

CASE 3090: Application of TENNECO
OIL CO. for salt water disposal,
San Juan County, New Mexico

CASE NO.

3090

Application,
TRANSCRIPTS,
SMALL Exhibits
ETC.

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 22, 1964

EXAMINER HEARING

IN THE MATTER OF:

Application of Tenneco Oil Company for salt
water disposal, San Juan County, New Mexico.
Applicant, in the above-styled cause, seeks
authority to dispose of produced salt water
in the Pictured Cliffs formation through
its Callow Well No. 2 located in Unit B,
Section 33, Township 29 North, Range 13
West, West Kutz-Pictured Cliffs Pool, San
Juan County, New Mexico.

Case No. 3090

BEFORE: DANIEL S. NUTTER, Examiner.

TRANSCRIPT OF HEARING

DEARNLEY-MEIER REPORTING SERVICE, Inc.

FARRINGTON, N. M.
PHONE 325-1182

SANTA FE, N. M.
PHONE 983-3971

ALBUQUERQUE, N. M.
PHONE 243-6691



MR. NUTTER: We will call Case 3090.

MR. DURRETT: Application of Tenneco Oil Company for salt water disposal, San Juan County, New Mexico.

MR. MORRIS: If the Examiner please, I am Richard Morris of Seth, Montgomery, Federici and Andrews, Santa Fe, New Mexico, appearing on behalf of the Applicant, Tenneco Oil Company. We'll have one witness in this case, Mr. John Lacey, and ask that he be sworn as a witness.

(Witness sworn.)

(Whereupon, Applicant's Exhibits 1 through 6 were marked for identification.)

JOHN J. LACEY

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

DIRECT EXAMINATION

BY MR. MORRIS:

Q Mr. Lacey, please state your name, by whom you are employed and in what position and where you are located.

A My name is John J. Lacey. I am employed by Tenneco Oil Company as a Senior Petroleum Engineer in Durango, Colorado.

Q Have you previously testified before the New Mexico Oil Conservation Commission or one of its Examiners and had your qualifications made a matter of record?



A Yes, I have.

Q Are you familiar with the application of Tenneco in Case 3090?

A Yes, I am.

Q What is it that Texaco seeks by its application?

A Tenneco Oil Company seeks authority to dispose of produced salt water into the Pictured Cliffs formation through its Callow Well No. 2, located in Unit B, Section 33, 29 North, Range 13 West in the West Kutz-Pictured Cliffs Pool, San Juan County, New Mexico.

Q If you would refer now to what has been marked as Exhibit No. 1 in this case and state what it is and some of the details shown on it, please.

Q Exhibit 1 is a plat showing the location of all of the wells drilled in the area of the Callow 2. Wells which have been drilled to the Pictured Cliffs, either as producers or as dry holes, are identified in red. The Callow No. 2 is identified in green.

The plat also shows the boundaries, the western boundaries of the West Kutz-Pictured Cliffs field limit as defined by the Commission. It shows the boundary of the Central Totah Unit. It also shows the structure contours on top of the Pictured Cliffs formation in the area and it also identifies the cross sections



A-A¹ and B-B¹ in the area.

Q Mr. Lacey, as I understand it, all the Pictured Cliffs wells are designated in red even though some of them, a great number of them are not producing at this time?

A That is correct. The closest producing Pictured Cliffs well to the Callow No. 2 is Tenneco Oil Company's Callow No. 4, located in the Southwest Quarter of the Southwest Quarter of Section 28, 29 North, 13 West. The next closest producing Pictured Cliffs well is Aztec's Hagood No. 2, located in the Southwest of the Northeast Quarter of Section 34 of 29 North, 13 West. The well immediately south to the Callow No. 2 is a dry hole that has never been productive.

Q What is the present status of your proposed injection well, and is it a producing well at this time?

A The Callow No. 2 is completed in the Pictured Cliffs formation, was drilled in 1953 by Bay Petroleum Corporation. In May, or spring of 1959, the well was shut-in as non-productive or commercially non-productive, and since that time has been shut-in. The well has not been plugged, or was not plugged at the time because we saw a possibility of a future use for the well in waterflood operations.

Q If you would turn now to your Exhibit No. 2, showing cross sections A-A¹ and B-B¹ and point out some of the features



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of that exhibit.

A Exhibit No. 2 is a cross section of electric logs of wells in the area cross section A-A¹ and B-B¹. They are identified on Exhibit 1 as to the wells they include and their direction. This cross section is based on electric logs of deeper wells in the area which were logged through the Pictured Cliffs formation. It identifies the top and the bottom of the Pictured Cliffs formation, it identifies the Callow No. 2 on section B-B¹ in a schematic diagram showing the relationship of this well to the Pictured Cliff formation in the area and where the well is completed, presently completed.

MR. NUTTER: Mr. Lacey, are these logs of these wells hung on a common datum?

A No, sir. They are not hung on a common datum. They are hung on the top of the Pictured Cliffs.

MR. NUTTER: Then the top of the Pictured Cliffs is a straight line across here?

A No, sir, the top of the Pictured Cliffs formation can be identified by the contours shown on Exhibit 1.

MR. NUTTER: I think on this Exhibit 2 the top of the Pictured Cliffs is a straight line?

A Yes.

MR. NUTTER: So this doesn't show the structure?



A It does not. I refer you to Exhibit 1 for the structure of the Pictured Cliffs. I would like to explain a little bit more about Exhibit 2. The gas-productive interval in the Pictured Cliffs formation is the upper twenty to thirty feet of the Pictured Cliffs. In other words, the top twenty or thirty feet below the top of the Pictured Cliffs is the gas-productive interval. The remaining section is water-productive.

You will note on Exhibit 1 that the Pictured Cliffs, the top of the Pictured Cliffs is structurally higher to the southwest and there are no productive Pictured Cliffs wells structurally higher than the Callow 2, and that even the upper portion of the Pictured Cliffs becomes water-bearing as you go updip.

Q (By Mr. Morris) Referring now, Mr. Lacey, to what has been marked Exhibit No. 3 in this case, the diagram of the injection well, would you explain the present status of that injection well and how you propose to convert it to water injection if this application is approved?

A Exhibit No. 3 is a diagrammatic sketch of the Callow No. 2 showing the interval which is presently supposed to produce in the well. The well is presently shut-in and has a one-inch siphon tubing string in the well. We propose to convert the well by removing the one-inch siphon tubing string, running 2-3/8ths EUE tubing with a hook wall packer set at approximately the bottom



of the 5- $\frac{1}{2}$ " casing and loading the annulus between the tubing and the 5- $\frac{1}{2}$ " casing with corrosion-inhibited fluid, and injecting produced Gallup water down the tubing into the open hole.

