement at the end?

MR. LEMAY: Oh, yeah, I'm sorry.

MR. HOCKER: I just wanted to make sure that was clear.

MR. LEMAY: I'm sorry, I needed to say that.

Our general policy is to have the proponents in the case present their evidence first, and there's cross examination, and all that, and then we have the other side again with the same procedure, and then at the end we do accept statements, unless -- if any of you have any time constraints because you have to leave early, we can accept statements earlier.

Are you okay, there?

MR. HOCKER: Fine.

MR. LEMAY: Mr. Carr.

MR. CARR: May it please the Commission, I have a brief opening statement.

Amoco Production Company is before you here today to review its activities as operator of the Bravo Dome Carbon Dioxide Gas Unit as it is required to do by this Commission's order which originally approved the unit agreement.

There have been a number of hearings over the past ten years involving the Bravo Dome i

Unit, not only the approval hearings but hearings directed at appropriate spacing in the unit, testing procedures, things of that nature, and although we've been before the Commission on numerous occasions, none of you have been on the Commission at that time.

And so what we're intending to do is to provide you with a general overview of our operations in the unit and tell you where we are today and what we are doing as unit operator.

I think it's fair to say that development of carbon dioxide in northeastern New Mexico has been an imaginative project. It's been a major undertaking even for companies the size of Amoco and the other companies involved in the development of this resource.

As perhaps you know, this is a unit that is the largest gas unit anywhere unit anywhere in the world. It's comprised of over a million acres. It's in a relatively remote area and as the resource was developed and the early decisions were made, they were made really with relatively limited data for it was not known exactly how to produce carbon dioxide, what it would require to treat it, how it could be transported; in fact, it wasn't even really known how it would work in a reservoir when injected for enhanced oil recovery purposes.

But it was apparent that there

was a potential for this resource in tertiary oil recovery.

So, in the 1970's Amoco and others undertook an aggressive leasing program in northeastern New Mexico. They drilled some wells, developed initial data, and then it was decided that because of all the uncertainties, because of the large area, because of the remoteness, unitized development of this resource was the appropriate way to go and in the late 1970's Amoco and the other working interest owners in the area met and they developed a unit agreement whereby they would share the burdens and the benefits that they hoped could be obtained from the development of carbon dioxide gas. This unit agreement is, and always has been voluntary in nature, and it contains some unique provisions. We won't go into all those today but one, I think, that is important at this point to note is that prior to this unit becoming effective, we provided in that agreement that we would come to this Commission, seek and obtain its approval, and in 1980 we appeared before you on two occasions, there were two hearings. Following both of those hearings the New Mexico Oil Commission approved the Bravo Dome Unit.

We obtained approval from the Commissioner of Public Lands. We obtained approval from the Bureau of Land Management, and the unit was in effect.

The unit -- the orders from

this Commission that approved the agreement gave you a continuing role. Various things apply to it, but one of the things, the reason we're here today, is that that order required that we would come back before you once every four years and tell you and show you that we were doing what we were at that time saying we were going to do; that is, develop this area in an efficient and effective manner.

And so for that reason we're here today before you to give you our progress report, and in doing this we're going to call three witnesses.

The first witness is a geologist. His name is Jim Wyles, and we will start by giving you a brief, general background of the development of the Tubb formation from a geologic point of view.

We will start from that point and then we will show you what Amoco has done, particularly in the last four years, since the first four years will be apparent, what we have done to further define and understand this reservoir, and we will show you that our early impression has been confirmed, that the Tubb is present throughout the unit area, and we're going to also show you that we now have a much clearer picture of this formation and that we are, even though development is down because CO_2 is tied with oil prices, that has not slowed us down in terms of actively and aggressively trying to understand the

reservoir and develop the information that we need to carry out our duties as unit operator as we move toward full development of those areas which we determine to be capable of commercial carbon dioxide production.

We will then call an engineering witness, Mr. Jim Collier, and he is going to take you briefly through the history of the development of this unit and he's going to show you that we have explored and are developing this resource in an efficient, orderly, and economical fashion and that there have been economies achieved in drilling, gathering, treating, and producing this resource, and that these reduced costs are beneficial to all those who have an interest in the Bravo Dome Unit Area, including the State.

We then will call the Manager of CO_2 Sales and Supply, David McElhaney. He is going to review with you the volumes of production that have been obtained to date, the investments made, and the benefits that we see flowing from the Bravo Dome Unit in terms of royalty payments and taxes.

This is New Mexico's only CO_2 source at this time and the industry which it serves, the oil industry, as we all know, is down but we will show you that even with the industry down Amoco, through its efforts in Bravo Dome, is marketing and producing substantial

volumes of carbon dioxide gas.

This is, and has been, an ambitious project and we have felt from the beginning at our request this Commission became our partner in that endeavor. We've made huge capital investments. We've put $150-million into the project before the first MCF of CO_2 was sold.

We have over $280-million in the effort now. We are producing and we are marketing carbon dioxide. We are continuing to study the reservoir and we believe at the end of this hearing you will see that in all ways we are continuing to meet our duties as unit operator and we are achieving what we believe are our common goals, ours and yours, to develop this resource in an efficient manner, preventing waste of the resource, and protecting the interests of all interest owners in the Bravo Dome Area.

Thank you, Mr. Chairman.

MR. LEMAY: Mr. Pearce, did you have an opening statement?

MR. PEARCE: Nothing, thank, you, Mr. Chairman.

MR. LEMAY: Are there any other opening statements?

If not, I would like the wit-

nesses to stand now and be sworn in.

(Witnesses sworn.)

MR. LEMAY: Mr. Carr, you may call your first witness.

MR. CARR: Mr. Currens will present Amoco's witnesses.

MR. LEMAY: Mr. Currens?

MR. CURRENS: We have previously handed you Commissioners a booklet that contains the exhibits that we will be going through here today. Some of them, when our witnesses are talking from them and testifying from them, we'll mount on some easels over here so they can be more readily seen throughout the room and we'll communicate a little better in that manner.

JAMES C. WYLES,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CURRENS:

Q Will you state your name, please?

A My name is James C. Wyles.

Q By whom are you employed, Mr. Wyles?

A Amoco Production Company in Houston, Texas.

Q And in what capacity?

A I'm a geologist.

Q Mr. Wyles, have you ever testified before this Commission before?

A No, sir.

Q Would you briefly give us some of your background? What's your educational background in geology?

A In 1981 I graduated from the University of Akron in Akron, Ohio, and received a Master's degree in geology.

Q And upon graduation with a Masters in geology, what did you do?

A I began employment in that same year with Amoco Production Company in Houston, Texas, working in the Exploitation Projects Group in west Texas, eastern New Mexico.

Q And very briefly, have your assignments in that area had to do with normal geological exploitation assignments a geologist would have?

A Yes, they have. My major responsibility was the evaluation and exploitation of certain existing

fields that Amoco operated in the Permian Basin.

Q Did that include the Bravo Dome Carbon Dioxide Gas Unit Area?

A Yes, it did. In 1984 I began my study of the Brave Dome Carbon Dioxide Gas Unit and since that time I've devoted approximately 50 percent of my time towards that effort.

Q In conjunction with this hearing today have you had occasion to take your knowledge, your studies, and prepare or have prepared certain exhibits that you will present?

A Yes, sir.

MR. CURRENS: I submit his qualifications as a geologist.

MR. LEMAY: His qualifications are acceptable.

Q Let me ask you to turn to Exhibit One. You have a set of exhibits there, Mr. Wyles?

A Yes, sir.

Q Exhibit One and tell us very briefly what's shown on that exhibit, please.

A This is a regional geographic location map of the Bravo Dome Carbon Dioxide Unit.

The Bravo Dome Unit is located in north-eastern New Mexico, near the Texas, Colorado, and Oklahoma

borders.

The inset map that you see there shows the unit boundary in the three counties which Bravo Dome covers, Union County, Harding County, and Quay County.

Q Okay, with that general location, and in that inset it also shows the outline of the unit, is that correct?

A That is correct.

Q Now this unit that we're talking about here is -- is it producing currently?

A Yes, it is.

Q And from what is it producing?

A It's producing from the Tubb formation.

Q And what substance is it producing?

A CO_2.

Q Carbon dioxide --

A That's correct.

Q -- out of the Tubb formation.

A Yes, sir.

Q Mr. Wyles, perhaps it would be generally helpful to us if you could give us a little background knowledge on the Tubb formation in this area; perhaps as to how it came to be deposited.

A Okay, if you will look at Exhibits Two-A, Two-B, and Two-C, these are three exhibits which

show the schematic depositional models of the Bravo Dome Unit Area through geologic time.

You'll note in the lower righthand corner of each of these exhibits the name Bruce I. May appears. He was the previous geologist that had worked on Bravo Dome and developed these models and we still believe these models to hold true today.

Q Why don't you start with the Two-A Exhibit, then, and discuss what that shows?

A Okay. Just to orient you on each of these exhibits, what I'd like to do is say that underneath the writing of the Sierra Grande Uplift, that will be the Sierra Grande Area on the block diagram, and below the writing where it says the Bravo Dome Area, that will be the general area for the Bravo Dome Area, and then to the right will be the Palo Duro Basin Area, and keep in mind these are schematic.

Q Okay, so this goes from the west on the left to the east on the right.

A That is correct.

Q Okay, go ahead with discussion of Two-A, please.

A This model that you see in Two-A is of Middle Pennsylvanian time. At this time we had a basement reactivation of faulting in the Sierra Grande Area as well

as the Bravo Dome Area, and this is shown by the red area in the lower lefthand corner where you can see a fault drawn in with up and down arrows with it.

This caused uplifting in both the Bravo Dome Area as well as in the Sierra Grande Area. This created horst and graben areas within the Bravo Dome Unit.

At this time we had high relief in the area and we had erosion of this PreCambrian basement rock, which was mainly granite.

We had deposition mainly through alluvial sand which deposited Granite Wash in these lower lying graben areas. This Granite Wash is indicated in the subsurface you'll see in the center of the photo, or diagram, by the orange area with the orange triangles.

Okay, going on to Exhibit Two-B, this is late Pennsylvanian time. As you can see in the Bravo Dome Area, we have lower relief as a result of the erosion that was going on.

Also you can see that the Granite Wash has begun to fill in the graben area. At this time you begin to have a reworking of the Granite Wash sediment by braided streams, but again, the main deposition at this time was the Granite Wash.

Moving to Exhibit Two-C --

Q Now that's a later time period.

A That is correct.

Q Okay.

A This is early Permian in Exhibit Two-C and at this time the Basement rock was well eroded or covered by Granite Wash. Now we see the dominant environment, an alluvial plain system, or reworking of Granite Wash by ephemeral streams. We've deposited fine grained sandstone, which is shown as the yellow area in the subsurface with crescent-shaped symbols in them. This fine grained sand developed good porosity and permeability and became the major contributor to the Tubb formation which is the reservoir in the Bravo Dome Unit.

Later in the Permian time we had a major transgression of the Palo Duro Basin Sea from the east and it transgressed up over the Bravo Dome Area. This was a very restricted shallow sea and deposited an evaporite of anhydrite, which is the Cimarron Anhydrite, which is shown as the gray area in the subsurface. This became the vertiseal for the Bravo Dome Unit in the Tubb formation.

Q Okay. This series, then gives us some background and perhaps understanding as to how this Tubb, which we -- from which we produce came to be deposited, is that correct?

A Yes, sir.

Q Now, have you a type log of the kind that is

normally run in drilling operations that depicts this Tubb formation?

A Yes, I do, in Exhibit Three-A and Three-B.

Q Now, this is two parts of the exhibit, A and B, but is this just one log that we're looking at here?

A That is correct.

Q Our Xerox just couldn't handle the whole thing on one piece of paper?

A That's correct, sir.

Q Okay. All right, tell us what's on the Three-A part of this exhibit, then.

A Okay. This is a type log of a typical well within the Bravo Dome Carbon Dioxide Gas Unit. The information that is shown here on this is the header information. On this particular header is the write-in compensated neutron formation density log, and that is the typical log that is run within the Bravo Dome Unit.

Q Okay, where -- where is this well located in the unit, just in general terms?

A In the west central portion of the unit.

Q All right. Anything else with respect to the header information?

A No, sir.

Q Let's move on down to the meat of the

log, the Three-B part of the exhibit.

A Okay. the curves that are shown on this exhibit are -- in the first track is the gamma ray curve, the track farthest to your left, and the other, the second track we have the porosity as determined by the compensated neutron density log.

The unitized interval of the Tubb formation is defined at the base of the Cimarron anhydrite or the top of the Tubb formation to the top of the PreCambrian Basement rock. And the PreCambrian Basement rock is shown here in this exhibit by the reddish area.

Lying unconformably above the PreCambrian Basement rock is the Tubb formation and the first thing that you encounter in the basal portion of the section is the Granite Wash, as I explained to you in the earlier exhibit, and this whole interval of the Tubb formation is colored in orange.

Within that Tubb formation, then, towards the top of the log, we have the fine grained sands which make up the major portion of the reservoir, the major contributor to the reservoir.

Above that, shaded in blue is the vertical seal, the Cimarron anhydrite.

Q Okay, is there any other particular that you care to point out with respect to Exhibit Three-A and

B?

Q No, sir.

Q Now, Mr. Wyles, I believe that you're familiar with or have read the transcript of the proceedings in the last of these hearings, the one we had four years ago reporting our progress at that time, is that correct?

A Yes, sir.

Q Do you recall whether or not we had obtained any seismic information at that time?

A Yes, sir. At that time we had shot 600 miles of seismic but not -- had not processed it.

Q Okay. So we had acquired data but hadn't had a chance to process it four years ago.

A That is correct.

Q Now, in the intervening time have we gathered any more geophysical information?

A Yes, we have. We have shot and processed another 800 miles of seismic, for a total of 1400 miles at a cost of approximately $3.5-million.

Q Okay, so we've got the additional 800 miles and we process the 600 we had before plus the 800 since then.

A Yes, sir.

Q Now, very broadly, has this seismic

coverage been pretty well throughout the unit area?

A Yes, sir.

Q Let's look at Exhibit Four and I think that we'll best work from one here we can put up on the easel.

And let me just ask you to tell us what's shown on Exhibit Four.

A The bold line around the seismic is the seismic is the Bravo Dome Unit boundary.

The lines that you are seeing within that unit boundary, then, are the seismic lines that were shot and processed, and again there were 1400 miles of total seismic in this area.

You'll note that we have a slight hole here in the south central portion of the unit and that's where we have most of our well control.

Over to the west we have a little bit sparse control there and that was mainly due to budgetary constraints when we shot the seismic.

Q Okay. Now, anything in particular further that you want to point out with respect to this?

A Just that the type log that we found in the previous exhibit is located approximately here.

Q Okay. The "here" being in the --

A West central portion of the unit.

Q Thank you, Mr. Wyles, as you well recognize, the record can't pick up your hand motion.

Now, you've mentioned the type log and you've mentioned the area it was in, what value does the geophysical information have to you as a geologist? How do you use it?

A Well, by working as a team, I get information from him on the approximate or the best top that he can give me from the seismic data on the top of the Tubb formation.

Q Is that coordinated with the results you've had from well logs and the drilling and samples and things of that nature?

A That is correct.

Q So in addition to the geophysical information, or the seismic information that you've gathered here, you've had other tools that you've been able to look at and study the geology and structure of this Bravo Dome.

A Yes, sir.

Q What would that be, primarily, wells?

A Yes, wells, seismic data, and making a Tubb structure map from them.

Q Okay, about how many wells have you looked at in conjunction with your work in this area?

A There are approximately 400 wells.

Q All right, and have you prepared a structure map?

A Yes, sir, I have.

Q Let's put that up as Exhibit Five.

Now, we've put Exhibit -- a copy of exhibit Number Five up on that easel. I believe you said that was a structure map you had prepared.

A Yes, sir. This is the Tubb structure map. The contour interval is 100 feet. The scale on the map is one inch equals 8000 feet. I'd like to point out to you that one of these square blocks is a township, we're dealing with 6 miles by 6 miles in this, so from the southern portion of the unit to the northern portion of the unit we're dealing with approximately 50 miles.

Q And from east to west?

A Is approximately 30 miles.

Q All right, sir, and also on this map are shown wells that are within the unit area, is that right?

A That's correct. Above the well symbols you will see the unit well number and below that symbol you will see the Tubb datum and you will note that that is a positive value; that is, the elevation is above sea level.

Q Okay. Now, were all the wells in the unit area a part of your study?

A No, sir. They are not shown on this

map. The only thing that is shown on this map are unit wells. To make this contour map I also did use wells that were outside the unit to the southwest, south, southeast, north, and northwest.

Q All right. Why don't you just give us a general rundown of what you've depicted by the structure map?

A Okay. There is a regional Tubb pinchout as we go towards the northwest. That is outside of the unit boundary.

Q Now, is that that wavy line in the upper left of this exhibit?

A Yes, sir. I've drawn a wavy line in this case because I'm indicating that the Tubb pinchout is somewhere in this band. The only thing I have to go by on that is three wells outside the unit that did not have Tubb present at all.

Q So you know there's no Tubb that far --

A That's correct.

Q -- to the northwest, but you don't know precisely where it pinches out.

