CASE No. 5177

Application,

Transcripts,

Small Exhibits

ETC.

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 27, 1974

EXAMINER HEARING

Application of Atlantic Richfield Company for the amendment of Order No. R-4549, Eddy County, New Mexico	Case No. 5177

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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I N D E X

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E X H I B I T S

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Applicant's Exhibits 1 through 5		20

MR. NUTTER: We will call Case No. 5177.

MR. DERRYBERRY: Case 5177. Application of Atlantic Richfield Company for the amendment of Order No. R-4549, Eddy County, New Mexico.

MR. HINKLE: I am Clarence E. Hinkle of Roswell appearing on behalf of Atlantic Richfield Company. We have one witness we would like to have sworn.

(Witness sworn.)

HUGH CHRISTIANSON

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

MR. HINKLE: We have five exhibits. There is the official copy and here is another copy.

DIRECT EXAMINATION

BY MR. HINKLE:

Q State your name, your residence and by whom you are employed?

A Hugh Christianson, I am employed by Atlantic Richfield Company in Midland, Texas, and my position is Senior Analytical Engineer.

Q Have you previously testified before the Commission?

A Yes, sir, I have.

Q Have you originally testified in the Empire-Abo Case for unitization and for pressure maintenance?

A Yes, sir, I did.

Q And at all the Hearings which we have had on this?

A That is correct.

MR. HINKLE: Are his qualifications sufficient?

MR. NUTTER: Yes, sir, they are.

BY MR. HINKLE:

Q Are you familiar with the Application of Atlantic Richfield in this case?

A Yes, sir, I am.

Q What is Atlantic Richfield seeking to accomplish?

A We seek an increase in project allowable after gas injection from 40,192 barrels a day, as granted in Order R-4549, to 40,555 barrels of oil per day, or an increase of 363 barrels per day. Then we seek that the gas injection incentive allowable be based on reinjection of all available residue gas rather than 70 percent of the produced gas as Order R-4549 now states. We further seek the establishment of a gas bank to guard against lost oil allowable due to possible unavoidable mechanical problems in the gas injection system. We seek amendment

of Order R-4549, Rule No. 14, to authorize administrative approval of water injection wells into the Empire-Abo formation and lastly we seek amendment of Order R-4549, Attachment A, Equation 1, so as to give reservoir voidage replacement credit for water injected into the unitized Abo formation.

Q Have you continued your studies of the Empire-Abo area since you last appeared as a witness here?

A Yes, sir, I have.

Q Have you prepared or has there been prepared under your direction any Exhibits for introduction to this Case?

A Yes, sir, there has.

Q Are they Exhibits which have been marked 1 through 5?

A That is correct.

Q Refer to Exhibit 1 and explain what this is and what it shows?

A Exhibit 1 is a map of the entire Empire-Abo Unit area and, as a matter of fact, it is the same as Exhibit 1 presented at our Hearing on January 3rd, 1974. The green-colored tracts here are those which were not expected to join the Unit when the original Hearing was held April 25th, 1973, but which did later join the Unit. The red-colored

tracts were not expected to join the Unit at the time of the April 25th, 1973, Hearing and in fact did not join the Unit and still remain outside the Unit.

Q Now, refer to Exhibit No. 2 and explain what this is and what it shows.

A I might just mention that those tract numbers of the green tracts, just to get in order with our previous Hearing of January 3, 1974, the tract numbers of the green tracts which have come in are 49, 73C, 77, and 95A. Okay, now we go to Exhibit No. 2.

Exhibit No. 2 is a table which illustrates the method used to calculate the unitized project area allowable of 40,555 barrels per day which we are asking the Commission to grant us after gas injection has begun. As I mentioned before, this would be an increase of 363 barrels of oil per day above the allowable of 40,192 barrels of oil per day which has been previously granted by the Commission for the unitized project area. A project area, as I pointed out before, at the time the 40,192-barrel-a-day allowable was granted, the project area was not anticipated to include Tracts 49, 73C, 77, and 95A, or the green tracts shown in Exhibit 1. All right, the present nonparticipating tracts, which are the red tracts in Exhibit 1, are listed

here in Exhibit 2 by tract number along with their current daily oil allowables as noted by the asterisk at the bottom line. These allowables are from the January-April 1974 NMOCT Schedule. These tracts are listed in the right-hand column; they're allowables from the proration schedule; those allowables are totaled under the totals line and they total 1645 barrels a day. This 1645 barrels a day has been subtracted at the bottom of the table from the maximum allowable used in the Empire-Abo Numeric Model Study which was previously testified to. The 42,200 barrels a day from the Numeric Model maximum allowable, less the 1645 barrels a day for those tracts remaining outside the Unit currently, leaves us the allowable we are requesting now of 45,555 barrels a day for the unitized project area. I might further point out that under this type of allowable, to make a comparison, for example, the time period prior to the unitization, the unitized project area as now constituted for 1972 had an average oil rate of 24,111 barrels per day.

MR. NUTTER: Now, what was that from?

THE WITNESS: This is the average, 1972 average oil rate for the unitized project area.

MR. NUTTER: Now, that's the tracts that are

in the Unit?

THE WITNESS: Right, the tracts that are now in the Unit. This does not include the non-unit tracts, and this, incidentally, is the same figure that I gave you in one of the Exhibits at the Hearing of January 3rd, 1974.

BY MR. HINKLE:

A Now, I'm just going to make a comparison here, a little bit of a comparison of oil rates and voidages after we start injecting gas to those oil rates and voidages prior to unitization. So this first period I'm talking about is prior to unitization when the 1972 average oil rate was 24,111 barrels a day from the unitized project area. Now, that resulted in a reservoir voidage rate of 56,513 barrels of oil per day. Now, that same project area immediately prior to unitization, that is in September, 1973, was producing 23,252 barrels of oil per day, but the voidage, it is primarily the gas oil ratio increases, had gone up to 61,802 reservoir barrels per day of voidage. On our unitized case, after gas injection at the allowable we are asking for here, which would be 40,555 barrels of oil per day, with a return of residue gas, would result in a voidage of less than 30,000 barrels a day. In other words, 30,000 barrels of reservoir space or less. In

other words, less than half the voidage that was being voided from the reservoir just prior to unitization, that is from the unitized project area just prior to unitization, although at that time the oil rate was only 23,252. In other words, we're going to kick the oil rates from 23,252 a day up to 40,555 but reduce the voidage from almost 62,000 reservoir barrels per day down to less than 30,000 reservoir barrels per day.

Q What about deficiency of these rates?

A A simple means for measuring efficiency, is simply divide the reservoir voidage rating barrels per day by the stock tank barrels of oil produced that resulted in that voidage, so the voidage rate in September of 1973 for the project area was running about 2.66 reservoir barrels per barrel of stock-tank oil produced. After injection of the residue gas we expect it to be in the neighborhood of .71 reservoir barrels per stock-tank barrel.

Q Now, refer to Exhibit No. 3 and explain what this is and what it shows.

A First, let me point out that Finding 8 of Order R-4549, grants additional allowable up to 40,192 barrels per day and that is the figure that we are here asking be increased to 40,555 barrels per day. It grants that

additional allowable as an incentive for injection-produced gas and the maximum incentive allowable in the Order is based on reinjection 70 percent of the produced gas. We wish to point out at this Hearing that the actual amount of plant residue gas available for injection must be a fixed amount, not a fixed percentage of produced gas. Rather it will vary with the season, with the extractive efficiencies of the gasoline plants involved, and with plant fuel requirements, and also with the volumes of leased fuel required to operate such equipment as heater treaters.

Exhibit 3 is simply designed to illustrate, based on the historical data from Empire-Abo area, from the Empire-Abo gas plant, as a matter of fact, which processes about 68 percent of the unit produced gas. This illustrates how this ratio of available residue gas can vary with the season and just vary with time. So, what we've got here in Exhibit 3 is a table listing the months December down through January of 1973 in the left-hand column and then, for instance, on December's line we have a figure in the second column "Gas Reduction Measured at the Plant Master Meter" MCF's -- this is on a monthly basis -- we have 626,907 MCF. We have a ratio of available residue-produced gas of 62.3 percent for that month of

December. In a similar manner, down through the months we see the largest gas production measured at the plant master meter and the percentages, and the ratio of available residue to produce gas, and you see the last line shows that the average gas production on a daily basis was 24,365 MCF per day and the average ratio of available residue to produce gas was 68.1 percent over the period we're looking at. Now, these numbers are after lease fuel requirements, I might add, and it was necessary for us to estimate approximately what lease-fuel requirements would be on a percentage basis after we start our current-rate production because, of course, we don't have any historical basis and we are going to be having to treat this oil in heater treaters and this will require additional amounts. We estimated approximately 1.5 billion cubic feet per day would be what would be required for leased fuel. After we get the higher rates, and I point out too that we're switching, we're now using sour gas out there -- that is we're getting some H2S -- we're using sour gas in our heater treaters, but we'll be going to entirely sweet gas so we're going to be eliminating that minor source of air pollution by going to sweet gas on leased fuel that we're burning in our heater treaters.

I want to emphasize that as your operator, Atlantic Richfield is going to endeavor to the best of its ability to inject all plant residue gas that's available for injection into the gas cap of the unitized Abo formation, so considering the foregoing Exhibit and statements, Atlantic Richfield would like to request that Order R-4549 be amended to state the gas injection criteria as all available residue gas, rather than the 70 percent of the produced gas as now stated, for example, in Rule 3 and 4 of Order R-4549.

Q Now refer to Exhibit 4 and explain what this shows.

A Exhibit 4 is entitled, up there about the fourth line from the top, as a "Gas Bank Statement." This is simply a suggested form for recording gas-injection credit, and before going into it I would like to talk a little bit about what we mean by "gas injection credit," what we're talking about. Under Order R-4549, as it is now written, injection of anything less than the maximum required volume of residue gas, which is now stated as 70 percent of produced gas, and which, if the Commission grants our Petition today, would be stated as all available residue gas. But at any rate, injection of anything less

than the maximum required volume of residue gas will result in an immediate reduction in oil allowable. So what we're seeking by this proposed gas bank is a means of protecting both the working and royalty-interest owners against loss of income from such an allowable reduction, which, under the Order as it is written now, could result from mechanical failure no matter how brief this might be, and we're proposing this protection to come establishment of this gas bank and such a bank as we propose it would provide that all gas-injection volumes above 90 percent of available residue gas would be considered as credit to be drawn on at any time that injection volumes, due to mechanical failure, fall below 90 percent of available residue gas and that the balancing period shall be on an annual basis and that injection of 90 percent of available residue gas shall enable the unitized project area to achieve the maximum oil allowable. Applicant re-emphasizes that in the event of a mechanical failure, and that we can't inject some portion of the available residue gas, any portion we can't inject will go to the gas-sales market and certainly it will not be flared. We point out that the use of the gas bank is expected to be extremely rare. The reason for this is that we're installing three main

gas-injection compressors. Any two of these three machines will be usually capable of handling the total volume of residue gas that we expect to be available for injection. Our compressor-design engineers tell me that each of these machines is likely to be down no more than about 30 percent of the time, so from that you can see that the likelihood of our having to use the gas bank is slim, and we consider it extremely slim. Nevertheless, there is the possibility that two of these machines, even though they are operating under a 30 percent down-time-chance factor, they might be down simultaneously.

Q This would only be for probably a relatively short time?

A Short time, right. Really we don't anticipate very much chance of two of the three being down simultaneously, but what we're really seeking here then is just a little bit of flexibility, you might say, in the event of unforeseen mechanical failure. Now, I might move then to the gas bank statement form itself.

This is just a form, one way of handling the build-up of a gas-bank credit and the values shown here, for instance in Column two,"Gas Produced, MCF Per Month" are not actual figures, they are just approximate numbers that we

are putting here for purposes of illustration of how this gas-bank statement could work. The key points to notice, for example, we're showing in Column 5 that the percent of available residue gas injected in January was 100-percent-injected-all-available residue. With our gas bank that we are asking for, we would be taking 10 percent of that or .1 times the volume over in Column 3 and getting Column 7, which is the amount of gas-bank credit, or 89,890.2 MCF gas-bank credit that we would build up during the month January. Carrying on over, the important column is Column 14, which shows the gas-bank balance, and there's our 89,890.2 MCF build-up for the first month of injection. Now, we go along over in Column 14 building up credit in the gas bank until in the month of July we have a simulated cut-in, and as you can see over in the month of July, Column 5, we injected 54.8 percent of available residue gas due to compressor-mechanical failure. This resulted in a gas-bank debit over in Column 10 of 316,414 MCF and you jump all over Column 14 and you see that we subtracted that 316,414 MCF from the build-up accumulative gas-bank balance of 524,842.7 MCF that we had built up through the month of June and that reduced our gas-bank balance to 208,428.7 MCF and then it starts building up again because

we're back injecting 100 percent of available residue gas in August and going right on. The key point here, when you get down to December, you see that through December we had built up 652,080.3 MCF credit and then we show January, and the reason we're showing that is to show what we're proposing, that the gas bank would be wiped out as of the end of December and we start all over again building up another gas bank in January.

Q This would be on a yearly or annual basis?

A Right, as we're proposing.

Q I believe you have asked for administrative approval for injection wells. What is you comment with respect to that?

