CASE 3409: Application of DR. SAM G. DUNN for a secondary recovery project by injection of air.

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ETC.

GOVERNOR
JACK M. CAMPBELL
CHAIRMAN

State of New Mexico
Oil Conservation Commission

LAND COMMISSIONER
GUYTON B. HAYS
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

P. O. BOX 2088
SANTA FE

June 8, 1966

Mr. Jason Kellahin
Kellahin & Fox
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

Re: Case No. 3409
Order No. R-3076
Applicant:
Dr. Sam G. Dunn

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

Carbon copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other Mr. Frank Irby

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. 3409
Order No. R-3076

APPLICATION OF DR. SAM G. DUNN
FOR A SECONDARY RECOVERY PROJECT,
CHAVES COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on May 25, 1966, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 8th day of June, 1966, 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, Dr. Sam G. Dunn, seeks permission to institute an air injection project in the Leslie Spring-San Andres Pool by the injection of air into the San Andres formation through three injection wells in Section 26, Township 7 South, Range 26 East, NMPM, Chaves County, New Mexico. Further, that the applicant seeks an administrative procedure whereby said project could be expanded and additional wells placed on air injection without notice and hearing.

(3) That the cores of the wells in the project area indicate a high degree of oil saturation, but there appears to be an almost complete lack of reservoir energy to move the oil to the well bore.

(4) That the applicant proposes to inject air into the upper portion of the reservoir, thereby forming an artificial gas cap in an effort to reduce the viscosity of the oil and create sufficient reservoir energy to produce the oil.

(5) That the proposed air injection project may result in the recovery of otherwise unrecoverable oil, thereby preventing waste.

(6) That the subject application should be approved and the project should be governed by the provisions of Rules 701, 702, and 703 of the Commission Rules and Regulations.

IT IS THEREFORE ORDERED:

(1) That the applicant, Dr. Sam G. Dunn, is hereby authorized to institute an air injection project in the Leslie Spring-San Andres Pool by the injection of air into the San Andres formation through the following-described wells in Section 26, Township 7 South, Range 26 East, NMPM, Chaves County, New Mexico:

Dale Federal Well No. 5, located 2310 feet from the North line and 1650 feet from the West line;

Dale Federal Well No. 6, located 2310 feet from the North line and 330 feet from the West line; and

Dale Federal Well No. 7, located 1650 feet from the North line and 990 feet from the West line.

(2) That the subject air injection project is hereby designated the Leslie Spring Air Injection Project and shall be governed by the provisions of Rules 701, 702, and 703 of the Commission Rules and Regulations.

(3) That the Secretary-Director of the Commission may authorize the injection of air by the applicant into additional wells in the Leslie Spring-San Andres Pool or within one mile thereof without notice and hearing provided offset operators have been notified of such proposed injection and have not objected thereto within a 15-day waiting period.

(4) That monthly progress reports of the air injection project herein authorized shall be submitted to the Commission in accordance with Rules 704 and 1120 of the Commission Rules and Regulations.

(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

JACK M. CAMPBELL, Chairman

GUYTON B. HAYS, Member

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

esr/

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
May 25, 1966

EXAMINER HEARING

IN THE MATTER OF:

Application of Dr. Sam G. Dunn for a secondary recovery project, Chaves County, New Mexico.

Case No. 3409

BEFORE:

Daniel S. Nutter, Chief Engineer

TRANSCRIPT OF HEARING

MR. NUTTER: Call Case 3409. Application of Dr. Sam G. Dunn for a secondary recovery project, Chaves County, New Mexico.

MR. KELLAHIN: If the Examiner please, Jason Kellahin, Kellahin and Fox, Santa Fe, appearing for the applicant. We have one witness I would like to have sworn.

(Witness sworn.)

(Whereupon, Applicant's Exhibits 1 through 15 marked for identification.)

* * *

L E W I S C. J A M E S O N, a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Lewis C. Jameson.

Q Who are you employed by and in what capacity?

A I am employed by Petroleum Consultants, Incorporated. The corporation was formerly Val R. Reese and Associates, Incorporated. The name change was approved by the State Corporation Commission, effective August, 1965. I'm a geologist and Vice President and Manager of Petroleum Consultants.

Q Have you testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes, I have.

MR. KELLAHIN: Are the witness' qualifications acceptable?

MR. NUTTER: Yes.

Q (By Mr. Kellahin) Mr. Jameson, in what way is Petroleum Consultants, Incorporated interested in the application of Doctor Sam G. Dunn in this case?

A We were employed by Doctor Dunn to compile the information in support of the application.

Q And are you familiar with the application?

A Yes, I am.

Q Would you briefly state what that proposes?

A Doctor Dunn proposes to inject air into wells on the updip end of the Reservoir in the Leslie Springs San Andres Pool, and as the air injection continues the air-cap will expand and will extend horizontally in conformance with the overlying trap area and it will extend vertically downward toward the base of the porous section. The operator proposes to continue air injection above the air-oil contact and to produce oil from wells below the air-oil contact.

Q If I understand your answer, then you propose to establish an artificial gas cap or air-cap which will drive the oil down the structure to the lower wells, is this correct?

A Yes, that's correct. In injecting air into the reservoir there are two approaches. And one method, of course, is very familiar since it's used most commonly in flooding by use of natural gas, that's simply to inject with a pattern and at rates that will cause the compressed gas to be air or natural gas to pass through the oil and to be produced with the oil production. This method uses a frontal drive in which the fluid movement is mostly horizontal. The second approach is simply to aid nature by establishing an artificial gas cap which exerts a downward force on the oil, and mostly in this case is vertically. This causes the oil to move downward until it reaches a more permeable section and then horizontally to the nearest producing well.

Q Why was the air-cap or vertical movement chosen for this particular field?

A Well, in this field there is no bottom hole pressure and it's going to take a lot of injection to change the pressure significantly over this large of an area. Therefore, it was felt that to utilize a vertical drive would give a faster initial effect since there would be some small amount of movement start immediately, and then this movement would extend laterally and increase in aerial extent. By use of the gas cap or air-cap there will be a minimum of waste on the compressed air. The air will be retained in the reservoir and

will continue to exert a force so long as it is in a compressed state. And this is a distinct advantage since even with a mechanical breakdown there isn't a serious damage to your flood because your gas cap expansion continues to exert an expelling force on the oil. In contrast, the effectiveness of a frontal drive is lessened immediately if injection stops and fluid segregation begins.

Q Were there other considerations in arriving at your decision?

A Yes. Since production rates were initially rather high under virgin pressure, which at very best was very low, there doesn't seem to be a need to wash the reservoir by forcing the injecting air or gas through the reservoir. In other words, so long as there was any pressure at all, production from the reservoir was at substantial rates, in fact, the Number 2 Dale-Federal Well produced at a rate of 30 barrels of oil per day for 3 days, at which time its pressure was rather dissipated and production dropped considerably.

Q In these fields the pressure has dropped quickly after the well has been drilled?

A Yes.

Q Why is it proposed to use air for injection instead of natural gas?

A There's no gas produced in association with this oil and, in fact, electricity is used in pumping the wells. The nearest gas production is in the Acme Pool approximately 3-1/2 miles to the Southeast, and it's rather doubtful that this source would furnish sufficient gas to use in flooding the reservoir, the transmission of gas over this distance prior to compression, and then after the secondary recovery project is terminated the recompression of the gas for sale, and you might say salvage is rather expensive. And where gas must be transmitted this distance from a doubtful supply the economics certainly favor the use of another injection media.

Q Aren't there some disadvantages to using air for injection purposes?

A Yes, sir, the major disadvantage, which comes to mind, when a significant amount of gas is present and air is injected into the reserves, there is a possibility of obtaining an explosive mixture. This isn't any greater than the possibility you run for an explosion when air drilling. However, the possibility does exist. Such a possibility seems to be rather remote in this pool since the most optimistic report of gas production is, there has been a trace, and another consideration would be that if a field considered for air injection contains a significant amount of gas you would want to consider the fact that the injected air would be

contaminating the gas that already exists in the reservoir and make that gas unavailable.

Q Aren't there certain advantages to using natural gas as a media?

A Yes, the methane in the gas is absorbed under pressure into the oil and makes the oil more moveable in the reservoir since the gravity is increased and the viscosity is reduced, and this, of course, simply increases the effectiveness of the permeability.

Q To sum this up, then, Doctor Dunn proposes to use air primarily for economic reasons, is this correct?

A Yes.

Q If gas were available at an economic media he would prefer to use gas, is this correct?

A Yes, since you do have additional benefits with the gas that you don't have with air.

Q Has a vertical drive and pressure media been tried in other areas?

A Yes. What brought this to Doctor Dunn's mind was his personally witnessing of a field being flooded by this method in Kansas. A Mr. Ralph Spearow of Osawatomie, Kansas has used this method on his company wells in the Osawatomie Field, and he is very enthusiastic about the results that he has obtained. In fact, Mr. Spearow holds several patents on

the vertical drive use of air as an injection flood, much in the same method that one of the major oil companies holds the patent on the use of oil in reservoirs to fracture. This method has been discussed in several publications. "The Petroleum Engineer" magazine for January of 1954 and for July of 1954 contained articles by Mr. Spearow on this method.

Q Do you know whether the method has been used in New Mexico?

A To my knowledge it hasn't.

Q What is the location of the Leslie Spring Pool?

A The pool is approximately 26 miles Northeast of Roswell, North side of the Roswell to Portales highway, located in Township 7 South, Range 26 East. The portion of the pool to be included in the proposed secondary recovery area is in Section 26 and an additional well is included within the defined limits of the pool in Section 27 of that Township and Range.

Q Have you prepared a plat showing this area?

A Yes, my Exhibit 1 is an area map that shows the wells and acreage ownership within a two-mile radius of the proposed secondary recovery area.

Q Is this the same map filed with the application?

A Yes, with the exception that the Well Number 7 and 8 have been corrected. The previous map showed the Number 8

Well as being located 990 feet from the West line and 1650 feet from the North line of Section 26, when in actuality this is the location of Well Number 7. The Well Number 8 is located 2310 feet from the West line, 1650 feet from the North line, and this is the location shown for Well Number 7 in the previously furnished map.

Q Is this information based on a personal inspection by you?

A Yes. I visited the area last Saturday to determine what the location of these two wells were, since the reported locations were rather in confusion in the Commissions records. Both wells are carried in the Commission's files as drilling and the final forms have not been filed.

Q Would you discuss the other information shown on Exhibit 1?

A The proposed secondary area is included in red. The area is extended to include the 40 acres dedicated to Well Number 3. This has not been included within the defined limits of the pool since the Commission's records do not include a copy of Form C-104 on this well. The reason for this, I believe, is probably due to the form never having been typed. I have a copy of a handwritten C-104 showing an initial potential taken on this well in September of 1964 during which production was 2 barrels of oil and 2 barrels of water per

day.

Q Will you file a C-104 on this well?

A Yes, I will.

Q As I understand, no allowable has ever been assigned to the well?

A No, the well is not being produced at this time since it is such a low producer and doesn't make a significant amount of water compared to its production of the lease.

Q Your Exhibit 1 shows additional information. Would you continue your discussion of that?

A Yes. The acreage ownership within this area is shown. This is mostly Federal acreage and the acreage ownership was obtained from the Bureau of Land Management Records. The land that is owned by the State of fee has not been checked in the County Records to determine the ownership. The ownership in this case was determined from commercial lease ownership maps.

Q Do you have any information on lease sales in this area?

A Yes. After Shell drilled a dry hole in the Northwest Quarter of Section 14, it's my understanding that Shell offered Doctor Dunn their acreage in Section 14. That was the entire section, and the North half of Section 23 and

the North half of Section 34 if Doctor Dunn would simply pay the rentals. Since this time these tracts have reverted to the Government and they have been refiled upon. The map shows the new ownership of these three tracts. In addition, Doctor Dunn has allowed two 40-acre tracts in Section 36 to revert to a previous owner, Mr. Hanson, after Doctor Dunn drilled a dry hole in the Northwest Quarter of Section 36. Based on this information it seems that acreage in this area is changing hands rather cheaply.

Q The map does however show a number of producing wells. What is their productive capacity?