I might explain a little further, the well was originally completed to a depth of 1594 by Bay Petroleum Corporation and was shot with nitroglycerin. In May of '62 we deepened this well through the entire Pictured Cliffs formation with the water-bearing portion of it in an attempt to possibly use it as a source well, as a water supply source well for a waterflood operation. This, however, proved unsuccessful, the quantities of water were not adequate, so the well was shut-in again and has remained in its present condition until now.

I might point out that referring to Exhibit No. 2, the diagrammatic sketch of the well shows that the open hole interval below the 5- $\frac{1}{2}$ " casing has the entire Pictured Cliffs sand exposed in the well bore, which includes both the upper gas-productive interval and the water-bearing portion of the formation. We anticipate that salt water injected into this well will be confined to the open hole interval below the 5- $\frac{1}{2}$ " casing.

Q Would go into the entire open hole interval?

A Yes. Since the entire Pictured Cliffs formation is exposed in the well bore, we would anticipate that injected water would go into the entire section.



Q What is the source of the water to be injected into this well, Mr. Lacey?

A The water which we propose to dispose in this well is produced water from the Central Totah Unit, which is under a secondary recovery project.

Q What quantities of water are being produced at the present time and what quantities do you expect to be produced and injected into this well in the future?

A At the present time the Central Totah Unit has approximately 150 to 200 barrels of water a day, which is now being disposed of in an open pit. We anticipate that this well would serve approximately half of the producing wells in the unit and that our produced water which we would need to dispose of would increase in the order of a thousand to fifteen hundred barrels a day. The ultimate amount of water which we would anticipate to be injected into the well would be on the order of a million to a million and a half barrels.

Q Why do you feel it's necessary to dispose of this water by injection rather than by surface means?

A Exhibits 4, 5 and 6 are water analyses of, two of them are water analyses of the indigenous Pictured Cliffs formation, and one is a water analysis of the water presently being produced from the Central Totah Unit Well No. 4, and shows that the salient



of the water being produced from the Gallup is too high for us to dispose of large quantities of water at the surface.

Q What do the exhibits reflect as to the salient or dissolved solids in the water indigenous to the Pictured Cliffs formation?

A The exhibits show that the indigenous or the formation water in the Pictured Cliffs is considerably more salient, or carries considerably more dissolved solids than the water which we propose to dispose in the Callow No. 2. The water analyses taken together show, or would indicate that there are no fresh water zones in the Pictured Cliffs formation down to and including the Gallup formation.

Q So the injection of produced water from the Gallup into the Pictured Cliffs formation would not have the effect of increasing the salient of that water?

A No, it would not.

Q Have copies of these analyses as well as all pertinent exhibits in this case been furnished to the Office of the State Engineer?

A Yes, they have.

Q Mr. Lacey, in your opinion what will be the effect of the injection of water into the Pictured Cliffs formation insofar as other wells in the area are concerned?



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A First let me state that I believe that any effect the water injected in the Callow 2 will be very little on the producing wells or other wells in the area for the reason that the water will go not only into the formerly gas-productive interval, but will go into the entire open hole section of the Callow 2, and will go in the water-bearing formations.

The effect, what little effect water injection will have I would anticipate to be slightly beneficial since water injection into the gas zone would tend to maintain pressure in this portion of the field, and possibly permit the Pictured Cliffs producing gas wells in the area to produce a little longer than they might under a normal pressure depletion.

I might add that the producing Pictured Cliffs wells in this area are now at the latter stages of their economic life and that the gas-producing rates are very marginal.

Q Have you made any study concerning the amount of water that would have to be injected into this gas-producing portion of the formation in order for it to have any detrimental effect upon adjoining producing wells?

A Yes, I have. Volumetric calculations indicate that it would require, approximately fourteen million barrels of water would have to go into the gas-productive interval alone based on the average porosity and gas saturation now existing before, and



assuming that it went out in a radial pattern, it would take approximately fourteen to fifteen million barrels of water before it would reach the closest offset well, which is Tenneco's Callow No. 4.

Q And you have testified previously that the maximum amount of water you would expect to inject would be on the order of one million rather than fourteen or fifteen million?

A That is correct. One to one and a half million barrels. We, therefore, feel that the effect for the reasons previously stated will be very small, if any, on the producing wells in the area.

Q Of course, your assumptions are also based on all of that water going into the gas-productive formation when you are talking in terms of fourteen or fifteen million barrels producing any undesirable result?

A Yes, I am. This estimate of fourteen, fifteen million barrels assumes that the water would go only into the top twenty or thirty feet of the Pictured Cliffs, which is the gas-productive interval, and not the entire section that is exposed in the well bore.

Q So, based upon your evaluation of the effect that production into this well will have on Pictured Cliffs wells in the area, do you see that it will have any injurious effect?



A No, I do not.

Q Were Exhibits 1 through 6 prepared by you or under your direction?

A Yes, they were.

MR. MORRIS: We offer Exhibits 1 through 6 in evidence.

MR. NUTTER: Tenneco's Exhibits 1 through 6 will be admitted in evidence.

(Whereupon, Applicant's Exhibits 1 through 6 were offered and admitted in evidence.)

MR. MORRIS: I would like to state for the record at this time, Mr. Examiner, that I am informed that Mr. Irby has sent a letter to the Oil Commission, but that it has not as yet been received. I would ask that it be made a part of the record at the time that it is received by the Commission. We understand that it is not interposing any objection on this application, is that correct, Mr. Lacey?

A I might add that this application has been discussed with Mr. Irby verbally on Monday. He has copies of all the exhibits presented in the hearing and he expressed verbally at that time that he would have no objection.

MR. MORRIS: I believe the letter will confirm that position.

MR. NUTTER: Thank you, Mr. Morris. I promise you



we will read the letter when we receive it. Are there any questions of Mr. Lacey?

CROSS EXAMINATION

BY MR. NUTTER:

Q This is water that is being produced from your pressure maintenance project in the Gallup sand, is that right?

A Yes, it is.

Q Why isn't the water recirculated?

A The problem of mixing produced water with our water source presents problems that would make it extremely difficult, it would complicate our problem; from a standpoint of operations it's extremely more desirable to handle the two waters separately.

Q So, none of your produced water is being ^{recycled} recirculated then?

A At the present time it is not.

Q What is the source water that you finally developed here?

A The water that we are using as a source is the San Juan River. We take water directly out of the San Juan River and treat it with a municipal type of treating system with a fluxation-producing process.

Q Then this water isn't compatible with that water?