A Well, I'd just state that we are asking the Commission, if they so please, to amend Order R-4549 of Rule 14 to authorize that administrative approval of injection wells for the purpose of injecting water is to be unitized Abo formation. Our present plans are not in final form so far as what wells we would use, however, if you'll look back on Exhibit 2, we're thinking in terms of converting a well or wells in the far-east end of the reservoir. As a matter of fact, Well C-49 would probably be our first candidate. Now, we're not proposing this at this Hearing,

I just want to give you a feel for where we were talking about putting the water, provided we are able to get the Commission's permission to handle this matter administratively, but we'd be injecting water into the Abo reef at a point below the water level in the well and the wells in this area, I might point out, are essentially watered-out at the present time.

Q Do you have any further comments with respect to water injection?

A Well, not at least as far as this administrative approval, but I did want to go on. I guess we should move to Exhibit 5.

Q All right, refer to Exhibit No. 5 and explain that.

A All right. Exhibit 5 follows somewhat from if we do take on in returning produced water into the Abo reef we'd like to get credit for it in our reservoir-voidage formula and so Exhibit 5 illustrates a proposed revision of Order R-4549, Attachment A, "Reservoir Voidage Formula." If the Commission sees fit to grant our request here to inject the Abo-produced water back into the unitized Abo formation then we'll be reducing reservoir voidage by the amount of water injected and so we would like to get

credit for this reduction. That's the reason for the formula change proposed in Exhibit 5, and I might just point out that the only change here from the formula previously submitted, Equation 1 over here in the water term which is on the right side of Equation 1, after the final plus mark you see the brackets, QWT, which is water produced, minus -- in parenthesis -- QWE, which is aquifer-water-influx rate plus QWI, which is water injected, close parenthesis, close brackets, times the water formation volume. Now, that term is quite similar to the one that was in Equation 1 at the original hearing. The original term there in Equation 1 was QWP in parenthesis minus QWE water influx from the aquifer, times the water-formation-volume factor so all we've done really is just add QWI to the QWE term to give credit for the volume of produced water that we reinject back into the formation.

Q In your opinion, will approval of this Application result in the recovery of any greater amount than you anticipated in the unitized structure?

A I think as far as the fact that any of today's proposals on increased recovery from pressure maintenance would be so small as to be within the normal range of accuracy of reservoir engineering calculations involving

any type of increased recovery from pressure maintenance project of this type.

Q In your opinion, would approval of this Application be in the interests of conservation, the prevention of waste and the protection of correlative rights?

A Yes, it will.

Q In your opinion, will the increased allowable which has been requested be in line with the Government policy of increasing rates of production to alleviate the present energy crisis?

A Yes, sir, it will.

Q Who is running the oil Empire-Abo area at the present time?

A Amoco Pipe Line is running it at the present time.

Q Is the capacity of pipeline sufficient to take care of the increased production that's anticipated?

A Yes, it is.

Q Are your surface facilities adequate to handle increased production?

A We are in the process right now of installing surface facilities and, of course, we won't start producing the higher rate until they are available, but we expect them

to be ready by the time our gas injection system is ready to inject gas.

Q And about when will that be?

A Latter part of May is the date we have now.

MR. HINKLE: We would like to enter Exhibits 1 through 5.

MR. NUTTER: Applicant's Exhibits 1 through 5 will be admitted into evidence.

(Whereupon, Applicant's Exhibits 1 through 5 were admitted into evidence.)

MR. HINKLE: That is all I have.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Christianson, in reviewing your Exhibit No. 4, it appears that, as I understand you, that you would get gas-bank credit when you're injecting 90 percent or more of available residue gas. Is that correct?

A You'd get what now?

Q Your proposal is that you would get gas-bank credit only when you're injecting 90 percent or more of the available residue gas?

A Yes, that's right. It would have to be injecting more.

Q Right, Okay.

A No. Yes, 90 percent of the available residue, yes.

Q That's the cut-off point?

A Yes.

Q You only get gas-bank credit when you are injecting at least 90 percent?

A Yes.

Q Okay, now in looking at your figures here in Column 7, as you build up your gas-bank account, what are you doing; you're assigning yourself 10 percent of the available residue each month if you're injecting 90 percent or more?

A That's right. You see, we are injecting 100 percent over here in our simulated case in Column 5 so we're giving ourselves 10 percent; 1.0 or 100 minus 90, or 10 percent.

Q I wondered, is this a flat 10 percent each month or is it just a percentage above 90 percent that you're giving yourself? In other words, if you're injecting 95 percent of the available residue, does your bank account grow by 5 percent?

A Yes. Then this term here would be .05 instead of

.1 and it would build up more slowly, about half as rapidly, in other words.

Q In other words, what you're giving yourself credit for is the percentage over 90.

A Right. Well, we're always injecting all the available residue unless some mechanical problem causes us to fall below that.

Q And any time you go less than 90 you'll draw on your account?

A Right.

Q Then the account would only carry to the end of the year and it would be cancelled each December 31?

A Right.

Q Now, you've got a formula here for getting credit for water injected on Exhibit No. 5.

A Right.

Q Would the credit for water injected be in addition to the 40,555 barrels maximum allowable?

A No. As stated, the 40,555 is really just a substitution for the 40,192 and the way the Order's written, whatever that number is, that's our maximum.

Q And that's cealing?

A As long as we can get voidage with that maximum

production that is left and the average voidage for 72,and since the average voidage for 72 was 56,500-and-some-odd barrels per day and we're expecting to be down around 30,000 barrels per day, we'll have no problem with voidage. We just want to keep the reservoir mechanics straight here, really.

Q So this water injection voidage credit wouldn't be in addition to the maximum allowable?

A No. There might be some point down the line somewhere years away that we would be using it, but at the present time you can see our voidage is going to be way less then what's needed, way less than the maximum.

Q For instance, if your gas bank account got in the red,and you weren't getting full credit for gas injection, then you might call on water injection?

A Well, at some future date, but I don't think, I mean when you see these numbers you see that we don't need it and really that is in essence a separate situation. We're trying to say we're going to inject all the available residue but at the same time what we're trying to do here is just give ourselves a little bit of leeway if we do have some down-time on the compressors. There is really no specific connection between a voidage here and this situation

on our Exhibit 4.

Q In the event that your gas-injection bank account went in the red and you couldn't get your full allowable for gas injection, then presumably you could call on water injection?

A Presumably we could but we wouldn't be dealing with a whole lot of volume compared to what we're doing with the gas injection. I don't foresee a time when that would be necessary but it could be used that way, that's true. But the current water production out there right now is like 1300 barrels of water a day and so, of course, we can't reinject anymore than we could produce.

Q Now you said C-49 is the initial production well?

A Right.

MR. NUTTER: Are there any further questions of Mr. Christianson? Yes, sir, Mr. Kellahin?

MR. KELLAHIN: I am Jason Kellahin, Kellahin and Fox, Attorneys for City Service Oil Company.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Christianson, in connection with this gas bank, in the question Mr. Nutter was asking you, do I

understand that you are asking for credit for water injection within this gas bank?

A No. Actually not. The water injection is simply, at the time we originally set up Equation 1, I guess we just failed to realize that at some point we might want to inject produced water back into the reef and we didn't set the Equation up to allow for that to give ourselves credit.

Q So your gas bank would be strictly limited to gas injection?

A Yes, right.

Q But no credit for water?

A That's right.

Q I didn't quite understand your answer to Mr. Nutter.

A Yes, well I guess I wasn't too straight on that.

Q Would there be any limit on the amount of credit you could use or the total accumulated credit during the year, or how do you go about that?

A On the gas bank?

Q Yes.

A Well, we hadn't proposed any limit other than that we couldn't build up any faster than this 10 percent of available residue per month and build up something like

we've shown on the Exhibit here.

Q You would build that up in the period of one year, and then it would be cancelled?

A And then it would be cancelled.

Q Probably a year later?

A Right.

Q Some states limit that to three months, do they not?

A Well, I guess that will be up to the Commission. This is what we're proposing.

Q Do you know whether the other states do this?

A No, I don't, I am not familiar with --

Q (Interrupting) Does Texas?

A West Texas does, I know that.

Q Would there be any limit on the purpose for which you could go on the gas bank? In other words would it have to be a breakdown of equipment or could you voluntarily shut it in and draw on the bank for a period of time?

A Well, we're committed to the USGS to inject all available residue as well as we're committing ourselves right here that we're going to do it, and so we're going to have to prove to both the USGS and to the Commission that we're not just shutting in.

Q Well, would you object to a limiting provision

in the order?

A No, I can't say that we would.

Q Now you are talking about available gas and that's a rather loose term. Are you talking about all of the gas that is not used for lease purposes, compressors, and so forth on the project?

A Yes, it would be all that is available after it's run through the plant, of course.

Q Tail-gate gas at the plant?

A Right.

Q Tail-gate gas?

A Right.

Q There would be no sales?

A No what?

Q There would be no sales, gas sales?

A That's right, no sales.

Q And you would not object to a limiting provision in the Order to that, would you?

A Well, in the sales there is this item here, as I stated in here, that if we are shut-down due to mechanical problems and we use our gas bank to maintain our oil allowable, then during that period we would not be able to inject all of the available residue, so we would be going to sales

during the few days until we could get our mechanical problems solved and go back to 100 percent.

Q There would be an emergency sale?

A Right.

Q Now, the present Order does not authorize water injection does it?

A No, I don't believe it covers it. That's the reason we were asking for it.

Q Now you have no program on injection wells at the present time, do you?

A No, not specifically, other than we're going to bet out in the far-east end of the reservoir away from the oil producers and initially it would be in effect a pressure-maintenance type injection rather than any kind of a pattern.

Q There are tracts inside the unit boundary area in which the work being done is not communicated, , is that correct?

A Oh, yes.

Q Would you object to staying three locations away from those tracts within the water injection well?

A I think we're restricted now that on our gas injectors to 1650 feet away from the nearest unit boundary and we didn't ask for a change in that.

Q But on water injection you have something a little different than gas. Would you object to 2640?

A I think so, yes. Actually, gas injection, I feel like the 1650 is plenty.

Q I mean water.

A Yes, I know, but I mean gas you might say is even a little bit more mobile than water in terms of movement toward some non-unit tract.

Q It is also a saleable commodity.

A Yes, that's right.

Q You don't have any sales for water, do you?

A Not that I know of.

Q But you think 2640 feet would be unreasonable?

A Yes, I think so. We're willing to live with the 1650 that's already in the Order.

MR. KELLAHIN: That's all the questions I have, Mr. Nutter, however we do have some terms being proposed here today which we feel should be actually defined in the Order. I think for the most part this is fine on the basis of the testimony that has been offered but we would also like the opportunity to submit to the Commission, say next week, our suggestions on this point.

MR. NUTTER: For a definition of terms?

MR. KELLAHIN: Yes, if there is no objection to that.

MR. NUTTER: Any objection to that, Mr. Hinkle?

MR. HINKLE: I don't believe so.

MR. NUTTER: I'll give him a week to respond then.

MR. KELLAHIN: Yes, sir.

MR. NUTTER: We'll allow you a week to file your definitions and Mr. Hinkle a week to respond.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Christianson, on your Exhibit No. 3 you talk about the Empire-Abo plant and the available gas as a percentage of produced gas. This is for the Amoco, this Empire-Abo plant?

A Right.

Q Well now doesn't Phillips operate a gas plant in this area also?

A That's right. They have a plant which, I think I mentioned, that this plant, that we showed figures on, handles about 68 percent of the unit gas and Phillips handles the rest, the other 30. Well I think it's 62 and 38; something like that. It's around 62 percent for the Amoco plant

and 38 percent for Phillips.

Q But your point in this Exhibit is that of the produced gas that goes to the Amoco plant 68 percent average is available as residue gas?

A That's right.

Q So 32 percent of it is used out in the field somewhere or in the plant?

A Well, no, the bulk of it is for shrinkage to get plenty of liquids.

Q And just coincidentally this 68 percent here also represents 68 percent of the field gas?

A Right.

Q And the other 32 percent goes to the other plant?

A Right.

Q And is their ratio about the same --

A (Interrupting) I'm a little off on that; yes, their ratio as far as their shrinkage are similar between the Phillips and the Amoco plant so this would be a similar situation but I couldn't say that it would come out exactly, but it would be similar.

Q About 68 percent field gas would be available as

residue gas?

A Right, and here again I would point out that this is an estimate itself because we don't know for sure how much lease fuel we're going to be using once we go to the higher oil rates. We estimated that number to get these numbers you see over here on the last column.

Q I think you said about a million and a half?

A Right, in the neighborhood of a million and a half.

MR. NUTTER: Are there any further questions of Mr. Christianson? If not, he may be excused.

Do you have anything further, Mr. Hinkle?

MR. HINKLE: No, that's all.

MR. NUTTER: Are there any witnesses, Mr. Kellahin?

MR. KELLAHIN: No.

MR. NUTTER: Does anyone have anything they wish to offer in Case 5177? Mr. Currens?

MR. CURRENS: Mr. Examiner, Dave Currens, Amoco Production Company. Amoco would like to make a statement in this case.

Amoco recommends that the Commission approve Atlantic Richfield's request to increase the project allowable

after gas injection commences to the figure of 40,555 barrels of oil per day. Amoco further recommends that the incentive oil allowable be based on reinjection of available residue gas rather than a fixed percentage of total field gas production, or unit gas production, further permitting all over 90 percent of that available residue gas to be credited into a gas bank to compensate for those hopefully rare periods when there may be some mechanical failure and occasional under-injection. Further, it appeared that the Order could be improved to consider future water injection as a possibility and the administrative approval of the plants for water injection that they recommended seems good too. And then it is only logical, of course, that the voidage formula give credit for water injection so that there is a true voidage formula in the Order.