A Doctor Dunn's 9 wells in Section 26 have a total capacity at this time of 5 barrels of oil per day. In conjunction with this, from 6 to 8 barrels of water is produced. This production is obtained from the Number 1, 2, 4 and 5 wells. The Number 3, 6 and 9 wells are not being produced at this time. The Number 7 and 8 wells are not yet completed. Number 7 has been perforated and treated with acid and has not yet been potentialed. The Number 8 well is perforated but not yet treated with acid. If additional wells from these 9 are produced in order to increase the oil production to a 7 to 8 barrel per day rate the water increase is greatly out of proportion to the increased production of oil, and at 7 to 8 barrels of oil production the water is 38 barrels per day.

Q Now, the plat also shows a well to the West and another well, Lee Number 1 in Section 33. What is the status of those wells?

A The Dunn Number 1 Dale-Federal A in Section 27 is being produced only intermittedly because of an excess water production. The only other producing well within the area is the Lee Number 1 Dale-Federal in Section 33. It is my understanding from talking to Doctor Dunn's production superintendent for this area that the Lee Well is in need of a pump replacement at this time, although it has produced well in the past.

Q In summary, what is the economics of operating wells in this area, under present conditions?

A The production rates are too low to justify continued operation of these wells. Although the reservoir looks good, the oil is simply not being recovered due to a lack of pressure. To quote Doctor Dunn, the wells are "dead ducks economically speaking."

Q Has there been any cumulative production of any consequence?

A No, sir.

Q This is really a salvage operation more than it is a depleted reservoir, is this correct?

A That's true. Doctor Dunn got a taste of fairly

good rates on his Number 1 and 2 wells and he kept trying to better this, and he was continually unable to equal it.

Q What were his drilling costs on these wells?

A Drilling costs are $4.00 a foot; completed well costs $12,000.00, and therefore Doctor Dunn's investment in these wells in Section 26 is approximately $108,000.00.

Q Have you prepared a well history on the wells involved here?

A Yes, I prepared an exhibit which is my Exhibit Number 2 from the information in the Commission's records giving completion information and the results obtained. The only information shown on my Exhibit Number 2 that wasn't from the Commission files was obtained from the service company records and consisted of pressure information on acid treatments. I believe there's one other exception to this, too, in that Doctor Dunn's wells in Section 26 show two different elevations. The first is listed as "Surveyed Elevation" and the next elevation is called "Mapped Elevation". This mapped elevation will be discussed in a later exhibit.

Q Is there any other information contained in Exhibit 2 that you should mention at this time?

A Yes, it should be pointed out that Dale-Federal A Well Number 1, Dale-Federal A, shown on Page 3 of the exhibit, was completed September of 1964 with the first production in

October of 1965, for initial potential of 5 barrels of oil per day and 20 barrels of water per day. Based on this information the Commission has extended the pool limits through Section 27 to include this well. This, of course, is within keeping of the rule that the well is within one mile of a producing pool. The production information on this well, however, simply indicates that the well is uncommercial and is in fact considerably passed what might be considered as commercial limits within the Leslie Spring Pool. And I base my belief that the well is passed this economic limit partly on the fact that the well will only produce oil intermittedly. It is shut in, and when pumping is resumed the first production is oil and then water is produced and you can in fact pump the water completely off and obtain only a rainbow of oil until once again the well is shut in and the oil is allowed to accumulate.

Another factor in forming of my belief that this is outside the commercial limits is that Well Number 6 and 7 in Section 26 produced a considerable amount of water, and wells Number 6 and 7 also had a significantly higher treating pressure than was obtained in wells to the Eastern side of the pool. Well Number 6 was initially potentialed for 5 barrels of oil and 75 barrels of water per day, and Well Number 7 has not yet been initially potentialed, however it does show

indications of being in large part simply a water well.

These wells are on the updip side of the field and it's very probable that the high pressures used in acid treating have simply broken into a higher water bearing section.

Q In your opinion, your Dale-Federal 1A Well is not properly a part of the project area as you see it, is this correct?

A No. I believe that the pool terminates in the area of the Number 6 and Number 7 wells.

Q In your opinion are Wells 6 and 7 in a better portion of the Leslie Spring's Pool?

A Yes, they are.

Q Referring to Exhibit 2, again, would you summarize the completion method that has been used on Doctor Dunn's wells?

A Casing has been set through on all wells except the Number 9. The Number 9 Well was completed through the open hole and the rest of the wells were perforated in the Slaughter Zone of the San Andres and then treated with acid and sand. 4-1/2" casing was used on the first five wells, and 5-1/2" casing was used on well Numbers 6, 7, 8 and 9.

Q Were different completion methods attempted on these various wells?

A Yes, various kinds of perforations were used; sand jetting was tried. Well Number 6 was treated with acid and

sand down the tubing by use of a packer set above the perforated intervals, and of course, as I mentioned, Number 9 was attempted as an open hole completion. None of these attempts showed any great improvement in the results obtained.

Q What about the treating pressures we used?

A In the Eastern portion of the pool the maximum treating pressures were approximately 1500 pounds. The Well Number 6, the treating pressure was 2500 psi, and in Well Number 7 the pressure was 3,000 psi, and on Well Number 7 it still took several hours to inject the acid, even under this high pressure.

Q Were any of the wells cored?

A Yes, my Exhibit 3 and 4 are the core analyses from Well Numbers 4 and 7 respectively. The analyses were made by Core Laboratories and are of the Slaughter Zone of the San Andres formation. The Exhibit Number 3, Well Number 4, shows that the log top at the Slaughter Zone was at 1489 feet. The cored interval did not begin until 1497 feet and therefore only a portion of the Slaughter formation has been analized. The well was perforated in a section opposite Sample Number 5 which was from 1501 to 1502, and Sample Number 6 which was 1502 to 1503, and Sample Number 8 from 1504 to 1505. The porosities on these three feet were 20 to 21 percent. The water saturations in the upper two feet were approximately

26 percent, and in the lower foot 42 percent.

Very little can actually be determined from this core analysis except a significant amount of oil is in the reservoir. The water saturations are rather erratic throughout the cored section and there is no clear-cut water table. Completion has been in the more porous section and no attempt has been made to open sections which are slightly lower in porosity, but which in many instances do contain low water saturations.

Q What is shown on Exhibit 4 in regard to the core analysis on the Number 7 Dale-Federal Well?

A The log top was at 1442 feet. Again, the cored section did not begin until 1461 feet after a considerable portion of the Slaughter Zone had been drilled. The well was cored to a total depth of 1502. I don't have the perforations on this well but a fairly good porous section is noted opposite Sample Numbers 7, 8, 9, 10 and 11. This is the interval from 1467 feet through 1472 feet. The porosity on this interval averages 21 percent, and the water averages 24 percent. The permeability in this five foot interval is erratic, being 34 millidarcys, 3.7, 18, 1.8 and 8.5 millidarcys.

Q Were logs run on all these wells?

A Yes. Gamma Ray-Neutron logs were run on all the wells.

My Exhibits 5 through 12 are Xerox copies of these logs with the exception of the log on Well Number 5. Although the well was logged, Doctor Dunn didn't have a copy of the log in his files, and although his production superintendent was to furnish me a copy, the copy was not received prior to the hearing.

Q What other information is shown on the logs?

A The casing points and the perforations and the initial potentials. The tops of the Slaughter Zone are shown on the exhibits.

Q This top of the Slaughter Zone, was that the information used in compiling your structure map, which is Exhibit 13?

A Yes, it is. My Exhibit Number 13 is a structure map of the proposed secondary recovery area.

Q Would you discuss the information shown on this map?

A The contours are on the top of the Slaughter Zone and are at intervals of 10 feet. The dip is to the east-northeast and is much steeper to the west where the dip is approximately 110 feet to the mile while the dip to the east is at a rate of approximately 55 feet to the mile. Some nosing occurs between the No. 1 and No. 4 wells where the rate of dip is the shallowest. Although structure does not seem to play a major

part in the accumulation, where the dip is shallow the best wells and lowest water production rates have been obtained even though this is on the structurally low side of the field. The highest well in the field, the Well Number 6, was previously mentioned as having produced five barrels of oil and 75 barrels of water on its initial potential test. The Number 1 Well, which is the lowest well in the field, produced 12 barrels of oil and 20 barrels of water on its initial potential test. The best production in the field is obtained from the Number 2 Dale-Federal Well which initial potentialed for 20 barrels of oil and 15 barrels of water.

Q Now, your Exhibit Number 2, as I recall, showed two different elevations on your tabulation of well information in Section 26. Which of these elevations was used in determining your structural map?

A The elevation shown on Exhibit 2 as mapped elevation was used in determining the contour points. Prior to making a structure map I make a practice of checking the surveyed elevation against my available topographic contour map. In making a check on this area I was surprised to find that the surveyed elevations were all either less than 3800 feet or only very slightly in excess of 3800 feet, while the topography map showed that the 3800 foot elevation and the 3850 foot elevation occurred along the eastern boundary of the section.

The information on the survey plat elevations, together with the elevations obtained from observations on the topographic map are shown on Exhibit 14.

Q How was Exhibit 14 compiled?

A The survey elevations were listed for the nine wells, and then the elevations were read from the topography map. In order to determine some reason for this difference, tabulation was made of the difference between the two elevations. It was observed that wells 5, 6, 7 and 8 had a difference in elevations of 54 feet. It so happened that these four wells were surveyed on May 5, 1964, and I checked on the topography map and found that an elevation was listed for the Southwest corner of the Section 26 that was exactly 54 feet higher than the elevation listed in the Southwest corner of Section 27. The elevation for the Southwest of 26 was 3795 feet, while the elevation listed in the Southwest corner of Section 27 was 3741 feet. It seems that in determining the rise in elevation from the section corner up to the well locations, the surveyor simply got a section off in reading his starting elevation. I was unable to find such an evident error to account for the other well elevations. It was evident that the accuracy in reading the elevation from the topography map was sufficient to contour the top of the Slaughter Zone in this area.

Q Now, referring back to your Exhibit 13 into which of the wells would air initially be injected?

A Initial injection would be into Well Number 6. As the air-cap expands injection would be expanded into Well Numbers 7 and 5. In actuality, injection into Well Numbers 7 and 5 should not begin until after air has been produced from the upper perforations in these two wells. Whether or not this will be feasible will be determined by the injected rate that's obtained after injection begins into Well Number 6. The use of dual purpose wells will be utilized wherever possible in order to inject air above the air-oil contact and to produce oil from below the contact. A diagrammatic sketch of this dual purpose well is my Exhibit 15.

Q Would you explain your Exhibit Number 15?

A The depths and completion information used on this diagrammatic sketch are from the Dale-Federal Number 6 Well. By use of a packer above the perforated interval, which is from 1405 to 1422 feet, air would be injected down the casing through perforations to be made in the top of the Slaughter Zone from 1400 to 1404 feet. After the air-cap is established and begins expansion, the packer will be removed in the Number 6 Well and the entire interval converted to air injection. After air breakthrough occurs in Well Number 7, which is 24 feet structurally lower than the Well Number 6, Well Number

7 will be converted to a dual purpose well. With additional expansion of the gas cap, the upper interval in Well Number 5 will be converted to air injection. The dual purpose well is an attempt to only inject into the air-cap and to produce only from below the air-oil contact. In practice, it will, of course, not always be possible to adhere strictly to this concept, but when it's impossible to do so the result will simply be in a loss of some air through your production perforations. This loss will, of course, be attempted to keep at a minimum, since to inject additional air we'll simply extend the economics of the secondary recovery project.

Q Do you have any additional information to offer in connection with this project?

A No, I don't. I simply believe that due to the poor economics of producing this area, which does seem to have an abundance of in-place reserves, there should be some attempt at secondary recovery, and I believe that the use of a vertical drive air flood will result in the recovery of a considerable amount of oil. The field seems ideally suited for this type flood.

Q This oil is oil that would not otherwise be recovered?

A Yes.

Q The approval of this application would result in the prevention of waste?

A Yes.

Q Would it effect the Correlative Rights of any other operator?

A No. Doctor Dunn owns all of the directly offsetting acreages.

Q Were Exhibits 1 through 15 prepared by you or under your supervision?

A Yes.

Q In connection with the application, Mr. Jameson, there was a request for approval of administrative procedure for production only and for other provisions as may appear necessary. Do you have any suggestions to make to the Commission in this regard?

A The nature of the flood that will be utilized in this pool means that we'll start out producing wells on the down-dip side, that will eventually start producing some of our air which is certainly of no use after it has been moved to the surface, and therefore it will be most imperative that methods be utilized to prevent this loss of injected media as rapidly as possible. And my recommendation would be that when this breakthrough does occur that the Commission be notified by the operator by letter that it is advantageous to convert an additional production well to a dual purpose well, or to suspend production entirely from a well that has previously been

a dual purpose well, and convert that well to a 100 percent air injection well.

