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

3 October 1984

EXAMINER HEARING

IN THE MATTER OF:

Application of Kaiser-Francis Oil Company for hardship gas well classification, Eddy County, New Mexico.	CASE 8336

BEFORE: Gilbert P. Quintana, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division:	Jeff Taylor Attorney at Law Legal Counsel to the Division State Land Office Bldg. Santa Fe, New Mexico 87501
For the Applicant:	William F. Carr Attorney at Law CAMPBELL & BLACK P.A. P. O. Box 2208 Santa Fe, New Mexico 87501

I N D E X

E X H I B I T S

MR. QUINTANA: We'll call next Case Number 8336.

MR. TAYLOR: The application of Kaiser-Francis Oil Company for hardship gas well classification, Eddy County, New Mexico.

MR. CARR: May it please the Examiner, my name is William F. Carr, with the law firm Campbell and Black, P. A., of Santa Fe, appearing on behalf of Kaiser-Francis Oil Company.

I have one witness.

MR. QUINTANA: Are there any other appearances?

MR. KENDRICK: H. L. Kendrick, El Paso Natural Gas.

MR. QUINTANA: Will all those witnesses wishing to testify stand up and be sworn at this time?

(Witness sworn.)

JAMES WILLIAM JOHNSTON,

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

DIRECT EXAMINATION

BY MR. CARR:

Q Will you state your full name and place of residence?

A My full names is James William Johnston. I live in Tulsa, Oklahoma.

Q By whom are you employed?

A I'm employed as a petroleum engineer by Kaiser-Francis Oil Company.

Q Have you previously testified before this Commission and had your credentials as a petroleum engineer accepted and made a matter of record?

A Yes, sir.

Q Are you familiar with the application filed in this case on behalf of Kaiser-Francis?

A Yes.

Q Are you familiar with the subject well?

A Yes.

MR. CARR: Are the witness' qualifications acceptable?

MR. QUINTANA: Yes, they are.

Q Mr. Johnston, would you please identify what has been marked for identification as Kaiser-Francis Exhibit Number A, as Letter A?

A Exhibit A is an application that was submitted to the Oil Conservation Division August 1st, 1984, our application for classification as hardship gas well, our Pure Gold A Federal No. 1, located in Section 21, 22 South, 31 East, Eddy County, New Mexico.

Q Mr. Johnston, has this application been revised since the original application was filed?

A Yes. Several of the exhibits that contain production data have been revised and updated to include the most recent data we have available to us.

Q Were copies of this application filed with the District Office of the Oil Conservation Division, as well as the Santa Fe Office?

A Yes.

Q Was an emergency hardship classification sought by Kaiser-Francis?

A Yes.

Q And was that emergency classification granted?

A No.

Q Will you please refer to the plat contained in Exhibit A and review the information contained thereon for Mr. Quintana?

A The plat in Exhibit A shows the location of the Pure Gold A Well in the south half of Section 21, 22 South, 31 East.

It's located in the West Sand Dune Morrow Gas Field. It's completed at a depth of approximately 14,400 to 14,600 feet. The proration unit for the well is the south half of Section 21.

The plat shows the two other offestting wells are completed in the Morrow common source of supply;

the first being in Section 17, the Santa Fe Energy Pure Gold C, and the in Section 29, the El Paso Natural Gas Mobil Federal Well.

The purchaser for the Pure Gold A is El Paso Natural Gas.

Q Mr. Johnston, is the Sand Dunes West Morrow Pool and prorated gas pool?

A No.

Q And is this a standard spacing unit that is dedicated to the subject well?

A Yes.

Q Does this plat also show the offsetting operators?

A Yes, it does.

Q Has notice of the application been given to each of these offsetting operators by certified mail?

A Yes.

Q And did the notice that was given them contain the minimum sustainable producing rate which you seek in this case?

A Yes.

Q What minimum sustainable producing rate is Kaiser-Francis seeking in this case?

A 350 Mcf per day.

Q And how was this rate obtained?

A This rate was obtained by inspection of our daily rate for the period May through June of 1984.

Q In your opinion will underground waste occur if production from this well is curtailed below that recommended minimum sustainable producing rate?

A Yes.

Q Would you please summarize generally the problem which Kaiser-Francis is experiencing with this well?

A In May of 1983 we experienced a rapid increase in our water production from this well, which we believe now to be the result of a downhole leak in the near vicinity of the producing zone.

The increased water production has, in our opinion, caused a decrease in the deliverability of the well and with logoffs and curtailment by the purchaser has put us in a posture where we were compelled to ask for hardship classification for this well.

Q Have you prepared a number of exhibits to detail the problem which you've been experiencing?

A Yes, I have.

Q Would you refer to the monthly gas production curve contained in Exhibit A and review this for Mr. Quintana?