Thank you sir.

MR. NUTTER: Thank you Mr. Currens. Anyone else? We will take the case under advisement.

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

COURT REPORTER

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 5177, heard by me on 2/27, 1974.

....., Examiner
New Mexico Oil Conservation Commission

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OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN
LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER
STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

April 30, 1974

Re: CASE NO. 5177
ORDER NO. R-4549-B

Applicant:

Atlantic Richfield Co.

Mr. Clarence Hinkle
Hinkle, Bondurant, Cox & Eaton
Attorneys at Law
Post Office Box 10
Roswell, New Mexico 88201

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other Mr. Jason Kellahin, Mr. Dan Currens

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5177
Order No. R-4549-B

APPLICATION OF ATLANTIC RICHFIELD
COMPANY FOR THE AMENDMENT OF ORDER
NO. R-4549, EDDY COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on February 27, 1974, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 30th day of April, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Atlantic Richfield Company, is the operator of the Empire-Abo Pressure Maintenance Project, Empire-Abo Pool, Eddy County, New Mexico, which project was authorized by Commission Order No. R-4549, and is governed by operating rules included in said order as amended by Order No. R-4549-A.

(3) That the applicant seeks the amendment of said Order No. R-4549, as amended, to include an increase in the maximum project allowable from 40,192 barrels of oil per day to 40,555 barrels of oil per day because of additional lands committed to the unit and participating in the project and to provide that the maximum project allowable of 40,555 barrels of oil per day would be achieved upon injection of "all available residue gas" rather than "70 percent of the produced gas," as now provided in the project rules.

(4) That the applicant further seeks the amendment of Order No. R-4549, as amended, to include a provision for administrative approval for water injection wells and to include a reservoir voidage replacement credit for water injected into the Abo formation within the project area, and to provide for the establishment of a gas injection credit "bank", against which

injection credit could be drawn in order to maintain full allowables during such times that full gas injection cannot be maintained because of injection plant shutdowns or other mechanical problems.

(5) That the increase in maximum allowable for the Empire-Abo Pressure Maintenance Project from 40,192 barrels of oil par day to 40,555 barrels of oil per day is justified inasmuch as the original 40,192 barrels was based on numeric model studies of the reservoir assuming only those tracts actually committed to the unit at the time of the original hearing would participate; that additional tracts have now been committed to the unit and the maximum permissible allowable should therefore be increased accordingly to 40,555 barrels of oil per day.

(6) That the aforesaid maximum allowable should be made available upon injection of 95 percent of all available residue gas rather than upon injection of 70 percent of the produced gas as is presently provided by Rule 3 of the Project Rules as promulgated by Order No. R-4549, as amended by Order No. R-4549-A; that "Available Residue Gas" should be defined as being all gas produced from the unitized formation less plant shrinkage and plant fuel and lease fuel required for operations; that there should be a prohibition against the sale of gas from the project except during emergency situations of temporary nature.

(7) That in addition to the administrative procedure currently in effect pursuant to Order No. R-4549 for approval of the injection of gas into the Abo formation without notice and hearing, an administrative procedure should be adopted whereby approval could be given for the injection of water into said formation within the project area without notice and hearing, provided certain restrictions regarding proximity to non-participating tracts are observed.

(8) That credit should be allowed in the project's Reservoir Voidage Formula for water injected into the reservoir as well as for gas, as now provided.

(9) That in order to allow for the maintenance of full allowables and full production schedules during such times as injection well failures, injection plant shutdowns, and other temporary conditions of unforeseen nature which prevent the injection of 95 percent of all available residue gas, a provision should be made in the project rules for the establishment of a system for the accumulation of gas injection credits which could be applied in the "Additional Allowable" formula contained in Rule 4 of the project rules; that monthly gas injection credits which may be accumulated should be limited to the volume of gas injected which exceeds 95 percent of the residue gas available for injection during any given month; and that the maximum amount of gas injection credits which should be permitted to

accrue to the gas injection credit bank should be equal to 100 percent of the average of the total monthly injection volumes for the previous three months, not including the month being reported.

IT IS THEREFORE ORDERED:

(1) That Rule 3 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project as promulgated by Order No. R-4549, as amended by Order No. R-4549-A, is hereby amended to read in its entirety as follows:

> "RULE 3. That the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage in the project area for calendar year 1972 (56,513 reservoir barrels) or 33,000 barrels of oil per day, whichever is less, except that when injection of 95 percent of all available residue gas is achieved, the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage in the project area for calendar year 1972 (56,513 reservoir barrels) or 40,555 barrels of oil per day, whichever is less."

(2) That Rule 4 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

> "RULE 4. That upon commencement of gas injection and for as long thereafter as such injection continues, extra allowable in addition to the 33,000 barrels per day described above may be assigned to the project area, provided that such additional allowable shall be based upon the proportion of residue gas available for injection which is actually injected into the unitized formation and shall be computed in accordance with the following formula:

$$\text{Additional Allowable in Excess of 33,000 BOPD} = 39.76 \left[2 \left(\frac{\text{MCF gas inj. previous month x 10}}{\text{MCF residue gas available prev. month}} \right)^2 + \left(\frac{\text{MCF gas inj. previous month x 10}}{\text{MCF residue gas available previous month}} \right) \right]$$

That the maximum additional allowable which may be earned by gas injection shall be 7,555 barrels per day. That this maximum may be earned by the injection of 95 percent of the available residue gas into the unitized formation; that gas volumes in excess of said 95 percent which are injected into the unitized formation shall be credited each month to a gas injection bank account which shall be permitted to accrue such gas injection credits up to 100 percent of the average of the total monthly injection volumes for the three previous months, not including the month being reported; that during such times as injection well failures, injection plant shutdowns, and other temporary conditions of unforeseen nature which prevent the injection of at least 95 percent of the available residue gas, said gas injection bank account may be charged a sufficient volume to add to the actual volume of injection achieved to equal 95 percent of the available residue gas for the month. In the event there are insufficient credits accrued to the gas injection bank account to bring actual injection plus applied credits up to 95 percent of available residue gas, production shall be reduced to 33,000 barrels of oil per day plus the amount which the actual injection plus the accrued credits will actually earn. Production beyond this amount shall be considered over-production and shall be compensated for by underproduction during the following month.

For the purpose of these rules, "Available Residue Gas" shall be defined as being all gas produced from the unitized formation less plant shrinkage, plant fuel, and lease fuel required for operation of the lease.

No raw gas nor plant residue gas attributable to the project shall be sold or otherwise disposed of by any means other than injection into the unitized formation except during emergency situations of temporary nature."

(3) That Rule 5 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

"RULE 5. That all calculations of reservoir voidage shall be made in accordance with the formula set forth in Attachment "A" to this order entitled "EMPIRE-ABO UNIT AREA-Reservoir Voidage Formula - Gas and Water Injection Credit" utilizing the reservoir and fluid data set forth in Attachment "B" to this order entitled EMPIRE-ABO UNIT AREA - Table of Fluid Properties."

(4) That Rule 14 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

"RULE 14. The Secretary-Director of the Commission is hereby authorized to approve such additional producing wells and gas injection and water injection wells at orthodox and unorthodox locations within the boundaries of the ARCO Empire-Abo Unit Area as may be necessary to complete an efficient production and injection pattern, provided said wells are drilled no closer than 660 feet to the outer boundary of said unit nor closer than 10 feet to any quarter-quarter section or subdivision inner boundary and provided that no well shall be approved for gas or water injection when such well is located closer than 1650 feet to a tract which is not committed to the unit and on which is located a well producing from the same common source of supply. To obtain such approval, the project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional production or injection wells shall include the following:

(1) A plat identifying the lands committed to the unit agreement and those lands not committed to said agreement, and showing the location of the proposed well, all wells within the unit area, and offset operators.

(2) A schematic drawing of the proposed well which fully describes the casing, tubing, perforated interval, and depth.

(3) A letter stating that all offset operators to the proposed well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed well if, within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators."

(5) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

dr/

EMPIRE ABO UNIT AREA

Reservoir Voidage Formula - Gas and Water Injection Credit

Equation 1: $$Vrvb = Qo \left[Bo + (Rpn - Rs)\, Bg \right] + \left[Qwp - (Qwe + Qwi) \right] Bw$$

Where:

Vrvb = Reservoir voidage, bbls. per day
Qo = Oil Production rate, Stock tank bbls. per day
Bo = Oil formation volume factor (1), reservoir volumetric bbls/stock tank bbl.
Rpn = Net producing gas-oil ratio, MCF/S.T.B.O.

$$Rpn = Rp \left(1.0 - \frac{Gi}{Gp}\right)$$

Where:

Rp = producing gas-oil ratio, MCF/BO
Gi = daily volume of gas injected, MCF/Day
Gp = daily volume of gas produced, MCF/Day

Rs = Solution gas-oil ratio (2), MCF/STBO
Bg = Gas formation volume factor (3), RVB/MCF
Qwp = Water production rate, S.T.B.W./Day
Qwe = Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD
Qwi = Daily volume of water injected, S.T.B.W./Day
Bw = Water formation volume factor, RVBW/STBW, use 1.0

(1), (2), (3): These values calculated from Table of Fluid Properties, Attachment "B".

EMPIRE ABO UNIT AREA

Table of Fluid Properties

P_{base} = 15.025 psia P_{bp} = 2231 psia T_{res} = 109° F (569° R)

P_r (PSIA)	BO (RVBO/STBO)	Bg RVB/MCF	Rs (MCF/BBL)	Z
15.025	1.000	194.696	0	1.0
100	1.125	28.229	.180	.965
200	1.163	13.749	.235	.940
300	1.193	8.970	.290	.920
400	1.218	6.692	.345	.915
500	1.244	5.236	.395	.895
600	1.263	4.276	.445	.877
700	1.285	3.644	.495	.872
800	1.304	3.108	.540	.850
900	1.325	2.746	.585	.845
1000	1.344	2.437	.625	.833
1100	1.364	2.178	.675	.819
1200	1.384	1.962	.725	.805
1300	1.404	1.790	.775	.795
1400	1.425	1.649	.825	.789
1500	1.445	1.516	.875	.777
1600	1.465	1.404	.925	.768
1700	1.485	1.304	.975	.758
1800	1.505	1.220	1.025	.751
1900	1.525	1.147	1.075	.745
2000	1.548	1.053	1.125	.720
2100	1.573	1.000	1.175	.718
2200	1.597	.953	1.225	.717
2231	1.606	.939	1.250	.716

P_r = Reservoir average pressure at datum -2264' subsea, lbs/in^2 absolute.

B_o = Oil formation volume factor, reservoir volumetric bbls/stock tank bbl.

B_g = Gas formation volume factor, reservoir volumetric bbls/thousand std. cu. ft.

R_s = Solution Gas/Oil Ratio, Thousand std. cu. ft/stock tank bbls. oil.

Z = Gas Compressibility Factor.

Attachment "B" Order No. R-4549-B

6/20/74

Agreed today with ARCO people (Jeff Boucher, C.R. Leggett, and W.B. Davis) that for determination of additional allowance in accordance w/ Rule 4 of Empire Abo Pressure Maintenance Project Rules (R-4549-B) the numerator in the formula should be the gas metered downstream from the injection plant at meter No FR-3 on Drawing No E-M-32, Sheet 1, and that the denominator should be the sum of the meter readings downstream from the gasoline plants (Amoco meter No FR-1 on Drawing No. E-M-52, Sheet 1 and Phillips meter No FR-2 same drawing) plus the meter reading downstream from the wet gas compressor (Meter No. FR-101 Drawing No E-M-32 Sheet 3) We do not have copies of these drawings - would have to refer to ARCO's copies if any question arises.

H.A. Quillen

File Case No
5177

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 4953
Order No. R-4549

APPLICATION OF ATLANTIC RICHFIELD
COMPANY FOR A PRESSURE MAINTENANCE
PROJECT, EDDY COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on April 25, 1973, at Santa Fe, New Mexico, before Examiner Richard L. Stamets.

NOW, on this 15th day of June, 1973, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Atlantic Richfield Company, seeks authority to institute a pressure maintenance project in the Empire-Abo Pool in its Empire-Abo Unit Area, Eddy County, New Mexico, by initially limiting reservoir voidage, and within one year by reinjection of approximately 70 percent of the produced gas, as plant residue gas, into the Abo formation through eight wells in Section 36, Township 17 South, Range 27 East, Sections 3, 4, and 9, Township 18 South, Range 27 East, and Sections 26, 31, 32, and 33, Township 17 South, Range 28 East.

(3) That the applicant further seeks the designation of the project area and the promulgation of special rules and regulations governing said project, including provision for the assignment of special allowables to wells in the project area based on reservoir voidage factors, net gas-oil ratios, the shutting in or curtailment of less efficient wells, and allowable credit for gas injection wells.

