Form O-11B (rev. 2-76)

SAMPLE NO._____

THE WESTERN COMPANY

Hobbs, New Mexico

Service Laboratory
Midland, Texas
Phone 683-2781 Day
Phone 683-4162 Night

Service Laboratory
Oklahoma City, Oklahoma
Phone 840-2771 Day
Phone 751-5470 Night

WATER ANALYSIS

PENNZOIL
JUL 06 1976
MIDLAND

County	Eddy	**Date Sampled**	7-2-76
Field	Ranch Windmill	**Date Received**	7-2-76
Operator	Pennzoil	**Submitted By**	J. C. Raney
Well	Smith Ranch	**Worked By**	Chuck Kelley
Depth	Unknown	Other Description	
Formation			

CHEMICAL DETERMINATIONS as parts per million

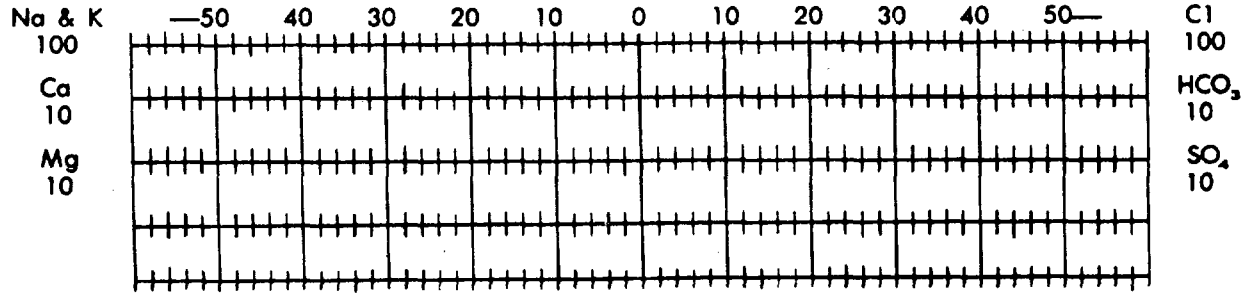
Density	1.00	pH	7.0
Iron	None	**Hydrogen Sulfide**	None
Sodium and Potassium	1,587	**Bicarbonate**	366
Calcium	800	**Sulfate**	
Magnesium	121.5	**Phosphate**	
Chloride	4,000	as Sodium Chloride	

TOTAL ppm _____

Resistivity _____ ohm-meters

Remarks:

for Stiff type plot (in meq./1.)



Per _____

19 31

NW NW

.131

2nd well

1/12/71

NE SW NE

.232 1/12/71

19/32 Sec 26

NE NE SE

Quality of Water

Rain water, having been distilled by natural processes, is relatively pure. Once water is in contact with the land surface, however, the water begins to dissolve organic and inorganic matter; and as the water moves through an aquifer, it dissolves rock materials. Ground water in arid and semiarid areas commonly contains enough dissolved mineral matter to limit its usefulness.

Among the most common chemical substances found in ground water are silica (SiO_2), iron (Fe), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), carbonate (CO_3), bicarbonate (HCO_3), sulfate (SO_4), chloride (Cl), fluoride (F) and nitrate (NO_3). Of these, the bulk generally is distributed among calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, and chloride. The concentrations of silica, fluoride, and nitrate generally are a minor part of the dissolved solids, and for some purposes sodium and potassium are grouped together and treated as one. Similarly, carbonate and bicarbonate may be grouped together.

The chemical characteristics of a water may be identified through study of the concentration and relative abundance of the principal ions it contains. Table 8 gives analyses of water from wells in the southern Lea County area, and Table 9 gives analyses of water pumped from oil wells.

Other characteristics commonly reported in chemical analyses of water samples are dissolved solids, specific conductance, hardness, pH, and percent sodium. A brief explanation of these characteristics follows.

Most of the dissolved-solids concentrations presented in Tables 8 and 9 are computed values for the total mineral constituents of the water sample, based on the constituents determined in the analysis, except that bicarbonate has been reported as carbonate. The dissolved-solids content can be determined directly by evaporating a sample to dryness at 180°C. A rough measure of the dissolved-solids concentration is provided by the specific conductance, which expresses the ease with which an electrical current can be passed through the water. The conductance depends directly on the amount and nature of the dissolved solids; thus no information on the chemical nature of the dissolved mineral matter is obtained from the specific-conductance measurement. For water in the Triassic, Tertiary, and Quaternary rocks in southern Lea County, the dissolved-solids concentration is approximately equal to the specific conductance at 25°C multiplied by a factor of 0.65.

Hardness of water is attributable to the presence of alkaline earth cations, which in natural waters are principally calcium and magnesium. It is an indication of soap-consuming power of the water. The cations that cause hardness can combine with certain anions to form troublesome deposits in boilers and other heat-exchange equipment.

From Ground-Water Report 6
Geology & Ground-Water Conditions
in Southern Lea County, N. M.

The pH value of an aqueous solution represents the hydrogen-ion concentration of the solution and ranges from 0 to 14. Ordinarily a value of 7.0 is considered neutral; values below 7.0 indicate acid solutions; and values above 7.0 indicate alkaline solutions. The pH values reported for many of the analyses given in Table 8 are questionable because of the long period of storage between time of collection and time of analysis, during which the pH can and does change. (The bicarbonate concentrations reported are subject to the same conditions.)

Percent sodium indicates the amount of sodium relative to the other cations present in the water and is useful in classifying the water for irrigation purposes. Inasmuch as all the analyses shown in Table 8 show the combined concentrations of sodium and potassium, the sodium percentages indicated include potassium also. However, since the ratio of potassium to sodium probably is very small, the figures shown under "percent sodium" probably are only slightly high.