A That is correct.

Q Okay, go ahead, don't let me interrupt so much.

A The regional dip of the Tubb formation

is towards the southeast. It is also towards the east toward the Palo Duro Basin. the Palo Duro Basin.

A You will notice that there is one major feature here. That's one major fault which cuts the top of the Tubb formation. The maximum displacement on this fault is approximately 300 feet. The "U" just above the fault line is an indication that that's the upthrown side, while the "D" is an indication that that is the downthrown side.

Now I will note, as we go down towards the southeast along this fault, we have a -- what I consider as a scissors fault, so now, this, the southern side is now the upthrown side and the northern side is the downthrown side, and you can see that from the contours.

Q Now, you've seen prior maps and interpretations of the structure in this are, have you not?

A Yes, I have.

Q And my recollection from a number of those was that there were indications of many more and more complex faulting than is depicted on your map, is that right?

A Yes, sir.

Q And what -- what -- to what to you attribute the difference in your current interpretation and those earlier interpretations?

A Basically an evolution of the data that

we've been able to have. The earlier work in that Tubb pressure map you were referring to, we had many less wells than what we have now and we did not have the seismic control that we have now, also.

Q In fact we didn't even have any seismic that had been processed four years ago, did we?

A That is correct.

Q Okay, now, I notice a few other little odd things on this structure map that you have. There appear to be some sort of egg-shaped areas that are stippled. What are those?

A There are three areas which you are referring to. That is the Basement subcrop area; there are three of them, two in the south and one in the northwest.

What I believe these to be are inselberg, or erosional remnants of that Basement rock. This were located by a drilling well. We have a P&A'd well, located here, which did not encounter any Tubb in the southernmost inselberg; however, we were able to produce in that same section to the southwest, to drill another well that did have Tubb present and was productive.

So we have wells all around this particular inselberg that we can define as to areal extent.

Q So with respect to these little features, I have difficult in pronouncing that word, with

respect to these, you have some idea of the areal extent of them by surrounding wells that did penetrate the Tubb, even though there would be a well that had no Tubb whatsoever in it?

A Yes, sir. The second one that we have up here only encountered 36 feet of Tubb and there was no porosity present in that wellbore, and from seismic we could also pick up this inselberg, or Basement subcrop, on the seismic.

Now, the well -- the inselberg up in the northwestern portion of the unit, we had a well drilled there that did not have Tubb present, so we do not have any immediate well control for the areal extent and that was based upon seismic.

Q All right. So you are discussing and illustrating the use of the wells actually drilled in the area and the geophysical, or seismic, information that you've obtained. Are there other tools that you geologists use in the study of the structure? Is there other information?

A Oh, yes, sir.

Q Is there other information such as data sources, such as --

A Oh, yes, sir, --

Q -- samples --

A -- cores.

Q -- cores?

A Yes.

Q Cores.

A And we've had 44 cored wells in the unit and if you stacked all of the cores on top of each other, you'd have over a mile of core, approximately 5,840 feet of core.

Q Do you have some particular familiarity with some of these cores?

A Yes, I do. As a matter of fact I sat one of the cored wells in the western portion of the unit.

Q You sat the coring of that particular well in the western part. You seem to have some particular reason that you have that one etched in your memory.

A Yes, it's a very vivid memory. It was on December 24th, 1984, Christmas Eve.

Q Not an unusual situation for geologists, is it?

A No, but at 2:00 a.m., also.

Q With respect to your Exhibit Five and your structure map, if I understand what you told me, this is your current interpretation of the structure, it being an evolutionary thing, and this is how far we've gotten at this time with the data that we have. Is that a fair sum

mary?

A Yes, sir, that's correct.

Q Is there anything else with respect to any of your exhibits that you'd care to cover, Mr. Wyles?

A Nothing.

MR. CURRENS: I would offer Exhibits One through Five and all of their parts, and Mr. Wyles for examination.

MR. LEMAY: Without objection, the exhibits will be entered in the record.

Anything further, Mr. Currens?

MR. CURRENS: No, I offered him for examination.

MR. LEMAY: Mr. Pearce?

MR. PEARCE: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MR. PEARCE:

Q Mr. Wyles, I'm Perry Pearce and I'm here representing Norman Libby and I've just got a couple of very quick ones, I think.

Do you -- well, first of all, which was the -- which well did you have the unfortunate experience of sitting?

A I believe it was the 21, 29, the one in the north -- northern portion.

Q The northwest of 21, 29?

A I believe so.

Q That well appears to have the number 2853 below it, is that -- and unfortunately I've got a crease on the upper number so I can't --

A Yes, that would be the sub-datum below that well.

Q Do you have a list of all of the wells which have been cored in the Bravo Dome?

A Yes, I do.

Q Do you happen to have that with you, sir?

A Yes, I do.

MR. PEARCE: Mr. Currens, I'd like a copy of that. I do not have any questions for him on that list at this time, but if I could have a --

MR. CURRENS: We'd be happy to furnish that to you in the next several days, Mr. Pearce.

MR. PEARCE: Okay, fine.

Nothing further, Mr. Chairman.

MR. LEMAY: Are there additional questions of the witness?

QUESTIONS BY MR. LEMAY:

Q Only for the record's sake, I'd like to ask you, Mr. Wyles, on your Exhibit Number -- the cross section, Exhibit Two -- the type log.

MR. CURRENS: The type log is Exhibit Three-A and Three-B.

Q Exhibit Three-B, do you want to identify that formation above the Cimarron anahydrite? Is that Yeso?

A Yes, sir.

Q For the record, what kind of lithology, generally?

A Sand.

MR. CARR: I have no questions.

MR. LEMAY: The witness may be excused.

MR. CURRENS: My next witness will be Mr. Collier.

JAMES W. (JIM) COLLIER, JR.,

being called as witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CURRENS:

Q Will you state your name, please?

A My name is James W. Collier.

Q By whom are you employed, Mr. Collier?

A I'm employed by Amoco Production Company in Houston, Texas.

Q And in what capacity?

A I'm employed as a Senior Petroleum Engineering Associate in our Region Office.

Q Now, Mr. Collier, I know you've testified before the Division before but have you ever testified before the Commissioners?

A No, sir, I have not.

Q Let's then briefly go through your background, education and work experience.

What is your educational background, Mr. Collier?

A Okay, I graduated from Texas A & M University in May of 1972 with a Bachelor of Science degree in petroleum engineering.

Q And upon graduation what did you do?

A At that time I was employed by Amoco as a production engineer in west Texas, and for the next five years following that I was assigned various engineering

duties in operations and in the reservoir aspects of our industry.

Q And after that five year period?

A Following that I then served two years as an engineering supervisor at a district office, followed by a year in our Chicago general office, Planning and Economics Department, assigned as the Coordinator of DOE regulations within our company.

Q All right, after your work with the DOE regulations in Chicago, what was your next assignment?

A Okay, following that, for a period of two years I was assigned as a Division Reservoir Engineer supervising a group of engineers handling joint geological engineering exploitation efforts of our reservoirs in west Texas and in eastern New Mexico.

Q And subsequent to that?

A That was followed by a four years as Division Reservoir Engineer supervising engineering duties over our west Texas secondary waterfloods and our enhanced recovery feasibility studies, as well as our west Texas, eastern New Mexico operations.

Q And subsequent to that assignment.

A Okay, for the past two years I've been assigned as a Senior Petroleum Engineering Associate in our Regulatory Affairs Group, handling regulatory affairs in

New Mexico and Texas.

Q Now, Mr. Collier, in conjunction with this hearing today have you had occasion to make a study looking at the activities that Amoco as unit operator of this unit had performed over the life of the unit?

A Yes, sir, I have.

Q And have you prepared or had prepared under your direction and supervision certain exhibits to be used in your testimony today?

A Yes, sir, I have.

MR. CURRENS: Mr. Chairman, I would submit his qualifications as an expert petroleum engineer.

MR. LEMAY: His qualifications are accepted.

Q Mr. Collier, let's turn our attention to Exhibit Number Six. I think we have a big copy of that, don't we?

A Yes, we do.

Q Tell us, please, what's shown on Exhibit Six.

A All right. Exhibit Six is a map that in this mapped area shows the current Bravo Dome Carbon Dioxide Gas Unit. That is outlined with a heavy, solid border.

Q And what else is shown there?

A Also shown by the cross hatched area is the area that was proposed back in 1980 to be in the original area but which did not qualify to be in the unit; therefore it is not in the unit.

Q Okay, as I understand it, the large outline, including all the cross hatched area, is the initial unit proposal that was made for the formation of this voluntary unit back in 1980, is that right?

A That's right.

Q And that as a result of the approval of this unit those who committed their interest to it gave us the resulting unit of being the un-cross hatched area within that big outline.

A That's correct. The un-cross hatched area, which is the current unit, consists of the voluntary participants to the unit and the total commitment of acreage to that unit was approximately 1,035,000 acres.

Q So that's about 1,036,000-acre unit at this time and how large was the unit when it was originally proposed?

A Approximately 1,174,000 acres.

Q Now, why -- there seems to be a rather large area in the southwest portion that has bee cross hatched there that's not part of the unit.

Why is that large -- area so large?

A The unit agreement that was reached between the parties in this unit stipulated that in order for tract to qualify it had to be contiguous with the remaining acreage.

There were leases and tracts along a present border of the unit which -- these interests were not committed; therefore it technically served to make this large area noncontiguous with the main body of the present unit; therefore, all of this cross hatched area became disqualified.

Q So by the terms of the agreement itself it could not be included in the unit that we had initially proposed.

A That's correct.

Q Do you know what has happened with respect to that area or a substantial portion of it since then?

A Yes, a very major portion of this area has since that time been formed into another unit.

Q And do you know the name of that other unit?

A Yes, that's called the West Bravo Dome CO_2 Gas Unit.

Q And do you know its operator?

A It's operated by OXY USA.

Q And that would have been by some other name at the time it apparently --

A I believe at the time it was Cities Service.

Q All right. I have trouble getting name changes straight sometimes.

A Now, are there some well symbols shown on that map?

A Yes, sir, there are.

Q And what are those?

A Okay, we've shown three different symbols. First the conventional gas well symbol. There are symbols both inside the present unit and outside in the cross hatched area.

Q Uh-huh.

Q Secondly there's the conventional P&A well symbol. Again there are some of those inside the present unit and some outside the present unit.

And thirdly, there's an open circle which indicates an incomplete well.

Q Okay. Now, they're fairly widely scattered and not too many. What's the advantage of those wells?

A All these wells were in existence as of

the effective date of the Bravo Dome, so these were all drilled prior to 1980.

Q Or prior to November 1, 1980, when the unit became --

A Prior to November 1st.

Q -- effective.

All right, anything else that you want to cover in this exhibit?

A No, sir, I don't believe so.

Q Okay, since that time have a large number of wells been drilled since the unit became effective?

A Yes, they have.

Q Do we have exhibits that depict the development history of the unit to this point?

A Yes, sir, we do.

Q Well, let's look at Exhibit Seven, which is in five parts.

Let me refer you to Exhibit Seven-A and ask you the time frame depicted on that exhibit.

A Again, this time frame of this exhibit is the status as of November 1st of 1980.

Q Okay, and that shows the wells that are within the existing unit area that were there at that time.

A Yes, sir, this shows the wells that had penetrated and had been completed in the Tubb formation as of November 1st of 1980.

Q All right, sir. When did the next drilling activity take place?

A The next major drilling was at the tail end of 1980 and continued on through 1981.

Q All right. Does Seven-B show that activity?

A Yes, sir, it does.

Q Okay, by -- on Exhibit Seven-B you show the wells that were drilled in '80 and '81. How are they depicted?

A These are depicted on this overlay, which is Exhibit Seven-B as solid square symbols.

Q And they seem to be widely spread throughout the unit area?

A Yes, sir, that's correct, they are.

Q How many were drilled in that drilling program, approximately.

A Approximately 170 wells.

Q Now, this is in the period immediately after the unit became effective that these wells were drilled?

A Yes, sir, that's correct. This is late

1980 and going on in through 1981.

Q Were we in anticipation that production from this are would commence so soon after unitization?

A No, sir.

Q Why did we drill so many wells right after the unit was put together before it was ready to be produced?

A The majority of these 170 wells in this program were drilled to protect expiring leases.

Q Underlying lease obligations, then.

A That's correct.

Q All right, and that dictated where the wells were drilled.

A Yes, sir.

Q Underlying lease obligations.

A Almost exclusively that was the reason.

Q When was the next drilling program?

A The next drilling program was in 1982 and the major part followed into 1983.

Q And that's Exhibit Seven-C?

A Yes, sir.

Q The Commissioners will note that we just put a piece of white paper behind this. We'll take it off in just a second, but with the cumulative nature of these exhibits it's a little easier to see what happened in

this program.

With respect to Exhibit Seven-C, about how many wells were drilled at that time?

A In the years '82 and '83 we drilled approximately 95 wells and these are shown by the diamond symbols on Exhibit Seven-C.

Q And at that time in '82 and '83 were we in contemplation of production beginning?

A Yes, sir, we were at that time.

Q And did that affect the reason for the drilling of these wells at these locations?

A Yes, sir, at that time, as I'll show you later, we had designed a gas processing facility and a gas gathering facility, so the location of these wells was (unclear) so as to feed that delivery system and supply that planned gas processing plant with CO_2 gas.

Q Yeah, Well, why don't we take the white sheet off the back there and we'll see how it all fits into the wells that already exist?

So that gives us a rather dense area sort of in the east central part of the unit --

A Correct.

Q -- of development, and is that where the plants were planned to be located initially?

A Yes, sir.

Q Okay. Anything else with respect to Seven-C?

A No, sir, I don't believe so.

Q Okay. Let's move on then to Exhibit Seven-D. That would be our next drilling program.

A That's correct.

Q Now when did the drilling in this program occur?

A This occurred in the year 1984.

Q It appears to me that there are a fair number of wells that will just sort of add on that plant area that we had awhile ago.

A That's correct. You'll notice that there is a concentration by the way the symbols here are solid circles for the 1984 wells drilled. Approximately 40 wells were drilled into the program. The majority of them again were in this south central region, southeast central region, again in anticipation of production coming on stream in 1984. These wells were drilled to supply additional gas to meet the design specifications of our processing facilities.

Q Okay, so they were designed to feed into the plants that were either under construction or had been built already at that time.

A Correct.

Q Now, I see scattered around, particularly to the north and south, sort of some stray dots. What are those?

A Okay, in conjunction with this plan, or program in the productive area, or the connected area, we drilled wells that were remote to this connected area.

Q Uh-huh.

A And you notice those are generally in the northwest part of the unit and also down along the southern portion of the unit.

Q Now, were those wells going to be connected to the plants, then?

A Not in any near term time frame, no, sir.

Q Well, why did we want to drill those wells?

A For additional data. As we've already stated, this is a large unit. We had to get some sort of data to evaluated the reservoir to get the reservoir parameters and to help us to plan future expansion programs when the time came to make that necessary.

Q Okay. Why don't we take the white off there?

So in addition to the immediate need or utility of wells to be drilled in the area and be connected

to the plants, Amoco and the other working interest owners in the unit made investments, drilled wells remote from that area, so that they could be in a position to expand, as necessary, is that right?

A That's correct.

Q All right. Was there another drilling program?

A Yes, sir, there was one major drilling program following this one.

Q Let's look at it. I believe that will Seven-E. How many wells in this program?

A Again, approximately 40 to 50 wells in this program.

Q Again do I see a dual purpose drilling activity here like we did on the last exhibit?

A Yes, sir. Again the well symbols in the 1985 drilling program are depicted as downward pointed triangles --

Q Okay.

A -- in that particular exhibit. Some wells were drilled around the outlying area of the connected CO_2 area. In other words, the area connected to our gathering facilities.

Q And again I see apparently a scattering of wells north and west and south from there.

A Yes. Again those were drilled for the same purpose as the remote wells in 1984, that being to cover the unit as best we could to get additional reservoir data for future production planning purposes.

Q Okay. Why don't we take the white off there?

Now, in those last two programs you had additional wells that were drilled to feed the two plants that were built in the area. Did we need those wells from the standpoint of deliverability at that time? Did we have to have it? Were we running short of gas or what?

A Well, at the time we were selling all the gas that we could produce but the design conditions of the processing facilities were such that a range of suction pressures with about 100 pounds, 200 pounds, was the optimum range in which to operate that plant.

But what we did by drilling these expansion wells was to keep the conditions at that plant inlet more towards the higher range, thereby increasing the efficiency of that processing facility.

Q So they were primarily drilled for increased plant efficiency.

A That's correct.

Q As opposed to their immediate need for deliverability.

A Correct.

Q Gave us another deliverability (unclear), didn't it?

A Yes, sir, it did.

Q Why would we want to make the investment to drill things just to make -- to drill wells just to make the plant more efficient?

A Well, the primary reason is with increased efficiency of the plant we, on a per unit basis, reduce operating costs, mainly in the form of reduced electrical power usage, and this results in a higher settlement price at the wellhead, which benefits both the royalty owners as well as the working interest owners in the unit.

Q Okay. Anything else with respect to Seven-A through E?

A No, sir.