(4) That initially the project area should comprise only the following described area:

EDDY COUNTY, NEW MEXICO

TOWNSHIP 17 SOUTH, RANGE 27 EAST, NMPM
Section 34: S/2 SE/4
Section 36: S/2

TOWNSHIP 17 SOUTH, RANGE 28 EAST, NMPM
Section 25: S/2 and S/2 N/2
Section 26: S/2, S/2 NE/4, and SE/4 NW/4
Section 27: N/2 S/2, SE/4 SE/4, and SW/4 SW/4 + SW/4 SE/4
Section 31: S/2 and S/2 N/2
Section 32: S/2, NE/4, S/2 NW/4, and NE/4 NW/4
Section 33: S/2, NE/4, S/2 NW/4, and NE/4 NW/4
Section 34: N/2, SW/4, and N/2 SE/4 + S/2 SE/4
Section 35: N/2 and N/2 S/2
Section 36: N/2 NW/4 and SW/4 NW/4

TOWNSHIP 17 SOUTH, RANGE 29 EAST, NMPM
Section 29: S/2 NW/4 and N/2 SW/4
Section 30: SW/4, S/2 N/2, and N/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 27 EAST, NMPM
Section 1: All
Section 2: S/2, NE/4 NE/4, SW/4 NE/4, S/2 NW/4, and NW/4 NW/4
Section 3: All
Section 4: SE/4, S/2 NE/4, S/2 SW/4, and NE/4 SW/4
Section 8: E/2 SE/4 and SE/4 NE/4
Section 9: All
Section 10: W/2 and NE/4
Section 11: NW/4, W/2 NE/4, and NE/4 NE/4
Section 15: N/2 NW/4 and SW/4 NW/4
Section 16: N/2, SW/4, N/2 SE/4, and SW/4 SE/4
Section 17: S/2 NE/4, NE/4 NE/4, SE/4 NW/4, NE/4 SW/4, and N/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 28 EAST, NMPM
Section 4: N/2 NW/4, SW/4 NW/4, and NW/4 NE/4
Section 5: NE/4 and N/2 NW/4
Section 6: NW/4, N/2 SW/4, N/2 SE/4, SW/4 SE/4, S/2 NE/4, and NE/4 NE/4 + NW/4 NE/4 and SE/4 SW/4

(5) That the applicant has been a major operator in the Empire-Abo Pool and that with a majority of the other operators in said pool has conducted extensive reservoir evaluations and studies in and of said pool.

(6) That said evaluations and studies show that the Empire-Abo Pool will be more efficiently produced through the curtailment of production from high gas-oil ratio wells or by reinjection of plant residue gas or both, and operation of the pool on a net reservoir voidage basis.

(7) That said evaluations and studies show that production from the project area as described in Finding (4) of this order should be limited to the average reservoir voidage for the project area for the calendar year 1972 or 30,000 barrels of oil per day, whichever is less, except that after reinjection of approximately 70 percent of the produced gas has been achieved, the production from said project area should be limited to the average reservoir voidage for the calendar year 1972 or 40,192 barrels of oil per day, whichever is less.

(8) That to provide incentive for the reinjection of produced gas prior to achievement of the full 70 percent reinjection planned, production in excess of the aforementioned 30,000 barrels per day should be permitted within the project area. Said excess production should be computed in accordance with the following formula and should be limited to 10,192 barrels per day:

$$\text{Additional Allowable in Excess of 30,000 BOPD} = 97.07 \left[2 \left(\frac{\text{MCF gas inj. previous month} \times 10}{\text{MCF gas prod. previous month}} \right)^2 + \left(\frac{\text{MCF gas inj. previous month} \times 10}{\text{MCF gas prod. previous month}} \right) \right]$$

(9) That the aforesaid pressure maintenance project, designated the ARCO Empire-Abo Unit Pressure Maintenance Project, and comprising the above-described area, is in the interest of conservation and should result in the recovery of approximately thirty million barrels of additional oil from said reservoir.

(10) That an administrative procedure should be established whereby said project area may be contracted or expanded for good cause shown and whereby additional injection wells and producing wells at orthodox and unorthodox locations in the project area may be approved without the necessity of notice and hearing.

(11) That special rules and regulations for the operation of the ARCO Empire-Abo Unit Pressure Maintenance Project should be promulgated and, for operational convenience, such rules should provide certain flexibility in authorizing the production of the project allowable from any well or wells in the project area in any proportion, provided that no well in the project area which directly or diagonally offsets a well not committed to said unit producing from the same common source of supply should be allowed to produce more than two top unit allowables for the Empire-Abo Pool.

(12) That approval of the application for a pressure maintenance project and the proposed special rules therefore is in the interest of sound conservation practices and will not cause waste or harm correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Atlantic Richfield Company, is hereby authorized to institute a pressure maintenance project in the Empire-Abo Pool in its Empire-Abo Unit Area, Eddy County, New Mexico, to be designated the ARCO Empire-Abo Unit Pressure Maintenance Project, initially by the shutting in or curtailment of production from less efficient wells within the project and within 12 months after the effective date of this order by the reinjection of approximately 70 percent of the produced gas, as plant residue gas, into the Abo formation, through the following described wells:

OPERATOR	LEASE NAME	WELL NO.	SECTION	LOCATION
Amoco	Malco "H" Federal	2	3	H
Amoco	Windfuhr Federal	4	4	J
Exxon	Chalk Bluff Draw Unit "A"	4	9	C

All in Township 18 South, Range 27 East, NMPM.

M. Yates III	Dooley Abo State	2	36	J

In Township 17 South, Range 27 East, NMPM.

Hondo	State "A"	21	26	K
Amoco	State "BM"	1	31	K
Amoco	State "BV"	1	32	F
Arco	M. Yates B (ARC)	8	33	G

All in Township 17 South, Range 28 East, NMPM.

(2) That the injection should be through 2 3/8-inch internally coated tubing installed in a packer set within 100 feet of the uppermost perforations, and that the casing-tubing annulus should be fitted with a pressure gauge in order to determine leakage in the casing, tubing, or packer.

(3) That Special Rules and Regulations governing the operation of the ARCO Empire-Abo Unit Pressure Maintenance Project, Eddy County, New Mexico, are hereby promulgated as follows:

SPECIAL RULES AND REGULATIONS
FOR THE
EMPIRE-ABO PRESSURE MAINTENANCE PROJECT

RULE 1. The project area of the ARCO Empire-Abo Unit Pressure Maintenance Project, hereinafter referred to as the Project, shall comprise the area described as follows:

Case No. 4953
Order No. R-4549

EDDY COUNTY, NEW MEXICO

TOWNSHIP 17 SOUTH, RANGE 27 EAST, NMPM
Section 34: S/2 SE/4
Section 36: S/2

TOWNSHIP 17 SOUTH, RANGE 28 EAST, NMPM
Section 25: S/2 and S/2 N/2
Section 26: S/2, S/2 NE/4, and SE/4 NW/4
Section 27: N/2 S/2, SE/4 SE/4, and SW/4 SW/4 + SW/4 SE/4
Section 31: S/2 and S/2 N/2
Section 32: S/2, NE/4, S/2 NW/4, and NE/4 NW/4
Section 33: S/2, NE/4, S/2 NW/4, and NE/4 NW/4
Section 34: N/2, SW/4, and N/2 SE/4 + S/2 SE/4
Section 35: N/2 and N/2 S/2
Section 36: N/2 NW/4 and SW/4 NW/4

TOWNSHIP 17 SOUTH, RANGE 29 EAST, NMPM
Section 29: S/2 NW/4 and N/2 SW/4
Section 30: SW/4, S/2 N/2, and N/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 27 EAST, NMPM
Section 1: All
Section 2: S/2, NE/4 NE/4, SW/4 NE/4, S/2 NW/4, and NW/4 NW/4
Section 3: All
Section 4: SE/4, S/2 NE/4, S/2 SW/4, and NE/4 SW/4
Section 8: E/2 SE/4 and SE/4 NE/4
Section 9: All
Section 10: W/2 and NE/4
Section 11: NW/4, W/2 NE/4, and NE/4 NE/4
Section 15: N/2 NW/4 and SW/4 NW/4
Section 16: N/2, SW/4, N/2 SE/4, and SW/4 SE/4
Section 17: S/2 NE/4, NE/4 NE/4, SE/4 NW/4, NE/4 SW/4, and N/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 28 EAST, NMPM
Section 4: N/2 NW/4, SW/4 NW/4, and NW/4 NE/4
Section 5: NE/4 and N/2 NW/4
Section 6: NW/4, N/2 SW/4, N/2 SE/4, SW/4 SE/4, S/2 NE/4, and NE/4 NE/4 + NW/4 NE/4 and SE/4 SW/4

RULE 2. The allowable for the Project shall be the sum of the allowables of the several wells within the project area, including those wells which are shut in, curtailed, or used as injection wells. Allowables for all wells shall be determined in a manner hereinafter prescribed.

RULE 3. That the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage in the project

33,000 (effective 1-1-74)
area for the calendar year 1972 or ~~30,000~~ barrels of oil per day, whichever is less, except that after reinjection of approximately 70 percent of the produced gas has been achieved the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage for the project area for the year 1972 or 40,192 barrels of oil per day, whichever is less.

33,000
RULE 4. That after gas reinjection has commenced but before the full 70 percent reinjection has been achieved, allowable in addition to the above-described ~~30,000~~ barrels per day may be assigned to the project area, provided that said allowable shall be based on gas produced and injected in the project area and shall be computed in accordance with Rule 10 below and the following formula and shall not exceed 10,192 barrels of oil per day:

33,000
$$\text{Additional Allowable in Excess of } \sim\!\!\sim\!\!30{,}000\sim\!\!\sim \text{ BOPD} = 97.07\left[2\left(\frac{\text{MCF gas inj. previous month x 10}}{\text{MCF gas prod. previous month}}\right)^2 + \left(\frac{\text{MCF gas inj. previous month x 10}}{\text{MCF gas prod. previous month}}\right)\right]$$

RULE 5. That all calculations of reservoir voidage shall be in accordance with the formula set out in Attachment "A" to this order utilizing the Table of Fluid Properties set out in Attachment "B" of this order.

RULE 6. Allowable credit for injection wells may be transferred to producing wells within the project area, as may the allowable credit for producing wells which, in the interest of more efficient operation of the Project, are shut in or curtailed because of high gas-oil ratio or are shut in for any of the following reasons: Pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or changes in characteristics of reservoir liquids or progress of sweep.

RULE 7. The allowable credit assigned to any well which is shut in or which is curtailed in accordance with the provisions of Rule 6 which allowable credit is to be transferred to any well or wells in the project area for production, shall in no event be greater than its ability to produce during the test prescribed by Rule 9 below or greater than the current top unit allowable for the pool during the month of transfer, whichever is less.

RULE 8. The allowable credit assigned to any injection well on a 40-acre proration unit shall be top unit allowable for the Empire-Abo Pool.

RULE 9. The allowable credit assigned to any well which is shut in or curtailed in accordance with Rule 6, shall be determined by a 24-hour test at a stabilized rate of production, which shall be the final 24-hour period of a 72-hour test throughout which the well should be produced in the same manner and at a constant rate. The daily tolerance limitation set forth in Commission Rule 502 I (a) and the limiting gas-oil ratio (2,000 to 1) for the pool shall be waived during such tests. The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission, if they so desire.

RULE 10. The allowable credit for residue gas injection shall be calculated in accordance with the appropriate fluid properties current in the reservoir (as determined in accordance with Attachment "B" to this Order) and shall be shown on the Pressure Maintenance Project Operator's Monthly Report.

RULE 11. The basic allowable assigned to each producing well in the Project shall be equal to the well's ability to produce or to top unit allowable for the pool, whichever is less. Wells capable of producing more than top unit allowable may also receive transfer allowable, provided however, that no producing well in the project area which directly or diagonally offsets a well not committed to the unit producing from the same common source of supply shall receive an allowable or produce in excess of two times top unit allowable for the pool.

RULE 12. Each month the project operator shall submit to the Commission a Pressure Maintenance Project Operator's Report, on a form prescribed by the Commission, outlining thereon the data required, and requesting allowables for each of the several wells in the Project as well as the total project allowable. The aforesaid Pressure Maintenance Project Operator's Report shall be filed in lieu of Form C-120 for the Project.

RULE 13. The Commission shall, upon review of the report and after any adjustments deemed necessary, calculate the allowable for each well in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and may be produced from the wells in the Project in any proportion except that no well in the Project which directly or diagonally offsets a well not committed to the unit producing from the same common source of supply shall produce in excess of two times top unit allowable for the pool.

RULE 14. The Secretary-Director of the Commission is hereby authorized to approve such additional producing wells and injection wells at orthodox and unorthodox locations within the boundaries of the ARCO Empire-Abo Unit Area as may be necessary to complete an efficient production and injection pattern, provided

said wells are drilled no closer than 660 feet to the outer boundary of said unit nor closer than 10 feet to any quarter-quarter section or subdivision inner boundary and provided that no well shall be approved for gas injection when such well is located closer than 1650 feet to a tract which is not committed to the unit and on which is located a well producing from the same common source of supply. To obtain such approval, the project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional production or injection wells shall include the following:

(1) A plat identifying the lands committed to the unit agreement and those lands not committed to said agreement, and showing the location of the proposed well, all wells within the unit area, and offset operators.

(2) A schematic drawing of the proposed well which fully describes the casing, tubing, perforated interval, and depth.

(3) A letter stating that all offset operators to the proposed well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed well if, within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators.

RULE 15. Expansion or contractions of the project area may be approved by the Secretary-Director of the Commission administratively when good cause is shown therefor.