The concentration of chemical constituents in water (tables 8 and 9) is expressed in ppm (part per million) and epm (equivalents per million). A part per million is a unit weight of a substance in a million unit weights of solution. Equivalents per million is a measure of the reactive weights of different ions. The atoms of the different elements have different relative weights which are know as atomic weights. The atomic weight of chlorine is 35.46 and that of sodium is 22.997. By dividing the atomic weight of sodium into the atomic weight of chlorine it can be seen that the chloride ion is 1.54 times heavier than the sodium ion. Hence, to form the simple compound of sodium chloride, in which each atom (or ion) of sodium combines with an atom of chlorine to form a single molecule of salt, the quantities required, in terms of weight, would be 1 part sodium to 1.54 chlorine. In such proportions there are equal numbers of sodium and chloride ions; that is, they are chemically equivalent. The concentration of a substance, in equivalents per million, is determined by dividing its concentration in parts per million by its chemical combining weight. The chemical combining weight is the atomic weight of the ion divided by its valence.

Usually, chemical analyses are reported in parts per million, but it is frequently more convenient for interpretative purposes to compare waters in terms of equivalents per million. In Tables 8 and 9 the concentrations of the different constituents are given in both terms. Some analyses by commercial laboratories express concentrations in grains per gallon. This expression can be converted into parts per million by multiplying by 17.12.

CHEMICAL STANDARDS FOR WATER USE

The U.S. Public Health Service (1946) sets up criteria for the quality of drinking water to be used on common carriers used in interstate traffic. These recommended limits have gained wide acceptance as stand-

ards against which to measure water quality, although they are somewhat conservative when applied in an area such as southern Lea County, where much of the ground water is mineralized. Recommended maximum concentrations (U.S. Public Health Service, 1946) for selected chemical constituents are as follows:

	PPM
Iron and Manganese	0.3
Fluoride	1.5*
Magnesium	125
Zinc	15
Chloride	250
Sulfate	250
Dissolved solids	500†

Numerous analyses in Table 8 exceed those limits with respect to one or more constituents. Although some of these samples reflect natural conditions, many appear to be contaminated. This aspect will be discussed in the section on brine contamination of shallow ground water.

Chemical requirements for industrial uses of water vary according to the industry, but requirements are most rigid where water is used in food, paper, or other chemical-process industries. The two most common industrial uses for water in southern Lea County are for cooling and boiler feed. Excessive concentrations of dissolved solids are troublesome in water used for cooling, inasmuch as the process of evaporation, by which cooling takes place, removes water in the chemically pure vapor state, leaving behind the dissolved matter in greater concentration than before.

The chemical-quality requirements of boiler feed water depend to a great extent on the operating pressure and design of the boiler system. High operating pressures impose very strict tolerance limits; for example, suggested tolerance limits for systems operating at more than 400 psi specify a concentration of dissolved solids of 50 ppm or less. Low-pressure systems, operating at less than 150 psi can use water having a dissolved-solids concentration of 500 to 3,000 ppm ([Calif.] State Water Pollution Control Board, 1957, p. 129). Nearly all the ground water sampled in southern Lea County requires some treatment to make it suitable for use as boiler feed water.

CHEMICAL CHARACTERISTICS OF GROUND WATER IN SOUTHERN LEA COUNTY

The dissolved chemical constituents in ground water reflect, to a great extent, the lithologic characteristics of the aquifer because presumably the water is in chemical equilibrium with the rock material with which it is in intimate contact. Differences in lithology will give

* Mandatory limit.

† Unless water of better quality is not available, in which case a total solids content of 1,000 ppm may be permitted.

Dockets Nos. 23-76 and 24-76 are tentatively set for hearing on August 18 and September 1, 1976. Applications for hearing must be filed at least 22 days in advance of hearing date.

DOCKET: EXAMINER HEARING - WEDNESDAY - AUGUST 4, 1976

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

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

CASE 5726: Application of Cities Service Oil Company for downhole commingling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to commingle production from the North Burton Flats-Wolfcamp Gas Pool and an undesignated Canyon pool in the wellbore of its State CT Well No. 1, located in Unit I of Section 16, Township 20 South, Range 28 East, Eddy County, New Mexico.

CASE 5727: Application of Big "6" Drilling Corporation for salt water disposal, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water into the Bone Springs formation through the perforated interval from 10,062 feet to 10,119 feet in its Ora Jackson "A" Well No. 1 located in Unit M of Section 5, Township 19 South, Range 35 East, Scharb-Bone Springs Pool, Lea County, New Mexico.

CASE 5728: Application of Pennzoil Company for an exception to Order No. R-3221, Lea County, New Mexico. Applicant, in the above-styled cause, seeks, as an exception to the provisions of Commission Order No. R-3221, permission to dispose of, in an unlined pit, produced salt water from its Mescalero Ridge Unit Well No. 1, located in Unit M of Section 20, Township 19 South, Range 34 East, Quail Ridge-Morrow Pool, Lea County, New Mexico.

CASE 5729: Application of Penroc Oil Corporation for compulsory pooling, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Pennsylvanian formation underlying the N/2 of Section 33, Township 19 South, Range 28 East, Eddy County, New Mexico, to be dedicated to applicant's Angell Ranch Well No. 1 to be drilled at an orthodox location in Unit B of said Section 33 to test the Morrow formation. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 5730: Southeastern New Mexico nomenclature case calling for the creation and extension of certain pools in Eddy, Chaves, and Lea Counties, New Mexico:

a) CREATE a new pool in Lea County, New Mexico, classified as a gas pool for Morrow production and designated as the Mid Bell Lake-Morrow Gas Pool. The discovery well is the Continental Oil Company Bradley "A" Well No. 1 located in Unit F of Section 19, Township 23 South, Range 34 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 34 EAST, NMPM
Section 19: W/2

b) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the East Burton Flat-Morrow Gas Pool. The discovery well is the Texas Oil and Gas Corporation Superior Federal Well No. 1 located in Unit G of Section 8, Township 20 South, Range 29 East, NMPM. Said pool would comprise:

TOWNSHIP 20 SOUTH, RANGE 29 EAST, NMPM
Section 4: W/2
Section 8: All
Section 9: All
Section 16: All
Section 17: All
Section 18: All

c) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Strawn production and designated as the East Burton Flat-Strawn Gas Pool. The discovery well is the Texas Oil and Gas Corporation Yates Federal Well No. 1 located in Unit N of Section 8, Township 20 South, Range 29 East, NMPM. Said pool would comprise:

TOWNSHIP 20 SOUTH, RANGE 29 EAST, NMPM
Section 8: S/2

d) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Wolfcamp production and designated as the East Burton Flat-Wolfcamp Gas Pool. The discovery well is the Texas Oil and Gas Corporation Yates A Federal Well No. 1 located in Unit F of Section 21, Township 20 South, Range 29 East, NMPM. Said pool would comprise:

TOWNSHIP 20 SOUTH, RANGE 29 EAST, NMPM
Section 21: W/2

e) CREATE a new pool in Eddy County, New Mexico, classified as an oil pool for Delaware production and designated as the Byrnes Tank-Delaware Pool. The discovery well is the Hanagan Petroleum Corporation Newman Well No. 1 located in Unit O of Section 7, Township 23 South, Range 26 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 26 EAST, NMPM
Section 7: SE/4

f) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Wolfcamp production and designated as the Catclaw Draw-Wolfcamp Gas Pool. The discovery well is the Hanagan Petroleum Corporation North Fork Well No. 1 located in Unit C of Section 2, Township 22 South, Range 25 East, NMPM. Said pool would comprise:

TOWNSHIP 22 SOUTH, RANGE 25 EAST, NMPM
Section 2: N/2

g) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Horseshoe Bend-Morrow Gas Pool. The discovery well is the Hanagan Petroleum Corporation Horseshoe Bend Well No. 1 located in Unit K of Section 34, Township 23 South, Range 25 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 25 EAST, NMPM
Section 34: W/2

h) CREATE a new pool in Eddy County, New Mexico, classified as an oil pool for Delaware production and designated as the Indian Flats-Delaware Pool. The discovery well is the Perry R. Bass Big Eddy Unit Well No. 47 located in Unit F of Section 35, Township 21 South, Range 28 East, NMPM. Said pool would comprise:

TOWNSHIP 21 SOUTH, RANGE 28 EAST, NMPM
Section 35: NW/4

i) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Laguna Grande-Morrow Gas Pool. The discovery well is the Exxon Corporation Laguna Grande Unit Well No. 1 located in Unit I of Section 28, Township 23 South, Range 29 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 29 EAST, NMPM
Section 28: E/2

j) CREATE a new pool in Lea County, New Mexico, classified as an oil pool for Paddock production and designated as the Leamex-Paddock Pool. The discovery well is the Kirby Petroleum Company State Well No. 2 located in Unit O of Section 22, Township 17 South, Range 33 East, NMPM. Said pool would comprise:

TOWNSHIP 17 SOUTH, RANGE 33 EAST, NMPM
Section 22: SE/4

k) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Atoka production and designated as the Nash Draw-Atoka Gas Pool. The discovery well is the Mesa Petroleum Company Nash Unit Well No. 2 located in Unit F of Section 18, Township 23 South, Range 30 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 30 EAST, NMPM
Section 18: N/2

l) CREATE a new pool in Lea County, New Mexico, classified as an oil pool for Bone Springs production and designated as the Rock Lake-Bone Springs Pool. The discovery well is the Amoco Production Company Rock Lake Unit Well No. 1 located in Unit L of Section 28, Township 22 South, Range 35 East, NMPM. Said pool would comprise:

TOWNSHIP 22 SOUTH, RANGE 35 EAST, NMPM
Section 28: SW/4

m) CREATE a new pool in Chaves County, New Mexico, classified as a gas pool for Pennsylvanian production and designated as the Tom Tom-Pennsylvanian Gas Pool. The discovery well is the Franklin, Aston & Fair, Ltd. Union Federal Well No. 1 located in Unit D of Section 1, Township 8 South, Range 31 East, NMPM. Said pool would comprise:

TOWNSHIP 8 SOUTH, RANGE 31 EAST, NMPM
Section 1: N/2

n) CREATE a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the North Winchester-Morrow Gas Pool. The discovery well is the Depco, Inc. DHY State Well No. 1 located in Unit F of Section 23, Township 19 South, Range 28 East, NMPM. Said pool would comprise:

TOWNSHIP 19 SOUTH, RANGE 28 EAST, NMPM
Section 23: N/2

o) CREATE a new pool in Eddy County, New Mexico, classified as an oil pool for Wolfcamp production and designated as the North Winchester-Wolfcamp Pool. The discovery well is the Depco, Inc. DHY State Well No. 1 located in Unit F of Section 23, Township 19 South, Range 28 East, NMPM. Said pool would comprise:

TOWNSHIP 19 SOUTH, RANGE 28 EAST, NMPM
Section 23: NW/4

p) EXTEND the Avalon-Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 20 SOUTH, RANGE 27 EAST, NMPM
Section 33: N/2

q) EXTEND the Blinebry Oil and Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 20 SOUTH, RANGE 38 EAST, NMPM
Section 28: SW/4

r) EXTEND the Cemetery-Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 20 SOUTH, RANGE 25 EAST, NMPM
Section 19: All
Section 32: E/2

s) EXTEND the Chaveroo-San Andres Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 8 SOUTH, RANGE 33 EAST, NMPM
Section 5: S/2

t) EXTEND the Drinkard Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM
Section 28: NE/4 NW/4

u) EXTEND the Hat Mesa-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 21 SOUTH, RANGE 32 EAST, NMPM
Section 3: S/2

v) EXTEND the Indian Draw-Delaware Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 22 SOUTH, RANGE 28 EAST, NMPM
Section 18: NW/4

w) EXTEND the Lusk-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 19 SOUTH, RANGE 32 EAST, NMPM
Section 9: All

x) EXTEND the South Lucky Lake-Queen Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 15 SOUTH, RANGE 29 EAST, NMPM
Section 16: SE/4 SW/4
Section 22: E/2 SW/4 & SW/4 SW/4
Section 27: W/2 NW/4

y) EXTEND the Nash Draw-Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 23 SOUTH, RANGE 30 EAST, NMPM
Section 18: N/2

z) EXTEND the South Osudo-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 21 SOUTH, RANGE 35 EAST, NMPM
Section 15: S/2

aa) EXTEND the Parallel-Delaware Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 20 SOUTH, RANGE 31 EAST, NMPM
Section 27: NE/4 NW/4

bb) EXTEND the Sulimar-San Andres Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 15 SOUTH, RANGE 29 EAST, NMPM
Section 13: SW/4 SE/4

cc) EXTEND the Teague-Devonian Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM
Section 22: SW/4

dd) EXTEND the Vest Ranch-Queen Associated Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 14 SOUTH, RANGE 30 EAST, NMPM
Section 9: E/2