MR. KELLAHIN: We would like to offer Exhibits 1 through 15.

(Whereupon, Applicant's Exhibits 1 through 15 offered into evidence.)

MR. NUTTER: If there are no objections the exhibits will be admitted.

(Whereupon, Applicant's Exhibits 1 through 15 admitted into evidence.)

MR. KELLAHIN: That's all I have to offer.

MR. NUTTER: Are there any questions of the witness?

CROSS-EXAMINATION

BY MR. IRBY:

Q What is to be done with the produced water which is indicated in your testimony, Mr. Jameson?

A The produced water at this time is being disposed of in plastic lined earthen pits.

Q Is this near this Lindrus San Andres Pool that Doctor Dunn is operating in?

A This area is, as I recall, approximately 5 miles Southeast of Lindrus San Andres Pool. The Lindrus San Andres Pool is the most limited section of Section 8, same Township and Range.

Q Is this plastic lined tubing sufficient to evaporate the water being produced?

A At this time they are. However, after we start this flood we have no way of knowing what our produced water will be, and it's very probable that these pits may have to be expanded in size.

MR. IRBY: That's all.

CROSS-EXAMINATION

BY MR. NUTTER:

Q Mr. Jameson, what type of equipment is contemplated for compressing the air?

A I don't know the capacity of the compressors. Their output is 350 psi and they will undoubtedly handle the pressure needs for a considerable period of time. It's entirely possible, however, that additional pressure will be needed later in the life of the flood, at which time Doctor Dunn would expect to start two-stage compression.

Q You know the pressure but not the rate of injection?

A No. Actually, the compressors have been used discharging at a pressure of 350 pounds with a suction pressure of around 60 pounds, and their capacities are going to have to be considerably adjusted to suck air, atmospheric, and I'm sure their discharge rate will be slightly less than the 350 pounds. And I have no way of determining what either the

discharge pressure or the rate of the volume of air that will be handled by the compressors. They are extremely large. In fact, both compressors are identical and they weigh 48,200 pounds.

Q Each or together?

A Each.

Q Will the produced air be recirculated?

A I think it would be more economical not to do so.

Q You have an adequate supply?

A I'm sure that we will have.

MR. NUTTER: Any other questions of Mr. Jameson? He may be excused. Anything further, Mr. Kellahin?

MR. KELLAHIN: Nothing further.

MR. NUTTER: If there is nothing further the case will be taken under advisement and the hearing is adjourned.

(Whereupon, the hearing was adjourned at 12:15 o'clock P.M.)

I N D E X

E X H I B I T S

NUMBER	MARKED FOR IDENTIFICATION	OFFERED	ADMITTED
Applt's. 1	2	24	24
Applt's. 2	2	24	24
Applt's. 3	2	24	24
Applt's. 4	2	24	24
Applt's. 5	2	24	24
Applt's. 6	2	24	24
Applt's. 7	2	24	24
Applt's. 8	2	24	24
Applt's. 9	2	24	24
Applt's. 10	2	24	24
Applt's. 11	2	24	24
Applt's. 12	2	24	24
Applt's. 13	2	24	24
Applt's. 14	2	24	24
Applt's. 15	2	24	24

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, BOBBY J. DAVIS, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me; and that the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

Witness my Hand and Seal this 9th day of June, 1966.

Bobby J. Davis
NOTARY PUBLIC

My Commission Expires:

March 13, 1969.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 3409, heard by me on 5/25, 1966.

Examiner
New Mexico Oil Conservation Commission

CASE 3002 - Continued:

said gas pool and the amendment of the special pool rules to include the classification of oil and gas wells in said pool, a provision for 80-acre spacing for oil wells, and the establishment of a limiting gas-oil ratio of 6000 to 1.

CASE 3407: Application of Midwest Oil Corporation for a pressure maintenance project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a pressure maintenance project by the injection of water into the Upper Pennsylvanian formation through its Harris State Well No. 1, located in Unit N, Section 29, Township 13 South, Range 34 East, Nonombre-Upper Pennsylvanian Pool, Lea County, New Mexico.

CASE 3408: Application of Marathon Oil Company for a waterflood project, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project by the injection of water into the Queen formation through three wells in Sections 10 and 15, Township 18 South, Range 31 East, Shugart Pool, Eddy County, New Mexico.

CASE 3409: Application of Dr. Sam G. Dunn for a secondary recovery project, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a secondary recovery project by the injection of air into the Upper San Andres formation through three wells located in Section 26, Township 7 South, Range 26 East, Leslie Spring-San Andres Pool, Chaves County, New Mexico. Applicant further seeks an administrative procedure to place additional wells on air injection if necessary.

Docket No. 13-66

DOCKET: EXAMINER HEARING - WEDNESDAY - MAY 25, 1966

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 Elvis A. Utz, Alternate Examiner:

CASE 3399: (Continued and Readvertised)

Application of Tenneco Oil Company for two non-standard gas proration units, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks approval of two non-standard gas proration units adjacent to the Blanco-Pictured Cliffs Pool and described as follows:

(1) A 155.40-acre unit comprising the SE/4 SW/4 and Lot 4 of Section 19, and the E/2 NW/4 and Lots 1 and 2 of Section 30, Township 30 North, Range 9 West;

(2) A 156.08-acre unit comprising the E/2 SW/4 and lots 3 and 4 of Section 30 and the NE/4 NW/4 and lot 1 of Section 31, Township 30 North, Range 9 West, all in San Juan County, New Mexico.

CASE 3404: Application of Tenneco Oil Company for a waterflood project, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project by the injection of water into the Grayburg and San Andres formations through six wells in Sections 22 and 28, Township 17 South, Range 29 East, Grayburg-Jackson Pool, Eddy County, New Mexico. Applicant further seeks an administrative procedure for expansion of said project to include additional injection wells and leases.

CASE 3405: Application of David Fasken for special pool rules, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks the promulgation of special pool rules for the North Indian Hills-Morrow Gas Pool in Section 4, Township 21 South, Range 24 East, Eddy County, New Mexico, including a provision for 640-acre spacing units.

CASE 3406: Application of Pan American Petroleum Corporation for special pool rules, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the promulgation of special pool rules for the Bough-Devonian Pool, Lea County, New Mexico, including a provision for 80-acre proration units.

CASE 3002: (Continued and Readvertised)

In the matter of Case No. 3002 being reopened pursuant to the provisions of Order No. R-2684-A, which order continued the original order for an additional year, establishing 320-acre spacing for the Fowler-Lower Paddock Gas Pool, Lea County, New Mexico. The original applicant, Pan American Petroleum Corporation, seeks continuation of the 320-acre spacing for

BEFORE THE OIL CONSERVATION COMMISSION
OF NEW MEXICO

Case 3409

APPLICATION

Comes now Dr. Sam G. Dunn and applies to the Commission for an order approving a secondary recovery project in the Leslie Spring-San Andres Pool, Chaves County, New Mexico, by the injection of air into the Upper San Andres formation through wells located in Section 26, Township 7 South, Range 26 East, N.M.P.M., and in support thereof would show:

1. Applicant proposes to inject air into three wells completed in said pool, which are located highest on the structure. It is tentatively contemplated that injection will be in the Dale Federal Wells No. 6, 8 and 3, as shown on the plat attached to this application and made a part hereof. Further study may indicate different wells may be utilized for air injection.

2. Applicant proposes to set tubing and packer, and to inject air through perforations above the packer, and above the air-oil contact, with production of oil through the tubing. A typical completion of an injection well is shown by the diagrammatic sketch attached hereto and made a part of this application.

3. Applicant further seeks approval of an administrative procedure for the addition of injection wells, for the conversion of wells from injection and production to production only, and for such other provision as may appear proper for the operation of this project.

4. By copy of this application, with exhibits attached, notice has been given to the New Mexico State Engineer of Applicant's proposal as required by Commission Rule 701.

Respectfully submitted,
DR. SAM G. DUNN

By _____
Kellahin & Fox
P. O. Box 1769
Santa Fe, New Mexico
ATTORNEY FOR APPLICANT

All Producing Wells Are Completed In Slaughter Zone – San Andres

AREA MAP

LESLIE SPRINGS – SAN ANDRES OIL POOL

Chaves County, New Mexico

Scale: 1" = 2000 feet

Proposed Secondary Recovery Area

prepared for Dr Sam G. Dunn

PETROLEUM CONSULTANTS, INC.

May 1966

Shell

16

State

Shell

15

George R. Brown

U.S.

George R

SHELL

1

LODEWICK-FEDE

14

U.S

Sun Oil

21

U.S.

Elliott Prod.

22

U.S.

George R

U.S.

23

Shell

J.M. Est

T 7 S

Dunn

DR. SAM G. DU

DUNN

5

SUN-FEDERAL

28

Dunn

DUNN

27

LESLIE SPRINGS

1-A

1-B DALE-FEDERAL

8

7

6

5

3

PECOS

DALE-FE

Chas. Lee

Chas. Lee

DUNN

3

DUNN

LEE

1

2

LEE

4

DALE-FEDERAL

33

Dunn

Tony Talento

Union Tex. Pet.