(4) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

S E A L

A. L. PORTER, Jr., Member & Secretary

dr/

EMPIRE ABO UNIT

Reservoir Voidage Formula:

Equation 1: $$V_{rvb} = Q_o \left[B_o + (R_{pn} - R_s) B_g \right] + (Q_{wp} - Q_{we}) B_w$$

Where:

V_{rvb} = Reservoir voidage, bbls. per day
Q_o = Oil production rate, Stock tank bbls. per day
B_o = Oil formation volume factor (1), reservoir .volumetric bbls/stock tank bbl.
R_{pn} = Net producing gas-oil ratio, MCF/S.T.B.O.

$$R_{pn} = R_p\left(1.0 - \frac{G_i}{G_p}\right)$$

Where: R_p = producing gas-oil ratio, MCF/BO
G_i = daily volume of gas injected, MCF/Day
G_p = daily volume of gas produced, MCF/Day

R_s = Solution gas-oil ratio(2), MCF/STBO
B_g = Gas formation volume factor(3), RVB/MCF
Q_{wp} = Water production rate, S.T.B.W./Day
Q_{we} = Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD
B_w = Water formation volume factor, RVBW/STBW, use 1.0

(1), (2), (3): These values calculated from Table of Fluid Properties, Attachment "B".

ATTACHMENT "A"

dr/

EMPIRE ABO UNIT AREA

Table of Fluid Properties (P Base = 15.025 P_{bp} = 2231)

Tres. = 109°F (569° R)

P_r(PSIA)	BO (RVBO/STBO)	Bg RVB/MCF	Rs (MCF/BBL)	Z
15.025	1.000	194.696	0	1.0
100	1.125	28.229	.180	.965
200	1.163	13.749	.235	.940
300	1.193	8.970	.290	.920
400	1.218	6.692	.345	.915
500	1.244	5.236	.395	.895
600	1.263	4.276	.445	.877
700	1.285	3.644	.495	.872
800	1.304	3.108	.540	.850
900	1.325	2.746	.585	.845
1000	1.344	2.437	.625	.833
1100	1.364	2.178	.675	.819
1200	1.384	1.962	.725	.805
1300	1.404	1.790	.775	.795
1400	1.425	1.649	.825	.789
1500	1.445	1.516	.875	.777
1600	1.465	1.404	.925	.768
1700	1.485	1.304	.975	.758
1800	1.505	1.220	1.025	.751
1900	1.525	1.147	1.075	.745
2000	1.548	1.053	1.125	.720
2100	1.573	1.000	1.175	.718
2200	1.597	.953	1.225	.717
2231	1.606	.939	1.250	.716

P_r = Reservoir average pressure at datum -2264' subsea, lbs/in^2 absolute.

B_o = Oil formation volume factor, reservoir volumetric bbls/stock tank bbl.

B_g = Gas formation volume factor, reservoir volumetric bbls/thousand std. cu. ft.

R_s = Solution Gas/Oil Ratio, Thousand std. cu. ft/stock tank bbls. oil.

Z = Gas Compressibility Factor.

ATTACHMENT "B"

dr/

LAW OFFICES
HINKLE, BONDURANT, COX & EATON
600 HINKLE BUILDING
POST OFFICE BOX 10
ROSWELL, NEW MEXICO 88201

TELEPHONE (505) 622-6510

CLARENCE E. HINKLE
W. E. BONDURANT, JR.
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CONRAD E. COFFIELD
HAROLD L. HENSLEY, JR.
STUART D. SHANOR
C. O. MARTIN
PAUL J. KELLY, JR.

ANDREW ALLEN

MIDLAND, TEXAS OFFICE
521 MIDLAND TOWER
(915) 683-4691

March 15, 1974

Mr. Dan Nutter
Oil Conservation Commission
Box 2088
Santa Fe, New Mexico 87501

Re: Empire Abo Unit hearing

Dear Mr. Nutter:

You will recall that at the request of Jason Kellahin, attorney for Cities Service Oil Company, consideration was to be given to the form of order to be issued by the Commission pursuant to the hearing held on February 27, 1974 with respect to certain definitions. This is covered by the letter of Mr. Kellahin dated March 5, 1974.

We enclose letter of Hugh Christianson of Atlantic Richfield addressed to me dated March 11, which sets forth the view of Atlantic Richfield with respect to the requests made by Cities Service.

Inasmuch as Cities Service did not see fit to join the unit and is not a party to the unit agreement, the requests being made by Cities Service are rather unusual and for that reason we believe that the requests of Atlantic Richfield should be respected in connection with this matter.

Yours sincerely,

HINKLE, BONDURANT, COX & EATON

By Clarence E. Hinkle
CS

CEH:cs
Enc.
cc: S. H. Christianson
cc: Horace N. Burton
cc: Jason Kellahin

AtlanticRichfieldCompany
North American Producing Division
Permian District
Post Office Box 1610
Midland, Texas 79701
Telephone 915 682 8631

March 11, 1974

Mr. Clarence Hinkle
Hinkle, Bondurant, Cox & Eaton
600 Hinkle Building
P. O. Box 10
Roswell, New Mexico 88201

Re: Empire Abo Unit
Hearing of February 27, 1974

Dear Mr. Hinkle:

We have received a copy of a letter dated March 5, 1974, from Mr. Jason W. Kellahin to Mr. Daniel S. Nutter, New Mexico Oil Conservation Commission.

This letter discusses Cities Service Oil Company's recommendations as to Commission handling of the Atlantic Richfield application for amendments to Empire Abo Pressure Maintenance Project, Order R-4549. This application was heard as Case No. 5177 on February 27, 1974. Mr. Nutter, as Examiner, requested Cities Service to put their recommendations in written form by March 6, 1974, with comments from Atlantic Richfield to be submitted by March 13, 1974.

After review with Mr. J. R. Rhotenberry, we recommend that you inform the Oil Conservation Commission as to Atlantic Richfield's position regarding the matters covered in Mr. Kellihin's letter as discussed in order below:

1. Atlantic Richfield proposes that if Order R-4549 is changed to define the term, "all available residue gas," the order should include the following definition: "Available Residue Gas is defined as being all residue gas from gas produced from the unitized formation less shrinkage, plant and lease fuel required for operations. There shall be no sales of gas from the project except during emergency conditions for a temporary period."

This is similar to the Cities Service request, with addition of the word "shrinkage." We see no reason to object to the addition of this statement, which agrees with Atlantic Richfield's intent and with testimony at the February 27, 1974 hearing.

2. Cities Service proposes to change Order R-4549 Rule 14. Atlantic Richfield proposes instead the following rewording of Order R-4549, Rule 14: "... and provided that no well shall be approved for gas or water injection when such well is located closer than 1650 feet to a tract which is not committed to the unit and on which is located a well producing from the same common source of supply." (Note: only the underlined words, "or water," are added to the original order.)

As stated at the hearing, Atlantic Richfield does not believe there is any need to remove water injection wells farther from non-unit tracts than gas injection wells. Mobility of the gas phase is actually greater than that of the water phase. As stated at the hearing, our current plans are to inject water in the far east end of the reservoir, miles away from any lease on which there is an unsigned working interest.

3. Cities Service has no objection to the proposal for inclusion of a voidage replacement credit for water injected. Atlantic Richfield naturally agrees with their supportive statement on this proposal.

4. As to the gas injection credit bank, Cities Service proposes careful evaluation by the New Mexico Oil Conservation Commission. We are certain that the Commission will, as always, give its usual careful considsration to this proposal.

   Atlantic Richfield contends that the gas bank provision as requested at the hearing of February 27, 1974, is necessary to minimize cutbacks in oil allowable, which under the present order would result from even minor mechanical failure in the injection system. The intent is simply some degree of flexibility in the event of unforeseen mechanical failure. Atlantic Richfield, as Unit Operator, has stated before the Commission in formal hearing that it will endeavor to the best of its ability to inject all plant residue gas available for injection into the gas cap of the Unitized Abo formation. In addition, we are here approving insertion into the order of the statement covering the same subject quoted in paragraph 1 of this letter.

These actions assure that all available residue gas from the Abo formation produced gas will be injected back into the Abo gas cap, except on those rare occasions when mechanical failure prevents it.

As hearing testimony indicated, the use of the gas bank provision is expected to be extremely rare.

As recommended at the hearing, we again recommend a 12-month balancing period for the gas bank, with the slate to be wiped clean at that point and a new "bank balance" begun. We are not aware that Texas "normally grants" a four-month balancing period as cited in Mr. Kellahin's letter.

Please let me know if there is anything further you will need to prepare your letter to Mr. Nutter.

Very truly yours,

S. H. Christianson

SHC/agp

DAN NUTTER

gas bank scheme

wtr inj wells

eliminate 70% gas
inj feature

change may allow
from 40,192 to 40,555.

EMPIRE ABO PLANT

1973	Unit Gas Production Measured at Plant Master Meter MCF	Ratio of Available Residue to Produced Gas without Deduction for Lease Fuel - %	Ratio of Available Residue to Produced Gas with Deduction For Lease Fuel - %
December	626907	70.2	62.3
November	643939	68.6	61.3
October	673738	70.5	63.3
September	804593	78.4	72.9
August	853333	75.5	70.2
July	912813	78.7	73.9
June	834135	73.3	68.1
May	764718	74.2	68.0
April	724678	72.7	66.4
March	718538	76.6	70.0
February	623714	74.5	67.5
January	712183	75.6	68.9
Average . . .	24365 MCF/Day	74.3	68.1

EMPIRE ABO UNIT: NON-UNIT TRACTS

ALLOWED OIL RATES - FOR USE IN DETERMINING MAXIMUM PROJECT AREA OIL ALLOWABLE.

TRACT NO.	OPERATOR-LEASE-WELL	OIL ALLOWABLE (BOPM)	(BOPD)
2	Citgo - Russell C No. 9	2970	
2	Citgo - Russell C No. 10	2220	
6	Citgo - Magruder A No. 13	3270	
6	Citgo - Magruder A No. 14	2430	
28	Cox - E. A. Fed. No. 1	S.I.	
41	Citgo -	No well	
42	Citgo - State CE No. 5	4380	
46	Citgo - Wright A St. No. 4	4260	
55	Penroc - Delhi A St. No. 1	4260	
56	Penroc - State No. 2	3960	
69	Est. of F. Turner B 9391 No. 1	4260	
79	C & K - Abo St. No. 1	4260	
84	Tenneco - State H No. 2	4140	
91	Signal - State E No. 1	4260	
91	Signal - State M No. 2	4680	
	TOTALS:	49350	1645

Sept allow 49350/30 =

Empire Abo Numeric Model Study, Maximum Allowable Used: 42,200 BOPD
Empire Abo Non-Unit Area Allowable: 1645 BOPD
Empire Abo Unitized Project Area Allowable: 40,555 BOPD

40,555 compares to
40,192 at orig hrg.

R27E

T 17 S

T 18 S

A,I 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

B C D E F G H I J K L M N O P Q R S

29 28 27 26 25 30 29

32 33 34 35 36 31 32

5 4 3 2 1 6 5

8 9 10 11 12 7 8

17 16 15 14 13 18 17

T, I 2 3 4 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

AMOCO "AE" (58) DEPCO (57B)

YATES (57) FRANKLIN ASTON FAIR (60) AMOCO "CC" (71) A R Co (37C) AMOCO "BV" (89) A.R.Co (81) PT

AMOCO "CM" (73A) MARTIN YATES DODLEY ABO (41) KERSEY (45) AMOCO "BE" (97) AMOCO PM (64) FRANKLIN ASTON FAIR (48) A R Co (37A) PT A.R.Co AMOCO "BG" (63)

AMOCO "EB" (80) GULF (67) RAMAPO AMOCO "R" (10) AMOCO "F" (27) AMOCO EA (98) FRANKLIN ASTON & FAIR (78A) (37A) PT FRANKLIN ASTON FAIR (80) AMOCO "BK" (33) AMOCO BH (53) MARATHO (30)

AMOCO "H" (26) AMOCO TRIGG (1) AMOCO (128) PT FEDERAL (12C) AMOCO BA (88) A R Co. (68) AMOCO "L" (25) (20) AMOCO "HUDSON A" (3) (1) MALCO (61A) AMOCO "AT" (61B) RUTTER WILBANK (39) MALCO - FEDERAL

AMOCO PT (29-1) STRAIN (21) AMOCO WINDFOHR (7) AMOCO MANN (8) AMOCO (128) PT AMOCO (61C) "AT" AMOCO AU (67) ARCo "AQ" (97) EXXON (19) EMPIRE ABO SUN "T" (95B)

AMOCO PT (29-1) STRAIN EXXON (23) AMOCO "E" (22A) PT GULF "I" NCT-A (87) PT AMOCO "AR" (61D) STATE AMOCO "A3" (93) GULF "I" NCT-B (87) PT AMOCO CD (32)

EXXON (24B) EXXON AMOCO "G" AMOCO "G" AMOCO (120) AMOCO "B" (109A) AMOCO "A" AMOCO "C" (13C) (13D) AMOCO "J" MALCO-FED MALCO-FED MALCO-FED

AMOCO (4) (24A) EXXON (17) (10) (19) AMOCO "K" (12A) AMOCO (22B) (13B) AMOCO (13E)

EXXON (12) (80) EXXON (40) PT (69A) EXXON "BF" (62) AMOCO "BR" (21A) AMOCO "N" AMOCO (21C)

EXXON (16) (27) (4-P) (100) (82) (72) (70) AMOCO "CE" AMOCO (21B)

(18A) (10C) (40) PT GULF "BU" (95B) PT (94B)

GULF (16) (95B) PT (94A)

R 28 E

R 29 E

T 17 S

T 18 S

UNIT OUTLINE

LEGEND

NON-PARTICIPATING TRACT ON UNIT EFFECTIVE DATE OF OCT. 1, 1973

TRACT ADDED TO UNIT AFTER HEARING DATE (4-25-73) AND BEFORE UNIT EFFECTIVE DATE (10-1-73)

UNIT BOUNDARY

TRACT BOUNDARY

(7) TRACT NUMBER

PT PARTIAL TRACTS

EMPIRE ABO UNIT

EDDY COUNTY, NEW MEXICO

EXHIBIT "A"

ATTACHED TO UNIT AGREEMENT

REVISED: DECEMBER 19, 1973

0' 1320' 2640' 5280'

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5135
Order No. R-4549-A

APPLICATION OF ATLANTIC RICHFIELD
COMPANY FOR AMENDMENT OF ORDER
NO. R-4945, EDDY COUNTY, NEW
MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on January 3, 1974, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 15th day of January, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That by Order No. R-4548, dated June 15, 1973, the Commission granted approval of the Empire-Abo Unit Agreement.