MEMO TO: Mr. Dan S. Nutter
Oil Conservation Commission
Santa Fe, New Mexico

FROM: John W. Runayn
Oil Conservation Commission
Hobbs, New Mexico

DATE: August 11, 1976

SUBJECT: MARK SMITH RANCH

I took two water samples from Mr. Smith's windmill at ranch house and one from Pennsoil's lease. One sample was sent to United Chemical of Hobbs for complete analysis and I ran one sample from windmill and the sample from Pennsoil's lease. Results are attached.

In an interview with Mr. Smith and his wife, he stated that the water from the windmill at the house is used for both stock and house use. They do bring in water for drinking, but the windmill water is used for all other household uses, such as washing, dishes, bathing, etc.

He also stated that in the past he has drilled for water in all directions from the ranch house for additional outlying water for his cattle but has met with negative results.

He stated that if the water at his house becomes contaminated where his cattle can not drink it, and they can not use it, he would be practically ruined. The only source of water would be to run a pipe line to the caprock, six miles to the northeast in order to get good water, and this would be extremely expensive, a prohibitive cost to him.

In April 1970, a report was made by me for Case No. 4336 and the results of this report has not changed appreciably.

(1) The water at the ranch house is a "perched water" situation.
(2) The local geologic structure of the area as noted from "The Ground Water and Geology of Lea County - Bulletin 6" shows that the near surface formations tilt down to the west due to the slumping that created Laguna Plata and Gatuna. Water that is put into a pit on the Pennzoil lease would move in the direction of Mr. Smith's house, instead of the normal southeast direction (regional dip).
(3) Also, note there is a SWD well located in Section 28, T19S, R34E, less than 2 miles from Pennzoil lease, east. There are now several P&A wells in the area located much closer to the Pennzoil lease that might have SWD possibilities.

I feel that any water put into pit(s) northeast of the ranch house could possibly cause eventual contamination of the local "perched water" in the area. The sand dune area around Mr. Smith's house is the main source recharge to the local water source during periods of rainfall.

Respectfully submitted,

John W. Runyan

John W. Runyan, Geologist District I

NEW MEXICO OIL CONSERVATION COMMISSION
Hobbs, New Mexico

WATER ANALYSIS

Well Ownership: Mr. Mark Smith **Well No.** #1

Land Status: ☐ State ☐ Federal ☒ Fee

Well Location: Unit I, Section 26, T 19 S - R 33 E Lea County

(NE of NE of SE Sec. 26 -- Smith Ranch House)

Type Well: Windmill * **Depth:** 101 feet.

Well Use: Stock and house use

Sample Number: #2 **Date Taken:** Aug. 11, 1976
(John W. Runyan)

Specific Conductance: 2200 m/ohm

Total dissolved Solids: 2024 PPM.

Chlorides: 284.0 PPM.

Sulfates: _____ PPM.

Ortho-phosphates: ☐ V. low ☐ Low ☐ Med. ☐ High

Sulfides: ☒ None ☐ Low ☐ Med. ☐ High

_____ : _____

Date Analized: August 11, 1976 **By:** John W. Runyan
N.M.O.C.C.

Remarks: * Windmill also has submergible pump as secondary back up -- depth to water 93 feet.

50 ml sample = 71.0 factor x 4.0 ml titration = 284.0 ppm cl.

NEW MEXICO OIL CONSERVATION COMMISSION
Hobbs, New Mexico

WATER ANALYSIS

Well Ownership: Penzoil Oil Company **Well No.** #1

Land Status: ☒ State ☐ Federal ☐ Fee

Well Location: Unit M, Section 20, T 19 S - R 34 E Lea County

Quail Ridge Unit #1

Type Well: Oil Well **Depth:** ____ feet.

Well Use: Sample taken from salt water storage tank

Sample Number: #3 **Date Taken:** August 11, 1976
John W. Runyan

Specific Conductance: ____ m/ℳ

Total dissolved Solids: ____ PPM.

Chlorides: 20,732.0 PPM.

Sulfates: ____ PPM.

Ortho-phosphates: ☐ V. low ☐ Low ☐ Med. ☐ High

Sulfides: ☒ None ☐ Low ☐ Med. ☐ High

____ : ____

Date Analized: August 11, 1976 **By:** John W. Runyan
N.M.O.C.C.

Remarks: Couldn't get the rate of produced water. Took water sample from valve at bottom of produced salt water holding tank at battery.

5.0 ml sample = 710.0 factor x 29.2 ml titration = 20,732 ppm cl.