34

Texaco

C.L. Nursworthy

3

T 8 S

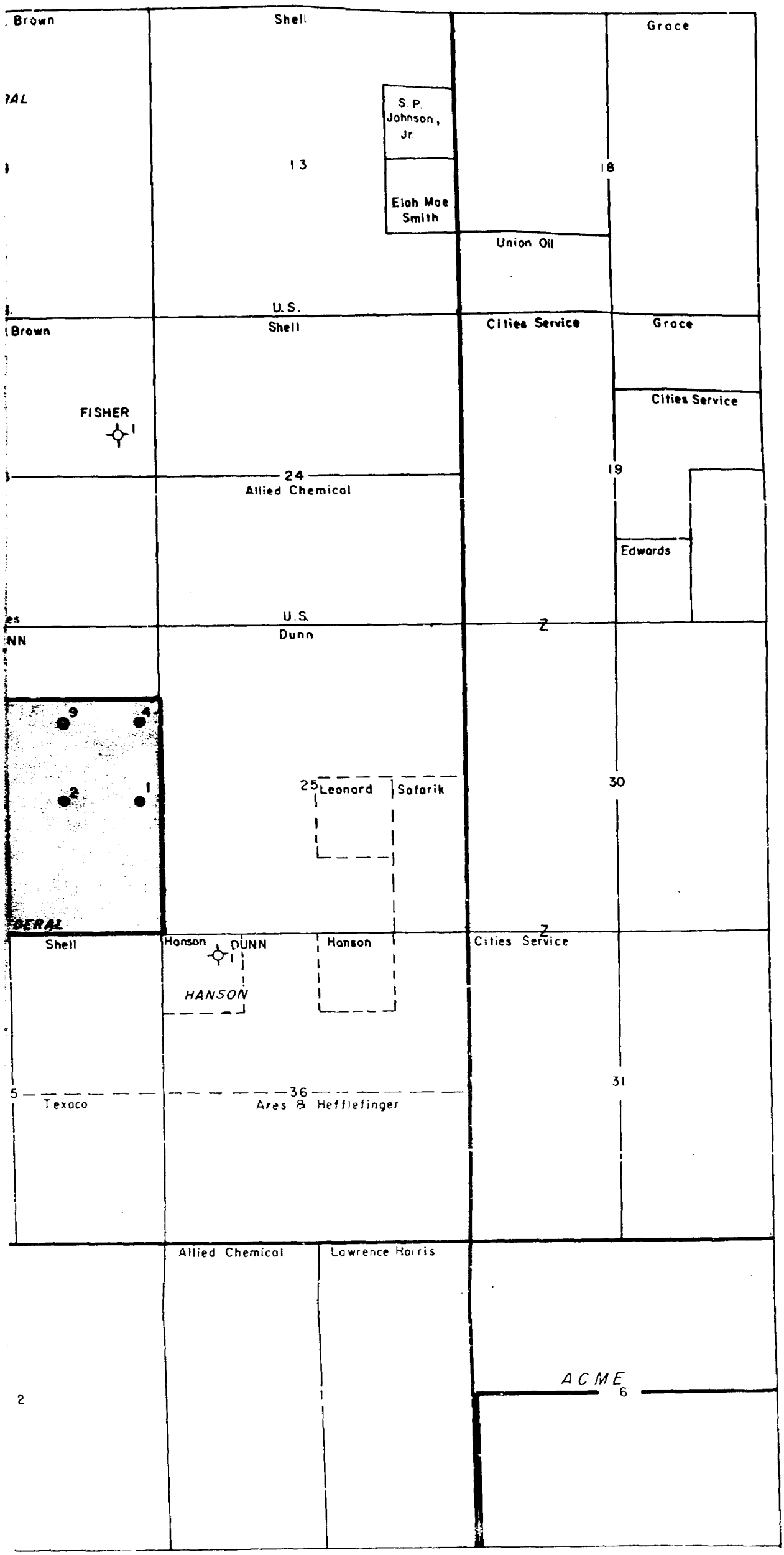
Snell

4

Atlantic

3

R 26 E


Brown
Shell
Grace
PAL
S. P. Johnson, Jr.
13
18
Elah Mae Smith
Union Oil
U.S.
Brown
Shell
Cities Service
Grace
FISHER
1
Cities Service
24
Allied Chemical
19
Edwards
es
U.S.
Dunn
Z
NN
9
4
2
1
25
Leonard
Safarik
30
DERAL
Z
Shell
Hanson
DUNN
1
Hanson
Cities Service
HANSON
31
5
36
Texaco
Ares & Hefflefinger
Allied Chemical
Lawrence Harris
ACME
2
6
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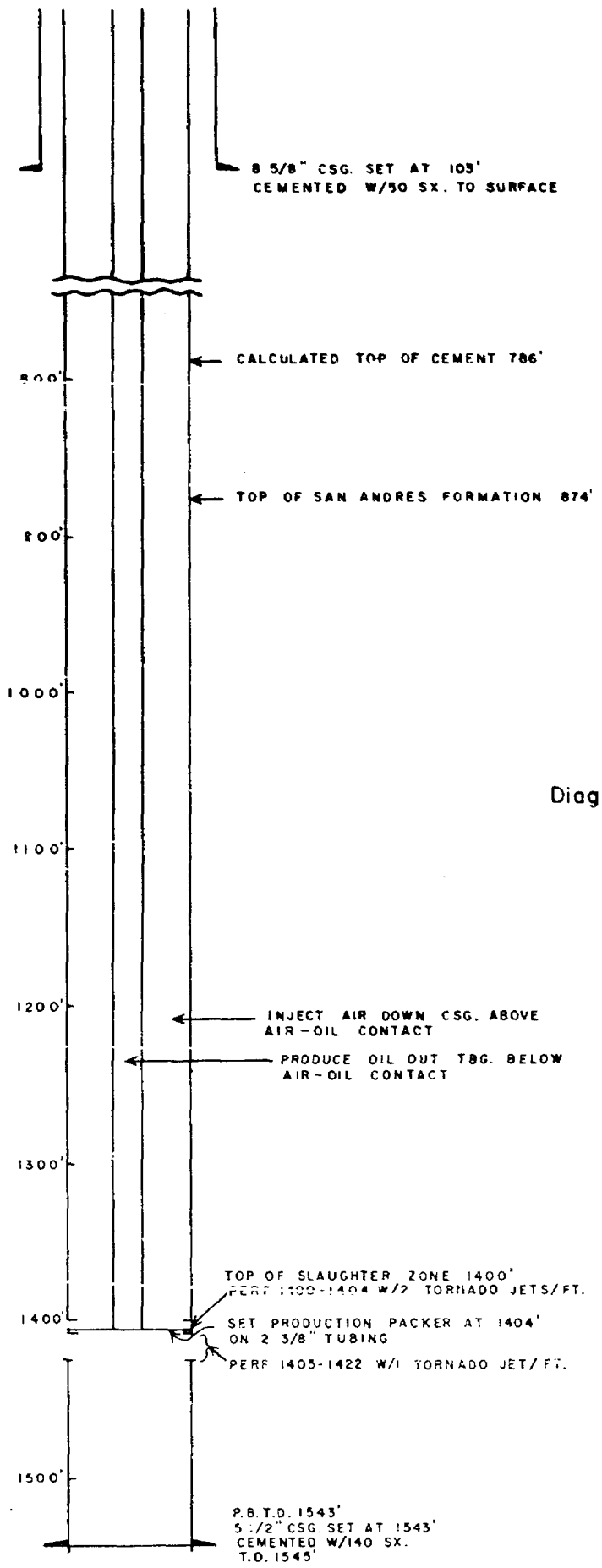


TYPICAL AIR INJECTION WELL

Leslie Springs - San Andres Oil Pool

Diagrammatic Sketch of Dale-Federal No.6 Well

Sec. 26 T 7 S, R 26 E

Chaves County, New Mexico

prepared for Dr. Sam G. Dunn

PETROLEUM CONSULTANTS, INC.

May 1966

Well History
Leslie Spring Area
Chaves County, New Mexico

Shell #1 Lodewick-Federal
990' fnl, 1650' fwl, Sec. 14, T-7S, R-26E
Elevation: 3753'
Spud: 7-28-65 Completed: 8-7-65
TD: 1465'
Cored 1370-1465. Rec 95', 20.5' shly anhy, 7' dolo w/scatt poro, bldg oil, 7' dolo anhy, 2.5' shly dns dolo, 57' dolo porous, bldg sul wtr.
IP: P & A

Dr. Dunn #1 Dale Federal
2310' fsl, 330' fel, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3813' Map Elevation: 3846'
Spud: 10-31-63 Completed: 11-30-63 First Production: 7-12-64
TD: 1545' PBTD: 1540'
Csg: 8-5/8" @ 150' w/100 sx, 2% calcium chloride, circulated
4-1/2" @ 1545' w/285 sx reg
Tbg: 2" @ 1506'
Perf: 1498-1516, 1520-1530 w/2 jets/ft
Treated: 1,000 gal 15% acid water, 15,000 gal 7-1/2% acid water and 7,000# 20-40 sand
IP: 12 BOPD, 20 BWPD

Dr. Dunn #2 Dale Federal
2310' fsl, 1650' fel, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3782' Map Elevation: 3829'
Spud: 4-9-64 First Production: 7-19-64
TD: 1503' PBTD: 1502'
Csg: 8-5/8" @ 110' w/75 sx, circulated
4-1/2" @ 1502' w/100 sx Pozmix
Tbg: 2" @ 1470'
Perf: 1 jet @ 1472', 1474', 1480', 1482', 1484'
Treated: 15,000 gal acid wtr, 1,000# sand
IP: 20 BOPD, 15 BWPD

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Engl EXHIBIT NO. 2
CASE NO. 3409

Dr. Dunn #3 Dale Federal
2310' fsl, 2310' fwl, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3778' Map Elevation: 3824'
Spud: 1-64 Completed: 2-24-64 First Production: 9-7-64
TD: 1474' PBTD: 1474'
Csg: 8-5/8" @ 105' w/50 sx
4-1/2" @ 1474' w/285 sx Pozmix
Tbg: 2" @ 1440'
Perf: 1446-1468 w/2/ft. Re-perf 1458-1468 w/4/ft. Sand jetted 1456-1458, 1464-1468
Treated: 1,000 gal 15% acid, 15,000 gal 7-1/2% acid and 3,000# sand
IP: 2 BOPD, 2 BWPD

Dr. Dunn #4 Dale Federal
1650' fnl, 330' fel, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3815' Map Elevation: 3848'
Spud: 4-30-64 Completed: 5-8-64 First Production: 10-1-64
TD: 1543' PBTD: 1540'
Cored: 1497-1531
Csg: 8-5/8" @ 114' w/50 sx, circulated
4-1/2" @ 1540' w/100 sx Pozmix
Tbg: 2" @ 1475'
Perf: 1 sd jet @ 1490', 1492', 1495', 1502', 1503', 1505'
Treated: 15,000 gal 7-1/2% acid, 7,500# 20-40 sand
IP: 5 BOPD, 5 BWPD

Dr. Dunn #5 Dale Federal
2310' fnl, 1650' fwl, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3779' Map Elevation: 3833'
Spud: 5-5-64 Completed: 5-30-64 First Production: 10-1-64
TD: 1475' PBTD: 1474'
Csg: 8-5/8" @ 110' w/50 sx, circulated
4-1/2" @ 1474' w/100 sx Pozmix
Tbg: 2" @ 1440'
Perf: 1 sd jet @ 1444', 1446', 1448', 1450', 1452'
Treated: 15,000 gal 7-1/2% acid and 7,500# 20-40 sand
IP: 2 BOPD, 2 BWPD

Dr. Dunn #6 Dale Federal
2310' fnl, 330' fwl, Sec 26, T-7S, R-26E
Surveyed Elevation: 3768' Map Elevation: 3822'
Spud: 6-6-64 Completed: 6-28-64 First Production: 6-17-65
TD: 1545' PBTD: 1543'
Csg: 8-5/8" @ 103 w/50 sx, circulated
5-1/2" @ 1543 w/140 sx

Tbg: 2" @ 1442', Frost packer @ 1365'
Perf: 1405-1422 w/1 Tornado jet/ft
Treated: 10,000 gal 10% acid, 3,000# sd, max treating pressure 2,500 psi @ 24.4 BPM, min treating pressure 1,700 psi @ 20.0 BPM
IP: 5 BOPD, 75 BWPD

Dr. Dunn #7 Dale Federal
1650' fnl, 990' fwl, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3786' Map Elevation: 3840'
Completed: 7-18-65
TD: 1502' PBTD: 1499'
Cored: 1460-1502
Csg: 8-5/8" @ 150 w/125 sx, 2% calcium chloride, circulated
5-1/2" @ 1499 w/150 sx Pozmix, 2% gel
Status: Well has been perforated and treated with acid but has not yet been tested.

Dr. Dunn #8 Dale Federal
1650' fnl, 2310' fwl, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3786' Map Elevation: 3840'
Spud: 5-18-65
TD: 1503' PBTD: 1502'
Csg: 8-5/8" @ 100 w/75 sx reg, 2% calcium chloride, circulated
5-1/2" @ 1502 w/150 sx Pozmix, 2% gel, circulated
Perf: 1472-1492 w/2 jets/ft
Status:Well has not yet been treated with acid.

Dr. Dunn #9 Dale Federal
1650' fnl, 1650' fel, Sec. 26, T-7S, R-26E
Surveyed Elevation: 3805' Map Elevation: 3846'
Spud: 4 7 65 Completed: 11-6-65 First Production: 11-6-65
TD: 1511'
Csg: 8-5/8" @ 101 w/100 sx reg w/2% calcium chloride, circulated
5-1/2" @ 1460' w/150 sx Pozmix, 2% gel, circulated
Tbg: 2" @ 1500'
Perf: Open hole 1460-1511' Top Pay 1486'
Treated: 11,440 gal 15% acid, max treating 1,500 psi, min 1,400 psi, shut-in 1,000 psi, avg rate 5-1/2 BPM
IP: 5 BOPD, 14 BWPD

Dr. Dunn #1 Dale Federal "A"
1650' fsl, 330' fwl, Sec 27, T-7S, R-26E
Elevation: 3743'
Spud: 8-12-64 Completed: 9-26-64 First Production: 10-3-65
TD: 1310' PBTD: 1309'

Cored: 1240-1300 Core not analyzed
Csg: 8-5/8" @ 105 w/50 sx, 7 @ 525 w/125 sx
5-1/2" @ 1309 w/120 sx, circulated
Tbg: 2" @ 1282'
Perf: 1272-1276', 1278-1282' w/2 Tornado jets/ft
Treated: 15,000 gal 15% acid, 3,000# sand
IP: 5 BOPD, 20 BWPD

Dr. Dunn #1 Dale Federal "B"
330' fsl, 330' fwl, Sec 27, T-7S, R-26E
Elevation: 3691'
Spud: 11-28-62 Completed: 1-3-63
TD: 1299'
Csg: 7-5/8" @ 127 w/25, circulated
4-1/2" @ 1236 w/50
Test Nat: 1-1/2 BO & 1/2 BWPD
Frac OH 1236-1299' w/500 bbls wtr, 13 tons CO2 and 10,000# sand.
Encountered excessive pressure. Flowed, swabbed, and pumped 140 bbls load water and 3 BO in 30 days. Left 360 bbls load water.
Treated down csg w/2,000 gals acid. Pumped 110 bbls load water in 21 days. Final gauge 2 bbls load wtr w/scum oil/day. Load to rec 312 bbls.
Treated w/10,000 gal reg acid. Pumped 178 bbls load wtr and 5 BO in 13 days. Last gauge 9 BW and 1/4 BOPD. Load to rec 398 bbls.
Status: Temporarily abandoned