(3) That by Order No. R-4549, dated June 15, 1973, the applicant, Atlantic Richfield Company, was authorized to institute a pressure maintenance project in the Empire-Abo Pool in its Empire-Abo Unit Area, Eddy County, New Mexico, designated the ARCO Empire-Abo Unit Pressure Maintenance Project.

(4) That Order No. R-4549 further promulgated Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project.

(5) That Finding (7) of Order No. R-4549 limits production from the project area as described in Finding (4) of said order to the average reservoir voidage for the calendar year 1972 or 30,000 barrels of oil per day, whichever is less, during the period prior to the start of gas injection.

(6) That the allowable figure of 30,000 barrels of oil per day was based on assumptions as to the future size of the unitized project area and the estimated gas and water production expected after unitization.

(7) That since the formation of the Empire-Abo Unit Pressure Maintenance Project the following additional tracts, comprising 200.13 acres of land, within the Empire-Abo Unit Area have been committed to the unit:

EDDY COUNTY, NEW MEXICO
TOWNSHIP 17 SOUTH, RANGE 28 EAST, NMPM
Section 27: SW/4 SE/4
Section 34: S/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 28 EAST, NMPM
Section 6: NW/4 NE/4 (Lot 2) and SE/4 SW/4

(8) That these additional tracts were not considered in arriving at the 30,000 barrels of oil per day project allowable provided for in Order No. R-4549.

(9) That the actual production of gas and water has been less than was anticipated under unitized operations.

(10) That due to more unit area wells and greater efficiency than was expected, an increased allowable can be produced while continuing to limit reservoir voidage to the average voidage set for calendar year 1972 in Order No. R-4945.

(11) That the project allowable should be increased to 33,000 barrels of oil per day effective retroactively to January 1, 1974.

(12) That increasing the project allowable to 33,000 barrels of oil per day is in the interest of conservation, prevention of waste and protection of correlative rights.

IT IS THEREFORE ORDERED:

(1) That Order No. R-4945 is hereby amended to include within the Empire-Abo Unit Pressure Maintenance Project the following tracts which comprise 200.13 acres:

EDDY COUNTY, NEW MEXICO
TOWNSHIP 17 SOUTH, RANGE 28 EAST, NMPM
Section 27: SW/4 SE/4
Section 34: S/2 SE/4

TOWNSHIP 18 SOUTH, RANGE 28 EAST, NMPM
Section 6: NW/4 NE/4 (Lot 2) and SE/4 SW/4

(2) That the project allowable is increased to 33,000 barrels of oil per day effective retroactively to January 1, 1974.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

dr/

CITIES SERVICE OIL COMPANY

Box 4906
Midland, Texas 79701
Telephone: 915 684-7131

March 15, 1974

Kellahin & Fox
P. O. Box 1769
Santa Fe, New Mexico 87501

Attention: Mr. Jason Kellahin

Re: Empire Abo Unit
Eddy County, New Mexico

Dear Jason:

On March 1, 1974, a letter was sent to you from Mr. Van Horn, which included an inter-office letter from Mr. E. H. Lowrey, concerning certain recommended changes in wording in a request of ARCO for amendment of R-4549.

That portion referring to establishment of gas bank was not written as intended and the following is recommended to be given to the New Mexico Oil Conservation Commission for their consideration:

"That volume of injected gas over and above 90% of the available residue gas shall be credited to the gas bank account each month and carried cumulatively forward. The accumulated gas bank may be applied to the injection volume during any future month in which less than 90% of the available residue is injected. The gas bank balance shall not exceed a maximum of the average of the monthly total injection volumes for the previous three months, not including the month being reported."

This procedure has worked well on gas injection projects in Texas operating under a net GOR rule and with a gas bank. I am attaching several copies of Texas Form W-9 which is used in Texas in reporting projects utilizing either gas or water for credit against a producing ratio. The main problem with balancing a gas bank as proposed by Atlantic is the fact that if mechanical trouble developed a month after an account was balanced to zero, it could cause serious problems in that it could take several months to bring the project into

balance. The proposal which we have made is a continuing bank and is never balanced. Such a procedure permits adequate gas to be put in the bank to provide for one month's operation without injection. We have also felt in the past that any mechanical problems could be remedied within one month and injection restored.

Since, as far as I can determine, New Mexico has never established a gas bank for injection projects prior to this, I suggest this matter be thoroughly discussed with them since it seems the first procedure usually sets precedence. If you feel a discussion of this matter with members of the Oil Conservation Commission would be of merit, please advise and I will try to set up a meeting. If you have any questions, please call. I tried to contact you by telephone on this date and apparently you were tied up at the Commission all day.

Very truly yours,

E. F. Motter
mfg

E. F. Motter
Engineering Manager
Southwest Region
E & P Division

EFM:mfg

Enc.

JASON W. KELLAHIN
ROBERT E. FOX

W. THOMAS KELLAHIN

KELLAHIN AND FOX
ATTORNEYS AT LAW
500 DON GASPAR AVENUE
POST OFFICE BOX 1769
SANTA FE, NEW MEXICO 87501

TELEPHONE 982-4315
AREA CODE 505

March 5, 1974

Oil Conservation Commission
of New Mexico
P. O. Box 2088
Santa Fe, New Mexico 87501

Attention: Mr. Daniel S. Nutter, Examiner

Gentlemen:

Case No. 5177, the application of Atlantic Richfield Company for amendment of Order No. R-4549, was heard before Mr. Daniel S. Nutter, Commission Examiner, on February 27, 1974. At that time Cities Service Oil Company was granted one week in which to file its proposals as to definitions that should be included in the order proposed by Atlantic Richfield.

The application covered several points, and we will discuss them in order:

1. It was proposed to increase the maximum project allowable from 40,192 BPD to 40,555 BPD, to be achieved by injection of "all available residue gas" rather than the injection of "70% of the produced gas" as provided by Order R-4549. The allowable for the unit is determined by a voidage formula and is tied to the average daily voidage during 1972. ARCO testified that after fuel is subtracted from the residue, there remains only about 68% of production available for reinjection, instead of the 70% required by the present order. We have no information to refute this, however, we feel that changing the wording to "all available gas" is insufficient without defining what is "available". We would propose the order include the following definition:

> "Available Residue Gas is defined as being all residue gas from gas produced from the unitized formation less plant and lease fuel required for operations. There shall be no sales of gas from the project except during emergency conditions for a temporary period."

2. Atlantic Richfield proposes to inject water into the east end of the Unit, where considerable volumes of water are

presently being produced, and further asks for an administrative procedure for the approval of additional water injection wells. Cities Service has no objection to this but proposes that the terms of the order provide:

> ". . . provided that no well shall be approved for gas injection when such well is located closer than 1,650 feet to a tract which is not committed to the Unit and on which is located a well producing from the same common source of supply and provided that no well shall be approved for water injection when such well is located closer than 2,640 feet to a tract which is not committed to the Unit or in which there is an unsigned Working Interest."

3. Atlantic Richfield proposes the inclusion of a voidage replacement credit for water injected. Cities Service has no objection to this proposal.

4. Atlantic Richfield proposes the establishment of a gas injection credit bank, which is not an unusual concept in the industry, but would establish a precedent in New Mexico, and for that reason we urge the Commission to proceed cautiously in establishing such a concept in this state. Its effect on future operations in the state should be carefully considered. Under ARCO's proposal any volume of gas over 90% of the "available residue" would be credited to the "Bank" and that a twelve month balancing period be used. The effect of this would be to permit 10% downtime without there being any penalty on allowable and would require the injection of only 61.3% of the available residue on a monthly basis. This would or could defeat the concept of reinjection as required by the present order. We would also suggest a 4 month balancing period such as the state of Texas normally grants, rather than 12 months.

Thank you for the opportunity to submit these suggestions.

Yours very truly,

Jason W. Kellahin

Jason W. Kellahin

JWK:ks

cc: Messrs: Clarence E. Hinkle
Hugh Christianson
K. D. Van Horn
C. R. Mitchell
Robert F. LeBlanc

CASE 5055: (Reopened)

In the matter of Case No. 5055 being reopened pursuant to the provisions of Order No. R-4651 to permit the applicant, Merrion and Bayless, to appear and present evidence as to the method for allocating oil production to the Devils Fork-Gallup Oil Pool and to an undesignated Greenhorn Oil Pool, and gas to the Basin-Dakota Pool in its Canada Mesa Well No. 3 located in Unit A of Section 14, Township 24 North, Range 6 West, Rio Arriba County, New Mexico, said production having been commingled in the wellbore under authority of said Order No. R-4651.

CASE 5175: Application of Flag-Redfern Oil Company for an unorthodox oil well location, Lea County, New Mexico. Applicant, in the above-styled cause, seeks, as an exception to the West Sawyer-San Andres special pool rules, authority to drill a well at an unorthodox location 1980 feet from the South line and 660 feet from the East line of Section 23, Township 9 South, Range 37 East, Lea County, New Mexico.

CASE 5176: Application of R. Q. Silverthorne for salt water disposal, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water into the Yates formation in the perforated interval from 2485 feet to 2506 feet in his Kenwood Well No. 4 located in Unit K of Section 30, Township 18 South, Range 31 East, Shugart Pool, Eddy County, New Mexico.

Clarence Hinkle
Hugh Christenson

CASE 5177: Application of Atlantic Richfield Company for the amendment of Order No. R-4549, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks the amendment of Order No. R-4549, which order established project rules for the Empire-Abo Pressure Maintenance Project, Eddy County, New Mexico, to raise the maximum project allowable from the present 40,192 barrels per day to 40,555 barrels per day because of additional lands committed to the unit, and to provide for administrative approval for water injection wells in said project, and for inclusion of a reservoir voidage replacement credit for water injected into the Abo reservoir; applicant further seeks the amendment of Order No. R-4549 to provide that the maximum project allowable of 40,555 barrels per day would be achieved upon injection of "all available residue gas" rather than "70% of the produced gas", as now provided in the project rules. Applicant further seeks the establishment of a gas injection credit "bank", against which injection credit could be drawn in order to maintain full allowables during such times as injection plant shut-downs, etc.

CASE 5178: Application of El Paso Natural Gas Company for the amendment of Order No. R-1670 and Order No. R-333-F-1, San Juan Basin, New Mexico. Applicant, in the above-styled cause, seeks the amendment of Rules 8(C)3 and 10(B)2 and 3 of the Northwest New Mexico Gas Proration Rules as prescribed by Order No. R-1670, as amended, and Section 1 B of Chapter I of the Gas Well Testing Rules for Northwest New Mexico as prescribed by Order No. R-333-F-1, as amended, to provide for a 90-day period within which to conduct deliverability tests on newly completed wells. Applicant further seeks the amendment of the gas well testing rules to provide a production penalty for delinquency in testing non-prorated wells in the same manner as such penalty is currently applied to delinquency in testing prorated wells. Applicant further seeks clarification for the classification of exempt-marginal status for wells upon which tests are not required.

Docket No. 5-74

DOCKET: EXAMINER HEARING - WEDNESDAY - FEBRUARY 27, 1974

9 A.M. - OIL CONSERVATION COMMISSION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING - SANTA FE, NEW MEXICO

The following cases will be heard before Daniel S. Nutter, Examiner, or Richard L. Stamets, Alternate Examiner:

CASE 5173: (Continued from the February 13, 1974, Examiner Hearing)

Application of Mobil Oil Corporation for compulsory pooling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Pennsylvanian formation underlying the W/2 of Section 3, Township 23 South, Range 27 East, South Carlsbad Field, Eddy County, New Mexico, to be dedicated to its Maude Rickman Com Well No. 1 located in Unit L of said Section 3. Also to be considered will be the cost of drilling and completing said well and the allocation of such costs, as well as actual operating costs and charges for supervision. Also to be considered is the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 5128: (Continued from the January 30, 1974, Examiner Hearing)

Application of Gulf Oil Corporation for a non-standard gas proration unit and simultaneous dedication, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for a 160-acre non-standard gas proration unit comprising the NE/4 SW/4 and W/2 SE/4 of Section 28 and the NW/4 NE/4 of Section 33, both in Township 21 South, Range 37 East, Blinebry Gas Pool, Lea County, New Mexico, to be simultaneously dedicated to its J. N. Carson Wells Nos. 4 and 9 located in Units O and K, respectively, of Section 28.