A Any time you mix produced water with another water, or water from another source, particularly fresh, you can get into these problems of incompatibility that might present extreme

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problems to overcome or elaborate equipment to treat.

Q Isn't this procedure that you are following here of using continuous new water for injection and disposing of the produced water, isn't this the exception rather than the rule in normal waterflooding or pressure maintenance operation? Isn't it the normal practice to use the produced water and to just add whatever make-up water from the fresh water source is necessary?

A Well, I would say probably this is true. However, I might point out that what you probably have reference to now is probably five-spot waterflooding where there is a tremendous amount of water to be produced and handled, and that has to be disposed of. The Central Totah Unit, if you recall, is a double-ended line drive project where the whole unit, the design of the whole unit is such that the oil would be recovered with not a lot of produced water to be handled in the project.

Q Didn't you say that you believed that your total ultimate production of water here would be in the neighborhood of a thousand barrels a day?

A Possibly, right.

Q And that you would eventually produce about a million barrels of water?

A Right.

Q What is your projection of the total volume of water



you are going to need to flood the Gallup?

A Well, somewhere in the order of say ten million barrels.

Q But you'd only produce a million of it back?

A Right. The type of unit that this is, like I say, it's a peripheral type project where normally you don't anticipate handling large volumes of produced water through the project. In other words, you are going to, most of your secondary oil recovery is going to be at relatively low water cuts, as opposed to a pattern waterflood.

Q Once a well is watered out?

A It will be shut-in and the water moved forward or moved past it, that's right.

Q When you were giving the location of the nearest Pictured Cliffs wells I wasn't able to identify the sections on Exhibit No. 1. I have them identified now. Would you give me the nearest well again and what its location is?

A The closest producing Pictured Cliffs well to the Callow No. 2 is Tenneco Oil Company's Callow No. 4. It is located, well, it looks like it's located in the Southwest Quarter of the Southwest Quarter of Section 28.

Q That's approximately three quarters of a mile northwest of this well, is that correct?

A That is correct, approximately 2750 feet.



Q What's the next one?

A The second closest producing Pictured Cliffs well is Aztec Oil and Gas Company Hagood No. 2, which is located in the Southwest Quarter of the Northeast Quarter of Section 34, Township 29 North, Range 13 West.

Q Slightly more than a mile to the east?

A Yes.

Q Then what you did there, you took your Well No. 2 and drew a circle around that well, the radius of which was the distance from your Well No. 2 to your Well No. 4?

A That is correct.

Q And then you computed the porosity in the gas-bearing portion of the Pictured Cliffs formation only in that circle?

A That is correct.

Q And it came out to be fourteen million barrels?

A Yes. We have a core analysis on a Pictured Cliffs well in the area. It's the Callow No. 1 located in the Northeast Quarter of the Southeast Quarter of Section 29, and the average porosity in the gas-productive interval is approximately 25 percent. Just using a reasonable estimate of what the connate water is in the gas-productive interval of 30 percent, the barrels of space, of gas space then in an acre foot is on the order of fourteen hundred barrels, and twenty feet of pay it's on the order of



27,000 barrels for an acre.

Q The Pictured Cliffs formation is dipping northeast in this area, is that right?

A The Pictured Cliffs formation is dipping northeast in the area.

Q And the water is in the bottom part of the Pictured Cliffs formation, but as you come upstructure the water is in the top of the Pictured Cliffs formation?

A The entire Pictured Cliffs formation becomes water-bearing, yes. This is normal to all of the gas-producing formations in the San Juan Basin.

Q So, if your injected water would follow the pattern of nature, the water would go upstructure rather than downstructure?

A No, I would anticipate the injected water in the Callow 2 to actually go out in a radial pattern. For this reason the pressure in both the gas-bearing portion of the Pictured Cliffs formation and in the water-bearing portion is approximately the same, it has to be or we would now be seeing water encroachment or water drive on the gas field which cannot be produced, proved by current production, so that a high pressure point in a low pressure reservoir, the water is going to extend all directions equally.

What I'm trying to say here is that the presently producing



wells, gas-productive wells that are now lower structurally to the water-bearing Pictured Cliffs formation to the southwest are not cutting tremendous quantities of water. In other words, the pressure in the water-bearing formation can't be higher than the gas-bearing portion.

Q There are a couple of wells directly south here, a couple or three miles, which are structurally higher than your Callow No. 2 in the Pictured Cliffs, aren't they? That one there about 4325, and then there's another one up at 4400 feet way down at the bottom edge of your exhibit.

A Yes.

MR. McGRATH: That one at 4325 was a dry hole.

A The well identified in the Northeast Quarter of the Southeast Quarter of Section 33, immediately south to the Callow No. 2 was drilled as a dry hole and was never completed as a producing well.

Q Right, but the well that's another mile southeast of it is a producer?

A Yes.

Q What's your No. 4 currently capable of making?

A I don't have the exact producing rate on this well, but it's a marginal well. All of our Callow wells are marginal.

Q Do you know what the deliverability of it is?



A No, I do not, but they are exempt from deliverability tests I believe.

Q Have you any idea of the estimated remaining reserves in that No. 4 well?

A No, I don't have an estimate. However, I would venture a guess and say on the order of a quarter million feet, or something like that.

Q This No. 2 did produce from the Pictured Cliffs at one time?

A Yes, it did. It was completed as a producing well from the Pictured Cliffs.

Q How much did it produce from the Pictured Cliffs, do you know?

A No, I do not. The production, here again, it was on the order of possibly a half a million cubic feet.

Q What did it do, decline to an uneconomic limit or water out?

A It just declined. The well made a little bit of water. The record suggested it made a little bit of water even at its initial completion, and this was as the pressure declined in the gas zone this little bit of water that it did produce was sufficient to make the thing load up and become non-productive.

MR. NUTTER: Are there any further questions of Mr.



Lacey?

BY MR. McGRATH:

Q You said the No. 1 Callow, what did you give as the location of that?

A It looks like it's in the Northeast Quarter of the Southeast Quarter of Section 29.

MR. NUTTER: You said 29, I think you mean 27.

A I beg your pardon, Section 27.

Q I couldn't find it.

A Section 27.

Q No, as far as I'm concerned I don't see anything wrong with it.

MR. NUTTER: If there's no further questions, the witness may be excused.

(Witness excused.)

MR. NUTTER: Do you have anything further, Mr. Morris?

MR. MORRIS: No, sir, I do not.

MR. NUTTER: Does anyone have anything they wish to offer in Case 3090? Case 3090 will be taken under advisement and we will recess the hearing until 1:30.

(Whereupon, a recess was taken.)

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PHONE 243-6691

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, 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 3rd day of August, 1964.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:

June 19, 1967.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 3090 heard by me on July 22, 1964.