Dr. Dunn #5 Sun-Federal
2310' fnl, 2310' fwl, Sec 28, T-7S, R-26E
Status: Made water. Temporarily abandoned

Charles A. Lee #1 Dale-Federal
1650' fnl, 330' fwl, Sec. 33, T-7S, R-26E
Elevation: 3682'
Spud: 10-15-61 Completed: 10-29-61 First Production: 10-29-61
TD: 1170' PBTD: 1166'
Csg: 8-5/8" @ 102 w/15, circulated
4-1/2" @ 1170 w/200, circulated
Perf: 1128-1134', 1140-1146', 1154-1160'
IP: 26 BOPD, 6 BWPD

Dr. Dunn #2 Dale-Federal
1700' fwl, 1650' fnl, Sec. 33, T-7S, R-26E
Status: Well makes water. Possible mechanical difficulties

Charles A. Lee #3 Dale-Federal
990' fnl, 330' fwl, Sec 33, T-7S, R-26E
Status: Well makes water

Dr. Dunn #1 Dale-Federal
1650' fnl, 990' fel Sec. 33, T-7S, R-26E
Cored: 1241-1268
Status: Perf one 2' and one 4' section. Well has not yet been treated or tested. Expect well to make water

Dr. Dunn #1 Hanson
330' fnl, 990' fwl, Sec. 36, T-7S, R-26E
Spud: 3-1-64
IP: P & A 4-2-64

CORE LABORATORIES, INC. *Petroleum Reservoir Engineering*

COMPANY [illegible] FILE NO. [illegible]

WELL [illegible] DATE 5-5-64 ENGRS. [illegible]

FIELD [illegible] FORMATION SAN ANDRES ELEV. [illegible]

COUNTY [illegible] STATE NEW MEXICO DRLG FLD. WATER BASE MUD CORES DIAMOND 3.5"

LOCATION [illegible] REMARKS SAMPLED AS DIRECTED BY CLIENT

SAMPLE CHARACTERISTICS
F-Fractured L-Laminated FS; MD; CG Type Grain Size S Stylolitic V Vug(s)

PROBABLE PRODUCTION
O-Oil W-Water G-Gas T-Transitional

TOTAL WATER O—
PERCENT PORE SPACE
75 50 25

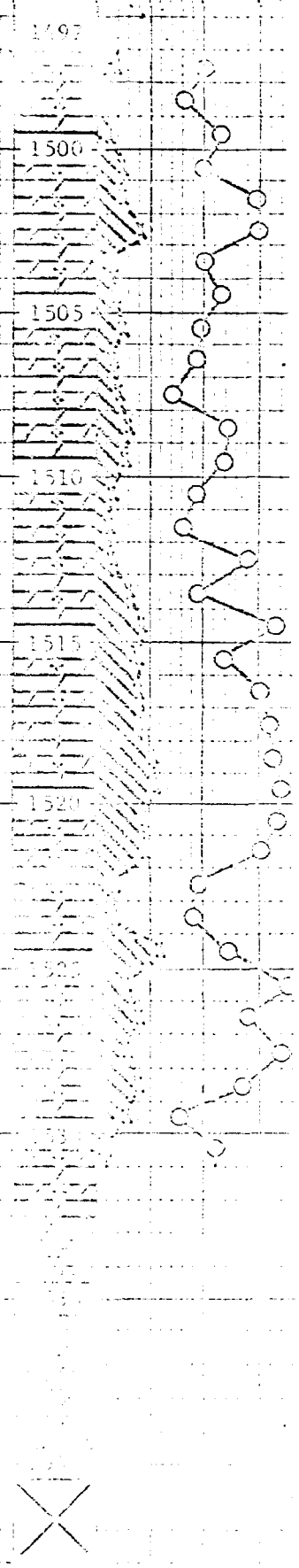
SAMPLE NUMBER	DEPTH FEET	PERMEABILITY, MD (Horizontal Perm. Plug) HORIZONTAL K	POROSITY %	RESIDUAL SATURATION % PORE SPACE OIL	RESIDUAL SATURATION % PORE SPACE TOTAL WATER
		CONVENTIONAL ANALYSIS			
	Log Top Sloughy Zone				
1	[illegible]	0.1	15.1	9.9	49.0
2	[illegible]	<0..	16.9	1.2	58.0
3	1499.0-00.0	<0.1	22.7	6.6	47.1
4	1500.0-01.0	<0.1	22.6	11.9	50.1
5	01.0-02.0	2.0	21.8	12.4	26.6
6	02.0-03.0	1.5	20.6	21.8	25.6
7	03.0-04.0	0.2	24.0	7.5	49.6
8	04.0-05.0	0.2	21.4	8.4	42.0
9	05.0-06.0	0.1	15.2	12.5	51.9
10	06.0-07.0	0.4	26.7	7.1	52.8
11	07.0-08.0	0.2	21.2	10.4	64.6
12	08.0-09.0	0.2	23.6	14.8	38.2
13	09.0-10.0	0.2	24.0	13.8	40.0
14	10.0-11.0	<0.1	27.3	7.3	52.0
15	11.0-12.0	<0.1	28.2	6.0	59.6
16	12.0-13.0	<0.1	23.9	7.1	28.4
17	13.0-14.0	0..	12.4	15.3	51.6
18	14.0-15.0	2.0	11.6	21.5	17.2
19	15.0-16.0	1.0	19.0	19.0	40.0
20	16.0-17.0	0.3	14.4	19.4	24.9
21	17.0-18.0	3.2	15.3	22.5	20.9
22	18.0-19.0	0.1	17.7	26.0	18.8
23	19.0-20.0	0.3	11.5	28.0	13.9
24	20.0-21.0	0.4	12.2	25.0	16.4
25	21.0-22.0	0.2	15.3	23.4	23.4
26	22.0-23.0	<0.1	10.3	8.7	52.5
27	23.0-24.0	<0.1	8.3	8.4	54.3
28	24.0-25.0	<0.	6.5	29.2	38.6
29	25.0-26.0	<0.1	10.7	13.1	1..2
30	26.0-27.0	0.1	13.6	20.6	30.2
31	27.0-28.0	3.2	19.1	14.6	15.7
32	28.0-29.0	<0.1	13.8	20.2	31.2
33	29.0-30.0	<0..	3.8	13.9	61.7
34	1530.0-31.0	<0..	11.0	4.3	64.3

PERMEABILITY O—O MILLIDARCYS 10 5

POROSITY X---X PERCENT 20 10

OIL SATURATION X--
PERCENT PORE SPACE
25 50 75

Perf
Perf
Perf



DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 3
CASE NO. 3409

CORE LABORATORIES, INC. CORE-LAB *Petroleum Reservoir Engineering*

COMPANY [illegible] FILE NO. [illegible]
WELL [illegible] DATE [illegible] ENGRS. [illegible]
FIELD [illegible]) FORMATION [illegible] ELEV.
COUNTY [illegible] STATE [illegible] DRLG. FLD. [illegible] CORES [illegible]
LOCATION [illegible] REMARKS [illegible]

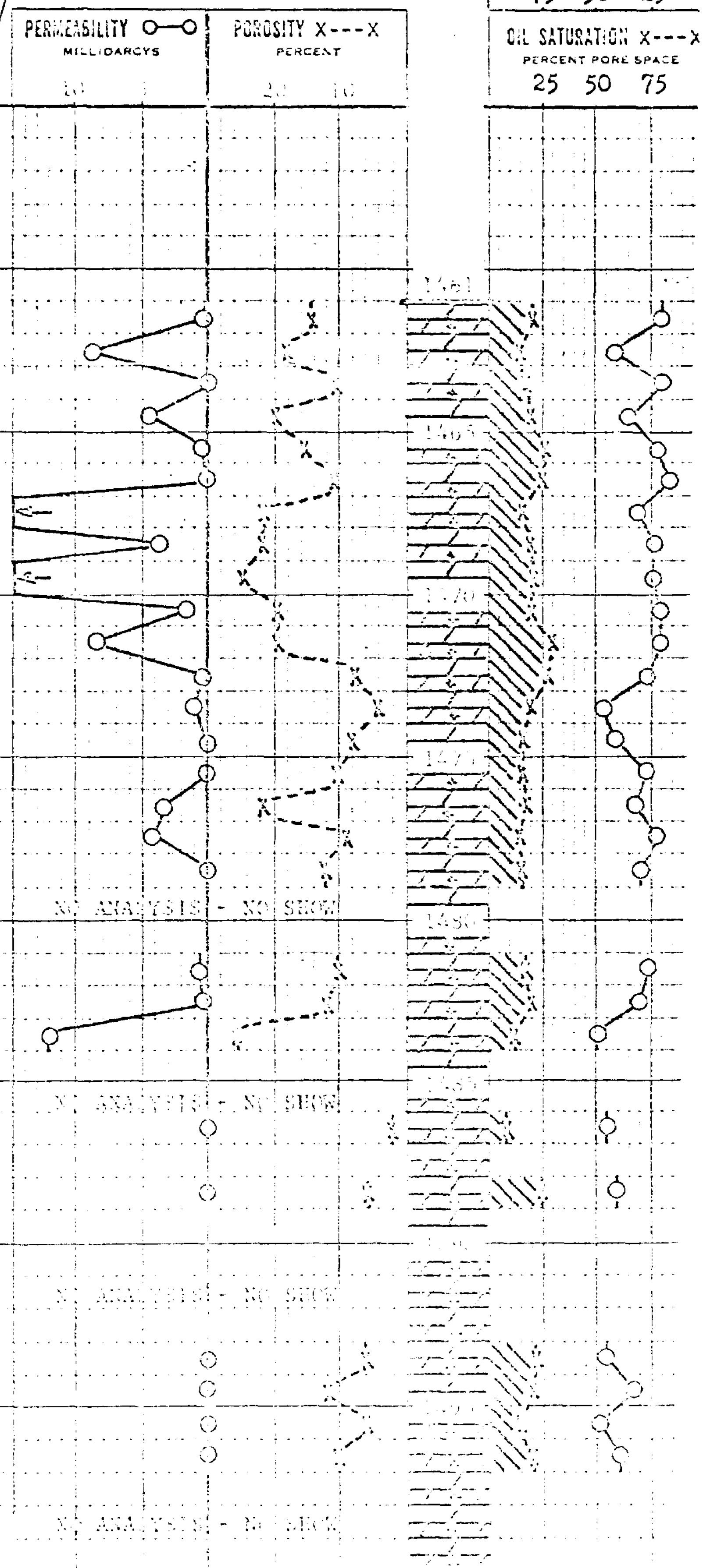
SAMPLE CHARACTERISTICS: F: Fractured L: Laminated FG; MG; CG - Type Grain Size S: Stylolitic V: Vuggy

PROBABLE PRODUCTION: O: Oil W: Water G: Gas T: Transitional

CONVENTIONAL ANALYSIS

Log Top Slaughter Zone 1442

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY, MD (Horizontal)		POROSITY %	RESIDUAL SATURATION % PORE SPACE OIL	TOTAL WATER
1	1461.0-62.0	0.1		14.7	21.8	20.4
2	62.0-63.0	8.8		15.7	15.0	41.1
3	63.0-64.0	<0.1		16.7	17.8	[illegible]
4	64.0-65.0	4.4		19.8	19.7	[illegible]
5	65.0-66.0	0.3		15.3	26.8	22.9
6	66.0-67.0	<0.1		10.9	25.6	16.5
7	67.0-68.0	34		21.3	16.9	31.0
8	68.0-69.0	3.7		21.6	19.9	24.5
9	69.0-70.0	18		24.8	21.2	23.3
10	70.0-71.0	1.8		19.4	21.7	21.7
11	71.0-72.0	8.5		19.2	29.1	21.5
12	72.0-73.0	0.2		7.2	27.8	[illegible]
13	73.0-74.0	0.8		4.2	19.0	[illegible]
14	74.0-75.0	<0.1		7.9	16.5	41.7
15	75.0-76.0	<0.1		10.5	16.2	28.0
16	76.0-77.0	3.5		21.2	18.9	31.0
17	77.0-78.0	4.2		8.7	14.9	23.0
18	78.0-79.0	<0.1		12.4	16.1	29.0
19	1481.0-82.0	0.6		16.0	17.0	26.0
20	82.0-83.0	0.3		11.5	19.1	30.4
21	83.0-84.0	12		25.5	11.8	48.0
22	1486.0-87.0	<0.1		2.4	8.3	45.5
23	1488.0-89.0	<0.1		[illegible]	24.1	43.5
24	[illegible]	<0.1		[illegible]	21.7	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	95.0-96.0	<0.1		[illegible]	14.3	45.2
[illegible]	96.0-97.0	<0.1		[illegible]	19.6	39.2