KE-TONE®

UNITED CHEMICAL CORPORATION

OF NEW MEXICO

601 NORTH LEECH
P.O. BOX 1499
HOBBS, NEW MEXICO
88240

PHONE
(505)
393-7751

TO: New Mexico Oil Conservation

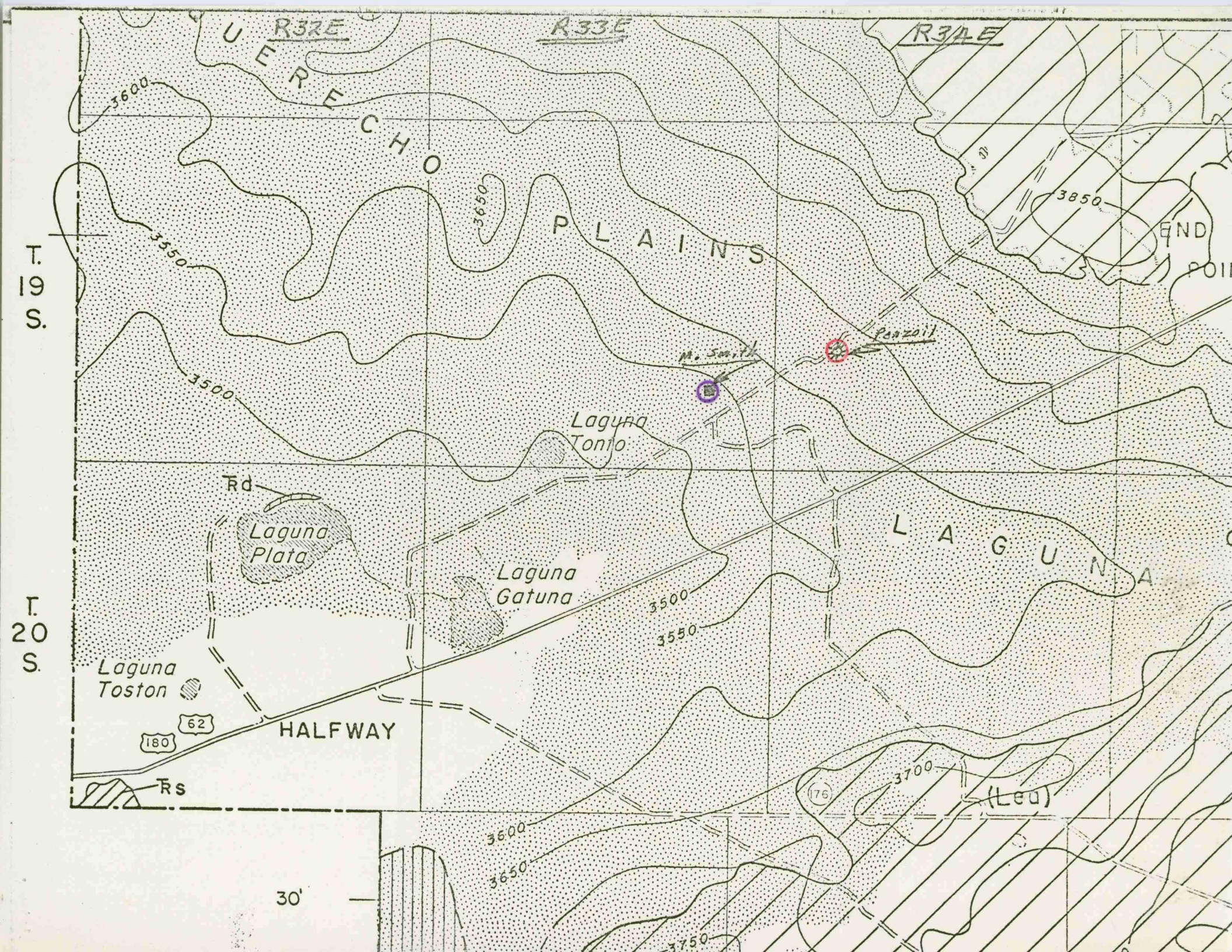
DATE 8-11-76

PLANT Mark Smith Ranch

REMARKS AND RECOMMENDATIONS

Windmill at house

SAMPLE SOURCE							
pH	7.8						
Total Hardness as $CaCO_3$ (PPM)	624						
Calcium as $CaCO_3$ (PPM)	332						
Magnesium as $CaCO_3$ (PPM)	292						
Total Phosphate as PO_4 (PPM)	0						
Orthophosphate as PO_4 (PPM)	0						
Polyphosphate as PO_4 (PPM)							
M Alkalinity as $CaCO_3$ (PPM)	212						
P Alkalinity as $CaCO_3$ (PPM)	0						
Chloride as Cl (PPM)	286						
Total Dissolved Solids (PPM)	2,095						
Sulfate as SO_4 (PPM)	800						
Sulfite as SO_3 (PPM)							
Iron as Fe (PPM)	0.06						
Silica as SiO_2 (PPM)	75						
Carbon Dioxide as CO_2 (PPM)							
Chromate as CrO_4 (PPM)	0						
Specific Conductance (mmhos)							
Concentrations Chloride							
Concentrations Hardness							
Specific Gravity	1.002						


R32E
R33E
R34E
UERECHO PLAINS
3600
3650
3550
3500
3850
END
T. 19 S.
T. 20 S.
M. Smith
Panzoil
Laguna Tonto
Rd
Laguna Plata
Laguna Gatuna
LAGUNA
3500
3550
Laguna Toston
62
180
HALFWAY
Rs
3700
176
(Lea)
3600
3650
30'
3750

Form O-11B (rev. 2-76)

SAMPLE NO._____

THE WESTERN COMPANY

Hobbs, New Mexico

Service Laboratory
Midland, Texas
Phone 683-2781 Day
Phone 683-4162 Night

Service Laboratory
Oklahoma City, Oklahoma
Phone 840-2771 Day
Phone 751-5470 Night