[Signature] Examiner
New Mexico Oil Conservation Commission

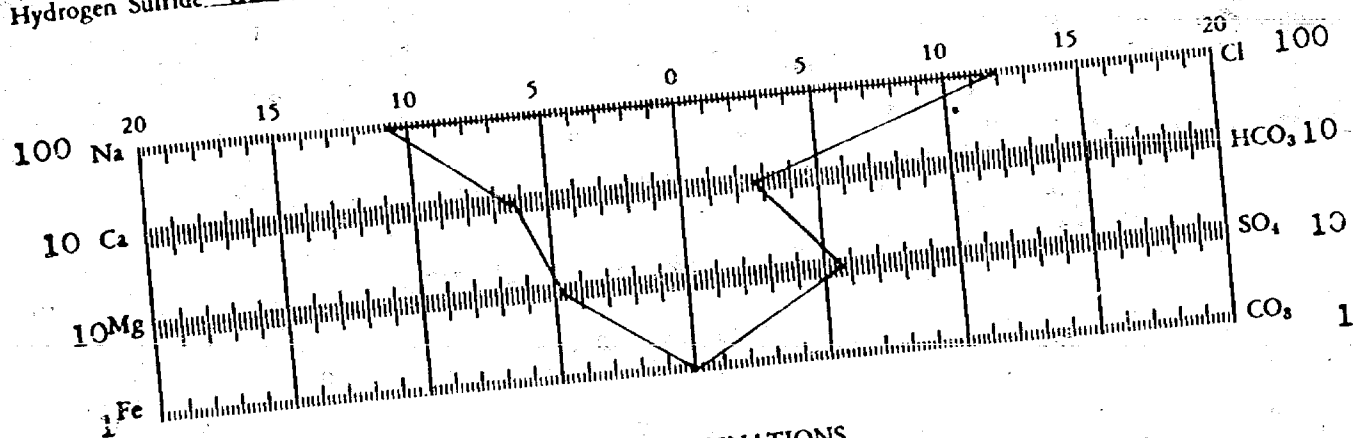




CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS
WATER ANALYSIS

Company TENNESSEE GAS TRANSMISSION CO. File RP-3-WA-233
Well Name USA GLEN H. CALLOW Sample No. 1
Formation PICTURED CLIFFS Depth _____
Location _____ Field W. KUTZ CANYON P.C. County SAN JUAN State NEW MEXICO
Date Sampled _____ Date Analyzed 3/12/60 Engineer ENGLISH
Constituents

Constituents	Meq/L	ppm
1. Total Solids	<u>75.453</u>	<u>ppm</u>
2. pH	<u>5.0</u>	
3. Sp. gr.	<u>1.049</u>	<u>@ 70 °F.</u>
4. Resistivity	<u>0.105</u>	<u>@ 68 °F.</u>
5. Hydrogen Sulfide	<u>abs</u>	
6. Sodium	<u>1167</u>	<u>26.841</u>
7. Calcium	<u>63.3</u>	<u>1.230</u>
8. Magnesium	<u>47.9</u>	<u>583</u>
9. Iron	<u>TR</u>	<u>TR</u>
10. Barium	<u>0</u>	<u>0</u>
11. Chloride	<u>1195.3</u>	<u>42.387</u>
12. Bicarbonate	<u>27.1</u>	<u>1,654</u>
13. Sulfate	<u>56.3</u>	<u>2,708</u>
14. Carbonate	<u>0</u>	<u>0</u>
15. Hydroxide	<u>0</u>	<u>0</u>



HYPOTHETICAL COMBINATIONS			
Constituent	ppm	Constituent	ppm
1. Calcium Chloride	<u>3545</u>	4. Sodium Chloride	<u>64,976</u>
2. Magnesium Bicarbonate	<u>1980</u>	5. Sodium Sulfate	<u>3,997</u>
3. Magnesium Chloride	<u>988</u>		



MAIN OFFICE OCC

TENNECO OIL COMPANY • P. O. BOX 1714 • 835 SECOND AVENUE • DUNSMO, COLORADO 80640

July 1, 1964

New Mexico Oil Conservation Commission
Mr. A. L. Porter - Secretary
P. O. Box 2088
Santa Fe, New Mexico

Re: Request for hearing to convert Glenn H. Callow
No. 2 (shut-in) Unit B, Section 33, T. 29 N.,
R. 13 W., San Juan County, New Mexico, West
Kutz Pictured Cliff Field to a water disposal
well for the Central Totah Unit

Dear Sir:

Tenneco Oil Company requests a hearing at an early date before the Oil Conservation Commission to permit Tenneco to convert a nonproductive well in the West Kutz Picture Cliff field to a water disposal well.

The well, Glenn H. Callow No. 2, is now shut in and has been nonproductive since June 1959 because of high water production. We propose to convert this well to a water disposal well for the Central Totah Unit. It will be used for the subsurface disposal of the produced water from the Central Totah Unit, a pressure maintenance project in the Totah Gallup field.

This well is approximately 3150' from the nearest offset producing well, Tenneco's Callow No. 4 (Unit M, Section 28, T. 29 N., R. 13 W.) marginal well and we do not anticipate that either quality or quantity of water to be injected will adversely affect the reservoir or gas production in the vicinity.

Attached is a plat showing the location of the well and nearby wells. A copy of this letter is being sent to the offset operator, Aztec Oil and Gas Company.