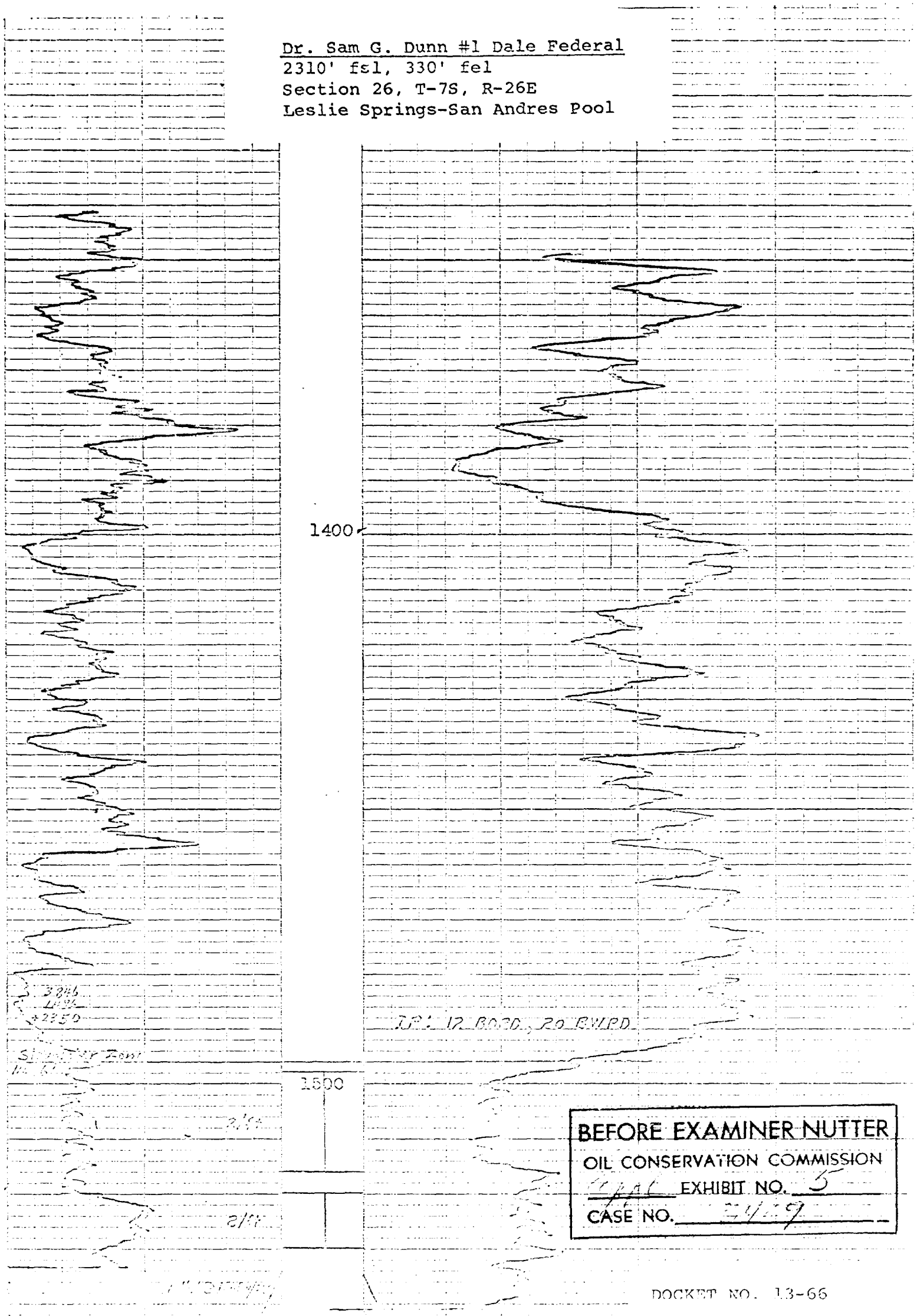
DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
[illegible] EXHIBIT NO. 4
CASE NO. [illegible]

Dr. Sam G. Dunn #1 Dale Federal
2310' fsl, 330' fel
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool



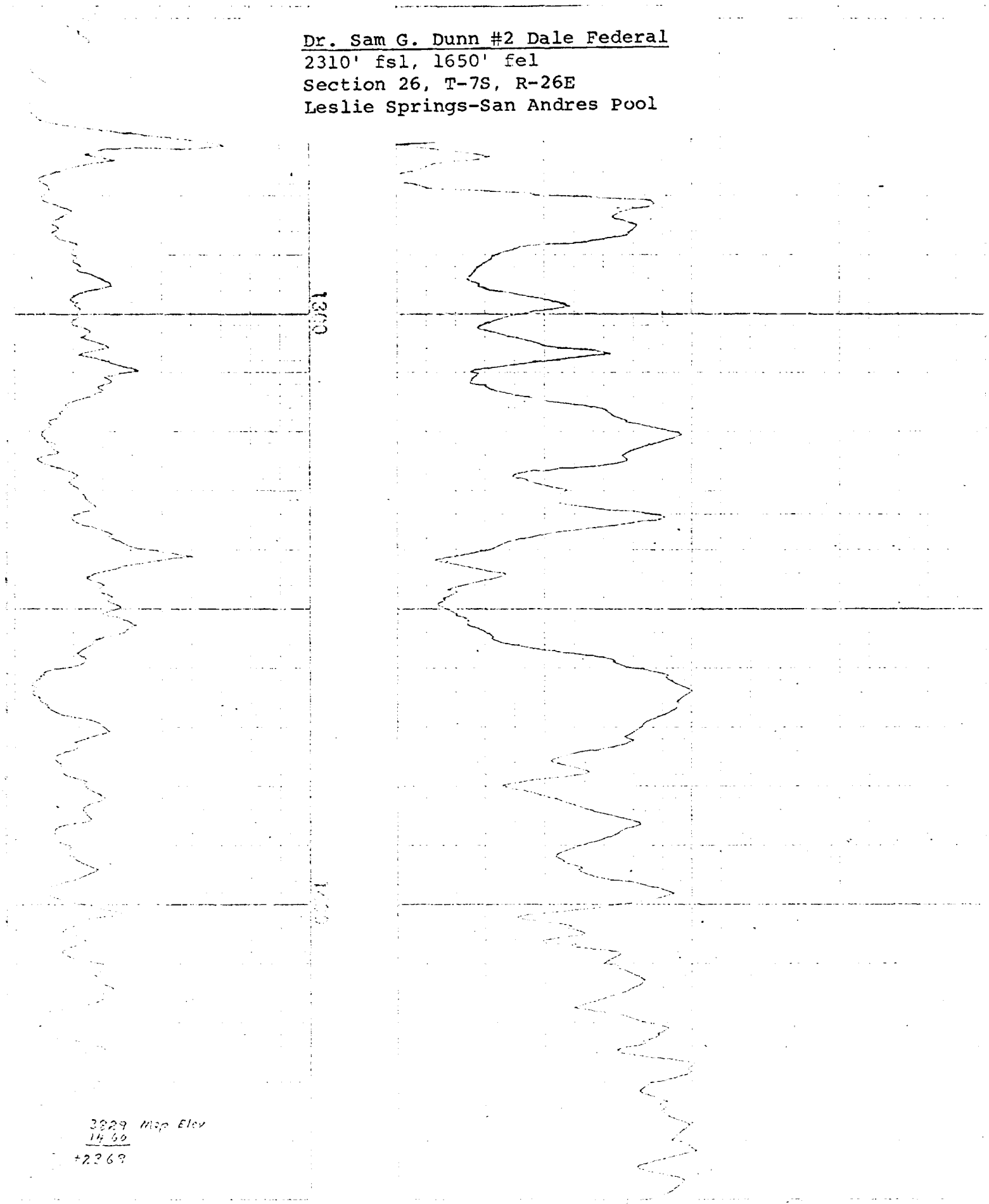
BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Dunn EXHIBIT NO. 5
CASE NO. 3409

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

Dr. Sam G. Dunn #2 Dale Federal
2310' fsl, 1650' fel
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool



3829 Map Elev
14 60
+2369

IP: 20 BOPD, 15 BWPD

Schlumberger Zone
11,439

1 jet

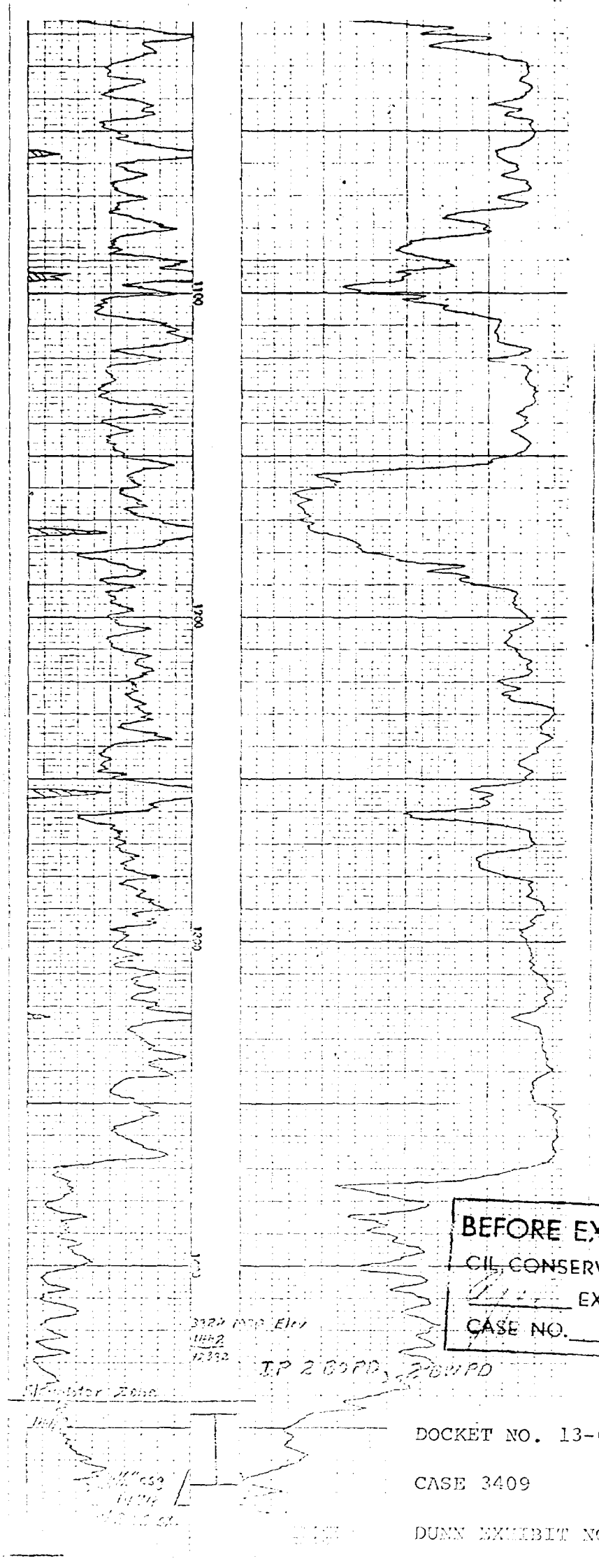
4½" @ 1502
w/ 100 sx.