A All right. The production graph in Exhibit A is a plot of the monthly gas production from the Pure Gold A No. 1 versus time in months.

If you'll refer to the first year of production history on this well, 1981 through the middle of 1982, during that period of time the well was on a capacity

decline, or there were no market or curtailment problems.

In mid-1982 we began experiencing curtailment as a result of market demand problems. As I mentioned earlier, in May of 1983 the well began producing substantial volumes of water. Prior to that time the well had produced in the nature of a barrel of water per day.

In May of 1983 the well produced 900 barrels of water and has produced 5 to 8 barrels of water per day on the average since that time.

The well was shut in a total of 29 days in June and July of 1983 and swabbing was required to restore production.

The next down time that you see in early 1984 was again a result of curtailment. Again swabbing was required to restore production.

Since May of this year the well has been shutin most of the time.

Referring back to the early time period, the capacity decline before curtailment was extrapolated along the line that we've indicated on the exhibit to an ultimate recovery of approximately 1.4 Bcf.

If you'll also note on this curve, the capacity decline indicates that currently if the well were producing at capacity without any kind of water problems at all, if the leak had not occurred, the well should be able to produce in the neighborhood of 600 Mcf per day, and we'll have more to say about that later.

Q Would you now refer to the material balance curve and review that for the Examiner?

A The next part of Exhibit A is a gas material balance curve for the Morrow reservoir completed in the Pure Gold A. It's a plot of corrected bottom hole pressure as calculated from surface pressure, shut-in pressure data versus cumulative gas production. The original point shows -- excuse me, is based on an original bottom hole pressure of 6750 pounds. That point and the next two points were taken early in the life of the well before any appreciable water production occurred, and we believe could be extrapolated to another measure of ultimate recovery, which, as you can see, is also in the neighborhood of 1.4 to 1.5 Bcf.

We feel this confirms the decline extrapolation and tells us that we have a volumetric reservoir here without water drive.

The last point on the graph was taken in July of 1983 and shows the effect of the increased water production on the surface tubing pressure, and this is a result of water loading and a waterleg existing in the well when it's shut in.

Two other points from this graph: Our current cumulative production from the well is approximately 930-million cubic feet of gas. This then would indicate remaining reserves on the order of 450 to 470-million cubic feet.

Also indicates that our current reservoir pressure is in the neighborhood of 2200 pounds.

Q Will you now go to the production data and review that material?

A The next part of Exhibit A is a table detailing monthly production data for the well for 1982, 1983, and 1984. We've shown 1981 as a yearly summary at the very top.

What we show here is monthly gas production in Mcf; the flowing tubing pressure averaged from our gauge reports; the shut-in days, again from our gauge reports; swabbing costs from actual invoices paid to wireline companies; and for the water produced that was determined from invoices from our water hauling charges.

And what this shows is, first of all, the effect on our flowing tubing pressure when we had the leak. If you'll look at our flowing tubing pressure prior to may, they were running in the 950-pound range. After the leak we dropped down to 700 to 800 pounds.

You can also see in May the water production, and the steady water production that has occurred in the neighborhood of 6 or 7 barrels of water per day since then when the well is on.

Turning to the second page of this exhibit, turning your attention to the last few months here, you can see that from the shut-in days and the production that we've been down more than we have been on. Our swabbing

costs are running in the neighborhood of about $3-to-$5000 per month currently, and with our monthly production averaging in the 2-to-3-million per month range and our swabbing costs added on top of our normal operating costs, we're doing little more than breaking even economically right now.

Q Would you now refer to the table showing monthly average deliverability and review that?

A The next part of Exhibit A is a table showing what we calculated to be monthly average deliverability for the latter part of 1983 and 1984.

This shows the days produced in the time periods shown. By the way, 1983 is the interval August through December of 1983.

And then monthly data for 1984.

The average deliverability in Mcf per day is simply the monthly production divided by the days produced. We feel this is true deliverability since the well was not curtailed or pinched back in any way. It was delivering at capacity during this period of time to the pipeline company when it was producing.

We also show the average wellhead flowing tubing rpessure for the respective month or time period.

I might point out here, July looks a little strange. The well was only on for about three hours, I believe, a few hours in July and it was shut-in the entire rest of the month, so you have to discount that number.

I refer you back, if you will, to our

production decline curve, and we said at that time that the extrapolation of that capacity decline prior to our curtailment and our leak problems would indicate that the well should be capable currently of producing in the neighborhood of 600 Mcf per day in mid-1984, and that's taking into account an adjustment for the fact that, of course, this capacity was not met and the curve has to be shifted slightly because of that.

If you'll not from our average deliverability table here, in the first part of 1984 we were running in the neighborhood of 450 to 550 Mcf per day generally, and this is down some from our expected, excuse me, our expected 600 Mcf per day.