Q Okay, let's -- perhaps you might want to return to your seat up there, and let's look at Exhibit Eight, and tell me what you've shown on Exhibit Eight.

A Exhibit Eight is a bar chart showing the cumulative number of wells existing in the Bravo Dome Unit by years with the time scale across the bottom and number of wells on the Y axis on the left.

Q How many wells altogether have been

drilled in the unit area?

A 390.

Q Now how many wells are connected to those plants?

A At the present time 260 wells are connected.

Q And when did the first plant, first production start to operate out there?

A In April of 1984.

Q Okay, how many wells did we have at the end of 1983?

A Approximately 304.

Q Okay, so we have wells scattered throughout the unit that were not connected to the plant even at the time of first production.

A Correct.

Q Anything else with respect to Exhibit Eight?

A No, sir.

Q We've been talking about the wells. Is this a complex operation from the standpoint of the surface facilities involve at the individual wellsites?

A No, sir, in fact it's quite a simple, straightforward design.

Q I believe you prepared Exhibit Nine to

illustrate the fairly simple nature of that exhibit and I'll ask you to turn to it.

A Okay.

Q I'll further ask you not to talk about it in great detail since there's a legend there that labels the parts, but give us just a rough flow diagram here.

A Okay.

Q What happens?

A Well, this is just simply a schematic drawing of a typical wellhead, meter run, and flow line installation in Bravo Dome Unit. All of our producing wells connected to the system look like this.

On the lefthand side of the schematic, of course, is the wellhead coming off a tee. Just to the right there is a shut-off valve. That's labeled number 3 in this schematic drawing. That is connected to our remote telemetry system and can be shut in through computer telemetry.

Q Okay, and then the gas flows through that metering system and on into what, a gathering system?

A Yes. It goes through the meter run, which is the long horizontal section of pipe to a differential pressure meter, then down through a flow line down underground into a trunk line system.

Q Now you mentioned a remote telemetry

arrangement. Explain that to us.

A Okay. If you notice in the upper righthand corner of the schematic drawing there is what appears to be an antenna. That's what it is, it's an antenna unit. This system is a solar -- well, it's run by batteries which are solar charged. Each well has one of these installations and this serves the purpose of data transmission as well -- to the central plant, as well as accepting commands and activation of various systems at the wellhead.

Q If we turn to Exhibit Ten will be get a little better visual image of what this looks like?

A Yes, sir, I believe so.

Q Let's turn to Exhibit Ten and tell me what that -- that's a photograph of.

A Yes. It's a photograph of a typical well installation in Bravo Dome. I might point out that the view of this is reversed from the schematic such that the wellhead is actually over on the righthand side of the location. You can see the wellhead coming up out of the ground and then the horizontal line, which is the meter run, and then further on the left going -- the flow line going down into the subsurface where it connects to the trunk line system.

Q Very compact and straightforward ar-

rangement, isn't it?

A Yes, sir, I believe so. Further, you can see the mast on the far left, which contains the antenna, the solar collectors, this is part of the automation system which I described earlier.

Q Okay. Let's -- unless you have something else on that one, let's flip over and look at Exhibit Eleven, and tell me what you're showing with that photograph.

A Okay, again this is another view of a typical installation, well installation. The only difference here, the reasons we're showing this is to show that this particular well is equipped with an automatic chemical feed which is over on the righthand side of the location. The yellow drum contains corrosion inhibition chemicals, which again are introduced into the flow line system for protection of -- of the metal.

Q Okay. Anything else on Eleven?

A No, sir.

Q Now, we've drilled wells; we have wellheads; we have measuring systems; we've got to get this to a plant someway or another, so what's the next step in the sequence?

A Well, the next step is to gather the gas into some sort of system.

Q Let's look at Exhibit Twelve-A, then, and see if we can learn a little bit more about that gathering system.

Now again on Exhibit Twelve you've shown the -- outlined the exterior boundary of the unit and the wells that exist there and now we've added something to it. Looks like a bunch of veins or something.

A All right, this Exhibit Twelve-A shows our first -- what we call Phase One. The reason we call it Phase One is connected to the Phase One Plant. We have two plants, so each system that leads into a respective plant is referred to the Phase One Gathering System or the Phase Two Gathering System.

Q Okay.

A And this overlay depicts the Phase One system. This was the original delivery system in the field with the subsequent expansion that was made to it to gather gas from the drilling expansions that I've described earlier.

Q Okay, so that the gathering system that you show here on this exhibit is as it exists today.

A That's correct.

Q How many wells are connected to that gathering system?

A At the present time there are 68 wells

in the system.

Q And initially in 1984 when we first kicked off?

A Approximately 50 wells.

Q How long is that system?

A At the present time it's about 70 miles with buried pipelines, ranging in size from about 4 inches -- well, from 4 inches in diameter up to 28 inches in diameter, with the larger diameter pipes being closer to the central processing facility and then tapering out toward the ends to smaller diameter pipe.

Q Okay, now you said we have two plants out there so I take it -- and that we have two gathering systems.

A Correct.

Q Let's look at Twelve-B and tell me what you're showing with the material you've added in Twelve-B.

A All right, Twelve-B is -- the overlay shows the Phase Two gathering system which ties to the Phase Two Gas Processing System. This came on stream after the Phase One Processing System.

Q And both those plants then are located on the tract around where all of these legs come into a central point?

A Yes. You can see that the system is

formed by a series of measured components coming in in radial fashion to the central facility with spokes or laterals coming off of those to connect to individual wells.

So the gas processing plants are located centrally right here where the trunklines come in.

Q Okay, right there being the central point where all of those meet.

A That's correct. sir.

Q Now, does that depict the Phase Two system as it now exists?

A Yes, sir, it does.

Q And how many wells, about, are connected to that, just approximately?

A About 170 wells.

Q And about how many miles of pipe in there?

A Let me amend that answer. It's really closer to 200 wells; about 190 wells. There's roughly --

Q Okay.

A -- roughly 200 miles of pipe in the Phase Two system.

Q Starting out and building up through those --

A It started out around 150 or 152. It's

now up to about 200 wells, with the drilling expansions.

Q All right. That then depicts our two gathering systems feeding our two plants, if I understand it correctly.

A That's correct.

Q Okay, now we've got wells; we've got gathering systems; we've been talking about plants; let's look at Exhibit Thirteen.

What are we showing on Exhibit Thirteen? I'm sorry, you're not to it, yet.

A Exhibit Thirteen is a schematic plan -- view of the Phase One facilities, the gas processing plant that we call the Phase One Plant.

Q Now this, too, is a rather simply and straightforward operation, is it not?

A Yes, sir, it is.

Q Just very briefly tell us the elements in it.

A Okay. in the upper lefthand corner of the schematic we have two plant inlet lines, or trunk lines, coming into the Phase One facility. The gas, which has entrained water in it must go through an inlet separation process to remove the majority of that free water before it moves into the various stages of compression.

At the lower, in the lower third of the

schematic you see the word "compression". This is actually a building housing three 6000 horsepower compressors, so there are three stages of compression and between each stage, or prior to and between each stage the gas must be additionally dehydrated and cooled before it goes to the next stage of compression.

Q Okay, and then when it's compressed and dry it leaves the plant and goes where?

A Okay, it goes, as shown here, through a metering station and then it's discharged to a transmission line.

Q Okay, so there's delivery to a line that takes the gas from this area.

A That is correct.

Q From this plant.

A Correct.

Q Now, is there more than one line that leaves the Bravo Dome Area going to alternate users of this gas?

A Yes, sir, there is.

Q Which of those transmission lines does this line connect to?

A Okay, this plant connects to the Rosebud Line, which is an east/west line roughly about 20 miles long, which ultimately connects to the Sheep Mountain CO_2

line.

Q And that goes on down to the Permian Basin?

A Yes, sir, it does.

Q Generally what are the outlet conditions on this, just broadly?

A Roughly 2100 psi.

Q And the conditions that the plant conditions the gas to with respect to whatever the pipeline specifications are for gas for that particular pipeline, is that right?

A Yes. Specifications include both pressure as well as water content.

Q Okay. Mr. Collier, you have included, oh, roughly a half a dozen pictures in here as the next exhibits. Why don't you just identify them and very briefly tell the Commissioners what you're showing there?

A Okay. Exhibit Fourteen is a shot of construction operations. This is the Phase One Compressor Building.

Q Okay, what's Fifteen?

A Fifteen is a shot of a glycol reboiler skid mounted before it was installed in the Phase One plant back in 1984.

Q And the next one?

A Exhibit Sixteen is inside the Phase One Compressor Building. This shows one of the -- one of the three 6000-horsepower compressors I mentioned earlier. The white cylinder on top is simply a second stage suction bottle.

Q Okay, and what's the next one? That would be what, Seventeen?

A Seventeen is a photograph showing a close-up view of a second stage scrubber. This is between the two stages of compression and this removes any additional water that's not removed when the gas first comes into the plant initially.

Q Okay, what's Exhibit Eighteen?

A Exhibit Eighteen is a -- one member of a bank of ten fan coolers. The gas must be cooled between stages. This is simply a fan mechanism, gas-to-air heat exchanger, where the heat is dispersed out the top through a series of fans.

Q And what's Exhibit Nineteen?

A Exhibit Nineteen is elevation view of the Phase One Plant facility. You can see the compressor building in the background and the various dehydration vessels and storage vessels in the front.

Q Okay, Now, let me ask you to turn to Exhibit Twenty and tell me what we're showing on Exhibit

Twenty, what you're showing there, please.

A Well, Exhibit Twenty is again a plant view schematic only this time it's the Phase Two gas processing facility.

Q Same nature as the Phase One Plant but just different equipment.

A That's correct.

Q Without going into great detail here, is the principal difference just the size?

A That is the only difference. Say we have six 8000 horsepower compressors in the Phase Two facility as compared to the three 6000 horsepower compressors in Phase One. There are five plant inlet lines in this facility as compared to two in the Phase One facility. Of course this reflects the nature of the -- just a bigger delivery system connected to Phase Two as compared to Phase One.

Q Now, where does the gas that leaves this plant principally go? To whom is it delivered?

A Okay, this gas is delivered to the Bravo pipeline system.

Q Let's look at Exhibit Twenty-one and tell me what you're showing there.

A This again is a planned view schematic simply -- very simply showing the relative location of the

two plants. They are on the same 80-acre tract. You can see an east/west highway -- state highway, I think it's labeled 65 on this exhibit, and the Phase One Plant is closer to the highway; the Phase Two Plant is behind the Phase One Plant.

Q So it's just kind of a general layout.

A That's correct.

Q Would Exhibit Twenty-two give us a better picture of that?

A Yes. Exhibit Twenty-two again is a photograph, this time taken from the aerial vantage point.

You can see the state highway running at an angle across the -- about the top third of the photograph. Again this is an east/west highway. And then coming down from that towards the left, or in this case towards the the south, you can see the Phase One facility with the compressor building, and then you can see a road with a -- looks like a turn-around or a cul-de-sac, and then on the other side of that is the Phase Two compressor building and then the associated dehydrating and cooling equipment behind that.

Q This is our field operations headquarters as well as the plant location, is it not?

A That's correct.

Q And the computer information all comes

in here and work is directed from this location, and so on.

A Yes, sir.

Q What are -- what are these big white things down in the foreground of this picture?

A Well, these are caliche-covered staging areas and our pipe storage yards which at the present time this picture was taken, it doesn't look like they were being used except for future activity.

Q So that is during the period of construction and building the, oh, 250 or 300 miles of gathering system that we have out there and all of the activity in the plant construction, this is the area where the material, supplies, are kept.

A That's correct.

Q What are these little boxy things down here in the most -- the lower foreground of one of these pads?

A Well, those appear to me to be trash receptacles which to my understanding, these are stored there and then during periods of active drilling and/or construction activity, these are transported to the remote sites for refuse disposal.

Q Okay, so we don't throw trash on the ground.

A That's correct.

Q All right. Mr. Collier, in your background and experience and your study of the activities that have been conducted in the Bravo Dome Carbon Dioxide Gas Unit, is it your opinion that the activities in which we've engaged and the things that we have done and the things that we are doing are of the nature that they have and will continue to result in the prevention of waste and the protection of correlative rights?

A Yes, sir, in my opinion they have done that.

Q Do you have anything further with respect to your testimony?

A No, sir, I do not.

MR. CURRENS: I would offer Exhibits Six through Twenty-two and all of their parts.

MR. LEMAY: Without objection those exhibits will be entered into evidence.

MR. CURRENS: And I would offer Mr. Collier for any questions you may have.

MR. LEMAY: Fine. Mr. Pearce, any questions for Mr. Collier?

MR. PEARCE: Yes, just a few.

Mr. Currens, could we pull Exhibit Six back out, please?

That's the big one, isn't it?

CROSS EXAMINATION

BY MR. PEARCE:

Q Mr. Collier, looking at Exhibit Six, when you discussed that earlier you indicated that the area to the southwest of the Bravo Dome Area was not included because it was not contiguous with the other acreage, is that correct?

A That's correct.

Q What that means is there are leases all along the this boundary which prevent that connection.

A That's correct.

Q I also notice there are some hachured areas throughout the unit which show as not being part of the unit.

What's the situation with regard to that acreage?

A Those acres or tracts also did not qualify for a different reason.

Q And what is that reason, if you know?

A Lack of sufficient committals of that -- those tracts to the unit agreement.

Q Does the unit agreement provide for a specific percentage of interest to commit?

A I'm sure it does. I do not know that number.

Q If acreage within the present Bravo Dome Unit boundary is leased to Amoco but the royalty owner has not agreed to have his acreage unitized, do you know how that acreage is reflected on this exhibit? Is that acreage hachured or do you know?

A It's in the unit.

Q So it is not hachured.

A That's correct.

Q Mr. Collier, are you the gentleman who's familiar with the producing ability of the unit at this time?

A I guess you'll have to define the term "ability".

Q Well, how much gas is being produced on an average daily basis now?

A I can answer that question or we'll have another witness that will go through that.

MR. CURRENS: We are going to cover that with our next witness, Mr. Pearce.

MR. PEARCE: And in the summary of the next witness marketing was discussed and I assume if I ask him any questions with regard to that he will defer to that next witness?

A Yes, sir, I would.

Q I'd like for you, if you would, please,

sir, to refer to what we marked -- you marked as Exhibit Number Eight, which is the bar graph of cumulative well development. Just to make sure I understand, that shows no additional wells added to the unit since 1985, is that correct?

A That's correct.

Q Are you familiar with Amoco's future development plans for the unit?

MR. CURRENS: I believe those are going to be covered by our next witness.

MR. PEARCE: Fine.

MR. CURRENS: If you want to answer, you may, of course.

A I'll defer to the next witness.

MR. CURRENS: Okay.

Q At the conclusion of your testimony, Mr. Collier, you expressed your professional opinion that unit operations had been and were currently operating in the best interest of the prevention of waste and the protection of correlative rights, is that correct?

A Yes, sir, that is my opinion.

Q I'd like to get a little more deeply into that opinion and try to determine exactly what you mean by that.

When you say that the unit has in the

past and is presently operating to prevent waste, what do you mean by the terms?

A Simply that this unit coming together has upgraded the vehicle for gas to be developed, to be gathered, to be processed, and to be delivered to a gathering system. I feel that in the absence of such a unit those processes would not have taken place.

Q What effect -- in the regard to the prevention of waste, what effect have those operations had on the areas which are not now connected to the Phase One or Two -- or Phase Two system?

A Well our operations to date, as Mr. Currens, or Mr. Carr, I believe, said, we've been before the Commission many times in the last ten years to talk about different phases of this unit. Among those are spacing.

We have come before this Commission on several occasions to show that we feel that one well in this unit will drain a specified amount of acreage and we feel that that's about 640 acres.

So in the process of developing the unit, producing in the last four years, we have gathered the needed information to be able to plan additional expansions in the unit.

So it's been an evolutionary process

over the last, well, I guess, 7-1/2 years since the unit was formed and the last four years since production commenced.

We are producing gas economically, efficiently, and we continue to do that.

Q My question was going more toward the area from which you are not producing gas and how the operations of Amoco in the Bravo Dome Unit over the last 7-1/2 years or so have acted to prevent waste in those areas if there has been an effect.

A As I showed you before, we have covered the unit with a very dense coverage of seismic information. We have been able to tie in that seismic by drilling additional wells, even in areas that are not connected to the gathering system, so we have made the financial commitment to drill wells, even though we knew for the time being there would be no financial advantage to do so.

We have processed the geophysical and geological data. We have reconciled it with additional well control information and as we expand, as the market, hopefully, continues to develop, we'll be able with a minimum, you know, delay to expand into those areas, because we do have that information.

Q All right, sir, let's turn our attention now, if you would, please, to the portion of the opin

ion you expressed relating to the protection of correlative rights. Could you describe for me what you mean by that?

A Simply that this is a voluntary unit, that the participants in this agreement took the burden of commitment to commit their acreage to this unit for the purpose of giving them the opportunity to have those reserves produced, to have their fair share produced.

And that's strictly what I mean.

Q Does the -- do the operations of the unit in the past and at the present, in your opinion, have any impact upon the correlative rights of individuals who have not agreed to participate in the unit?

A Yes, they could.

Q Would you explain to me how they could have an impact on those?