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

Dr. Sam G. Dunn #3 Dale Federal
2310' fsl, 2310' fwl
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool

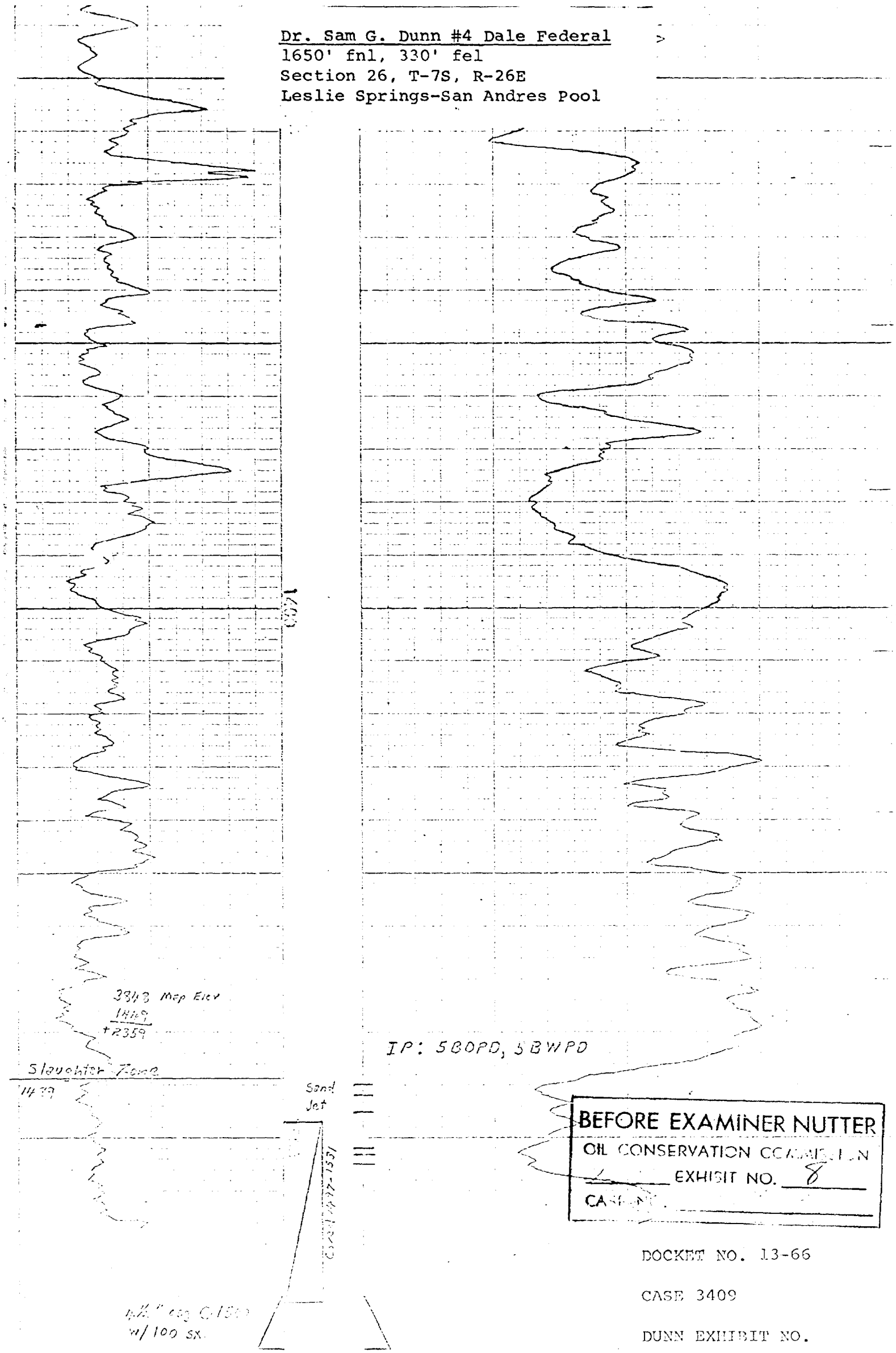


DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

Dr. Sam G. Dunn #4 Dale Federal
1650' fnl, 330' fel
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool

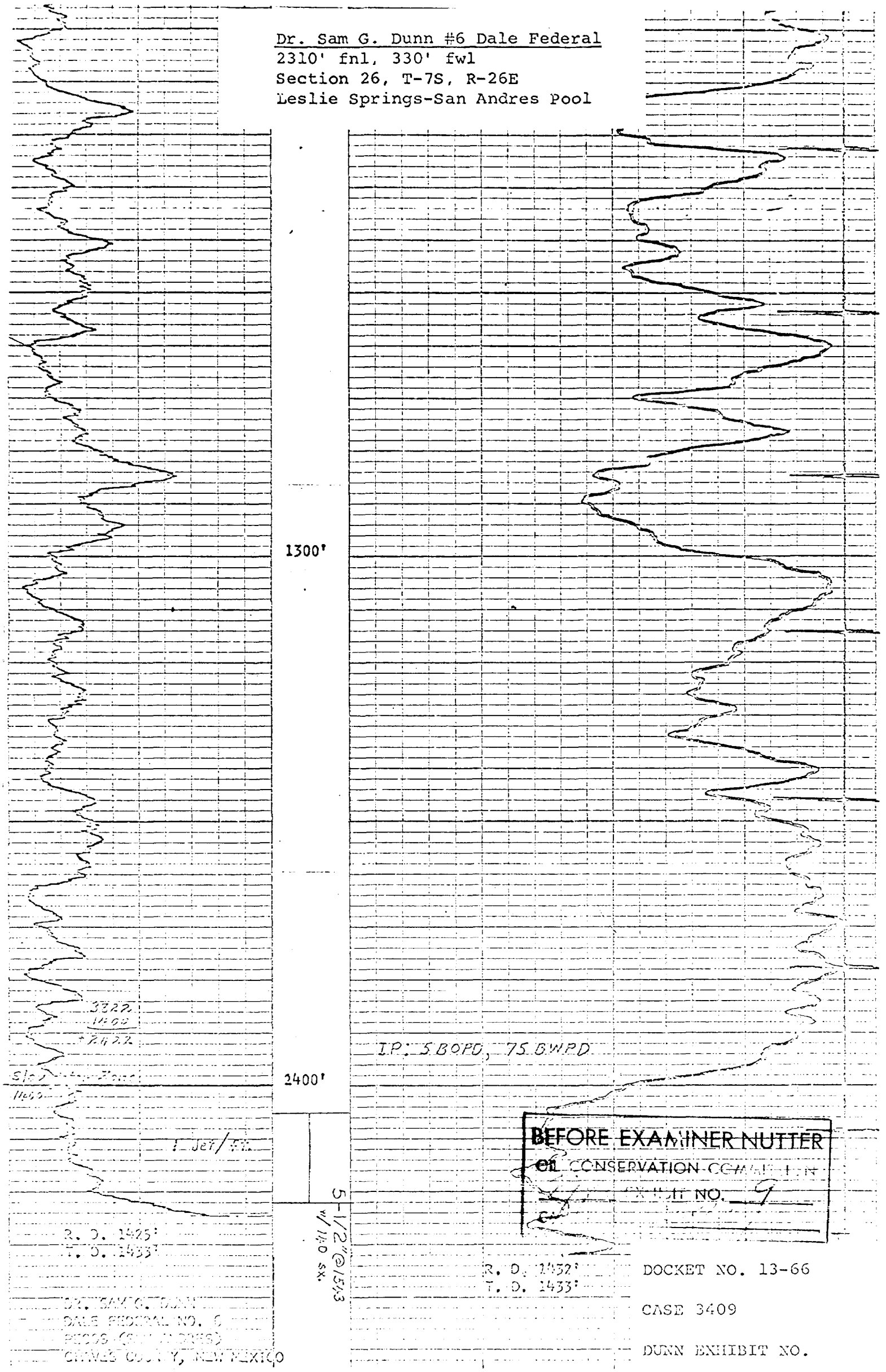


BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 8
CASE NO.

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.



BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 7

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

Dr. Sam G. Dunn #7 Dale Federal
1650' fnl, 990' fwl
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool

1300

1350

1400

3840
1442
+2398

1450

4 1/2" @ 1491 w/ 150 sx
Circ. 1481-1502

R.D. 1480.5'
T.D. 1492'