Since May of 1984 the extensive down periods have caused the well to only be capable of in the neighborhood of 300 to 350 Mcf per day when it is producing. And if you'll note, we have a corresponding drop in our flowing tubing pressure along with that. In other words, it takes more drawdown and we're getting less gas rate.

We have two other observations here that we'd like to make that do not reflect in the table.

The last data that I have showed that it took eight days of continuous swabbing in late August and early September to restore this well to production, and that was after being down essentially all of July and 21 days in August.

Previously we would often see a flush

production for a few days after the well was swabbed back in and put on sales production. As of late we have not seen that and the well has had a much harder time recovering.

This information, to us, is a strong indication that the water in admission into the Morrow reservoir is getting worse as down time increases and as the reservoir pressure continued to decline as a result of depletion.

It's my opinion that this is causing a permanent loss in productivity that will get worse with time. The deliverability trend since April bears this out.

We've asked for a 350 Mcf per day minimum sustainable rate. We're concerned now that the well may not even be capable of that.

We have plans to put a compressor on the well shortly to keep it flowing while it is on and producing. The compressor, however, is not going to eliminate the productivity problem caused by the extended down time and the well will still have to be swabbed to keep it shut in.

Q Mr. Johnston, is it your testimony that the recent curtailments have resulted in a permanent loss of deliverability?

A Yes.

Q If this well were permitted to produce at longer -- for longer periods of time, do you believe that you would see a higher deliverability figure?

A Perhaps.

Q When the well comes on you're not seeing the surge of production that you originally did, is that correct?

A No, we're not.

Q Would you now refer to the daily well history and review that for Mr. Quintana?

A We mentioned earlier that our minimum sustainable rate number was determined from inspection of cur daily gauge data from May and June and we've detailed that for you in this next exhibit.

The first page is the daily data, production volumes and flowing tubing pressure, uncorrected numbers from our gauge reports from May, and the second page is the same data from June.

The, if you'll glance at these numbers, you'll see that these two months contain five separate incidences of logoff and these have occurred generally at rates ranging from about 200 Mcf per day up to 350 Mcf per day.

We do have surges in the line pressure out there and we have had logoffs in the range of 300 to 350 Mcf per day, so we feel that a minimum of 350 Mcf per day with sustained production in the face of the line pressure surges that we see out here.

Q Would you now refer to the wellbore sketch and initially explain if in your opinion there are any mechanical changes you could make in the well to eliminate this problem without seeking a hardship classification?

A All right. The last part of Exhibit A is a wellbore sketch, cross section, of the tubing and casing in place in the well.

The well is completed under a packer on 2-7/8ths inch tubing set at 14,338 feet. It's completed behind two strings of production casing and two production liners, the last one being a 5-inch liner as you see on the diagram here.

When the leak occurred in May of 1983, we thought that one of two things was probably happening; either we had -- our packer fluid was leaking into the wellbore behind the packer or we had a leak in the casing or from one of the liner tops. With all these things, we thought that the likely thing was. We tested the tubing-casing annulus and we've had neither a gain nor a loss in our packer fluid and we're able to hold pressure on the back side of the tubing and casing.

So we have mechanical integrity the top of the packer.

This leads us to conclude that the leak is occurring behind the last 5-inch liner into the wellbore via the perforations.

With that in mind, we looked at the logs to see where we might have an aquifer or a zone that produces water that might be leaking into the wellbore. We didn't see anything that wasn't either hydrocarbon production or, we feel, too tight to produce, except for one zone,

the zone at 14,225 feet on the logs, that calculates 5-to-8 percent porosity and 40 percent water saturation.

Drill stem tests over this interval, and several other zones, gave up gas along with water. So we feel that this is probably where, excuse me, probably where the water is coming from.

If that's the case, then it's leaking behind the 5-inch liner past the packer into the perforations across the Morrow completion.

In order to fix that we'd have to pull the tubing and that would mean dumping 14,400 feet of packer fluid on the Morrow. Again, the Morrow is down to 2200 pounds. We'd have to squeeze cement the leak, which is going to have to be done in the vicinity if not through the producing perforations across the Morrow. It's going to have to be done at several hundred pounds surface pressure, which means several thousand pounds pressure at the sand face, and we feel that what you're going to do is have a squeeze job on your Morrow producing zone.

The squeeze cement is going to take the path of least resistance, just as the water has, so in all likelihood we'd wind up squeezing off our remaining, roughly, half a Bcf of reserves if we tried to fix this.

We have looked at, briefly, at trying to lift the well, put in smaller diameter tubing, a plunger lift. At almost 15,000 feet of depth, all of these alternatives are just not practical; mechanically not feasible.

Q Do you believe installation of a compressor will alleviate the problem?

A Installation of a compressor will allow the well to flow better when it's on production. It will not eliminate the problem when the well is shut in. We'll still have a logoff and the well will still have to be swabbed.