Very truly yours,

TENNECO OIL COMPANY

Robert E. Siverson
Robert E. Siverson
District Production Superintendent

JJL:hes

Attachment

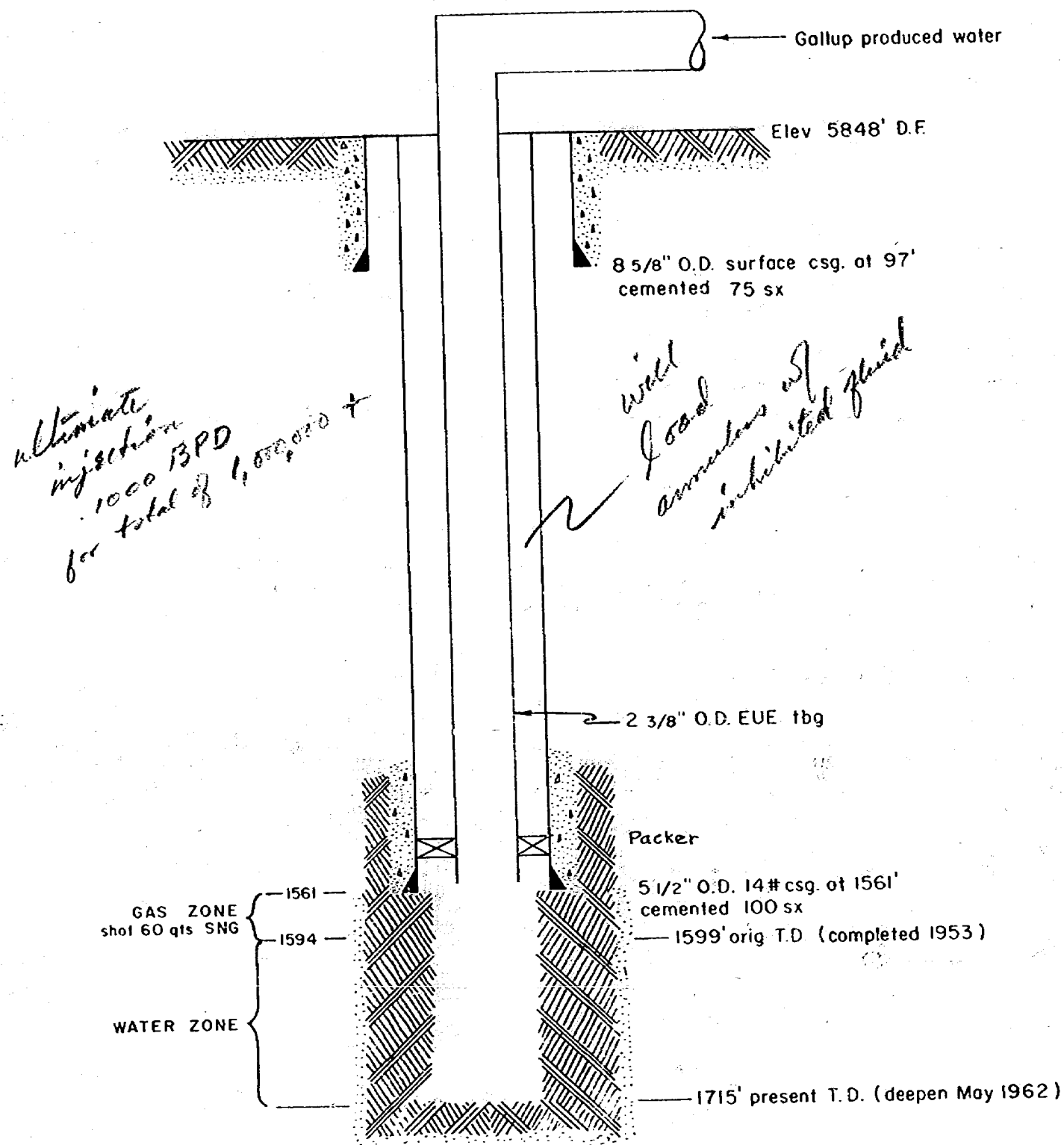
CC: W. T. Wells, Jr. - Midland
J. D. Moon - Midland

R. Morris - Santa Fe
Aztec Oil & Gas Co. - Farmington

Emery Arnold, New Mexico Oil Conservation Commission - Aztec / Attachment

DOCKET MAILED

Date 7/8/64



BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Tenneco EXHIBIT NO. 3
CASE NO. 3090

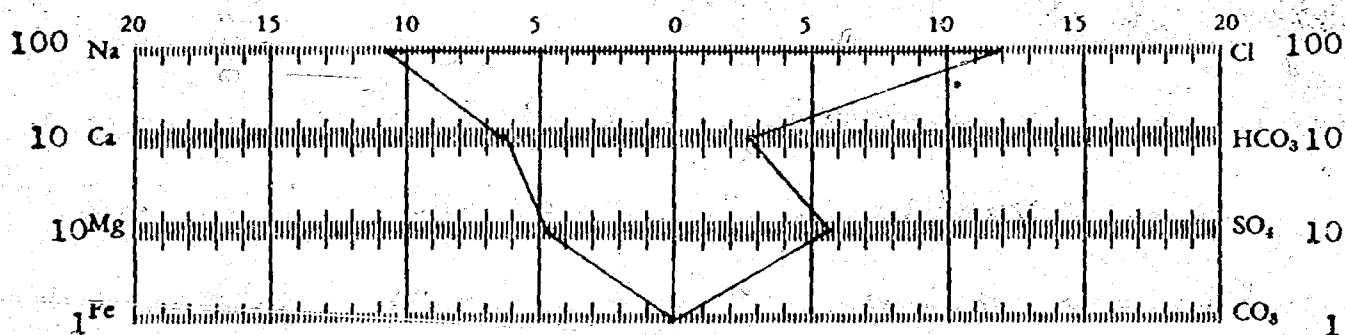
Proposed Water Disposal Well
TENNECO OIL COMPANY
Glenn Callow No. 2
Sec. 33, T29N R13W
SAN JUAN COUNTY, NEW MEXICO
7-1-64



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS
WATER ANALYSIS

File RP-3-WA-233
TENNESSEE GAS USA GLEN H. CALLOW
Compar. TRANSMISSION COMPANY Well Name # 2 Sample No. 1
Formation PICTURED CLIFFS Depth _____ Sampled From SEPARATOR
Location _____ Field W. KUTZ CANYON P.C. County SAN JUAN State NEW MEXICO
Date Sampled _____ Date Analyzed 3/12/60 Engineer ENGLISH

Constituents		Constituents	Meq/L	ppm	Constituents	Meq/L	ppm	
1. Total Solids	<u>75.453</u>	ppm	6. Sodium	<u>1167</u>	<u>26,841</u>	11. Chloride	<u>1195.3</u>	<u>42,387</u>
2. pH	<u>5.0</u>		7. Calcium	<u>63.3</u>	<u>1,230</u>	12. Bicarbonate	<u>27.1</u>	<u>1,654</u>
3. Sp. gr.	<u>1.049</u>	@ <u>70</u> °F.	8. Magnesium	<u>47.9</u>	<u>583</u>	13. Sulfate	<u>56.3</u>	<u>2,708</u>
4. Resistivity	<u>0.105</u>	@ <u>68</u> °F.	9. Iron	<u>TR</u>	<u>TR</u>	14. Carbonate	<u>0</u>	<u>0</u>
5. Hydrogen Sulfide	<u>abs</u>		10. Barium	<u>0</u>	<u>0</u>	15. Hydroxide	<u>0</u>	<u>0</u>



HYPOTHETICAL COMBINATIONS

Constituent	ppm	Constituent	ppm
1. Calcium Chloride	<u>3545</u>	4. Sodium Chloride	<u>64,976</u>
2. Magnesium Bicarbonate	<u>1980</u>	5. Sodium Sulfate	<u>3,997</u>
3. Magnesium Chloride	<u>988</u>		

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Jenneco EXHIBIT NO. 5
CASE NO. 3090

PRODUCTION PROFITS, INC.