A Now, are you talking about royalty owners who have not committed to the unit? Is that what you're saying?

Q All right, sir, let's start with that. You described that there -- I think I understood you to describe that there are areas which are not hachured on Exhibit Number Six, tracts in which the lessee has agreed to participate in the unit and the lessor has not agreed. Is that what you were describing to me?

A Yes, sir.

Q All right, let's discuss the protection of correlative rights with regard to interest owners in those tracts.

A Okay, and what -- what is your specific --

Q My question is how have unit operations in the past and how do they at the present operate to protect the correlative rights of those interest owners who did not agree to participate?

A Simply that the commitment of that acreage again goes towards a group of operators or a group of companies willing to take the financial burden to drill vast numbers of wells, to invest multi-million of dollars to develop this resource, to gather it, to process it, and to deliver it to a collection system, to give everybody in this unit the opportunity to have their fair share of CO_2 produced.

Q As I understand it, the individuals who are not participating in the unit have not participated in funding those operations, nor do they participate in the proceeds of those operations, is that correct?

A That's not correct. They are paid on -- rather than on a unit basis, they are paid on a tract or a lease basis.

Q And if their acreage is not developed

or produced?

A Then they'll be paid reflective of how much production, if any, is coming from that tract.

Q And if no production is coming from that tract.

A Well, then there's no revenue.

Q Mr. Collier, if I may, let me go back briefly, you indicated when we were discussing Exhibit Number Thirteen, which is a Phase One facility layout, that the outlet of that plant was connected to the Sheep Mountain Line through the Rosebud lateral, is that correct?

A Yes, that's correct.

Q And what is the ultimate destination of that gas?

A That gas, in my understanding, is delivered to the Permian Basin of west Texas, about 200+ miles away from here.

Q You indicated that the gas flowing into the Rosebud lateral and then the Sheep Mountain Line had to meet those pipeline specifications, is that correct?

A That's correct.

Q Are those pipeline specifications different than the pipeline specifications on what I believe you referred to out of the Phase Two facility as the Bravo pipeline?

A Yes, sir, they are different, slightly different.

Q Do you -- can you describe for me how those pipeline specs differ?

A I can't speak to the pressure requirement, although I think it's on the order of 200 and 300 psi difference. The --

Q With Sheep -- I'm sorry for interrupting, but with Sheep Mountain being higher or lower than Bravo?

A I can't -- I don't know.

The other specification is the water content. There is a specification in the Rosebud line into the Sheep Mountain line of a maximum water content of 15 pounds of water per million cubic feet of gas.

The specification for the Bravo pipeline is 25 pounds of water per million cubic feet of gas.

Q Mr. Collier, I believe you were not at least a witness and probably not present at the 1984 review hearing of that matter, is that correct?

A That's correct, I was not.

Q Have you reviewed the order which the Commission entered as a result of that hearing?

A Yes, sir, I have.

MR. PEARCE: Nothing further,

Mr. Chairman. Thank you.

Q Thank you, Mr. Collier.

MR. LEMAY; Are there additional questions of the witness?

MR. BROSTUEN: I have a question.

MR. LEMAY: Mr. Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q Just for clarification, referring back to your Exhibit Number Six, I'm not sure if I understood correctly a question you were asked by Mr. Pearce.

In regards to royalty owners, or working interest owners as well, to wells which are not connected to either Phase One or Phase Two plant, are they receiving revenue during the -- as CO_2 is being produced from the unit?

A Yes, sir, they are.

Q The -- the tract that are within the unit boundary but are hachured and not participating in the unit, are they a part of the West Bravo Dome Unit? You referred to the wells in -- in the hachured portion of the map in the southwestern portion of the map, lower right -- lower lefthand corner as being a part, I believe, of the West Bravo Dome Unit.

A That's correct.

Q Are there other tracts also included in the unit, the ones that are within the boundary of the -- of the Bravo Dome Unit?

A No, sir, the West Bravo Dome Unit is all contained within the large cross hatched area in the southwest part of this map.

Q Is there any royalty paid from production within the unit to those working interest owners or royalty interest owners within the hachured zones, areas within the outline of the Bravo Dome Unit?

A No, sir. Those -- those hachured areas do not participate in the unit at all. They're not in the unit.

Q Thank you very much.

MR. LEMAY: If there are no additional questions, the witness will be excused and we'll take a fifteen minute break.

(Thereupon a recess was taken.)

MR. LEMAY: Reconvene. Third witness, Mr. Currens?

MR. CURRENS: Thank you, Mr. Chairman.

JAMES DAVID McELHANEY,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CURRENS:

Q Will you state your name, please?

A James David McElhaney.

Q By whom are you employed, Mr. McElhaney?

A Amoco Production Company.

Q And in what capacity?

A As the Manager of Carbon Dioxide Sales and Supply.

Q Mr. McElhaney, have you ever testified before this Commission before?

A No, I have not.

Q Would you briefly tell us your educational background?

A I received a Bachelor of Science in petroleum engineering from the University of Oklahoma in May of 1975.

Q And upon graduation what did you do?

A I was employed by Amoco Production Company in Oklahoma City.

Q And what was the nature of your duties

at that time?

A During the first six to seven years with Amoco I worked at a number of assignments involving production, operations and reservoir engineering in a number of locations, including Oklahoma, Alaska, Colorado and Wyoming.

At that time, it was about the end of 1981, I was transferred to our Houston general office in the position of Enhanced Oil Recovery Coordinator for our general office.

Q And that's for all of Amoco Production's operations?

A Yes, sir, it is.

Q All right, sir, and after that assignment what did you do?

A In March of 1983 I was transferred to the Houston Region and was assigned as the Division Reservoir Engineer over a reservoir engineering group that had responsibilities for southeastern New Mexico and the Bravo Dome Unit.

Q And how long did you occupy that?

A I had that assignment for a little over two years.

Q And what happened next?

A In August of 1986 I was named the

Manager of Carbon Dioxide Sales and Supply.

Q With respect to this hearing here today, have you had occasion to prepare certain exhibits either by yourself or under your direction and supervision for presentation here?

A Yes, I have.

MR. CURRENS: I'll submit his qualifications as an expert on Bravo Dome.

MR. LEMAY: His qualifications are acceptable.

Q Let's look at Exhibit Number Number Twenty-three, Mr. McElhaney, and please tell us what's depicted on that exhibit.

A This is a production history curve for the Bravo Dome Carbon Dioxide Gas Unit, with a number of curves here reflecting different production components in the unit.

Q Okay, let's just start with the bottom curve and identify what the various data shown here are. The lowermost one is green. What is that?

A That is green and that reflects unit water production. It's scale is on the righthand side of the curve in 1000 barrels of water per day. You can see that the current rate in 1988 is approximately 450 barrels of water per day in the unit.

Q What's the next curve above that?

A That's the purple curve. That is the sales production figures for the Phase One facility. Its scale is the inner left scale at gross CO_2 rate in million cubic feet per day at 14.65 atmospheric pressure.

Q And what's a recent value appropriate to that curve?

A Recently that facility has averaged 106-million cubic feet per day.

Q Now, that's 106-million cubic feet a day at 14.65 or --

A No, sir, it's not. I have to apologize to the Commission. The engineer that prepared this exhibit for me prepared the numbers from our pipelines, who measure at a 14.65 pressure base. State of New Mexico, of course, is at 15025, and the numbers I'm quoting are the New Mexico numbers and are those that are recorded with the state.

Q All right. There are a pair of curves that pretty well parallel each other in blue above that purple curve. What do they depict?

A Yes, those are the suction pressures for the two facilities. Their scale is to the far left in the pounds per square inch gauge.

You can see that the Phase One facility's blue curve is denoted with asterisks, and the Phase

Two facility suction pressure curve is denoted with squares.

Q And approximately what are those suction pressures now?

A They are both at approximately 150 pounds right now.

Q Now, what's the lower design limit on our plants with respect to suction?

A The design, lower design limit is 100 pounds suction.

Q So these are operating at a suction pressure above the lower design limits.

A Yes, they are.

Q Does that have some benefit?

A It certainly does; from an engineering standpoint at higher suction pressures you are able to get out more gas or even the same amount of gas with less work. So that means that your compressors are not having to work as hard, you're not using as much horsepower. This translates to direct reduction in electrical usage.

Q And I guess that has some attendant money savings with it.

A It certainly does.

Q Okay. The next curve above that one is red.

A Yes. These are the sales production figures for the Phase Two facility. Similarly reflected at the gross rate of a million cubic feet per day at 14.65.

The average rate in 1988 in New Mexico standards is 262-million cubic feet per day for the Phase Two facility.

Q You told me that the topmost curve was colored pink, so that does the pink curve show?

A Yes, the pink curve is the summation of the red and purple curves and is the total sales production rate for the unit.

In 1988 the total sales have averaged 368-million cubic feet per day.

Q Now, now that we know what the curves mean, let's look at this on a time basis. Does this show when production began?

A Yes. You'll see that the first production recorded is in April of 1984, and that was from the Phase One facility, which was the first one to come on line.

You'll see that the pink and purple curves override each other here in that time frame.

Then in 19 -- December of 1984, the Phase Two facility began production. You can see the jump in the red curve at that point, as well as the jump in the

total production curve.

With the Phase Two facility coming on in 1985, we first jumped to a total of around 250-million cubic feet a day and then eventually up to 340-million cubic feet a day by the end of that year.

Since that time we have continued to increase production sales from the unit in '86 and '87 to the present rate of 368-million cubic feet per day.

Q All right, any general comments that you care to make before we leave this curve?

A Yeah, there is one particular comment that we have been very encouraged with and in the light of the falling oil prices in 1986 and '87, you asked me the questions about what I thought would happen in 1985, I would have been concerned about a fall in our production, but we've been very pleased that the production has increased in both '86 and '87 despite that fall in oil prices.

Q So there's still been strong sales, even though what one would expect to be -- in the face of what one would expect to be a weak marketplace.

A Yes, sir, there have been.

Q Okay, anything else that you have on Exhibit Twenty-three?

A No, sir.

Q I'll ask you to turn to Exhibit Twenty-four and tell us what's shown on that exhibit.

A Yes. This is an annual spending profile bar chart for the Bravo Dome Carbon Dioxide Gas Unit. This reflects the spending of the working interest owners in various categories as the unit has evolved.

Q Okay, let's kind of go through that evolution. It seems to start out mostly purple. What's that?

A Yes. The purple depicts the drilling in the unit and as Mr. Collier presented to you earlier, the program was fairly aggressive at the beginning and somewhat continuous through the years 1985 (sic) and you can see that high level of expenditures from 1980 through 1985.

Q Okay. The next big blob is a yellow blob.

A Yes. The yellow depicts the expenditures for the plant gathering facilities and as I said, the first thing you would do in a unit would be to drill the wells and then install those necessary plant gathering facilities to initiate sales. You can see that those plant gathering expenditures occur over roughly a 2-1/2 year period, '83 and '84 and then some in 1985 as sales were initiated.

Q Okay, so we've evolved the drilling of

wells, building of gathering and plant facilities. After that comes what?

A The next large wedge you see would be in red and that reflects the operating costs associated with producing the CO_2, and (not understood) a natural evolution of the field after you've made the expenditures, investments to get sales on. Operating costs then dominate towards getting those -- that CO_2 into the market.

Q What's the green that's shown on this?

A The green is the maintenance wedge. It's more or less a continuous type of dollars that are put into maintaining your facilities, your operating centers, the offices, the computer, and so forth. This wedge has been rather continuous since 1982.

Q It's just something that's part of continued operations.

A Yes, sir, it is.

Q Now I notice in 1988 you have depicted the full year in -- in that column.

A Yes, sir, I have. We only have the first quarter performance so far for 1988 and I have estimated that by multiplying by four.

Q Okay. Anything else on this exhibit?

A No.

Q Let's turn to Exhibit Twenty-five then

and tell me what's shown here.

A This is the same data that was presented in the last exhibit only in a cumulative nature, and the wedges are stacked on top of each other so you can identify the spending of individual components.

Q Now, you said production and you showed on your Exhibit Twenty-three that production began in early '84 and then really came on stream strongly at the end of '84, or 1-1-85, is that right?

A Yes, sir, that's correct.

Q What was the investment that we had made prior to the time that we actually had any significant production from the unit?

A The working interest owners in the unit had actually spent roughly $130-to-150-million before any sales had occurred in the unit.

Q And that's out of a total of how much shown on this --

A Total spent through the first quarter of 1988 has been $282-million.

Q Let me ask you about the operating expense portion of this. What's the expense, the red portion of this (unclear)?

A Total operating costs here include the actual direct cost of operating the plant, for field facil-

ity people that are there, the road work, and what well work that's done in the unit. It totals a total of $111-million roughly by the first quarter of 1988.

Q Let me similarly ask you what it doesn't include that's ongoing in nature?

A These expenditures here do not include any of the monies paid to, say, surface owners for damages, or leasehold costs that are paid to the individual lease owners, nor does it include any costs for the royalties or taxes paid to the State.

Q Now when you've talked about the benefits of the efficiency by keeping higher suction pressures, is it this red wedge that that affects?

A Yes, sir, it is.

Q And you said that it's cut our electrical costs.

A Yes, sir.

Q Electrical costs make up approximately 80 percent of our operating costs; essentially all the work that is done is to take the gas from low pressure in the field, dehydrate it, and compress it up. So most of our operating costs can be directly related to that horsepower required to boost up the pressure.

Q Now, a reduction in this operating cost benefits the working interest owners, doesn't it? It

doesn't cost them as much money to operate the unit?

A There's no doubt.

Q I guess that would ultimately translate into anticipated additional recovery.

A Yes, sir, it would.

Q Are there other benefits that accrue besides those to the working interest owners and the potential increase in ultimate recovery?

A Actually, all parties will benefit from this because the compression costs are, of course, a reduction into the wellhead price which is the basis for royalty and taxes, and if those operating costs are down, those are passed on to all the unit members, as well as all royalty interest owners.

And so they're seeing the benefits as well.

Q All right. Anything else on Twenty-five?

A No, sir.

Q Let's go to Number Twenty-six. You said that royalty was not included in your prior charts. This one seems to deal with royalty, is that right?

A Yes, sir, this is to depict on an annual basis the estimated annual royalty payments made to all parties in the Bravo Dome Unit. We have also individual

ized and pointed out the royalties paid to the State as well as royalties paid to other parties.

Q What are those royalties to the State currently? Approximately?

A Approximately 2.4-million in 1987.

Q And the total royalty '87?

A Total is roughly around 9.4-million.

Q You have a purple line on here. What's that?

A Yes, that is the cumulative royalties paid since the start of sales from the unit and by the end of 1987 those totaled roughly $26-million.

Q Anything else on Exhibit Twenty-six?

A There is one point I would like to make. I, recently, in looking over these figures, looked over the information from the New Mexico Oil and Gas Association for 1987; indicated the total State royalties collected in that year were around $104.7-million from oil and gas operations. You can see, then, that the 2.4 from Bravo Dome is roughly a little over 2 percent of that total.

Q That's impressive. Anything else from Twenty-six?

A No, sir.

Q Let's move on to Twenty-seven. What's that?

A This depicts the annual direct taxes paid to the State in blue and there is a yellow curve that depicts similar information related to the information from the (unclear) on the percentage of total taxes collected by the State.

Q All right, now what taxes are we talking about?

A These taxes are the production severance taxes which include the severance tax, actual severance, the emergency school taxes, the conservation taxes and the ad vapored taxes.

Q All right, what did that total in 1987?

A That was roughly $5-million in 1987.

Q And about what share of those type taxes from the oil industry did this amount to?

A That is also roughly about 2 percent.

Q Anything else with Exhibit Twenty-seven?

A No, sir.

Q Let's move on then, and look at Exhibit Twenty-eight, which seems to be a summary table. Tell me what's on it.

A Yes, sir. This summarizes both the production data and some of the information previously presented by Mr. Collier and Mr. Wyles on the wells and the

activity in the unit.

Q Why don't you just go through that and point out the pertinent things?

A Okay. We reflect the first number there is the total cumulative production to date from the unit, which totals 427 BCF, or roughly a half trillion cubic feet.

Q And that's to what date?

A That is through May of 1988.

We also show the average producing rate for 1988 at 368-million cubic feet per day; and also, then, we reflect the peak producing rate we've experienced out there, which was 381-million cubic feet per day in February of 1987.

Q Okay, that's the production data, almost half a trillion cumulative.

A Yes, sir.

Q Let's move into the area of the wells.

A Yes. On the well summary there's been a total of 390 wells drilled in the unit. 260 of those are now currently producing. We have another 111 wells that have been drilled in the unit that will be available to us at which time that we can expand outward.

There have been 17 plugged and abandoned wells and 2 salt water disposal wells.

Q And what's in the bottom third of this exhibit?

A The bottom denotes the seismic that Mr. Wyles previously pointed out, the 1400 miles that have been run in the unit.

We also reflect something that we have not touched on and that's the roads that have either been built or improved in the unit. There are a total of 751 miles of roads that have either been actually built or taking old cattle roads and improved.

375 miles of those area actual lease roads and 376 are county roads.

Q About half of the roadwork out there has been a direct benefit of county roads, and about half individuals.

A Yes, sir, it is.

Q Anything else on Twenty-Seven?