WATER ANALYSIS

County Eddy

Field Ranch Windmill

Operator Pennzoil

Well Smith Ranch

Depth Unknown

Formation

PENNZOIL
JUL 06 1976
MIDLAND

Date Sampled 7-2-76

Date Received 7-2-76

Submitted By J. C. Raney

Worked By Chuck Kelley

Other Description

CHEMICAL DETERMINATIONS as parts per million

Density 1.00

pH 7.0

Iron None

Hydrogen Sulfide None

Sodium and Potassium 1,587

Bicarbonate 366

Calcium 800

Sulfate

Magnesium 121.5

Phosphate

Chloride 4,000

as Sodium Chloride

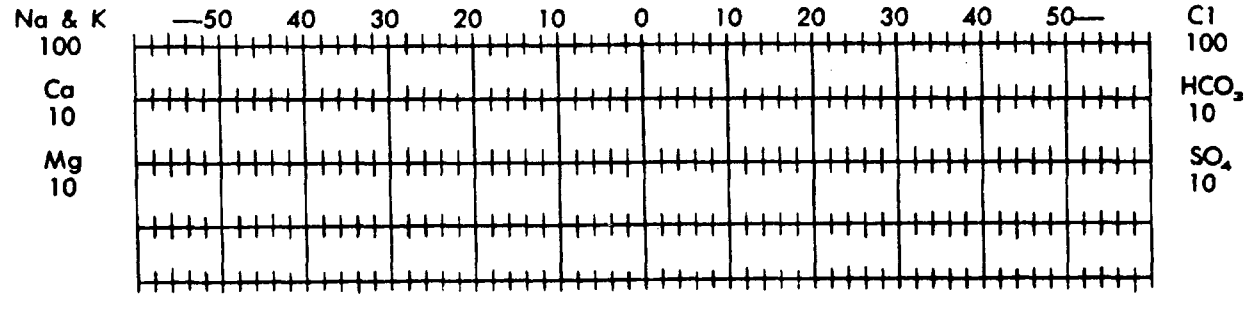
TOTAL ppm

Resistivity _____ ohm-meters

Remarks:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Pennzoil EXHIBIT NO. 2
CASE NO. 5728

for Stiff type plot (in meq./l.)



Per _____

Quality of Water

Rain water, having been distilled by natural processes, is relatively pure. Once water is in contact with the land surface, however, the water begins to dissolve organic and inorganic matter; and as the water moves through an aquifer, it dissolves rock materials. Ground water in arid and semiarid areas commonly contains enough dissolved mineral matter to limit its usefulness.

Among the most common chemical substances found in ground water are silica (SiO_2), iron (Fe), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), carbonate (CO_3), bicarbonate (HCO_3), sulfate (SO_4), chloride (Cl), fluoride (F) and nitrate (NO_3). Of these, the bulk generally is distributed among calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, and chloride. The concentrations of silica, fluoride, and nitrate generally are a minor part of the dissolved solids, and for some purposes sodium and potassium are grouped together and treated as one. Similarly, carbonate and bicarbonate may be grouped together.

The chemical characteristics of a water may be identified through study of the concentration and relative abundance of the principal ions it contains. Table 8 gives analyses of water from wells in the southern Lea County area, and Table 9 gives analyses of water pumped from oil wells.

Other characteristics commonly reported in chemical analyses of water samples are dissolved solids, specific conductance, hardness, pH, and percent sodium. A brief explanation of these characteristics follows.

Most of the dissolved-solids concentrations presented in Tables 8 and 9 are computed values for the total mineral constituents of the water sample, based on the constituents determined in the analysis, except that bicarbonate has been reported as carbonate. The dissolved-solids content can be determined directly by evaporating a sample to dryness at 180°C. A rough measure of the dissolved-solids concentration is provided by the specific conductance, which expresses the ease with which an electrical current can be passed through the water. The conductance depends directly on the amount and nature of the dissolved solids; thus no information on the chemical nature of the dissolved mineral matter is obtained from the specific-conductance measurement. For water in the Triassic, Tertiary, and Quaternary rocks in southern Lea County, the dissolved-solids concentration is approximately equal to the specific conductance at 25°C multiplied by a factor of 0.65.

Hardness of water is attributable to the presence of alkaline earth cations, which in natural waters are principally calcium and magnesium. It is an indication of soap-consuming power of the water. The cations that cause hardness can combine with certain anions to form troublesome deposits in boilers and other heat-exchange equipment.

From Ground-Water Report 6
Geology & Ground-Water Conditions
in Southern Lea County, N. M.

The pH value of an aqueous solution represents the hydrogen-ion concentration of the solution and ranges from 0 to 14. Ordinarily a value of 7.0 is considered neutral; values below 7.0 indicate acid solutions; and values above 7.0 indicate alkaline solutions. The pH values reported for many of the analyses given in Table 8 are questionable because of the long period of storage between time of collection and time of analysis, during which the pH can and does change. (The bicarbonate concentrations reported are subject to the same conditions.)

Percent sodium indicates the amount of sodium relative to the other cations present in the water and is useful in classifying the water for irrigation purposes. Inasmuch as all the analyses shown in Table 8 show the combined concentrations of sodium and potassium, the sodium percentages indicated include potassium also. However, since the ratio of potassium to sodium probably is very small, the figures shown under "percent sodium" probably are only slightly high.

The concentration of chemical constituents in water (tables 8 and 9) is expressed in ppm (part per million) and epm (equivalents per million). A part per million is a unit weight of a substance in a million unit weights of solution. Equivalents per million is a measure of the reactive weights of different ions. The atoms of the different elements have different relative weights which are know as atomic weights. The atomic weight of chlorine is 35.46 and that of sodium is 22.997. By dividing the atomic weight of sodium into the atomic weight of chlorine it can be seen that the chloride ion is 1.54 times heavier than the sodium ion. Hence, to form the simple compound of sodium chloride, in which each atom (or ion) of sodium combines with an atom of chlorine to form a single molecule of salt, the quantities required, in terms of weight, would be 1 part sodium to 1.54 chlorine. In such proportions there are equal numbers of sodium and chloride ions; that is, they are chemically equivalent. The concentration of a substance, in equivalents per million, is determined by dividing its concentration in parts per million by its chemical combining weight. The chemical combining weight is the atomic weight of the ion divided by its valence.

Usually, chemical analyses are reported in parts per million, but it is frequently more convenient for interpretative purposes to compare waters in terms of equivalents per million. In Tables 8 and 9 the concentrations of the different constituents are given in both terms. Some analyses by commercial laboratories express concentrations in grains per gallon. This expression can be converted into parts per million by multiplying by 17.12.

CHEMICAL STANDARDS FOR WATER USE

The U.S. Public Health Service (1946) sets up criteria for the quality of drinking water to be used on common carriers used in interstate traffic. These recommended limits have gained wide acceptance as stand-

ards against which to measure water quality, although they are somewhat conservative when applied in an area such as southern Lea County, where much of the ground water is mineralized. Recommended maximum concentrations (U.S. Public Health Service, 1946) for selected chemical constituents are as follows:

	PPM
Iron and Manganese	0.3
Fluoride	1.5*
Magnesium	125
Zinc	15
Chloride	250
Sulfate	250
Dissolved solids	500†

Numerous analyses in Table 8 exceed those limits with respect to one or more constituents. Although some of these samples reflect natural conditions, many appear to be contaminated. This aspect will be discussed in the section on brine contamination of shallow ground water.