Consultants in Petroleum Production

9130 VISCOUNT ROW

DALLAS, TEXAS

REPORT OF WATER ANALYSIS

SAMPLE NO. 8,573

TOTAL SOLIDS 7.023

CLIENT Tenneco Oil Company

OPERATOR _____

FIELD _____

COUNTY _____

STATE _____

LEASE AND WELL NO. Central Totah Unit No. 4

PROD. FORM Gallup Sand

SOURCE OF SAMPLE _____

DEPTH: TOTAL _____

PERF _____

SAMPLE OF: ☒ PRODUCED WATER

☐ INJECTION SYSTEM WATER

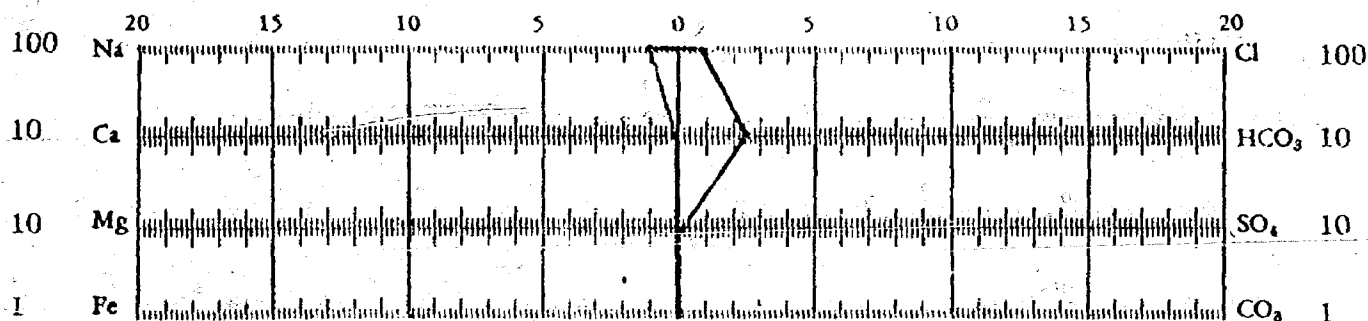
☐ OTHER

DATE COLLECTED Received in lab. 6-1-64

ANALYST _____

MINERAL ANALYSIS PATTERN

NUMBER BELOW ION NAME INDICATES MEQ SCALE UNIT



PRECIPITATED AND SUSPENDED SOLIDS

CONSTITUENT	MG/L (PPM)
TOTAL UNDISSOLVED SOLIDS	_____
IRON OXIDE	_____
CALCIUM CARBONATE	_____
CALCIUM SULFATE	_____
MAGNESIUM CARBONATE	_____
BARIUM SULFATE	_____
SILICA	_____
ORGANIC	_____

PHYSICAL PROPERTIES

SP. GRAVITY	<u>1.005</u>
PH	<u>8.1</u>
RESISTIVITY	<u>1.02</u> OHMMETERS @ 68°
STABILITY INDEX	@ 41°F _____
	@ 86°F _____
CASO ₄ SOLUBILITY	@ 41°F _____ MEQ/L
	@ 86°F _____ MEQ/L
MAX. CASO ₄ POSSIBLE	_____ MEQ/L

REMARKS:

DISSOLVED SOLIDS

CONSTITUENT	MG/L (PPM)
TOTAL SOLIDS	(CALC.) <u>7,023</u>
SODIUM	(CALC.) <u>2,480</u>
IRON	(TOTAL) _____
MANGANESE	_____
BARIUM	<u>0</u>
CALCIUM	<u>24</u>
MAGNESIUM	<u>3</u>
CHLORIDE	<u>2,961</u>
BICARBONATE	<u>1,495</u>
CARBONATE	<u>0</u>
SULFATE	<u>50</u>

DISSOLVED GASES

CONSTITUENT	MG/L (PPM)
HYDROGEN SULFIDE	_____
CARBON DIOXIDE	_____
OXYGEN	_____

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Tenneco EXHIBIT NO. 4
CASE NO. 3090

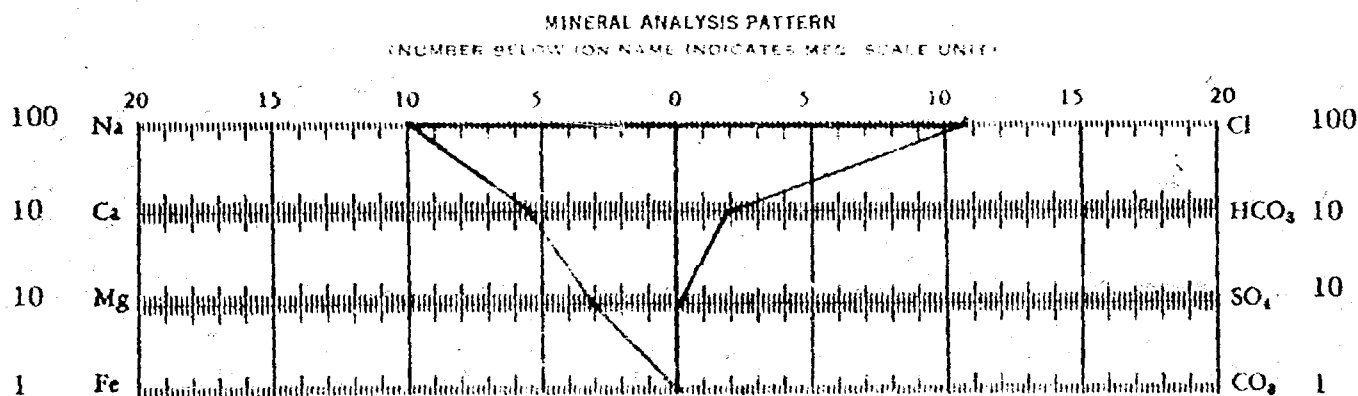
PRODUCTION PROFITS, INC.
Consultants in Petroleum Production

9130 VISCOUNT ROW
DALLAS, TEXAS

REPORT OF WATER ANALYSIS

CLIENT Tenneco Oil Co. OPERATOR _____
FIELD _____ COUNTY _____ STATE _____
LEASE AND WELL NO. Callow No. 4 PROD. FORM Pictured Cliff
SOURCE OF SAMPLE _____ DEPTH: TOTAL _____ PERF _____
SAMPLE OF: ☒ PRODUCED WATER ☐ INJECTION SYSTEM WATER ☐ OTHER ☐
DATE COLLECTED Received in lab. 6-1-64 ANALYST _____