A No, sir.

Q Turn to Exhibit Twenty-eight then, please, and tell us what's shown on that exhibit.

A This somewhat summarizes the physical summary of the unit, both in expenditures and in direct taxes and royalties paid out.

As I mentioned previously, through March of 1988 the working interest owners in the Bravo Dome

Unit had spent a total of $282-million on direct expenditures. That involves roughly $97-million on drilling, $58.8-million on plant gathering facilities; $15.3-million on maintenance expenditures for just to run our offices and to initially install our computer telemetry system, and another $110.8-million in operating expenses.

On the other hand, some of the other expenditures that the working centers have incurred have been direct taxes and royalties and through March of 1988 the total direct tax bill has totaled $15.2-million.

On royalties we have paid roughly $7.6-million to the State; an additional $20-million to individual owners in the unit, for a total of $26 -- $27.6-million.

Q All right, anything else on Exhibit Twenty-nine?

A No, sir.

Q Mr. McElhaney, with your familiarity with our operations in the unit, is it your opinion that the activities that we have conducted in the past and are conducting now and prepared to conduct, such that they will result in the prevention of waste in the past and on an on-going basis, and then the protection of correlative rights?

A Yes, we have. In addition, I would say

we've spent a considerable amount of money to insure that they will in the future.

Q Okay, Mr. McElhaney, up to this point we're pretty well walked the paths in fulfilling our obligation of showing the Commission the activity that we've had since this unit has been effective.

You stated your position was Manager of CO_2 Sales and Supply. Let me ask you in broad terms what you see for the future.

A We are very encouraged at the outlook for Bravo Dome based on a number of items.

The first is one I mentioned earlier, it's the fact that even during the oil price slide of the last two years, that our sales have actually increased each year, meaning that the demand has stayed up, not fallen during the time the oil prices have dropped.

I've also been very encouraged by my talks with other operators in the Permian Basin, who seem to be re-looking at CO_2 projects and there seems to be a renewed interest in that area.

I recently attended the SPE DOE Tertiary EUR Symposium in Tulsa and a number of operators presented their projects there and showed some very significant results and it was very encouraging to all.

In addition to that, in talking with

the other working interest owners in Bravo Dome, we have also heard that they may be interested in expanding their operations and also requesting more CO_2, and even though those demands are not firm right now, it's definitely left a very encouraging note for the future.

Q Okay, so you don't have a firm increase in demand at this moment, but you are optimistic that it will occur in the near term?

A Yes, sir, I am.

Q Well, what have you done, what are you doing to be in a position to respond if additional demand does develop, as you expect that it will?

A At Amoco we have evaluated a number of alternatives for additional development in the Dome; not necessarily tied to specific demand but to see what can be done by expanding outward.

Those have included some additional out- field drilling as we've done in the past to load the Phase One and Phase Two facilities; to continue to expand and maintain those facilities and also cut costs.

We've also looked at additional plants in other areas of the unit, and have evaluated what costs will be required to put those in place.

In a nutshell, I would say that Bravo Dome has established itself as a very competitive, stable,

reliable source of CO_2 in the industry today, and we are in a very good position to be able to react to when that demand occurs.

Q Thank you, Mr McElhaney.

MR. CURRENS: I would offer Exhibits Twenty-three through Twenty-nine.

MR. LEMAY: Without objection those exhibits will be entered into the record.

MR. CURRENS: And I would offer Mr. McElhaney for your questions.

MR. PEARCE: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MR. PEARCE:

Q Mr. McElhaney, just a few. I believe you were in the room when I broached a subject to Mr. Collier which he deferred to you.

(Not clearly understood) -- Phase One and Phase Two facilities?

A If we talk about design capacity, the current production rate represents roughly 110 percent of design capacity.

Q That's an interesting design. How much above 110 percent do you think you could go?

A I think we are very, very close to our limits. Different days you might be able to do a little better than that, but as I said, we've been able to primarily get there by operating above the, you know, we're basically above the mid-range of the design plan.

Q And your exhibit showed that your peak day so far was 381-million?

A Yes, sir.

Q You believed that was threatening your facilities?

A I believe that we were able to meet the demand that was called upon that day and we were basically about as far as we could go.

Q Okay. You indicated that in terms of planning for the future and meeting future increased demand, you had several scenarios. One of those was additional I believe you referred to it as out drilling to further load Phase One and Phase Two facilities. Could you explain how you're going to do that after the discussion we just had?

A Yes, I can. I think you can see back on the production curve, I believe that's Exhibit Twenty-three, that there has been a little decline in the suction pressure in the past two years as we've increased rates.

I would anticipate that we could get

these -- maintain these facilities at at least this level, and maybe increase them slightly by continuing to drill wells on the outer edges of development and to put additional gas into the facility. Now that does not mean I think I could increase the rate much more today, but for future planning and, say, we would like to have a market that says we need 368-million for the next three years, then that would be a way we would try to meet that.

Q I'm sorry, I didn't understand that. If we -- if we have a current average rate of 368, which is 110 percent of design, a former peak day of 381, my question involves what happens if the market goes to 400 or 425?

A Okay, I guess the way I can try to clarify this is facilities -- the 381 is probably the best you're ever going to do for those compressors. That was at a point when we had them stacked, I think you can look back and we had pressures in the neighborhood of 180 pound suction at that point, and to build up that kind of well volume to deliver that suction pressure, that's about the best you're going to do.

If you're going to need more than 400 -- 420-million cubic feet a day, you're probably talking about new compressors and new additional development.

Does that clarify it?

A It would take additional compression either in Phase One, Phase Two, or some Phase Three.

A Or a new plant, yes, sir.

Q You indicated that additional plants had been discussed and that you had looked at the cost of those facilities, let's hypothesize a market which jumps to 425. How -- how would you expect what you know now to meet that additional demand?

A You're asking a very tough question. Timing is important. Can you be more specific?

Q Well, let's -- let's say you get a call and somebody says that they want to purchase CO_2 which would raise the requirements on the Bravo Dome Unit to 425-million a day six months from today.

Would you -- would you accept that offer or purchase?

A We would most likely have to qualify it. Six months is a very short time frame. We do more in planning for a year from now and two years from now.

Q Okay, if -- if the demand went to 425, would you expect to ultimately meet that by increasing the compression in Phase One and Phase Two or by building a third facility, and I'm trying to judge at what point of demand --

A What point a new facility?

Q -- you've got to have a new facility.

A 425-million a day would probably -- probably be tied more into this facility at Phase One and Phase Two with additional compression there.

Q Can you give me some idea of what range of demand would require an additional facility?

A When you look in terms of, say, maybe another additional 100-million cubic feet a day, that is at the point that additional facilities begin to look more and more attractive.

Q In terms of planning for Bravo Dome operations, let's continue to hypothesize an increase in market.

A I'd like to do that a lot.

Q I was sure you did. What sort of development plans do you have to meet an increase in demand?

A We have no specific development plans at this point.

Q The wells that are currently connected to Phase One and Phase Two, I assume those wells are experiencing some natural decline as reserves are produced?

A Yes, they are.

Q Could you give me some indication of, for instance, percentage decline as results of producing those wells?

A You're going to get a -- I'll have to give you something on the average rate because obviously the wells closer to the plant are being -- will decline faster than the ones out far away, but it's been roughly on the average of around 7 to 10 percent.

Q 7 to 10?

A 7 to 10, yes.

Q Do you have an estimate of what the current producing capacity of the wells connected is now? Your average production is 368, as I understand it.

A Yes.

Q If those wells could -- could flow at maximum capacity, how much would they produce?

A I haven't seen a number on that in, say, the last two years, but it's obviously much higher than 368-million.

Q Well, last time you looked at that two years ago, or so, how much higher than --

A It was in the 400 - 420 range.

Q That was the same set of wells that are presently connected, is that right?

A We actually have tied in some expansion wells since that point in time and I'm afraid I've not seen numbers since that time.

Q You indicated, Mr. McElhaney, that you

and Amoco were encouraged looking at the broad view of the future of CO_2 production and utilization.

Have you used your intuition to try to predict what the market is likely to be two years from now?

A We have made numerous projections both from the down side situation and an up side situation. You naturally cannot look at or focus in on one particular situation.

We think that the markets two years from now will lie in the neighborhood of staying flat where they are to possibly as much as 150 to 200-million more.

Now that is industry-wide. That may not necessarily be the Bravo Dome's share.

Q What's Bravo Dome's current share of the market?

A At the present time we are supplying, based on what I've seen in industry-type of reports, a little over a third of the CO_2 that's being supplied in the Permian Basin.

Q Okay. Without careful thought I asked that question based on a 2-year period and that seems to coincide with something that you had looked at. Do you have other projections of what the market might be further into the future than 2 years?

A Primarily we look at 2 years. That is

the one that you can perhaps impact or should be shooting for.

Basically, yes, we carry those on out beyond the two years from what those things, you know, what the peaks we look for, and what those are going to do. The market, you have to understand, is very, very dependent on oil price, and I only would like to stick my neck out as far as -- I won't even stick my neck out on oil price.

Q Okay, you -- you've indicated that in your 2-year look, I think what you're telling me was that an optimistic projection might be 150 to 200-million MCF a day increase industrywide.

Assuming Amoco's one-third share would hold through that time period, and Amoco therefore --

A That's not Amoco's share, that's the Bravo Dome Unit's share.

Q I apologize then. That was not intentional. Bravo Dome's share of that market, Bravo Dome, then, if the average today is 368, with 50 or 60 additional two years from now, we're looking in the 420-million cubic feet a day range. Do you suspect that could be serviced through the present Phase One and Phase Two facilities?

A No, you will have to add compression to get that amount out.

Q And you suspect that in time --

A We will --

Q -- that you would add compression to Phase One and Phase Two to meet that market rather than going with a third plant.

A I suspect at this time.

Q Do you know whether or not that hypothesized 420 - 430-million cubic feet a day market could be met through wells currently connected to Phase One and Phase Two?

A Meaning can I install compression with the wells that are there?

Q Do you have to connect more wells to meet that market?

A We'll most likely connect more wells.

Q Do you have wells drilled and waiting connection now or would you be faced with drilling additional wells?

A More than likely it would involve some drilling and connection of existing wells, the combination.

Q However, as I understand -- understood an answer earlier to one of my questions, you don't have a development plan to meet that hypothesized market, is that --

A The specifically 425? Not specifically 425-million a day.

Q Okay, I may have missed --

A I think what I said was that we have a plan to react to whatever the market may do. I think that we can modify many of our plans we have looking at moderate expansions to big expansion to meet a 425 for two years down the road.

Q Did I understand you to testify that you did not currently have a future development plan for the Bravo Dome Unit?

A We do not have a specific plan for development of the unit.

Q Looking, Mr. McElhaney, at your Exhibit Number Twenty-four, the yellow area plant and gas gathering facilities, that is only the cost of installing the gathering system as opposed to any cost associated with operating it, is that --

A It's the cost of the pipe and installation of the gathering system.

Q And the day-to-day operational expense of that gathering system is shown in the red --

A Yes, sir.

Q -- red area as operating expense.

A Yes.

Q Okay. Looking Mr. McElhaney, again at Exhibit Number Twenty-four, it appears from that graphic

display as if the green area, Maintenance Investments, is expected to be smaller in 1988 than 1987.

A Yes, sir, it is.

A Can you explain what's having a difference in the maintenance area?

A Both from a standpoint of -- of controlling operating costs and trying minimize those expenditures that don't have to be made in this particular year, and as of the standpoint that, obviously, in the set-up of the office and set-up the computer system, you have a lot more expenditures earlier and those would tend to taper off as you tend to get more and more in your operating phase. We anticipate those to be down in 1988.

MR. PEARCE: One moment, please, Mr. Chairman.

Nothing further, Mr. Chairman. Thank you. Thank you, Mr. McElhaney.

MR. LEMAY: Additional questions of the witness?

Mr. Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q Mr. McElhaney, unless I've misunderstood Mr. Collier, I believe that he stated that there have been no new wells drilled since 1985, in referring to

Exhibit Number Seven, I believe.

And your Exhibit Number Twenty-four does show a small amount of expenditure for -- for drilling costs.

Could you explain as to what costs of going into (not clearly understood)?

A Yes, I can. What's involved in a drilling cost, both starts from the day that you set the location, make the location, drill the well, and then as you complete the well you have expenditures all the way up to that point.

Mr. Collier reflected the actual drilling and the wells getting to TD and the last well reached the TD in 1985; however, in 1986 we did do some additional work on some of those wells in the completion phase to test additional horizons, to frac, so on and so forth, and that's where those expenditures came from .

Q Thank you, very much.

QUESTIONS BY MR. LEMAY:

Q Mr. McElhaney, are you familiar with the nature of the water in the area, produced water?

A Somewhat familiar with it, yes, sir.

Q Are you familiar with any corrosion problems you might have out there in terms of your casing,

tubing?

A I'm not familiar with corrosion in the casing and tubing.

Q In the realm of waste, we understand that there is some problem because of the corrosive nature of carbon dioxide and water, protecting fresh waters, that there's -- I guess what I'm trying to get at, do you have program out there to insure the fresh water is protected in the area?

A I can comment on the program both that was reviewed in the casing programs, reviewed with the State, to put in out there, which is basically to cement to surface, or to the surface casing, and in all wells tubing is run with a packer with inhibited fluid on the annulus side to protect against any leaks that come back through that area.

We have an alarm system in the telemetry system to measure casing pressures and if we do have a leak or indication of pressure on the casing, we can detect it. Those can come and stem from packer leaks, tubing leaks, as well as casing leaks.

I'm not -- I'm not familiar that we've had a lot of casing leaks or casing problems out there.

We have had some tubing problems and packer problems.

Q But you do have a system that monitors that type of corrosion if it does occur?

A Yes, sir, we do.

Q Thank you.

MR. LEMAY: Any additional questions?

MR. CURRENS: No additional direct or redirect.

MR. LEMAY: The witness may be excused.

Is that all you have, Mr. Currens?

MR. CURRENS: That's all I have in the way of a direct case.

MR. LEMAY: I've forgotten, Mr. Pearce, do you have any witnesses or were you just --

MR. PEARCE: I do not, Mr. Chairman.

MR. LEMAY: That's fine. Let's wind this up with anything additional from you in the way of --

MR. CARR: I have a very brief statement.

MR. LEMAY: We'll take some statements, I think, in the case now and then we'll close

with that.

For Occidental and Cities Service?

MR. HOCKER: May it please the Commission, I'm Richard L. Hocker, representing OXY USA, formerly Cities Service Oil and Gas Corporation.

OXY has an interest in the Bravo Dome Unit operating plan. OXY recommends the Commission approve continued operations of the unit. We believe that the unit operations have continued to prevent waste and protect correlative rights, and that in our understanding of the order is a necessary finding.

Well, we concur, really, in Amoco's application.

MR. LEMAY: Thank you, Mr. Hocker.

Additional statements in the case?

If not, we shall take -- I'm sorry, we will have a brief closing statement by Mr. Carr, and Mr. Pearce, if he so desires.

MR. PEARCE: Thank you, Mr. Chairman, I will be very brief.

As I said when we started, I'm appearing in this matter on behalf of Normal W. Libby.

Mr. Libby owns some of that area, as you may have guessed, which is leased to Amoco under the terms of a lease which does not provide for unitization.

My client is not participating in royalty from unit operations.

We've had a discussion of what Amoco has done in the past; what they're doing presently; and we've been told that they do not have specific future development plans for the Bravo Dome Carbon Dioxide Gas Unit.

I would like to point out to the Commission that when this matter was heard previously in 1984 for a review, the Commission at that time specifically made a finding and it is Finding Number Eleven, and that finding says that for the interest owners in the unit area, not the unit, the unit area, to derive the benefits of unitization and for their correlative rights to be protected, Amoco, as unit operator, must develop the carbon dioxide throughout the unit area in a prudent and expeditious manner. Prudent and expeditious.

We are concerned that there is not a development plan. We are concerned when projections of future market can be met with modifications to current facilities when our acreage is not connected to any facility.

Thank you, Mr. Chairman.

MR. LEMAY: Thank you, Mr. Pearce.

Mr. Carr?

MR. CARR: May it please the Commission, you have now received our 4-year review of the Bravo Dome Unit. You've received our progress report.

For eight years we have been working in close association with this Commission as we've developed the carbon dioxide in this area and we hope to continue to do that with your support and in cooperation with you, meeting your concerns and desires as we move forward.

We believe today we can tell you that the benefits of unitization are being attained; that while the industry is down, while smaller units are not producing, Bravo Dome is producing and selling carbon dioxide gas in substantial quantities, and these sales are being affected in an efficient and we believe effective manner; that drilling is being done in an efficient way; that the resource is being processed and treated and marketed with state of the art equipment; and that we're doing what we purported we could do in 1980. We're maximizing the benefits of this production for all interest owners in the unit, and I think the best example given today,

perhaps, of what unit development means is, you saw it when Mr. Collier showed you that in 1985 there was a drilling program and it really wasn't designed for the current market but it was designed to enable Amoco to operate their plant most efficiently, reduce costs, and those costs then result in benefits to all interest owners in the unit.

We have an effective unit operation here and what it really boils down to is simply we're producing this resource and we're producing it without waste.