CASE 5174: Application of Gulf Oil Corporation for three dual completions and for the amendment of Order No. R-2909, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to dually complete three wells for water injection into its Central Drinkard Unit Waterflood Project in Township 21 South, Range 37 East, Lea County, New Mexico, and for production as follows:

H. T. Mattern Well No. 8, Unit I, Section 30: Blinebry Oil Pool;

W. T. McCormack Well No. 13, Unit A, Section 32: Tubb Gas Pool;

J. N. Carson Well No. 4, Unit O, Section 28: Blinebry Gas Pool;

Applicant further seeks the amendment of Order No. R-2909, which authorized said waterflood project, to provide for administrative approval of additional dual injection-production wells in said unit area.

EMPIRE ABO UNIT: NON-UNIT TRACTS

ALLOWED OIL RATES - FOR USE IN DETERMINING MAXIMUM PROJECT AREA OIL ALLOWABLE.

TRACT NO.	OPERATOR-LEASE-WELL	OIL ALLOWABLE (BOPD)*
2	Citgo - Russell C No. 9	99
2	Citgo - Russell C No. 10	74
6	Citgo - Magruder A No. 13	109
6	Citgo - Magruder A No. 14	81
28	Cox - E. A. Fed. No. 1	0 (S.I.)
41	Citgo -	0 (No well)
42	Citgo - State CE No. 5	146
46	Citgo - Wright A St. No. 4	142
55	Penroc - Delhi A St. No. 1	142
56	Penroc - State No. 2	132
69	Est. of F. Turner B 9391 No. 1	142
79	C & K - Abo St. No. 1	142
84	Tenneco - State H No. 2	138
91	Signal - State E No. 1	142
91	Signal - State M No. 2	156
	TOTALS:	1645

Empire Abo Numeric Model Study, Maximum Allowable Used: 42,200 BOPD
Empire Abo Non-Unit Area Allowable: - 1,645 BOPD
Empire Abo Unitized Project Area Allowable: 40,555 BOPD

(*Allowables from January-April 1974 N.M.O.C.C. schedule.)

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 2
CASE NO. 5177

EMPIRE ABO PLANT

1973	Gas Production Measured at Plant Master Meter MCF	Ratio of Available Residue to Produced Gas* %
December	626907	62.3
November	643939	61.3
October	673738	63.3
September	804593	72.9
August	853333	70.2
July	912813	73.9
June	834135	68.1
May	764718	68.0
April	724678	66.4
March	718538	70.0
February	623714	67.5
January	712183	68.9
Average . . .	24365 MCF/DAY	68.1

(*Estimated after deduction for shrinkage, lease and plant fuel.)

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 3
CASE NO. 5177

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 4
CASE NO. 5177

EMPIRE ABO PRESSURE MAINTENANCE PROJECT
(N.M.O.C.C. Orders R-4548, R-4549, R-4549-A, R-4549-B)
Atlantic Richfield Company Operator

GAS BANK STATEMENT

Monthly Report for 1974.

					If Column 5 is 90% or Greater.			If Column 5 is less than 90%.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
MONTH	GAS PRODUCED (MCF)	TOTAL PLANT RESIDUE AVAILABLE FOR INJECTION (MCF)	GAS INJECTED (MCF)	% OF AVAILABLE RESIDUE GAS INJECTED (a) (%)	(COL 5 -90.0) / 100.0 (Fraction)	GAS BANK CREDIT (COL. 6 x COL. 3) (MCF)	CUMULATIVE GAS BANK CREDIT (MCF)	(90.0-COL 5) / 100.0 (Fraction)	GAS BANK DEBIT (COL. 9 x COL. 3) (MCF)	CUMULATIVE GAS BANK DEBIT (MCF)	CUMULATIVE CREDIT (MCF)	CUMULATIVE DEBIT (MCF)	GAS BANK BALANCE (MCF)
January	1,382,926	898,902	898,902	100.0	.1	89,890.2	89,890.2			0	89,890.2	0	89,890.2
February	1,249,094	811,911	811,911	100.0	.1	81,191.1	171,081.3			0	171,081.3	0	171,081.3
March	1,382,926	898,902	898,902	100.0	.1	89,890.2	260,971.5			0	260,971.5	0	260,971.5
April	1,338,315	869,905	869,905	100.0	.1	86,990.5	347,962.0			0	347,962.0	0	347,962.0
May	1,382,926	898,902	898,902	100.0	.1	89,890.2	437,852.2			0	437,852.2	0	437,852.2
June	1,338,315	869,905	869,905	100.0	.1	86,990.5	524,842.7			0	524,842.7	0	524,842.7
July	1,382,926	898,902	492,946	54.8			524,842.7	.352	316,414	316,414	524,842.7	316,414	208,428.7
August	1,382,926	898,902	898,902	100.0	.1	89,890.2	614,732.9			316,414	614,732.9	316,414	298,318.9
September	1,338,315	869,905	869,905	100.0	.1	86,990.5	701,723.4			316,414	701,723.4	316,414	385,309.4
October	1,382,926	898,902	898,902	100.0	.1	89,890.2	791,613.6			316,414	791,613.6	316,414	475,199.6
November	1,338,315	869,905	869,905	100.0	.1	86,990.5	878,604.1			316,414	878,604.1	316,414	562,190.1
December	1,382,926	898,902	898,902	100.0	.1	89,890.2	968,494.3			316,414	968,494.3	316,414	652,080.3
January	1,382,926	898,902	898,902	100.0	.1	89,890.2	89,890.2			0	89,890.2	0	89,890.2*

(*Illustrates that balance starts over again with new year.)

(a) Column (4)/Column (3) x 100.0 = Column (5).

EMPIRE ABO UNIT

Reservoir Voidage Formula:

Equation 1: $Vrvb = Qo \left[Bo + (Rpn - Rs)\, Bg\right] + \left[Qwp - (Qwe + Qwi)\right] Bw$

Where:

Vrvb	=	Reservoir voidage, bbls. per day
Qo	=	Oil Production rate, Stock tank bbls. per day
Bo	=	Oil formation volume factor (1), reservoir volumetric bbls/stock tank bbl.
Rpn	=	Net producing gas-oil ratio, MCF/S.T.B.O.

$$Rpn = Rp\left(1.0 - \frac{Gi}{Gp}\right)$$

Where:

Rp = producing gas-oil ratio, MCF/BO
Gi = daily volume of gas injected, MCF/Day
Gp = daily volume of gas produced, MCF/Day

Rs	=	Solution gas-oil ratio (2), MCF/STBO
Bg	=	Gas formation volume factor (3), RVB/MCF
Qwp	=	Water production rate, S.T.B.W./Day
Qwe	=	Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD
Qwi	=	Daily volume of water injected, S.T.B.W./Day
Bw	=	Water formation volume factor, RVBW/STBW, use 1.0

(1), (2), (3): These values calculated from Table of Fluid Properties, Attachment "B".

Reveals R-4549

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 5
CASE NO. 5177

NET GAS-OIL RATIO REPORT

RAILROAD COMMISSION OF TEXAS

OIL AND GAS DIVISION

FORM W-9
Rev. 7/24/80

District _____

Field _____ Reservoir _____ Month _____, 19__

Operator _____ Address _____

1 LEASE NAME	2 RRC Lease Number	3 Well Number — All or Numerical Only	3 Well Number — Alphabetical Only	4 Oil Production BBLS	5 Gas Production (Gross) MCF	CREDIT: 6 Gas Injection MCF	CREDIT: 7 Water Injection (Gas Equivalent) MCF	CREDIT: 8 Gas To Legal Use* MCF	9 Net Gas Production MCF	10 Net Gas-Oil Ratio Cu. Ft./Bbl.
TOTALS										

See reverse side for instructions - - Please read carefully

CERTIFICATE:

I declare under penalties prescribed in Article 6036c. R.C.S., that I am authorized to make this report, that this report was prepared by me or under my supervision and direction, and that data and facts stated therein are true, correct, and complete, to the best of my knowledge.

Signature _____

Date _____ Title _____

Telephone _____ _____
(Area Code)

GAS BANK SUMMARY

Gas Bank Balance First of Month MCF	Total Gas Production MCF	Total Gas Injected During Month MCF	Total Gas Injection Credit Utilized MCF	Gas Bank Change Debit (+) Credit(-) MCF	Gas Bank Balance End of Month MCF

GAS EQUIVALENT WATER INJECTION BANK SUMMARY

Gas Equivalent Bank Balance First of Month MCF	Total Water Production BBLS	Total Water Injected During Month BBLS	Net Water Injected BBLS	Gas Equivalent of Net Water Injected MCF	Total Gas Equivalent Credit Utilized This Month MCF	Gas Equivalent Bank Change Debit(+) Credit(-) MCF	Gas Equivalent Bank Balance End of Month MCF

Water To Gas Equivalent Conversion Factor _____ MCF/BBL.

AUTHORIZATION FOR CREDIT

Gas to Legal Use	Gas Injection	Water Injection	Bank
Order No. or Date of Letter _____	Order No. or Date of Letter _____	Order No. or Date of Letter _____	Order No. or Date of Letter _____

Name of plant and/or compression facilities (as reported on Form GP - 1 or PM - 1) from which the basis for your gas injection credit is obtained.

Operator _____ Plant Name _____

REMARKS _____

*Gas diverted to legal use as provided in Article 6008, Sect. 7, Revised Civil Statutes of Texas.

INSTRUCTIONS

Time and Place of Filing – One copy of this report shall be filed with the Railroad Commission at Austin, Texas, no later than the 25th of the month following the month covered by the report. This due date will apply regardless of the date stated in field rules or orders authorizing net gas-oil ratio credit.

Order of the Report – A separate report shall be filed by each operator for each field. Report the leases numerically by lease number and the wells numerically by well number within each lease.

Well Number – Column 3 shall contain six position well designation as per RRC Schedule.

Well Number Limitations:

POSITION	REQUIREMENT	PURPOSE	EXAMPLE
1	Alphabetic or Numeric	Tract designation or high Well Number	A 1 1296
2, 3, & 4	Numeric only	Basic Well Number	146
5	Alphabetic only	Replacement Well Code	1A 1R
6	Alphabetic only	Multiple completion designation as per RRC Schedule or Coding System	10-T 129-C

Month – Show month of actual production and injection.

CLARENCE E. HINKLE
W. E. BONDURANT, JR.
LEWIS C. COX, JR.
PAUL W. EATON, JR.
CONRAD E. COFFIELD
HAROLD L. HENSLEY, JR.
STUART D. SHANOR
C. D. MARTIN
PAUL J. KELLY, JR.

ANDREW ALLEN

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600 HINKLE BUILDING
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MIDLAND, TEXAS OFFICE
521 MIDLAND TOWER
(915) 683-4691

Case 5177

February 4, 1974

Oil Conservation Commission
P.O. Box 2088
Santa Fe, New Mex ico 87501

Gentlemen:

We enclose in triplication application of Atlantic Richfield for an increased project allowable in connection with the Empire Abo Pressure Maintenance Project. This involves an amendment to Order R-4545A.

You will note that we have requested that this matter be set for the examiner's hearing on February 27 and Atlantic Richfield is particularly anxious that it be included on that docket.

Yours sincerely,

HINKLE, BONDURANT, COX & EATON

By

CEH:cs
Enc.
cc: Duncan Holt
cc: Hugh Christianson
cc: Mr. Horace Burton

BEFORE THE OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO

Case 5177

APPLICATION OF ATLANTIC RICHFIELD COMPANY FOR AN INCREASED PROJECT ALLOWABLE FOR THE EMPIRE ABO PRESSURE MAINTENANCE PROJECT AS APPFOVED BY ORDER R-4549 AND AMENDED BY ORDER R-4549A, FOR BASING THE GAS INJECTION INCENTIVE ALLOWABLE ON REINJECTION OF AVAILABLE RESIDUE GAS, FOR ESTABLISHING A GAS BANK, FOR ADMINISTRATIVE APPROVAL OF WATER INJECTION WELLS AND FOR VOIDAGE REPLACEMENT CREDIT FOR WATER INJECTED INTO THE UNITIZED ABO RESERVOIR.

Oil Conservation Commission
P.O. Box 2088
Santa Fe, New Mexico 87501

Comes Atlantic Richfield Company, acting by and through the undersigned attorneys, and hereby makes application for an increased project allowable for the Empire Abo Pressure Maintenance Project as approved by Order R-4549 and amended by Order R-4549A, for basing the gas injection incentive allowable on reinjection of available residue gas, for establishing a gas bank, for administrative approval of water injection wells and for voidage replacement credit for water injected into the unitized Abo reservoir. Applicant seeks to increase the project allowable after commencement of gas reinjection from 40,192 barrels of oil per day to 40,555 barrels of oil per day. In support of the above requests, applicant respectfully shows:

1. That as a result of Case No. 5135, Order No. R-4549A, the Commission has on file the latest plat showing the boundaries of the originally proposed unit area and showing those tracts within and without the present unitized project area.

2. The Oil Conservation Commission of the State of New Mexico granted approval of the Empire Abo Unit Agreement by Order R-4548 dated June 15, 1973, and granted approval of the ARCO Empire Abo Unit Pressure Maintenance Project by Order R-4549 also dated June 15, 1973, as subsequently amended by Order R-4549A dated January 15, 1974.

3. That Finding 7 of Order R-4549 limits production from the project area as described in Finding 4 of the same order to the average

reservoir voidage for the calendar year 1972 or 40,192 barrels of oil per day, whichever is less, after gas injection has been achieved.

4. The allowable figure of 40,192 barrels of oil per day testitifed to at the hearing of April 25, 1973 was based on certain assumptions as to future size of the unitized project area.