Chemical requirements for industrial uses of water vary according to the industry, but requirements are most rigid where water is used in food, paper, or other chemical-process industries. The two most common industrial uses for water in southern Lea County are for cooling and boiler feed. Excessive concentrations of dissolved solids are troublesome in water used for cooling, inasmuch as the process of evaporation, by which cooling takes place, removes water in the chemically pure vapor state, leaving behind the dissolved matter in greater concentration than before.

The chemical-quality requirements of boiler feed water depend to a great extent on the operating pressure and design of the boiler system. High operating pressures impose very strict tolerance limits; for example, suggested tolerance limits for systems operating at more than 400 psi specify a concentration of dissolved solids of 50 ppm or less. Low-pressure systems, operating at less than 150 psi can use water having a dissolved-solids concentration of 500 to 3,000 ppm ([Calif.] State Water Pollution Control Board, 1957, p. 129). Nearly all the ground water sampled in southern Lea County requires some treatment to make it suitable for use as boiler feed water.

CHEMICAL CHARACTERISTICS OF GROUND WATER IN SOUTHERN LEA COUNTY

The dissolved chemical constituents in ground water reflect, to a great extent, the lithologic characteristics of the aquifer because presumably the water is in chemical equilibrium with the rock material with which it is in intimate contact. Differences in lithology will give

* Mandatory limit.

† Unless water of better quality is not available, in which case a total solids content of 1,000 ppm may be permitted.

Form O-11B (rev. 2-76)

SAMPLE NO._____

THE WESTERN COMPANY

Hobbs, New Mexico

Service Laboratory
Midland, Texas
Phone 683-2781 Day
Phone 683-4162 Night

Service Laboratory
Oklahoma City, Oklahoma
Phone 840-2771 Day
Phone 751-5470 Night

WATER ANALYSIS

PENNZOIL
JUL 02 1976
MIDLAND

County Eddy

Field Quail Ridge Morrow

Operator Pennzoil

Well Mescalero Ridge Unit # 1

Depth

Formation Morrow

Date Sampled 6-30-76

Date Received 6-30-76

Submitted By Lloyd Murphy

Worked By Chuck Kelley

Other Description

CHEMICAL DETERMINATIONS as parts per million

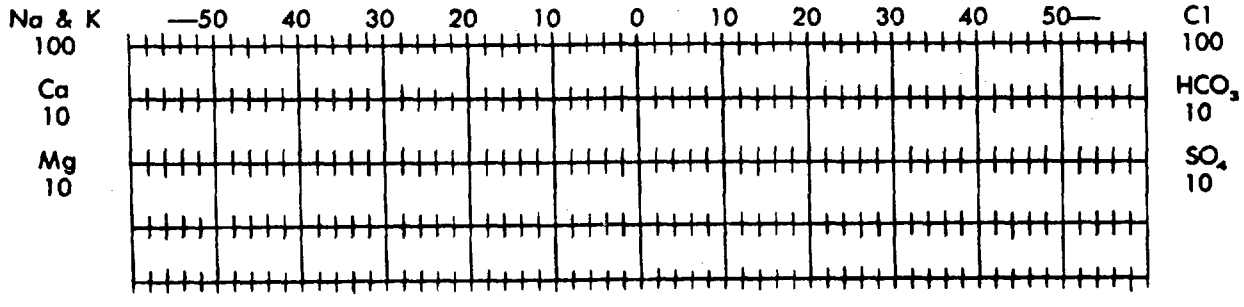
Density	1.025	pH	7.0
Iron	Very faint trace	Hydrogen Sulfide	None
Sodium and Potassium	13,064	Bicarbonate	1,098
Calcium	880	Sulfate	None
Magnesium	316	Phosphate	
Chloride	22,000	as Sodium Chloride	

TOTAL ppm

Resistivity _____ ohm-meters

Remarks:

for Stiff type plot (in meq./1.)



Per _____

PENNZOIL COMPANY
POST OFFICE DRAWER 1828 • MIDLAND, TEXAS 79701 • PHONE (915) 682-7316

July 14, 1976

Mr. Arthur Brown
U. S. Department of the Interior
Geological Survey
P. O. Box 1157
Hobbs, New Mexico

Re: Exception to "No Pit" Order
Unit M, Sec. 20, T-19-S, R-34-E
(Lease NM 014013)
Lea County, New Mexico

Dear Sir:

Pennzoil Company respectfully requests approval to use an unlined pit for the disposal of produced water. The Pennzoil Mescalero Ridge Unit No. 1 located 660' FS&WL of Section 20, T-19-S, R-34-E currently produces between 100 and 120 barrels of water plus 80 barrels of condensate and 1,500 MCF of gas is the only well which would be served by this pit.

In support of this request, the following data is submitted:

1. A complete Water Analysis of the produced water that will be disposed into the pit.

2. A complete Water Analysis of the nearest produced surface water (windmill). This windmill is located approximately 2-1/2 miles west of the Pennzoil Mescalero Ridge Unit #1. It should be noted this water is not potable for human consumption when compared to the U. S. Public Health Service "Chemical Standards for Water Use" table of recommended maximum concentrations for selected constituents. (Table attached copied from Ground Water Report No. 6 by the New Mexico Bureau of Mines & Mineral Resources dated 1961).

3. A Geological map of Southern Lea County (Plate 1). This is a structure map contoured on the surface elevations. As can be seen, the surface drainage is to the southwest toward the Laguna Gatuna Salt Lakes from the Pennzoil Mesclaero Ridge Unit #1. The Laguna Gatuna Salt Lakes are located

Ex. 6

approximately 7-1/2 miles from the Mescalero Ridge Unit #1 and is the current disposal system which our produced water is transported to by truck for a total cost of $0.616 per barrel.