SAMPLE NO. 8,772
TOTAL SOLIDS 63,758



PRECIPITATED AND SUSPENDED SOLIDS

CONSTITUENT	MG/L (PPM)
TOTAL UNDISSOLVED SOLIDS	_____
IRON OXIDE	_____
CALCIUM CARBONATE	_____
CALCIUM SULFATE	_____
MAGNESIUM CARBONATE	_____
BARIUM SULFATE	_____
SILICA	_____
ORGANIC	_____

PHYSICAL PROPERTIES

SP. GRAVITY 1.044
FH 6.9
RESISTIVITY 0.126 OHMMETERS @ 68°
STABILITY INDEX @ 41°F _____
@ 86°F _____
CASO₄ SOLUBILITY @ 41°F _____ MEQ/L
@ 86°F _____ MEQ/L
MAX. CASO₄ POSSIBLE _____ MEQ/L

REMARKS:

DISSOLVED SOLIDS

CONSTITUENT	MG/L (PPM)
TOTAL SOLIDS (CALC.)	<u>63,758</u>
SODIUM (CALC.)	<u>23,055</u>
IRON (TOTAL)	_____
MANGANESE	_____
BARIUM	<u>152</u>
CALCIUM	<u>1,078</u>
MAGNESIUM	<u>372</u>
CHLORIDE	<u>37,942</u>
BICARBONATE	<u>1,159</u>
CARBONATE	<u>0</u>
SULFATE	<u>0</u>

DISSOLVED GASES

CONSTITUENT	MG/L (PPM)
HYDROGEN SULFIDE	_____
CARBON DIOXIDE	_____
OXYGEN	_____

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Tenneco EXHIBIT NO. 6
CASE NO. 3090

DOCKET: EXAMINER HEARING - WEDNESDAY - JULY 22, 1964

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 3081: Application of Shell Oil Company for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project in the Langlie-Mattix Pool by the injection of water through four wells at unorthodox locations in Section 21, Township 24 South, Range 37 East, Lea County, New Mexico.
- CASE 3082: Application of Union Oil Company of California for salt water disposal, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water into the Devonian formation through perforations from 11,246 feet to 11,285 feet in its State-Gross Well No. 2 located in Unit L of Section 11, Township 12 South, Range 32 East, East Caprock Field, Lea County, New Mexico.
- CASE 3083: Application of General American Oil Company of Texas 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 Premier Sand through twelve wells located in Sections 27, 28, 33 and 34, Township 17 South, Range 30 East, Eddy County, New Mexico. Certain of the aforesaid injection wells would be drilled at unorthodox locations.
- CASE 3084: Application of Fair Oil Company for a buffer zone extension and pool redelineation, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an amendment of Order No. R-2033 to extend the waterflood buffer zone authorized by said order to include the SE/4 NE/4 of Section 36, Township 17 South, Range 29 East, Eddy County, New Mexico. Applicant further seeks the extension of the Loco Hills Pool to include said quarter-quarter section, and the associated deletion of said acreage from the Grayburg-Jackson Pool.
- CASE 3085: Application of Humble Oil & Refining Company for two non-standard oil proration units, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of two non-standard 80-acre oil proration units in Section 7, Township 19 South, Range 35 East, Scharb Bone Springs Pool, Lea County, New Mexico. The first unit would comprise the NW/4 NE/4 and the NE/4 NW/4 of Section 7 and be dedicated to applicant's Alves Well No. 1 located in Unit B of said Section 7. The second unit would comprise the SW/4 NE/4 and the SE/4 NW/4 of Section 7 and be dedicated to applicant's Alves Well No. 2, which would be drilled in Unit G of said Section 7.
- CASE 3086: Application of Texaco Inc. for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project in the Rhodes Yates Oil Pool by the injection of water into the Yates and Seven Rivers formations through two wells in Section 26, Township 26 South, Range 37 East, Lea County, New Mexico.

- CASE 3087: Application of William A. and Edward R. Hudson for an unorthodox location, Eddy County, New Mexico. Applicants, in the above-styled cause, seek authority to drill their Puckett "A" Well No. 26 at an unorthodox location 1295 feet from the North and West lines of Section 24, Township 17 South, Range 31 East, Eddy County, New Mexico. Said well would be projected to the Paddock formation at approximately 5400 feet.
- CASE 3088: Application of Phillips Petroleum Company for a unit agreement, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Ranger Lake Unit Area comprising 2,680 acres, more or less, of State land in Township 12 South, Range 34 East, Lea County, New Mexico.
- CASE 3089: Application of Phillips Petroleum Company for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project in the Ranger Lake-Pennsylvanian Pool in its Ranger Lake Unit Area by the injection of water into the Pennsylvanian formation through nine wells in Sections 14, 23, 24, 25, 26, 27, 34 and 35, Township 12 South, Range 34 East, Lea County, New Mexico.
- CASE 3090: Application of Tenneco Oil Company for salt water disposal, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water in the Pictured Cliffs formation through its Callow Well No. 2 located in Unit B, Section 33, Township 29 North, Range 13 West, West Kutz-Pictured Cliffs Pool, San Juan County, New Mexico.
- CASE 3091: Application of The British-American Oil Producing Company for a dual completion and pool commingling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the dual completion (conventional) of its North Wilson Deep Unit Well No. 1, located in Unit O of Section 31, Township 20 South, Range 36 East, Lea County, New Mexico, to produce oil from the Upper Bone Spring formation and the Lower Bone Spring formation through parallel strings of tubing. Applicant further seeks authority to commingle the production from said pools after separately metering the Lower Bone Spring production.
- CASE 3092: Application of The British-American Oil Producing Company for the creation of a new oil pool and special pool rules, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new oil pool for Upper Bone Spring production for its North Wilson Deep Unit Well No. 1, located in Unit O of Section 31, Township 20 South, Range 36 East, Lea County, New Mexico, which well is perforated from 7888 to 7901 feet. Applicant further seeks the promulgation of special rules for said pool, including a provision for 80-acre proration units.
- CASE 3093: Application of The British-American Oil Producing Company for the creation of a new oil pool and special pool rules, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new oil pool for Lower Bone Spring production for its North Wilson Deep Unit Well No. 1, located in Unit O of Section 31, Township 20 South, Range 36 East, Lea County, New Mexico, which well is perforated from 10,094 to 10,122 feet. Applicant further seeks the promulgation of special rules for said pool, including a provision for 80-acre proration units.