Now as to correlative rights, and as to the comments made by Mr. Pearce, I think it's important for you to remember this is a voluntary unit. We have had over 1500 interest owners in this area voluntarily commit their lands to this unit and Mr. Pearce's client did not. He could have but he did not, and he shares none of the risks or burdens of unit operation and he doesn't get the benefit of royalty from unit production. He could, but he elected not to.

Mr. Pearce talks to you about the unit area, well, I will tell you that the unit area is defined in the unit agreement and if you're not in, you're not in. In a voluntary agreement, if you elect to stay out, that's where you are, and your acreage is developed under your lease; it is not part of the unit operation.

And that is an election that Mr. Libby made while thousands -- or hundreds of other people decided not to go that way, but to come into the unit and operate under unitized operations, and when they came in their objective was to obtain production, production that could be obtained because of the size and the efficiencies that result from unit operation.

Those have been obtained. Now correlative rights is an opportunity to produce your share of the reserves. You can do that by leasing to somebody and standing on your lease. You can do that by coming into a unit and take advantage of the opportunities that unitized development presents, and that's what 1500 people have done and they are sharing in the proceeds and the results of this operation and their correlative rights are being protected.

Now, this is a big unit. There are not wells all over this map and this is nothing new. We didn't tell the Commission in 1980, we never purported to have full development in 1988, but I can tell you our goal is exactly what it was in 1980 and it's a goal we believe we are moving toward and will attain and that is that we will have fully developed the Tubb formation that can produce CO_2 in the Bravo Dome Area, and that we will do it as efficiently and as effectively and as quickly as the

market for CO_2 permits, and that's what we're doing. We believe we have presented to you today evidence of a project that's working; a project where our mutual goals of developing a resource efficiently, with concerns for the rights of all the interest owners, for that's being accomplished, we're now before you asking for your continued approval so we can go forward with these efforts that are, yes, in fact part drilling, others part research and studying the reservoir, but efforts which we believe are directed at the most efficient and effective production of this resource.

MR. LEMAY: Thank you, Mr. Carr.

Is there anything further in Case 9428?

If not, we shall take that case under advisement.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C. S. R. DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date AUGUST 3, 1984 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION
William F. Carr	Campbell + Black	Santa Fe
Bruce S. [illegible]	Amoco	Houston
C. A. Mate	Amoco	Houston
James C. Allen	Amoco	Houston
Gordon Russell	AZAZ	Joaquin TX
Marguerite Poling		Clayton
W. Poimboeuf	AZJZ	Joa TX
D. Knipel	AmeriGas	Philadelphia
Tom BAILEY	AMERIGAS	DALLAS
Dennis Shugart	Rancher Rosebud Ranch	Amistad N.M. Amistad, N.M.
Johnany Adee	Ranch	Logan, N.M.
[illegible] Moore	Ranch	Nara Visa N Mex.
[illegible] James	Marathon Oil	Midland Tx
[illegible]	R. N. ENFIELD	MIDLAND, TX
JAMES F. O'BRIANT	MARATHON OIL	MIDLAND TX
Verne E. Hull	R N Enfield	Roswell, NM
Edward [illegible]		

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date AUGUST 3, 1984 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION
R M Kroba	Self	Clayton N.M
J. B. Mapes	Self	" "
B. P. Nazgar	Amoco	Clayton, N.M
W. T. Kellahin	Kellahin & Kellahin	Santa Fe
Bob Hall	Byram	Santa Fe
[illegible]	[illegible] Law Firm	Santa Fe
[illegible]	Cities Service	Midland
Roy E Johnson	OCD	Santa Fe
Robert England	Self	Santa Fe

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

3 August 1984

COMMISSION HEARING

IN THE MATTER OF:

Case 8289 being called by the Oil Conservation Division on it own motion pursuant to the provisions of Division Order No. R-6446-B, regarding the Bravo Dome Carbon Dioxide Unit Agreement, Harding, Union and Quay Counties, New Mexico. CASE 8289

BEFORE: Commissioner Joe Ramey, Chairman
Commissioner Ed Kelley

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: W. Perry Pearce
Attorney at Law
Oil Conservation Commission
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant: Clyde A. Mote
Attorney at Law
Amoco Production Company (USA)
Post Office Box 3092
Houston, Texas 77253

A P P E A R A N C E S

William F. Carr
Attorney at Law
CAMPBELL & BLACK P.A.
P. O. Box 2208
Santa Fe, New Mexico 87501

I N D E X

E X H I B I T S

MR. RAMEY: The hearing will come to order, please.

We'll call first Case 8289.

MR. PEARCE: That case is in the matter of Case 8289 being called by the Oil Conservation Division on its own motion pursuant to the provisions of Division Order No. R-6446-B, which approved the Bravo Dome Carbon Dioxide Unit Agreement in Harding, Union and Quay Counties, New Mexico, to permit Amoco Production Company, the operator of said unit, to review operations and demonstrate to the Commission that its operations within the unit are resulting in the prevention of waste and the protection of correlative rights on a continuing basis.

I would call for appearances at this time.

MR. CARR: May it please the Commission, my name is William F. Carr with the law firm Campbell and Black, P. A. of Santa Fe, appearing on behalf of Amoco Production Company.

I'm appearing in association with Clyde Mote, a member of the Texas Bar and attorney for Amoco Production Company, Houston, Texas.

MR. RAMEY: Are there any other appearances?

Do you have any witnesses, Mr. Mote.

MR. MOTE: Yes, we will have three witnesses.

MR. PEARCE: Could I ask all three prospective witnesses to rise at this time, please?

(Witnesses sworn.)

Thank you, gentlemen.

MR. RAMEY: You may proceed, Mr. Mote.

MR. MOTE: Mr. Chairman, as stated by Mr. Pearce, this is a Commission-called hearing to permit Amoco, as operator, to review our operations and to demonstrate that operations within the unit are continuing to result in the prevention of waste and the protection of correlative rights.

We'll have three witnesses. Mr. Bruce May is going to be our geological witness. He'll be the first witness that you hear from.

He's going to give you some information about the unit history, its location, its composition. He'll tell you about the structure and the facilities that are present from a geological standpoint.

Next we'll hear from Mr. Jim Allen, our engineering witness. He'll give you the engineering aspects of it.

We then have a third witness,

Mr. Baldy Navejar, who will make a presentation, a pictorial presentation, and a walk-through of the facilities on the Bravo Dome site.

We'll call as our first witness Mr. Bruce May.

BRUCE I. MAY,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. MOTE:

Q Would you please state your name, by whom employed, and in what capacity and location?

A My name is Bruce May. I work for Amoco Production Company in Houston, Texas, as a geologist.

Q Have you previously testified before the Division and are your credentials as an expert in the field of geology a matter of public record here?

A Yes, they are.

Q Have you either prepared or had prepared under your supervision and direction all the exhibits which -- concerning which you'll be asked to testify in this hearing?

A Yes.

MR. MOTE: Is there any question concerning Mr. May's qualifications?

MR. RAMEY: No, Mr. Mote.

Q If you would, turn to your first exhibit, Mr. May.

Mr. May, with regard to the first exhibit, would you please explain what's shown here?

A Yes. This is a geographic map showing the location of the Bravo Dome Carbon Dioxide Unit. It is located in northeastern New Mexico. It contains parts of Union, Harding and Quay Counties, New Mexico.

The unit became effective on November 1st, 1980 under the Commission Order R-6446-B.

The unit itself is 1,036,000 acres. Approximately 28 percent of the unit acreage is State lands and surface usage is primarily ranchland with some farming.

The unit itself is also located geologically on the southeast flank of the Sierra Grande Arch.

Q All right, go to your next exhibit, Mr. May. What's shown by this Exhibit Number Two?

A The next exhibit is a type log from the Bravo Dome Carbon Dioxide Gas Unit. This particular well is the Amoco No. 1 State "FD", located in Township 20 North, 31 East, Section 23.

What this particular log shows is the unitized interval, which is defined from the top base of the Cimarron anhydrite, top of Tubb to the top of the Basement.

The unitized substance here is carbon dioxide. It also includes noncommercial quantities of hy-

drocarbons.

The average depth to the top of the Tubb is approximately 2200 feet; average depth of most wells is on the order of 2300 feet.

The reservoir itself is a very fine-grained sandstone deposited by fluvial processes and the average porosity for the reservoir, based on core analysis, is about 20 percent. The average permeability, 42 millidarcies.

Q Go to your Exhibit Number Three, Mr. May, and tell us about this exhibit.

A Exhibit Number Three is a structure map on top of the Tubb, or top of the unitized interval.

To get you oriented, the orange outline is the unit boundary.

This slide also illustrates some of the trapping mechanisms for the accumulation of carbon dioxide within the unit, that being the dip towards the southeast, the general pinchout towards the northwest, and the series of northwest/southeast trending fault systems, and in addition to those, the overlying impermeable Cimarron anhydrite which was shown on the previous slide.

Q Have you found an error on this exhibit you'd like to correct before we go any further?

A Yes, there is a well in Township 20 North, 32 East, Section 33, Well 1-D, which should be in 10 North, 32 East, Section 4, 1-D.

This is --

Q Point out that on this exhibit. Can you show it?

A Approximately in this location and it should be moved south. By moving that particular well south the daum corresponds correctly with the contours on the map. This is a drafting error that occurred and we just noticed it going over these exhibits.

Q Would just a drafting error in any way affect your interpretation or change what's shown on this exhibit?

A No, it would not.

Q All right. Do you have some nonproductive wells in this area? Has Amoco drilled any?

A Yes. We have fourteen unproductive wells within the unit boundary.

Q All right, starting over on the lefthand side, let's just take it by range.

How about Range 29, have you got any dry holes in Range 29?

A Yes. We have one dry hole in Range 29, Township 21, Section 9.

This particular well we perforated, acidized and swabbed, and we recovered primarily water but we did not see any CO2 in that particular well. As a result it was plugged and abandoned.

Q How about Range 30?

A Range 30, there are no dry holes within the unit.

Q Thirty-one?

A Thirty-one, yes, we have three dry holes within Range 31.

In Township 23 North, Section 20, there is a dry hole there where we perforated, acidized, we fraced and recovered primarily water with no CO2 and as a result the well was plugged and abandoned.

The next dry hole occurs in Township 22 North, Section 16. We drilled this particular well and found that there was no Tubb present in that -- that well.

The last dry hole in that particular range is in Township 20, Section 13. In this particular well we perforated, acidized, and recovered, again, primarily water with no CO2. As a result the well was plugged and abandoned.

Q How about in Range 33?

A Range 33, we do have four dry holes in that particular range.

Township 24 North, Section 30, on that particular well we perforated, acidized, and recovered primarily water.

We move further south in Township 23 North, Section 2, we have a dry hole but this was not drilled by Amoco. This particular well, the Dillard No. 1 State, was drilled in the 1950's primarily looking for

hydrocarbons and they drilled that particular well, did not find any hydrocarbons and as a result they plugged and abandoned the well.

Finally, in Township 22 North, Range -- again Range 33 East, Section 36, we have an unproductive well. This particular well was plugged and abandoned based on log calculations.

And then finally in Township 19 North, Section 7, we have an unproductive well that we perforated, acidized. We fraced with CO2, recovered 16 Mcf of CO2, and after that we swabbed primarily water with some show of CO2 but no CO2 flowed to the surface and as a result the well was plugged and abandoned.

Q Any more in Range 33?

A No, that's --

Q How about Range 34?

A Range 34, yes, we have a couple dry holes in Range 34, Township 23 North, this region, Section 21, this well again we perforated, acidized, and recovered primarily water, no CO2, and as a result was plugged and abandoned.

In Township 22 North, Section 1, there was a well that was drilled in the early evaluation of this area for carbon dioxide. It was plugged and abandoned based on log calculations and no tests were run in that particular well.

In Township 21 North, again Range 34, we

have three dry holes in that particular township. Section 4, which we perforated, acidized, and recovered primarily water, again no CO2, and it was plugged and abandoned.

And then again in Section 21 we again perforated, acidized, and recovered primarily water.

There is one dry hole within that section, the Quaker No. 1 Zurich was drilled in the 1930's looking for hydrocarbons. It was drilled down to the Basement and they did not see any hydrocarbons and as a result the well was plugged and abandoned.

I'd also like to note in that same section there is a productive well of CO2.

Q Is that the one that was -- they decided not to complete it on the log analysis?

A The one in Township 22 North, Section 1, was the one that they decided to not complete on -- based on log analysis.

Q Do you consider that a viable method of determining whether or not CO2 is present?

A No, I don't. I feel that -- that really the only way you can evaluate this reservoir is to test it, perforate and acidize and test the well.

Q All right, going on over to Range 35, are there any dry holes in that range?

A Yes, there is one dry hole in Range 35, located in this position. It would be Township 20 North, Section 15. This particular well we drilled, perforated,

acidized, and swabbed the well dry, and since we didn't recover any CO2, the well was plugged and abandoned.

Q How about Range 36?

A Range 36, we do not have any dry holes in Range 36.

Q All right, now based on your evaluation and study of these wells which are not productive, does this provide you with sufficient information to draw a zero Isopach map showing the productive limits of the Bravo Dome Unit?

A No, I believe it does not.

Q Do you change your interpretation from time to time in this reservoir or have you started out with one interpretation and continued all along?

A Our interpretation of this reservoir, the structure is constantly changing. Every time we drill a new well we learn something different about the reservoir, the structure map is adjusted, so we are continuously changing our description of this reservoir.

I might also point out that we've shot some 600 miles of seismic. It's still being processed but I imagine the reservoir description will again change once that seismic has been processed and integrated with the well control.

Q Has there been any production of CO2 outside the Bravo Dome Unit?

A Yes, towards the southeast there is one

productive well that's in Texas, the CO2-in-Action No. 1 Coots, which flowed 900 Mcf from an equivalent interval to our unitized interval.

Also, towards the southwest there are several productive wells of CO2, again from an equivalent interval to our unitized interval. The production of some of these wells reached a maximum of approximately 2-million cubic feet per day.

Q What are your -- what are Amoco's future geologic plans for this reservoir?

A Our future geologic plans are to process the seismic and integrate the well control and hopefully come up with a better structural interpretation of the unit itself.

In addition to that there will be wells that will be drilled within the unit and as a result we'll integrate that well control into our structure maps.

We're also planning on obtaining additional rock data so we can improve our understanding of the reservoir characteristics and properties and then we'll also be attempting to improve our completion techniques as we understand this reservoir better.

MR. MOTE: Mr. Chairman, that concludes the testimony of this witness.

We offer Exhibits One through Three into evidence and tender the witness for cross examination.

MR. RAMEY: Exhibits One, Two, Three will be admitted.

Are there any questions of Mr. May?

He may be excused.

MR. MOTE: Call as our next witness Mr. Jim Allen.

JAMES C. ALLEN,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. MOTE:

Q Will you please state your name and by whom employed and in what capacity and location?

A My name is James Allen. I'm employed by Amoco Production Company in Houston, Texas as a Regional Engineering Supervisor for the Regulatory Affairs Group.

Q Have you previously testified before this Division and are your credentials as an expert in the field of petroleum engineering a matter of public record?

A Yes, sir.

Q And are you familiar with the Bravo Dome Unit Area?

A Yes, sir.

Q How many years have you been familiar

with Bravo Dome and been working on it?

A Mr. Mote, at least for four years.

Q All right, and the exhibits that you'll be asked to testify concerning in this hearing, were they prepared by you or under your supervision and direction?

A Yes, sir.

Q All right, if you would, go to your first exhibit, which I believe is Exhibit Number Four, and explain, first of all, the incorrect spelling on it, and the rest of the exhibit.

A I think on the copy, the hard copy of the exhibits, that the word "competitive" has been spelled correctly. We did not get it corrected, however, on the slide for presentation today.

This map is -- shows both the major sources and market for carbon dioxide for enhanced oil recovery projects.

If you will note, in southwestern Colorado there is a McElmo Dome, which I believe is operated by Shell.

In southeastern Colorado, or south central is Sheep Mountain, operated by ARCO.

You'll note in west Texas the Val Verde Basin. I might point out that the CO2 source in Val Verde Basin is different than the other three sources which I will mention in that the CO2 here is primarily a waste product from hydrocarbon gas, or that it's taken from gas sweetening

plants.

The fourth major source of CO2, of course, is Bravo Dome in northeastern New Mexico.

Q So Bravo Dome has three separate competitive sources of gas for the use of enhanced oil recovery in the Permian Basin, is that correct?

A Yes, it is competing with the other three sources and, as shown on this map, it is the only major source of CO2 in the State of New Mexico.

Q All right, how are you going to get the CO2 from these various reservoirs, these various sources, to the Permian Basin for use in enhanced recovery?

A All right, sir, it's my understanding that from McElmo Dome, that the Cortez Pipeline is either already completed or shortly is to be completed, transporting CO2 from the McElmo Dome to west Texas.

The Sheep Mountain project is already completed and I failed to mention that in the McElmo Dome that pipeline has a published capacity of 650-million cubic feet a day with, I understand, the ability increase that capacity up to a billion cubic feet a day.

In the Sheep Mountain, that line is completed. It has a stated capacity ranging from 330-million to 500-million cubic feet a day.