5. That four additional tracts comprising 200.13 acres and containing four Abo producing wells, were committed to the Unit Agreement after the original hearing date and Order R-4549A dated January 15, 1974 approves inclusion of these tracts in the Empire-Abo Unit Pressure Maintenance Project.

6. That these additional tracts were not considered in the Project Area in ariving at the 40,192 barrels of oil per day project allowable provided for in Order No. R-4549.

7. Applicant requests an increase above the project allowable of 40,192 barrels of oil per day previously granted for the period after gas injection to 40,555 barrels of oil per day.

8. That Finding 8 of Order R-4549 grants additional allowable up to 40,192 BOPD as an incentive for injection of produced gas with the maximum incentive allowable based on reinjectionof 70% of the produced gas.

9. That the actual amount of plant residue gas available for injection is not a fixed percentage of the produced gas, but has varied, and will continue to vary, with the season, extractive efficiencies of the supplying gas plants, volume of lease fuel required, and other factors.

10. That applicant, as unit operator, will always endeavor to the best of its ability to inject all of the plant residue gas available for injection into the gas cap of the Unitized Abo Formation.

11. Therefore, applicant requests gas injection criteria be stated as "all available residue gas", rather than "70 percent of the produced gas", as now stated in Order R-4549.

12. That applicant wishes to protect both working and royalty owners against loss of income from allowable penalty, which under Order R-4549 could result from mechanical failure, by the establishing of a gas injection credit, or gas bank.

13. That such gas bank should provide all injection volumes above 90% of available residue gas be considered as credit to be drawn upon at any time injection volumes, due to mechanical failure, fall below 90% of available residue gas, that the balancing period shall be

on an annual basis, and that injection of 90% of available residue gas shall enable the Unitized Project Area to achieve the maximum gas injection incentive oil allowable.

14. That applicant requests Order R-4549, Rule No. 14, be amended to authorize administrative approval of water injection wells into the Abo formation.

15. That Order R-4549, Attachment "A", Equation 1, be amended so as to give reservoir voidage replacement credit for water injected into the Unitized Abo formation.

16. In the opinion of applicant, said pressure maintenance project, allowable increase, and other requests outlined in this application are in the interest of conservation, prevention of waste, the protection of correlative rights, and will tend to promote the greatest ultimate recovery of oil and gas from that portion of the Empire Abo Pool covered by the project.

17. Applicant requests that this matter be set for hearing at the examiner's hearing to be held on February 27, 1974.

Respectfully submitted,

ATLANTIC RICHFIELD COMPANY

By _____

HINKLE, BONDURANT, COX & EATON
Attorneys for Applicant
P.O. Box 10
Roswell, New Mexico 88201

90% 95% of acid residue = 100% alkali

Diff. between 100% and 90% or 95% is in gas bank

for use when compressor

station is down.

Set bank @ zero Each year

DRAFT

dr/

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5177

Order No. R-4549-B

APPLICATION OF ATLANTIC RICHFIELD
COMPANY FOR THE AMENDMENT OF ORDER
NO. R-4549, EDDY COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on February 27, 1974 at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 30th day of April, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Atlantic Richfield Company, is the operator of the Empire-Abo Pressure Maintenance Project, Empire-Abo Pool, Eddy County, New Mexico, which project was authorized by Commission Order No. R-4549, and is governed by operating rules included in said order as amended by Order No. R-4549-A.

(3) That the applicant seeks the amendment of said Order No. R-4549, as amended, to include an increase in the maximum project allowable from 40,192 barrels of oil per day to 40,555 barrels of oil per day because of additional lands committed to the unit and participating in the project and to provide that the maximum project allowable of 40,555 barrels of oil per day would be achieved upon injection of ~~"95 percent of~~ "all available residue gas" rather than "70 percent of the produced gas," as now provided in the project rules.

(4) That the applicant further seeks the amendment of Order No. R-4549, as amended, to include a provision for administrative approval for water injection wells and to include a reservoir voidage replacement credit for water injected into the Abo formation within the project area, and to provide further the establishment of a gas injection credit "bank", against which injection credit could be drawn in order to maintain full allowables during such times that full gas injection cannot be maintained because of injection plant shutdowns or other mechanical problems.

(5) That the increase in maximum allowable for the Empire-Abo Pressure Maintenance Project from 40,192 barrels of oil per day to 40,555 barrels of oil per day is justified inasmuch as the original 40,192 barrels was based on numeric model studies of the reservoir assuming only those tracts actually committed to the unit at the time of the original hearing would participate; that additional tracts have now been committed to the unit and the maximum permissible allowable should therefore be increased accordingly to 40,555 barrels of oil per day.

(6) That the aforesaid maximum allowable should be made available ~~only~~ upon injection of 95 percent of all available residue gas rather than upon injection of 70 percent of the produced gas as is presently provided by Rule 3 of the Project Rules as promulgated by Order No. R-4549, as amended by Order No. R-4549-A; that

"Available Residue Gas" should be defined as being all gas produced from the unitized formation less plant shrinkage and plant fuel and lease fuel required for operations; that there should be a prohibition against the sale of gas from the project except during emergency situations of temporary nature.

(7) That in addition to the administrative procedure currently in effect pursuant to Order No. R-4549 for approval of the injection of gas into the Abo formation without notice and hearing, an administrative procedure should be adopted whereby approval could be given for the injection of water into ~~the~~ said formation within the project area without notice and hearing, provided certain restrictions regarding proximity to non-participating tracts are observed.

(8) That credit should be allowed in the project's Reservoir Voidage Formula for water injected into the reservoir as well as for gas, as now provided.

(9) That in order to allow for the maintenance of full allowables and full production schedules during such times as injection well failures, injection plant shutdowns, and other temporary conditions of unforeseen nature which prevent the injection of 95 percent of all available residue gas, a provision should be made in the project rules for the establishment of a system for the accumulation of gas injection credits which could be applied in the "Additional ~~[illegible]~~ Allowable" formula contained in Rule 4 of the project rules; that monthly gas injection credits which may be accumulated should be limited to the volume of gas injected which exceeds 95 percent of the residue gas available for injection during any given month; and that the maximum amount of gas injection credits which should be permitted to accrue to the gas injection credit bank should be equal to 100 percent of the average of the total monthly injection volumes for the previous three months, not including the month being reported.

IT IS THEREFORE ORDERED:

(1) That Rule 3 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project as promulgated by Order No. R-4549, as amended by Order No. R-4549-A, is hereby amended to read in its entirety as follows:

"RULE 3. That the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage in the project area for calendar year 1972 (56,513 reservoir barrels) or 33,000 barrels of oil per day, whichever is less, except that ~~where~~ when injection of 95 percent of all available residue gas is achieved, the maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage in the project area for calendar year 1972 (56,513 reservoir barrels) or 40,555 barrels of oil per day, whichever is less."

(2) That Rule 4 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

"RULE 4. That upon commencement of gas injection and for as long thereafter as such injection continues, ~~not~~ extra allowable in addition to the 33,000 barrels per day described above may be assigned to the project area, provided that such additional allowable shall be based upon the proportion of residue gas available for injection which is actually injected into the unitized formation and shall be computed in accordance with the following formula:

$$\text{Additional Allowable in Excess of 33,000 BOPD} = 39.76\left[2\left(\frac{\text{MCF}}{\text{MCF}}\right)\right.$$

$$\left.\frac{\text{gas inj. previous month x 10}}{\text{residue gas available previous month}}\right)^2 + \left(\frac{\text{MCF gas inj. previous month x 10}}{\text{MCF residue gas available previous month}}\right)\Bigg]$$

That the maximum additional allowable which may be earned by gas injection shall be 7555 barrels per day. That this maximum may be earned by the injection of 95 percent of the available residue gas into the unitized formation; that gas volumes in excess of said 95 percent which are injected into the unitized formation shall be credited each month to a gas injection bank account which shall be permitted to accrue such gas injection credits up to 100 percent of the average of the total monthly injection volumes for the three previous months, not including the month being reported; that during such times as injection well failures, injection plant shutdowns, and other temporary conditions of unforeseen nature which prevent the injection of at least 95 percent of the available residue gas, said gas injection bank account may be charged a sufficient volume to add to the actual volume of injection achieved to equal 95 percent of the available residue gas for the month. In the event there are insufficient credits accrued to the gas injection bank account to bring actual injection plus applied credits up to 95 percent of available residue gas, production shall be reduced to 33,000 barrels of oil per day plus the amount which the actual injection plus the accrued credits will actually earn. Production beyond this amount shall be considered over-production and shall be compensated for by underproduction during the following month.

For the purpose of these rules, "Available Residue Gas" shall be defined as being all gas produced from the unitized formation less plant shrinkage, plant fuel, and lease fuel required for operation of the lease.

No raw gas nor plant residue gas attributable to the project shall be sold or otherwise disposed of by any means other than injection into the unitized formation except during emergency situations of temporary nature."

(3) That Rule 5 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

"RULE 5. That all calculations of reservoir voidage shall be made in accordance with the formula set forth in Attachment "A" to this order entitled "EMPIRE-ABO UNIT AREA-Reservoir Voidage Formula - Gas and Water Injection Credit" utilizing the reservoir and fluid data set forth in Attachment "B" to this order entitled EMPIRE-ABO UNIT AREA - Table of Fluid Properties."

(4) That Rule 14 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project is hereby amended to read in its entirety as follows:

"RULE 14. The Secretary-Director of the Commission is hereby authorized to approve such additional producing wells and gas injection and water injection wells at orthodox and unorthodox locations within the boundaries of the ARCO Empire-Abo Unit Area as may be necessary to complete an efficient production and injection pattern, provided said wells are drilled no closer than 660 feet to the outer boundary of said unit nor closer than 10 feet to any quarter-quarter section or subdivision inner boundary and provided that no well shall be approved for gas or water injection when such well is located closer than 1650 feet to a tract which is not committed to the unit and on which is

located a well producing from the same common source of supply. To obtain such approval, the project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional production or injection wells shall include the following:

(1) A plat identifying the lands committed to the unit agreement and those lands not committed to said agreement, and showing the location of the proposed well, all wells within the unit area, and offset operators.

(2) A schematic drawing of the proposed well which fully describes the casing, tubing, perforated interval, and depth.

(3) A letter stating that all offset operators to the proposed well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed well if, within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators."

(5) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

EMPIRE ABO UNIT AREA

Reservoir Voidage Formula — Gas and Water Injection Credit

Equation 1: $Vrvb = Qo \left[Bo + (Rpn - Rs)\, Bg\right] + \left[Qwp - (Qwe + Qwi)\right] Bw$

Where:

Vrvb	=	Reservoir voidage, bbls. per day
Qo	=	Oil Production rate, Stock tank bbls. per day
Bo	=	Oil formation volume factor (1), reservoir volumetric bbls/stock tank bbl.
Rpn	=	Net producing gas-oil ratio, MCF/S.T.B.O.

$$Rpn = Rp\ (1.0 - \frac{Gi}{Gp})$$

Where:

Rp = producing gas-oil ratio, MCF/BO
Gi = daily volume of gas injected, MCF/Day
Gp = daily volume of gas produced, MCF/Day

Rs	=	Solution gas-oil ratio (2), MCF/STBO
Rg	=	Gas formation volume factor (3), RVB/MCF
Qwp	=	Water production rate, S.T.B.W./Day
Qwe	=	Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD
Qwi	=	Daily volume of water injected, S.T.B.W./Day
Bw	=	Water formation volume factor, RVBW/STBW, use 1.0

(1), (2), (3): These values calculated from Table of Fluid Properties, Attachment "B".

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 5
CASE NO. 5177

Attachment "A" Order No R-4549-B

EMPIRE ABO UNIT AREA

Table of Fluid Properties ~~(P Base = 15.025 P_{bp} 2291)~~

~~T base 109°F (569° R)~~
$P_{base} = 15.025$ psia $P_{bp} = 2231$ psia $T_{res} = 104°F (524°R)$

P_r(PSIA)	BO (RVBO/STBO)	Bg RVB/MCF	Rs (MCF/BBL)	Z
15.025	1.000	194.696	0	1.0
100	1.125	28.229	.180	.965
200	1.163	13.749	.235	.940
300	1.193	8.970	.290	.920
400	1.218	6.692	.345	.915
500	1.244	5.236	.395	.895
600	1.263	4.276	.445	.877
700	1.285	3.644	.495	.872
800	1.304	3.108	.540	.850
900	1.325	2.746	.585	.845
1000	1.344	2.437	.625	.833
1100	1.364	2.178	.675	.819
1200	1.384	1.962	.725	.805
1300	1.404	1.790	.775	.795
1400	1.425	1.649	.825	.789
1500	1.445	1.516	.875	.777
1600	1.465	1.404	.925	.768
1700	1.485	1.304	.975	.758
1800	1.505	1.220	1.025	.751
1900	1.525	1.147	1.075	.745
2000	1.548	1.053	1.125	.720
2100	1.573	1.000	1.175	.718
2200	1.597	.953	1.225	.717
2231	1.606	.939	1.250	.716

P_r = Reservoir average pressure at datum -2264' subsea, lbs/in^2 absolute.

B_o = Oil formation volume factor, reservoir volumetric bbls/stock tank bbl.

B_g = Gas formation volume factor, reservoir volumetric bbls/thousand std. cu. ft.

R_s = Solution Gas/Oil Ratio, Thousand std. cu. ft/stock tank bbls. oil.

Z = Gas Compressibility Factor.

ATTACHMENT "B"

Order No R-4549-~~A~~ B

dr/