MAIL OFFICE OCC

STATE OF NEW MEXICO 1964 JUL 22 PM 1:19
STATE ENGINEER OFFICE

SANTA FE

July 20, 1964

ADDRESS CORRESPONDENCE TO:
STATE CAPITOL
SANTA FE, N. M.

are
3090
S. E. REYNOLDS
STATE ENGINEER

Mr. A. L. Porter, Jr
Secretary-Director
Oil Conservation Commission
Santa Fe, New Mexico

Dear Mr. Porter:

Reference is made to the application of Tenneco Oil Company which seeks authority to dispose of produced salt water in the Pictured Cliff formation through its Callow Well No. 2 located in Unit B, Sec. 33, T. 29 N., R. 13 W., West Kutz Pictured Cliff, San Juan County, New Mexico. This application is not on a standard form, but I am assuming that their letter to you dated July 1, 1964 constitutes an application. Mr. Siverson has submitted to me four exhibits:

1. A plat showing the location of the proposed well.
2. Cross-section B-B¹.
3. A diagrammatic sketch of the proposed injection well.
4. Copies of three different analyses of water samples from the following wells:

Central Totah Unit No. 4
Callow No. 4 and Callow No. 2

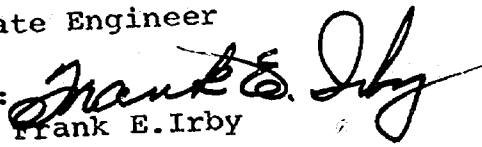
After studying the exhibits and discussing the application with Mr. Jerry Lacy, Tenneco representative at Durango, it appears that no threat of contamination to any fresh waters which may exist in the area will occur, provided the annulus between the tubing and casing is sealed by a packer placed

well below the top of the cement surrounding the 5½ inch
O. D. casing. Therefore, this office offers no objection to
the granting of the application provided the packer mentioned
above is included in the plan.

Very truly yours,

S. E. Reynolds
State Engineer

By:


Frank E. Irby
Chief
Water Rights Div.

FEI/ma

cc-Mr. Robert E. Siverson
Mr. Richard Morris

GOVERNOR
JACK M. CAMPBELL
CHAIRMAN

State of New Mexico
Oil Conservation Commission



LAND COMMISSIONER
E. S. JOHNNY WALKER
MEMBER

P. O. BOX 2088
SANTA FE

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

December 2, 1964

Mr. Richard S. Morris
Seth, Montgomery, Federici & Andrews
Attorneys at Law
Post Office Box 2307
Santa Fe, New Mexico

Re: CASE NO. 3090
ORDER NO. R-2816
APPLICANT Tenneco Oil Co.

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

ir/

Carbon copy of order also sent to:

Hobbs OCC X

Artesia OCC

Aztec OCC X

OTHER Mr. 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. 3090
Order No. R-2816

APPLICATION OF TENNECO OIL COMPANY
FOR SALT WATER DISPOSAL, SAN JUAN
COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on July 22, 1964, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 2nd day of December, 1964, 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, Tenneco Oil Company, is the owner and operator of the Callow Well No. 2, located in Unit B of Section 33, Township 29 North, Range 13 West, NMPM, West Kutz-Pictured Cliffs Pool, San Juan County, New Mexico.

(3) That the applicant proposes to utilize said Callow Well No. 2 to dispose of produced salt water into the Pictured Cliffs formation, with injection into the open-hole interval from 1561 feet to 1715 feet.

(4) That the injection should be accomplished through 2 3/8-inch tubing installed in a packer set near the bottom of the 5 1/2-inch casing; that the casing-tubing annulus should be filled with an inert fluid; and that a pressure gauge should be attached to the annulus in order to determine leakage in the tubing or packer.

-2-

CASE No. 3090
Order No. R-2816

(5) That approval of the subject application will prevent the drilling of unnecessary wells and otherwise prevent waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Tenneco Oil Company, is hereby authorized to dispose of produced salt water into the Pictured Cliffs formation through its Callow Well No. 2, located in Unit B of Section 33, Township 29 North, Range 13 West, NMPM, West Kutz-Pictured Cliffs Pool, San Juan County, New Mexico, injection to be accomplished through 2 3/8-inch tubing installed in a packer set within 100 feet of the 5 1/2-inch casing shoe, with injection into the open-hole interval from 1561 feet to 1715 feet;

PROVIDED HOWEVER, that the casing-tubing annulus shall be filled with an inert fluid, and that a pressure gauge shall be attached to the annulus in order to determine leakage in the tubing or packer.

(2) That the applicant shall submit monthly reports of its disposal operations in accordance with Rules 704 and 1119 of the Commission Rules and Regulations.

(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

Jack M. Campbell
JACK M. CAMPBELL, Chairman

E. S. Walker
E. S. WALKER, Member

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

esr/

DRAFT

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

CF Subj. _____

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

CASE No. 3090

Order No. R-2816

APPLICATION OF TENNECO OIL COMPANY
FOR SALT WATER DISPOSAL, SAN JUAN
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33, Township 29 North, Range 13 West, NMPM, West Kutz-Pictured
Cliffs Pool, San Juan County, New Mexico.

(3) That the applicant proposes to utilize said Callow Well
No. 2 to dispose of produced salt water into the Pictured Cliffs
formation, with injection interval from 1561 feet ^{into the open-hole} to 1715 feet.
feet.

(4) That the injection should be accomplished through 2 $\frac{3}{8}$ -inch ~~internally plastic coated~~ tubing installed in a packer set near the bottom of the $\frac{5}{8}$ inch casing; ~~at approximately~~ feet, that the casing-tubing annulus should be filled with an inert fluid; and that a pressure gauge should be attached to the annulus in order to determine leakage in the tubing or packer.

(5) That approval of the subject application will prevent the drilling of unnecessary wells and otherwise prevent waste and protect correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Tenneco Oil Company, is hereby authorized to dispose of produced salt water into the Pictured Cliffs formation through its Callow Well No. 2, located in Unit B of Section 33, Township 29 North, Range 13 West, NMPM, West Kutz-Pictured Cliffs Pool, San Juan County, New Mexico, injection to be accomplished through 2 $\frac{3}{8}$ -inch ~~internally plastic coated~~ tubing installed in a packer set within 100 feet of the $\frac{5}{8}$ inch ~~at approximately~~ into the open-hole ~~feet,~~ with injection interval from 1561 to 1715 feet;

PROVIDED HOWEVER, that the casing-tubing annulus shall be filled with an inert fluid, and that a pressure gauge shall be attached to the annulus in order to determine leakage in the tubing or packer.

(2) That the applicant shall submit monthly reports of its disposal operations in accordance with Rules 704 and 1119 of the Commission Rules and Regulations.

(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.

Casing Shot