4. A Ground-Water map of Southern Lea County, New Mexico (Plate 2). This is a structure map contoured on top of the Tertiary, Quaternary and Triassic Rocks. The area around the Mescalero Ridge Unit #1 is mapped on top of the Triassic Rock. As can be seen, the subsurface drainage is to the southwest toward the Laguna Gatuna Salt Lakes where produced brine is disposed.

In my opinion, the granting of this approval will not further damage the surface water in this area and will not violate the correlative rights of anyone. The granting of this approval will extend the life of this well and improve the recovery of gas that would be wasted and left in the reservoir. Without approval of this request, premature abandonment would result due to the high water hauling cost.

The proposed pit will be 100' x 100' x 4' and will have a five (5) strand barb wire fence with steel post set in concrete. The pit will be diked to prevent water from leaving the enclosed area.

The soil around the Pennzoil Mescalero Ridge Unit #1 is a loose blow sand that is only partially covered with shinnery that has little or no food value to livestock. Attached is a series of Polaroid pictures that shows the type of soil and vegetation in the area.

A hearing before the New Mexico Oil Conservation Commission is scheduled on Wednesday August 4, 1976 in Santa Fe to request their approval on this matter and you are invited to attend this hearing.

If you need any additional information or data concerning this request, please feel free to call.

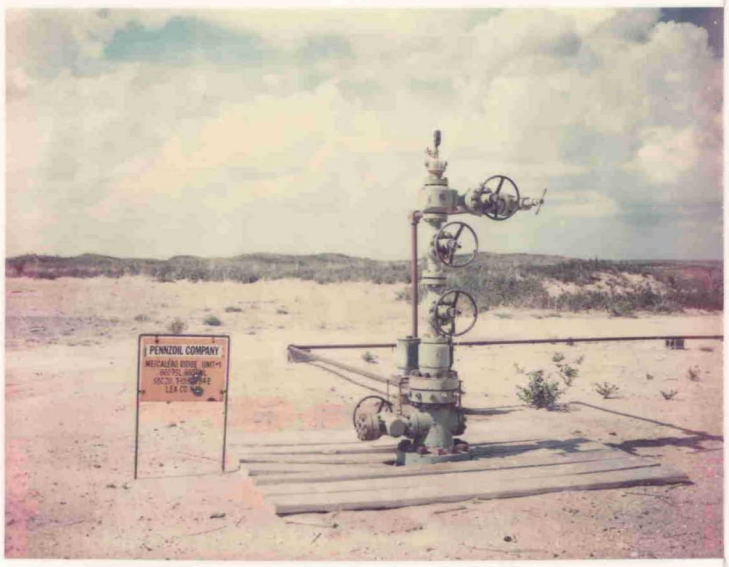
Yours very truly,

J. C. Ranney

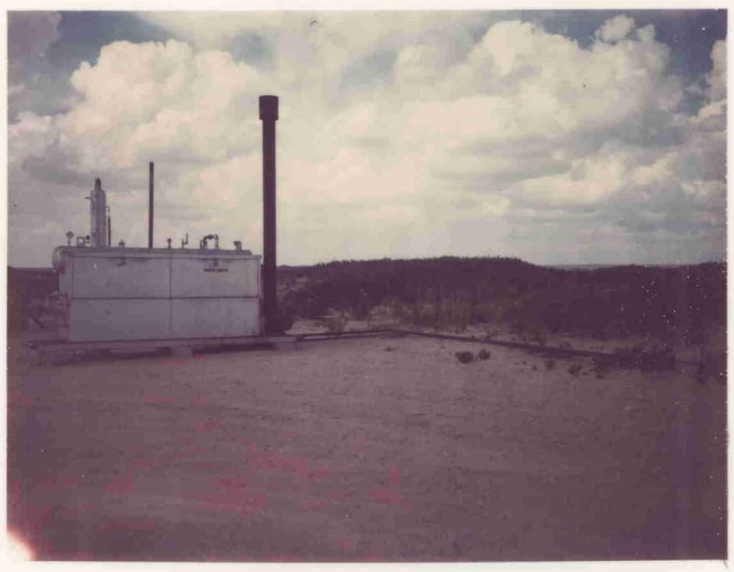
J. C. Ranney
Advanced Petroleum Engineer

JCR:tb
Enclosures

MESCALERO RIDGE UNIT NO. 1
LEA COUNTY, NEW MEXICO



1. LOOKING NORTH

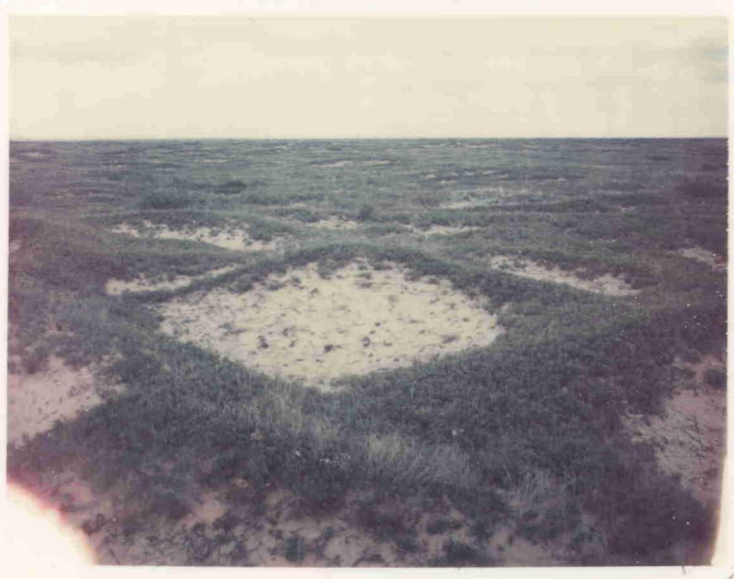


2. LOOKING NORTHEAST

3. LOOKING SOUTH

4. LOOKING EAST

5. NORTH FROM TOP OF TANK BATTERY



6. EAST FROM TOP OF TANK BATTERY

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Pennzoil EXHIBIT NO. 5
CASE NO. 5728