The Val Verde Basin Pipeline, which is operated, I believe, by Chevron and supplies primarily the SACROC Unit, there may be several others --

Q So you have three different pipelines that are going to be taking gas from various areas to the same similar source in Texas to use in enhanced oil recovery in the Permian Basin, is that correct?

A That is correct. Now the pipeline from McElmo Dome, Sheep Mountain, and the recently announced pipeline from Bravo Dome, will all three terminate in the Denver City, Texas area in west Texas.

Q Okay, is the Bravo Dome Carbon Dioxide Unit the only -- or that area, is that the only area of carbon dioxide that's known within the State of New Mexico, as far as you know?

A Yes, sir.

Q Is Bravo Dome currently producing any amount of CO2 to market?

A Yes, sir, at the current time CO2 is being produced from the Bravo Dome Carbon Dioxide Gas Unit. It's being delivered through Amerada Hess' sixteen mile, what is commonly referred to, I think, as a Rosebud lateral. It ties into the Sheep Mountain Pipeline and terminates in west Texas.

The --

Q Is that where the CO2 that's now being produced from Bravo Dome is being delivered in the vicinity of Denver City?

A Yes, sir.

Q All right, let's go to the method by

which Bravo Dome CO2 is being delivered into the Permian Basin.

Now tell us about the Bravo Pipeline, as much as you know about it.

A I believe that on July the 3rd that it was announced that the Bravo Pipeline would commence construction. It would be taking gas from the tailgate of our existing conditioning plant in the southeastern quadrant of the Bravo Dome Unit, and again will terminate in the vicinity of Denver City, Texas.

Q Is it a common carrier pipeline?

A It's my understanding it is, yes, sir.

Q All right, continue.

A I understand that the project construction commenced on July the 9th, 1984; projected completion date is November the 1st of 1984.

When completed, the pipeline will be some 210 to 220 miles in length, with approximately 20-inch -- I guess it is 20-inch pipe. The initial capacity is 400-million cubic feet a day with the ability to increase that capacity to 700.

Q When is the first time gas through this pipeline is slated to be used in the Permian Basin?

A In the fourth quarter of 1984.

Q All right, let's go to your Exhibit Number Five. Tell us about this exhibit, Mr. Allen.

A Exhibit Number Five is a map of the Bravo

Dome Carbon Dioxide Unit. It is the same base map that Mr. May used, although the unit outline, or the outer boundary of the unit outline is not highlighted on this map.

This is the status of development within the unit boundary at the date of unitization, being November the 1st, 1980.

Q How many wells are completed in there, do you know?

A The red dots indicate the wells that were completed as of that date on this map. There are 35 such wells.

There are two that I would like to -- two areas which really stand out. They look like almost a big blob right in here. The reason for this is there's actually three wells in those locations.

Q What were those three wells used for?

A Those wells were used to run some flow tests, primarily, to help us gain reservoir engineering properties, parameters.

Q Now, are those shown by arrows on the hard copy in the brochure that's been handed out?

A Yes, sir, I can identify the wells which were used in these flow tests.

One is in Township 20 North, Range 31 East, Section 23. I believe it's located here on the map.

The other two wells were located in Range -- Township 19 North, Range 33 East, Section 3, which is one

of the larger areas, here.

And the third location where the flow tests were run, of course, is in Township 20 North, Range 34 East, Section 36.

Q How many of the wells that were drilled as of the effective date of the unit have turned out to be dry holes?

A Excuse me, you say -- would you repeat that question?

Q How many nonproductive wells had been drilled as of the date of the unit?

A As of the date of the unit?

Q Yes.

A There were three.

Q What was the purpose for the flow tests from these three areas that you've just discussed?

A Well, the main purpose was to develop, primarily to develop and obtain geological and engineering data which will better help us define the optimum reservoir development pattern within the unit on a unit-wide basis.

Q Okay, let's go to Exhibit Number Six. Tell us about this exhibit, Mr. Allen.

A Exhibit Six is the same base map as the other maps of the Bravo Dome Carbon Dioxide Unit we have shown on previous exhibits. This is the status, or well status, within the Bravo Dome Carbon Dioxide Unit as of July the 15th, 1984.

Q How many wells does this show completed, Mr. Allen?

A There have been 304 wells that have been completed since the unit -- since -- well, there have been 269 additional wells drilled since unitization. There's a total of 304 wells have been completed.

Q And how many -- do you show plugged and abandoned wells on this exhibit?

A I believe they are highlighted. They would be hard to -- to pull out of this exhibit, Mr. Mote.

I've noticed they've used three different color codes. The red dots shown on this map indicate the wells that were completed as of the effective date of the unit. They are the same wells that were located on the previous exhibit.

The green dots, and unfortunately the green and blue don't stand out very well on this slide, are the wells which are completed as of this date or as of July the 15th.

The blue, or the wells indicated with the blue dots, are the wells that will be drilled in 1984.

Q How many of those have been authorized by Amoco but are not yet drilled?

A Thirty-one wells.

Q That's in addition to 304 that's already completed.

A Yes, sir. No, I believe that includes

the -- that is correct.

Q All right, I believe you've already said there were fourteen plugged and abandoned wells shown on this exhibit, did you not, or did you get that number?

A Yes, sir.

Q How about salt water disposal wells? How many salt water disposal wells are shown in the exhibit?

A There are two salt water disposal wells within the Bravo Dome Carbon Dioxide Unit.

Q Locate those for us on the map.

A All right, sir. One is -- is located in Township 20 North, Range 31 -- 34 East in Section 36, and I believe it's located in this area. This well was previously used as a monitor well during an interference testing.

The second salt water disposal well is located at the conditioning plant. It's in Township 19 North, Range 34 East, in Section 26.

Q You've already talked about the three wells that were used for short term flow tests. Does this also show the wells that were used in connection with long term flow tests?

A The hardbound copy of exhibits do indicate those wells that were used in the flow tests. They were not put on the slides since they would have covered up so many of the other -- the other wells.

They're highlighted by red arrows on the hardback copy of the exhibit.

Q All right, tell us where those wells that were used for long term flow tests are on this map.

A All right. One of the -- of course, as I noted earlier, there were three that were conducted prior to unitization in these three locations.

The location in Section 31 -- excuse me, in Section 3, which I believe is this location, was used in the long term flow test which was conducted after the date of unitization.

I'll just read the locations into the record of the four wells which were utilized. They're rather hard to spot from this distance.

One is in Township 19 North, Range 33 East, Section 3; and Township 19 North, Range 34 East, Section 11; Township 19 North, Range 34 East, Section 20; Township 19 North, Range 35 East, Section 22.

Q What was the purpose for long term flow tests, Mr. Allen?

A The primary purpose of conducting these flow tests was to determine what long term deliverability could be anticipated from the wells in the unit.

In addition, we hoped to evaluate what kind of corrosion problems we would encounter when the unit was on full production.

Q All right. Were the results of these long term flow tests discussed at length during the May 16th, 1984 640-acre spacing hearing?

A Yes, sir, the results were. That was Case Number 8190.

I might also note that the results of the earlier three flow tests were presented in Case Number 6823.

Q Okay, how about seismic? Mr. May mentioned the seismic. Would you tell us how much seismic has been run and what the status of that seismic is?

A To date some 600 miles of seismic have been shot within the Bravo Dome Unit. It is currently being processed.

In addition, Amoco management has authorized an additional 500 miles of seismic lines.

Q Have you made some calculations to determine if there's any increase in the drilling of the number of wells since the effectiveness of the unit as compared to the number of wells that were drilled prior to the unit?

A Yes, sir, it comes out to be about 768 percent increase.

Q What will dictate further development in this unit?

A Primarily further development within the Bravo Dome Unit is going to be dictated on the market demand and it would best be made, I believe, in stages as the market develops.

Q Are you also going to drill some wells for planning purposes or continued evaluation of this reservoir?

A Yes, sir. In the near term future I think that we will see additional drilling, not only probably in the area which has been developed, but we will see drilling in the north and western portions of the unit, and this drilling will be done for planning and development purposes.

Q All right, let's go to your next exhibit, Mr. Allen, Exhibit Number Seven.

Tell us about this exhibit.

A All right, sir. This is the same base map as we've been using on the previous exhibits. We have shown here the gathering systems from the producing wells to the conditioning plant site.

We've highlighted the two systems using two different colors.

The system in the northeast section, colored in red, is what we refer to as the Phase I, or the -- and the system which has been completed to date.

In green is the Phase II development area, which is currently under construction.

Q When was this gathering system initiated?

A I might, well, I note on the Phase I, or the red system, that construction commenced in June of 1983 and was completed in December. It consists of some 50 miles of pipeline and gathering system.

The objective of the Phase I development was to develop and deliver 86-million cubic feet a day to

the Sheep Mountain Pipeline via the Rosebud lateral.

Q How many miles of pipeline are in Phase, the first phase of the gathering system?

A In the first phase there are fifty miles.

Q And 50 wells in that Phase I are connected up now?

A That is correct.

Q How many of those 50 wells are now producing, as far as your information, into the system going to the Denver City area?

A There are 26 wells active.

Q What is the average daily production rate of that existing production?

A At the current time the average daily production from that area is 26-million cubic feet a day.

Q All right, you also talked about Phase II. I believe that's the green color?

A Yes, sir, it is.

Q How much is that designed to gather?

A The objective of Phase II is to develop an additional 250-million cubic feet of gas a day to be delivered to the Bravo Pipeline.

Q When was that gathering system commenced?

A It was commenced, I believe, in March of 1984. We anticipate completion by November and when that Phase II is completed, there will be some 180 miles of gathering system of which 60 has -- 60 miles has already

been completed.

Q All right, give us a total amount of Phase I and II. How many total miles are included in the exhibit showing gathering lines?

A When Phase I and -- well, when Phase I and II both are completed, the gathering system will consist of some 230 miles of pipeline, sizes ranging from 4-inch up to 28-inch. There will be 228 wells connected to the system.

Q All right, what will be the total cost of capital expenditures that has been spent upon the completion of Phase II?

A That cost, as close as we can figure at this time, will be $150,000,000.

Q And that's capital expenditures going into that --

A That is capital expenditures only, yes, sir.

Q All right, let's turn to your Exhibit Number Eight.

Explain this exhibit to the Commission.

A Exhibit Number Eight is a tabulation intended to show the drilling activity and production activity within the Bravo Dome Unit.

We have shown this by years, 1980 being the year that the unit became effective.

The first column, the Annual Well Count,

is the number of wells which were drilled and completed during that particular year.

The next column, the Cumulative Well Count, indicates the number of wells which existed and were completed at year end.

The following column, and I'll note that Sales, the word "sales", should be replaced by Production on this exhibit.

Q The hard copy has been changed.

A The hard copy has been changed to show that this is CO2 production.

If you will note here, production commenced in March of 1984 with 31-million cubic feet. This represents the volume of gas necessary to pack the Rosebud lateral.

Actual sales from the unit itself commenced on April the 2nd of 1984.

I would also like to note that the numbers shown as production were taken from the Commission Form C-115.

Q And you show some 2.7 Bcf actually having been sold as of June, 1984, correct?

A That is correct.

Q All right, let's go to your Exhibit Number Nine.

What's this exhibit, Mr. Allen?

A Exhibit Number Nine, we have taken the

base map of the Bravo Dome Carbon Dioxide Unit and we have indicated, using the heavy green and orange outlines, the spacing patterns that were adopted by Commission Order R-7556.

It is noticed the majority of the unit in the dark green is on 640-acre spacing pattern. The area in the southwest quadrant, 160 -- is on statewide 160-acre spacing pattern.

Q That looks like 60 but it's really 160. It's almost got the number one hid on that.

A Yes, sir, on the slide it's very difficult to see the 1, but that is 160 and not 60.

Q What are the advantages of 640-acre spacing, Mr. Allen?

A One of the biggest advantages of 640-acre spacing is that it allows Amoco to continue to develop on a 640-acre basis within the unit area. It provides for an orderly and efficient development in this manner, and at the same time it provides a mechanism whereby we can protect correlative rights of both committed and noncommitted royalty interest within the Bravo Dome Unit Area.

The adoption of the 640-acre spacing has eliminated the need to drill a lot of unnecessary wells for the sole purpose of protection of correlative rights when they do not develop any additional reserves.

At the same time it has eliminated the concentrated use of surface acreage. It will continue to

encourage a wider development of drilling within the unit area, which helps us prove up the entire unit at an earlier date.

Q All right, now with regards to 160-acre area, what's Amoco's plans for that area?

A We will continue to evaluate that area as additional drilling and geological data becomes available and some production data becomes available.

Q Is there some possibility that we may still need 640-acre spacing in that area?

A Yes, sir, there is.

Q And as your studies continue and your engineering and production data is accumulated is it possible you may come back to this Commission and ask for 640-acre spacing for that area, as well?

A That is possible, yes, sir.

Q All right. Now with regard to operations or plans by Amoco from the unit standpoint, what are the advantages of unit operation, Mr. Allen?

A There's numerous advantages of unit operations. I'll just point out a few.

One of the more obvious, I think, is that under a unit operation it does allow for central facility design capability and thereby it eliminates the need for a large number of individual lease surface facilities being constructed. Operating under a unit basis with less facilities like this will reduce operating expenses. That in turn

will result in a longer economic well life and it will maximize carbon dioxide recovery.

In addition, by operating on a unit basis the gathering systems will us to bring any water produced to a central point where it can be disposed of. This eliminates a large number of salt water or produced water holding tanks throughout the unit area. It permits us to use underground disposal as opposed to hauling it out by tank truck.

Q In your opinion does unit operation allow the more expedient and efficient development of CO2 reserves in this area?

A Yes, sir.

Q All right, in your opinion, Mr. Allen, do operations in the Bravo Dome Unit result in the prevention of waste and the protection of correlative rights on a unit basis?

A In my opinion, yes, sir.

MR. MOTE: That concludes our testimony from this witness and we offer Exhibits Four through Nine, inclusive, into evidence and tender the witness for cross examination.

MR. RAMEY: Exhibits Four through Nine will be admitted.

Are there any questions of Mr. Allen?

He may be excused.

MR. MOTE: We call as our next

witness Mr. Navejar.

BALDEMAR P. NAVEJAR,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. MOTE:

Q Would you please state your name, by whom employed, in what capacity and location?

A My name is Baldemar P. Navejar and I'm employed by Amoco Production Company, currently assigned in our Bravo Dome Clayton operations.

Q And would you please relate your educational experience to the Commission?

A I received a Bachelor of Science in natural gas engineering from Texas A & I University in May, 1976.

Later, in October, 1981 I obtained registration as a professional engineer in the State of Texas.

Q And what work experience have you had since graduation and before graduation?

A Prior to graduation I spent a number of years working in the oil and gas fields of south Texas as a roughneck and roustabout.

Later, then, after graduation I spent a little over eight years with Amoco Production Company as a

petroleum engineer.

Q What are your current duties, Mr. Navejar?

A I am currently the District Foreman of our Bravo Dome Operations Center, which primarily consists of the operations inclusive of the Bravo Dome Unit.

Q And how long have you been actively working with the Bravo Dome Unit Area?

A Since October of 1980.

Q And now your sole employment with Amoco deals with Bravo Dome Unit, is that correct?

A That is correct.

MR. MOTE: Are there any questions concerning this witness to testify as a professional engineer?

MR. RAMEY: No, he is qualified, Mr. Mote.

Q You'll be asked to testify concerning certain schematics and pictures. As far as schematics are concerned, were these prepared by you or under your supervision and direction?

A They were.

Q You'll also be asked to testify concerning certain pictures. Were these -- do these pictures correctly and accurately portray the scene depicted thereon?

A They do.

Q All right, if you would, turn to your Ex-

hibit Number Ten and explain to us what's shown by this exhibit.

A This is an aerial photo of a typical drilling rig used in our 1981 drilling program.

The key to the successful development in any project is the actual drilling. Our Bravo Dome drilling program consists of setting casing, or surface casing, rather, at 700 feet. We use a 6 percent mud system, drilling on down to TD, where we set 7-inch casing.

Q All right, go on to your next exhibit, Exhibit Number Eleven. What -- what's shown here?

A This is a slide illustrating construction of our gathering lines during Phase I. Here we see a 6-inch line being prepared to be lowered into the ditch to be backfilled later.

To expand on our collection gathering system, all inclusive of Phase I and Phase II, I would like to point out that the sizes of our gathering line ranges from 4-inch to 28-inch; that we provide for a 42-inch cover of all our lines.

As far as corrosion management, we see that our pipe has an external coating on it. It is basically a coal tar coating and as far as the internal integrity of our pipe, we do provide for injection of corrosion inhibitors.

All total, we have 50 miles of gathering lines under Phase I and 180 miles under Phase II.

I will point out also that additionally on our corrosion management we do have sacrificial anodes stratigically located in the lower areas to minimize external corrosion.

Q All right, let's go to your next exhibit, Exhibit Number Twelve. Tell us what we have here, Mr. Navejar.

A This slide basically graphically illustrates the layout for our Bravo Dome Unit Facility.

I'll start from the left and move to the right. We see our electrical substation area. Immediately north of that we have our salt water disposal well. Moving right we see the area designated as our Phase I Facility Development Area. Immediately below that we see the designated area in a dashed line for Phase II Facility development, which is currently under construction.