Q In your opinion if a hardship classification is not granted for this well, could it result in its premature abandonment?

A Yes. We, looking at two possibilities here, if -- if we don't have a loss in deliverability that's rapid and permanent, if the well continues to produce and we simply have to swab the well once a month with the current time we're seeing, the increased costs are going to raise the economic limit of this well to a point that we will lose 90-million cubic feet of remaining reserves.

The worst case, if we are not granted this classification and the well logs off permanently and we go out and swab it one day and are unable to get it back, we will have lost the remaining, roughly, half a Bcf of reserves.

Q Mr. Johnston, you set the minimum sustainable producing rate based on the productive -- or the production history from the well, is that correct?

A That's correct.

Q Would Kaiser-Francis be willing to run a

logoff test witnessed by the Oil Conservation Division to set a more exact minimum sustainable producing rate?

A Yes, we would.

Q In your opinion has Kaiser-Francis acted in a responsible and prudent manner attempting to eliminate the problems with this well prior to coming to the Commission seeking a hardship well classification?

A Yes.

Q Will granting this application result in the prevention of waste of natural gas?

A Yes.

Q Will granting the application be in the best interest of conservation and the protection of correlative rights?

A Yes.

Q Was Exhibit Number One prepared by you?

A Yes.

MR. CARR: At this time, Mr. Quintana, we would offer into evidence Kaiser-Francis Exhibit A, not Exhibit One.

I misspoke and said it was Exhibit One. It's Exhibit A.

MR. QUINTANA: Exhibit A will be introduced in evidence.

MR. CARR: That concludes my direct examination.

CROSS EXAMINATION

BY MR. QUINTANA:

Q Mr. Johnston, I have one question for you. Could you explain for the record the mechanism that occurs when flowing waters invade the Morrow zone?

A Two things can occur when foreign -- three things can occur when foreign waters invade the Morrow, depending on the chemical composition of the water and the Morrow water, you may have scaling, precipitation of solids, scale.

A very common occurrence in the Morrow, and it's widely known the Morrow is sensitive to foreign waters that are fresher than the Morrow, plat swelling can occur.

The third thing that can occur, we feel is the dominant factor here, is that if you load a low pressure gas reservoir that has inherently low permeability, you increase the water saturation around the wellbore and the water saturation, reduction in the gas saturation reduces the relative permeability to gas and thus the ability cf the formation to flow gas through it.

And this is what we referred to as water loading or inhibitions, and this can get to a point on a relative permeability relationship where you can no longer flow gas at economic rates.

Q Which do you think is the most prevalent cf the three mechanisms?

A It's our opinion now that of the three it's probably the third one that I've talked about.

MR. QUINTANA: That will be all. No further questions. The witness may be excused.

Case 8336 will be taken -- oh, excuse me.

MR. KENDRICK: I'd like to make a statement on the case.

El Paso Natural Gas Company neither concurs with nor objects to this application.

El Paso recognizes that some wells should definitely be recognized as hardship wells.

El Paso believes it must express to the New Mexico Oil Conservation Division that any time a well is declared a hardship well, then the extra volume of gas that is taken from this well must be subtracted from the total production from all other wells on our system. This increases the non-controllable gas taken into our system, thereby reducing our flexibility of pipeline operations to take ratably and protect correlative rights.

MR. QUINTANA: Thank you, Mr. Kendrick, for your comments.

MR. CARR: I also have a brief statement.

Mr. Examiner, Kaiser-Francis Oil Company comes before you seeking classification of its Pure Gold A Federal Well No. 1 as a hardship well. We sub-

mit that we have done all that can reasonably be done to eliminate the problem we're experiencing with this well without first coming before you seeking this classification.

We are aware that when a hardship classification is granted, it means that gas takes from this well may distort the market and that there may -- and that there will be somewhat -- a somewhat smaller take from other wells in the area.

We are in a situation, however, that -- and we believe the evidence shows that in the past when production has been curtailed the well has had a permanent loss in its deliverability; that if this continues, reserves will be lost; that waste will be caused; and that we may ultimately lose the well and not be able to produce reserves that are otherwise available to it, and we're concerned that there will be a permanent loss, not just a delay in takes as will be experienced by other wells which are connected to the same system and in the same pool.

We believe that granting this application is appropriate; that it is the only possible avenue available to us now to prevent the loss of these reserves, and that granting this application will in fact prevent the waste of natural gas.

MR. QUINTANA: Thank you, Mr. Carr.

Are there any other comments?

If not, the witness will be ex-

cused.

Case 8336 will be taken under advisement.

(Hearing concluded.)

C E R T I F I C A T E

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

Sally W. Boyd C.S.R.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 8336, heard by me on OCT. 17 1984.

Gilbert P. Quintana, Examiner
Oil Conservation Division