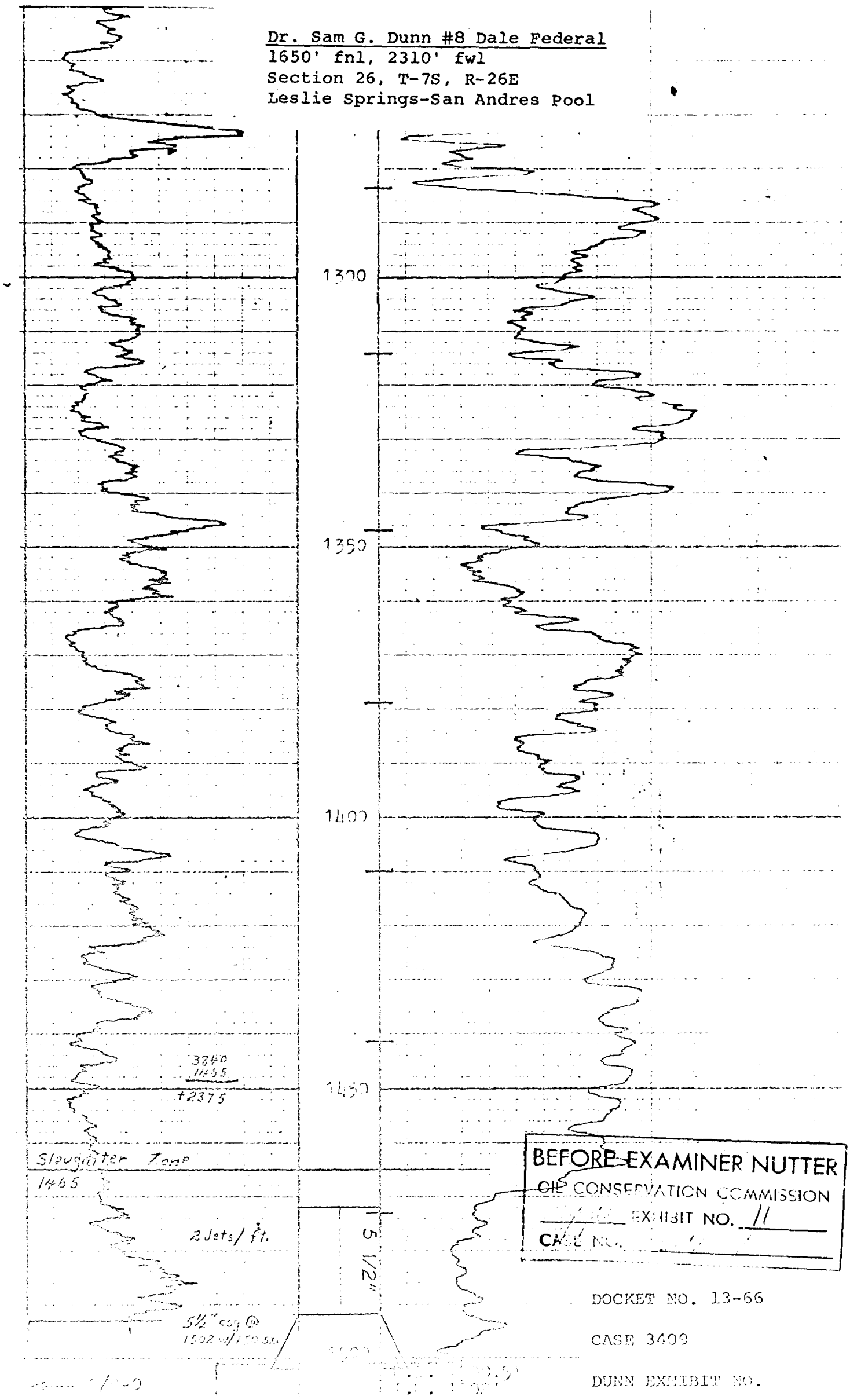
G/R-0

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 10

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

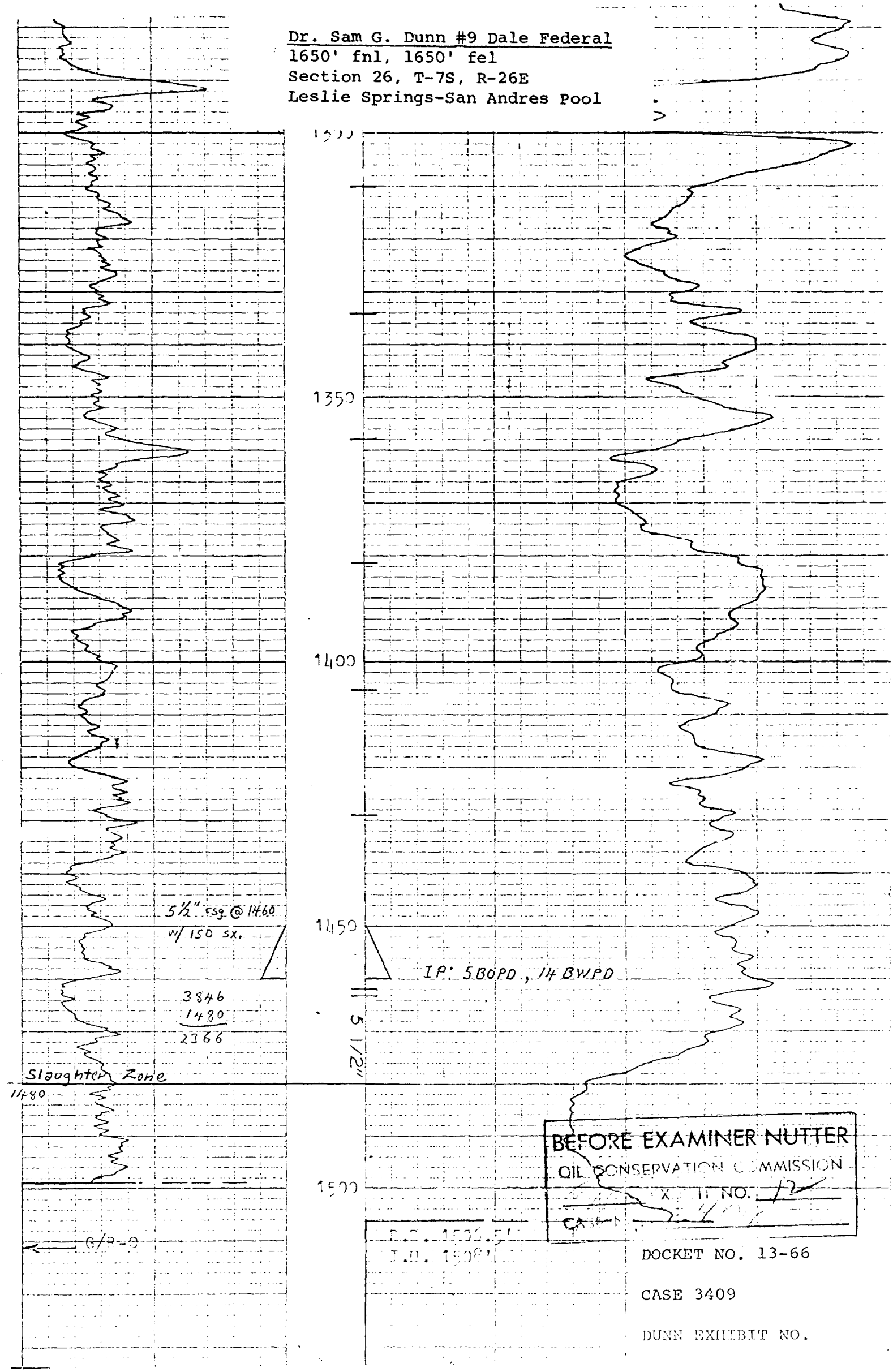


BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 11
CASE NO.

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.


Dr. Sam G. Dunn #9 Dale Federal
1650' fnl, 1650' fel
Section 26, T-7S, R-26E
Leslie Springs-San Andres Pool
1350
1400
1450
1500
5½" csg @ 1460
w/ 150 sx.
3846
1480
2366
IP: 5 BOPD, 14 BWPD
5 1/2"
Slaughter Zone
1480
G/P-9
BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
X EXHIBIT NO. 12
CASE
DOCKET NO. 13-66
CASE 3409
DUNN EXHIBIT NO.

STRUCTURAL MAP

Leslie Spring — San Andres Oil Pool

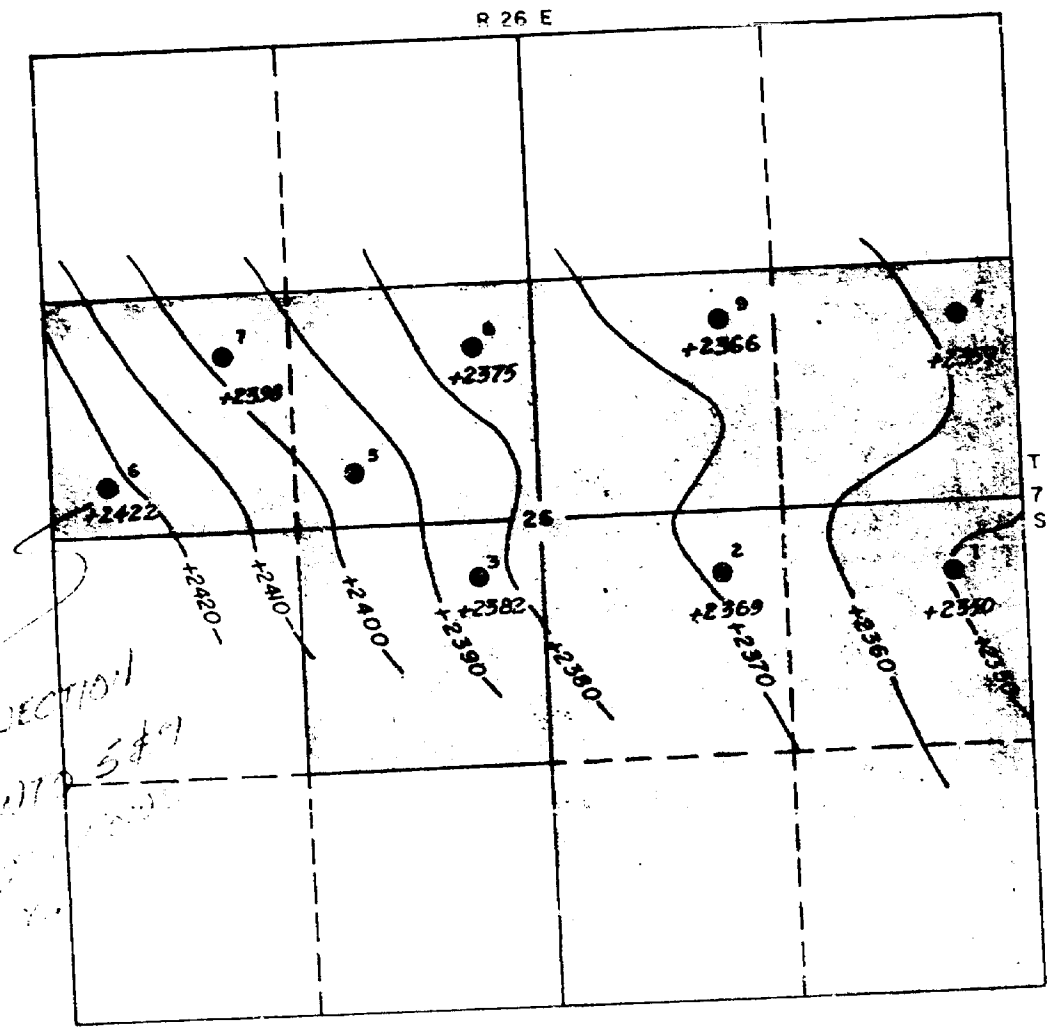
Sec. 26 T 7 S, R 26 E

Chaves County, New Mexico

prepared for Dr. Sam G. Dunn

PETROLEUM CONSULTANTS, INC.

MAY 1966



INITIAL PR INJECTION WELL NOT SET

Contoured on top of Sloughter Zone – San Andres

Contour Interval 10 feet

Scale 1" = 1000 feet

Proposed Secondary Recovery Area

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 13
CASE NO. 3409

DOCKET NO. 13-66
CASE 3409
DUNN EXHIBIT NO.

Tabulation of Elevations and Structure Data
Leslie Spring - San Andres Oil Pool
Section 26, T-7S, R-26E
Chaves County, New Mexico

Well	Survey Plat Elevation	Topo Map Elevation*	Elevation Difference	Log Top of Slaughter Zone	Structure Datum
Dale-Fed. 1	3813	3846	33	1496	+2350
Dale-Fed. 2	3782	3829	47	1460	+2369
Dale-Fed. 3	3778	3824	46	1442	+2382
Dale-Fed. 4	3815	3848	33	1489	+2359
Dale-Fed. 5	3779	3833	54	--	--
Dale-Fed. 6	3768	3822	54	1400	+2422
Dale-Fed. 7	3786	3840	54	1442	+2398
Dale-Fed. 8	3786	3840	54	1465	+2375
Dale-Fed. 9	3805	3846	41	1480	+2366

*Geological Survey map entitled "Eightmile Draw, New Mexico, dated 1962" on a scale of 1 inch = 2,000 feet with topography contoured on 10 foot intervals was used in determining elevations.

DOCKET NO. 13-66

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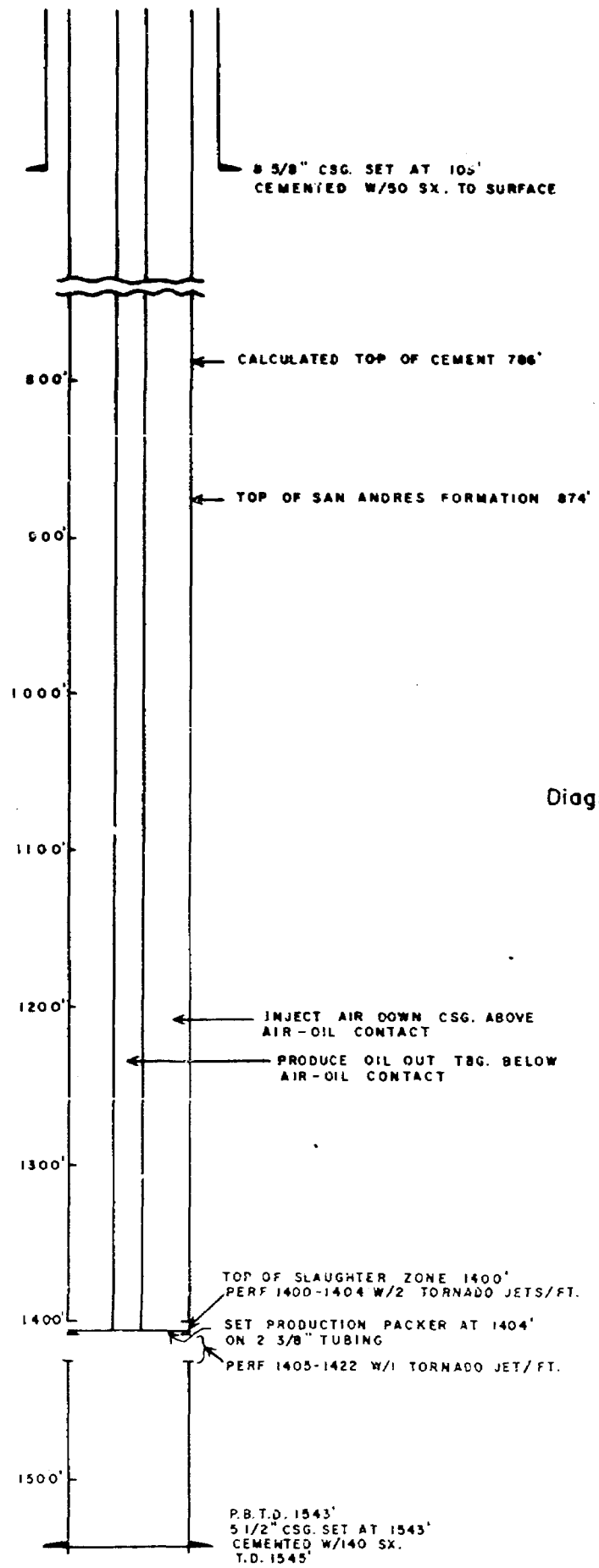
OIL CONSERVATION COMMISSION
EXHIBIT NO. 14
CASE NO. 3409

CASE 3409

DUNN EXHIBIT NO.



TYPICAL AIR INJECTION WELL

Leslie Spring — San Andres Oil Pool

Diagrammatic Sketch of Dale-Federal No.6 Well

Sec. 26 T 7 S, R 26 E.

Chaves County, New Mexico

prepared for Dr. Sam G. Dunn

PETROLEUM CONSULTANTS, INC.

May 1966

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OIL CONSERVATION COMMISSION
EXHIBIT NO. 15
CASE NO. 3409

DOCKET NO. 13-66

CASE 3409

DUNN EXHIBIT NO.

Dr ~~Sam~~ [illegible] Secondary [illegible]

Leslie Spring San [illegible] Chaves

Sec 26 7S 26E

inj. air thru ann above packer
production

7 Wells [illegible] 1/2 [illegible]