Above that we see a smaller square kind of in the center of the slide which is our control building. North of that we have our field office and coming back down to the center of the slide we see that we do have two fresh water wells serving the facility here, and this is directly offsetting State Highway 65.

Q All right, go on to your next exhibit. What do we see in Exhibit Thirteen, Mr. Navejar?

A Basically a pictorial representation of the layout we previously discussed.

Starting in the center of the slide on

the left side you see the on-going construction of the Phase II Compression Dehydration Facilities.

Moving toward the center, right here, is the compressor building.

Moving forward you see the vessels for cooling and dehydration of our CO2 gas.

Moving over we see our field office and just west of that is our microwave tower.

This is a picture taken right off State Highway 65.

Q All right, let's go on to your next exhibit. I believe this is Exhibit Number Fourteen. Tell us what you show by this exhibit.

A A graphical representation of our Phase I Facility layout.

We have two major trunk lines coming into our facility. We call them Leg One and Leg Two, bringing in the gas from 50 wells. We basically extract the water through our scrubbers and we go into three phases of compression in bringing the field pressure from 150 pounds up to what is currently running 1800 pounds.

The gas is also conditioned by three stages of cooling and dehydration and three stages of separation, as I previously mentioned.

After the gas is -- has seen its third stage of compression it's ready for metering. We then send it down the Rosebud lateral and on to the ARCO Sheep Moun-

tain line.

Q When was construction started on this Phase I?

A March of 1983.

Q And is it now completed and on line and producing gas?

A Yes, sir, it is completed and operational. We have 26 wells active at this time.

Q When did the gas sales commence, Mr. Navejar?

A April 2nd, 1984.

Q And what is the average daily volume that can be driven through that facility?

A The total capacity of the facility is 86-million cubic feet per day. We are currently averaging 23 to 26-million cubic feet per day.

Q It's really just a function of demand, is that correct?

A That is correct.

Q All right, let's go to your next exhibit, Exhibit Fifteen. What do we have here, Mr. Navejar?

A This is a front view of our Phase I Compression Dehydration Facilities. The subsequent slides will give you a little bit better view of the actual facilities themselve, but I do want to draw some attention to this flag here. You cannot really distinguish what it has on there, but that is a "3" and that represents our safety record.

We've actually earned a record of three years, no lost time, no accidents, no first aid.

Q Okay. Go on to Exhibit Number Sixteen. What does this show?

A This is a close-up view of our Phase I facilities.

I will start in the center of the slide and move from left to right and I'll basically describe some of the vessels we use for cooling and dehydration of our CO2 gas.

Here we have our second stage cooler. As we come up here we have our first stage, or inlet scrubber, where we drop out our water.

We have our third stage cooler here.

This silver tower here is our glycol contacter.

Our second stage scrubber, as well. I might note that after the second stage of compression everything goes to stainless steel and this cylinder tank here is 1000-barrel water storage tank.

Down over here we see our electrical substation.

Q All right, go on to your Exhibit Seventeen. What do have here, Mr. Navejar?

By the way, is this picture reversed from what's in the book?

A The slide is correct but the prints in

the book will be reversed.

Q Okay. Tell us what you show with this.

A We are now actually in the compressor building. Here is our control panel. Here is the inlet to our second stage pulsation bottle.

These pulsation bottles help keep the noise level down in our compressor building. The noise level, I will add, in the building is roughly 85 decibels.

This is our second stage compression cylinder.

We move on to our third stage pulsation bottle; third stage compression cylinder.

Q All right, go to Exhibit Eighteen. What do we have here?

A I wanted to point out the electric motors we need to drive these large compressors. We have three 6000 horsepower motors which drive these compressors. It requires 13.8 KV's to run these motors. When you start them up they draw roughly 900 amps. When they're fully loaded they run or require about 150 amps and when they're idling, about 50 amps.

Q All right, go on to your Exhibit Nineteen. What do we have here?

A This is now in our control building. This is our announciater (sic) panel and control panel. This lighted panel basically shows the various points we're monitoring in the plant, our compressors to our coolers, to

the temperatures, also to the scrubbers, and the glycol.

As we move on down this little red button there is a kill switch for the plant. If we ever have an upset we go ahead and shut it down there.

Moving down we have some pressure monitors here for our compressors, basically.

Moving further down here we've got our CO2 monitors. In the event we ever had a leak these monitors will alert us to that.

Further down on this control panel we see our moisture analyzer. I might add that the specifications for our CO2 for market require no more than 12 pounds per million water content and we're actually running 5 to 6 pounds.

Q All right, let's go on to your Exhibit Number Twenty. What do we have here?

A This slide illustrates some of the breakers we have in our electrical substation. Basically, we bring in 115 KV power into this station, transform it down at 13.8 and then we bring it on down to 480 volts for our auxiliary power needs.

Q All right, Exhibit Twenty-one, what is it?

A This building here is our sales meter shed. We've got our conditioned gas coming into a sales meter here and after it's metered it is going on down to the Rosebud lateral and on to the ARCO Sheep Mountain line.

We do have two microprocessors in there and we do have temperature control in here.

Q What are those things sticking up on top of the shed, Mr. Navejar?

A These are solar panels. The microprocessors we have in there are run by DC current through our batteries and the batteries are basically kept charged up with our solar panels.

Q Okay, go to your Exhibit Number Twenty-two. What do we have here?

A This is a graphical representation of the typical well configuration. I will not elaborate on all the points illustrated on this graph, but I will touch on some of the points that we do monitor through our automation telemetry system.

I will start at the well here. We do monitor our casing. Any time we see a pressure indicated here in excess of 30 pounds, that will give us an alarm status and we check for a tubing leak or a packer leak.

Moving on, this transmitter here is our pressure transmitter indicating our tubing pressure.

This item number three here is a Janesberry (sic) three inch actuated valve.

We have direct control on our wells on demand to open or close, the well status.

As we run along here, this is our meter run. Here we measure the upstream and downstream pressure.

We call it our differential pressure. That is one of the points that we would need for our calculating of gas volumes. We also monitor our static pressure leaving the orifice plate at that point and our temperature transmitter here.

These two valves here allow for hookup for individual well tests to allow us to get a good measurement on water volumes.

Toward the upper portion of the slide we see our RTU. That stands for Remote Terminal Unit and its antenna. We basically scan these points, draw the data, convert it into radio waves. The radio tower will then communicate with our microwave system, which will then be able to communicate with our field computer and run the calculations.

Q So what you've shown here shows that you can control most of these things from your control panel at your central facility, is that correct?

A All these points are monitored and/or controlled through our automation system on a demand basis.

Q Okay. Would you consider this a state of the art measurement communication system?

A Without any question. If I may, I'd like to point out some of the advantages of our automation telemetry system.

From an accuracy standpoint we will be scanning and running calculations on the volume of CO2 being

processed through each one of our individual wells on a five minute interval and we can also draw information on the statuses of any well on a demand basis. The reliability is also an advantage from the standpoint that it is not as adversely impacted by weather conditions.

As we've talked about, we do have immediate access both to well, individual wells, and gathering system.

Q So if something happens out there, you'd know about it almost instantaneously.

A Yes, sir. One last advantage would be, of course, the immense storage capacity of our computer for historical production data.

Q Okay. Go on to your Exhibit Number Twenty-three. What do we have here?

A A pictorial -- this slide is a pictorial representation of our typical wellsite. Again, this is our mast, we've got our antenna and our solar panel, which again powers or maintains the charge in our batteries in our RTU Unit located right here.

Here are the valves to hook up when we take our individual test. These blue points here are the scanning points in our transmitters. Down toward the very bottom here we've got our Murphy switch where we monitor our casing pressure.

We do have the well enclosed with this steel pipe panels and as you can see, we've got good growth

of the native grasslands here reestablished, and really you can see minimal damage left after we've fully completed the well.

Q I notice cows right around that. Is that unusual or is that the usual situation?

A No, sir, we, well, we could see that they're grazing very pleasantly around our well.

Q Doesn't seem to bother them very much, does it?

A It doesn't appear to.

Q All right. Let's go to your Exhibit Number Twenty-four. What's this?

A Again, another typical wellsite. We see good regrowth of the native grasses around here. It does look quite parched there, though. They're not as green as we'd like to have them out there.

But I would like to note in the background we do have the Southwest Electric Co-op line coming into and feeding and serving the plant.

Q All right, go to your Exhibit Twenty-five. What's this, Mr. Navejar?

A This is actual reseeding operations that were initiated in May of 1984. We initiated a program which provided for the re-establishing of the native grasses on our right-of-ways and individual locations for Phase I and we primarily chose the time where we have the best rainfall in the year, which is between late May and early July, as I

understand.

To give you some statistics, we reseeded a total of 196 acres. The hydromulch process, the -- consisted of a grass mixture of 50 percent blue grama, 20 percent buffalo grass, and 30 percent side oats grama, and we basically end up spraying a ton of mulch per acre, and this is the actual process where they're spraying it on the right-of-ways.

Q What is the composition of the mulch?

A Could you rephrase the question?

Q What is it you're spraying here on the right-on-way?

A What we do is mix our seed with water and a tackifier (sic). that tackifier gives it more or less a cohesive property so it will stay on any surface that you spray it on.

Q And what's the composition of grasses that you put in, or do you know?

A The actual grass mixture are native grasses and we use 50 percent blue grama, 20 percent buffalo grass, 30 percent side oats grama.

Q All right, go to your next exhibit. Is this a picture after you've reseeded it?

A Yes. It may be a little bit hard to distinguish but you can depict that this is an area that is unseeded right inside the wellsite and you can see more or less where the right-of-way for the gathering line came in

and what it looks like after we've reseeded.

Now, this is when we finished spraying this area with our hydromulch process, or reseeding it.

Q All right, now go on to your Exhibit Twenty-seven. What do we have here, Mr. Navejar?

A The heart of our automation system lies with this computer here. This a Perkin Elmers 816 Series Computer Processor. It basically has two Diablo disc drives with 64K storage capacity. It is powered through our UPS system, which stands for Uninterrupted Power Source, through direct current.

That also provides for control on any fluctuation or surges in power.

Q All right, go on to your Exhibit Twenty-eight. What do we have here?

A Exhibit Twenty-eight is a graphical representation of the Phase II Compression Dehydration Facility layout.

Toward the lower portion of this slide we have three lines coming from the westerly direction and two additional lines coming in from the southerly direction of this slide.

We have a total of five major gathering legs, or lines, if you would have it, coming in for and collecting the gas into the Phase II plant.

Here again we will condition the gas and make it ready for market.

We have six 8000 horsepower compressors. We will compress our gas in three stages. We will bring in the gas from the field at 150 pounds and compress it to 2400 pounds. That is the design capacity as far as the discharge of our gas.

At early start up we feel that we will be discharging our gas at roughly 1800 pounds.

We also have the same three stages of cooling and we also will require dehydration of our gas. Once the gas is conditioned it will be ready for metering and then discharged to the Bravo Pipeline.

Q When was work commenced on this facility?

A Work was initiated in March of 1984.

Q When do you expect it to be completed and on line?

A November of 1984.

Q What's supposed to be the total capacity of Phase I and Phase II simply considering the gas processing after they're completed?

A Phase II itself will have a capacity of 250-million cubic feet per day, so when you combine Phase I and Phase II we will actually have 836-million cubic feet of gas capacity per day.

Q All right, let's go to your Exhibit Twenty-nine. What's this, Mr. Navejar?

A This is a slide depicting early construction of our Phase II pressure dehydration facilities.

What you see in the background here is the ironworkers preparing for the pouring of our concrete blocks for our compressors.

In the background here you see our Phase I compressor building and our utility building here.

Q All right. Go to your next exhibit. I believe that's Exhibit Number Thirty. What do we have here?

A We wanted to give you an overview of the status of ongoing construction on Phase II conditioning facilities.

Here we see our coolers. We move to the center of the slide we see our glycol contactors, a scrubber here, and we've got our compressors mounted on the concrete foundations.

Q All right, how about Exhibit Thirty-one?

A A closer view of the ongoing construction. Here again the cooler. We've got a scrubber here, our glycol contactors, and the additional scrubbers here.

Q All right, Exhibit Number Thirty-two?

A Another close up. We primarily wanted to illustrate here the compressor again and you can almost depict the motors being mounted on these compressors. Again, these will be six 8000 horsepower compressors.

MR. MOTE: Mr. Chairman, this completes the testimony of this witness and we offer Exhibits Ten to Thirty-two into evidence, and tender the witness for cross examination.

MR. RAMEY: The Exhibits Ten through Thirty-two will be admitted.

Are there any questions of the witness?

Mr. Navejar may be excused.

Anything further, Mr. Mote?

MR. MOTE: This completes our case, Mr. Ramey.

MR. CARR: May it please the Commission, we have a brief closing statement.

MR. RAMEY: Does anyone else have anything to present in Case 8289?

All right, Mr. Carr.

MR. CARR: May it please the Commission, as you are aware, in 1980 and '81 you approved the unit agreement for the Bravo Dome Carbon Dioxide Gas Unit.

Under your continuing jurisdiction over this unit you entered Order R-6446-B, which contained findings that the unit operator should periodically be required at a public hearing to demonstrate to the Commission that it's operations within the unit are resulting in prevention of waste and the protection of correlative rights on a continuing basis.

We are here today to comply with that provision of Order R-6446-B.

This is an appropriate time for

Amoco to come in and review its activities. Phase I gathering systems have been completed. Phase II are under construction. The compression and dehydration facilities are complete for Phase I and sales from the unit have recently commenced.

Amoco has presented here today certain geological testimony which shows the structure as we understand it to be in the Bravo Dome, depicting the faults as we understand them to be, and also shows the wells in the unit. We've noted those wells that are for various reasons noncommercial.

We've also reviewed what on-going efforts are being made by Amoco to establish reservoir limits. We've emphasized the seismic work that is on-going at this time; noted the additional core data which we are reviewing and referenced the continuing efforts we are making to improve completion techniques.

Our geological presentation simply shows that it's too soon to redetermine the outer boundaries.

We've presented engineering testimony. Mr. Allen came before you and presented the general -- general background information on CO2 development in the area, noting other sources of CO2, existing transportation facilities, and the market conditions.

He then reviewed what has been done by Amoco during the first four years under unit development.

On November 1, 1980 there were 35 wells

in the unit area. Today there are 304. This is an increase of 768 percent.

We have constructed processing facilities to dehydrate and compress the CO2. We have drilled and completed salt water disposal wells; completed over 600 miles of seismic work; authorized now and undertaking 500 additional miles of seismic work and have conducted flow tests within the unit area.

We continue to develop this unit. Our plans for 1984 include the drilling of an additional 31 wells and, as Mr. Allen testified, our drilling will include additional wells in the north and western portions of the unit for planning and development purposes.

We also noted that capital expenditures through Phase I will total in excess of $150,000,000.

He then referred -- reviewed the benefits which come from development under a plan of unitization, noting that Amoco has been able to develop the area with central facilities; has been able to reduce its operating costs and there has been reduced opportunity for surface waste.

We submit that unit operation as shown by the presentation here today has resulted in a expedient and efficient development of CO2 in the Bravo Dome.

Mr. Navejar took us on a tour of the unit. He showed you current facilities, which we submit are truly state of the art.

He reviewed the construction that is underway and you showed you indivdual wellsites and reviewed the efforts made by Amoco to maintain and restore the surface.

He also showed you what is being done in Phase II to meet future demands for CO2.

We are here today pursuant to the call of this case to show that we have operated this unit so as to prevent waste and protect correlative rights.

We have reported to you on the current status of the unit and submit we have shown we are meeting our duty to all interest owners in the unit and diligently develop the unit area throughout the unit, to market the gas, and protect the surface estate.

We submit that correlative rights are being protected. Correlative rights is defined as the opportunity provided to each owner in a pool to produce so far as is practicable to do so without waste his just and fair share of those reserves.

It talks in terms, the statute talks in terms, however, of affording each interest owner the opportunity to produce his just and fair share of those reserves. Interest owners in the Bravo Dome area voluntarily committed their lands to a unit to avail themselves of this opportunity and through unitization are producing and receiving proceeds from CO2 development. They're receiving these proceeds because of the good faith activity of Amoco Production

Company as unit operator to explore, develop and sell carbon dioxide.

We submit the record shows that correlative rights are being protected.

The record also shows waste is being prevented. Waste is being prevented because through unitization we are able to develop this area in a more efficient manner; that we are developing in the most efficient possible spacing pattern, thereby preventing underground waste and economic waste which is the result of the drilling of unnecessary wells; and we have been able to develop with a reduced number of surface facilities, thereby preventing damage and waste to the surface estate.

We submit we're meeting our duties to all owners in the area and are acting as a prudent and responsible operator.

We now have reviewed our activities and submit that the evidence shown entitles us to an order finding that operations within the unit by Amoco Production Company are resulting in prevention of waste and protection of correlative rights on a continuing basis.

MR. RAMEY: Thank you, Mr. Carr.

Does anyone have anything further in Case 8289?

If not, we'll take the case under advisement, and I would request a suggested order from

you, Mr. Carr, and Mr. Mote.

MR. MOTE: Thank you.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR