OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

October 28, 1958

COPY

Mr. Jack Campbell
Campbell & Russell
P.O. Box 721
Roswell, New Mexico

Dear Mr. Campbell:

On behalf of your clients, we enclose two copies of each of the following orders issued by the Oil Conservation Commission on October 25, 1958:

Order R-975-C in Case 1225
Order R-1267 in Case 1511

These cases were both heard on October 2nd before an examiner at Santa Fe.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encls.

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 10-3-58

CASE NO. 511 HEARING DATE 10-2-58

My recommendations for an order in the above numbered case(s) are as follows:

1. Grant this Pilot Water Flood as requested.

2. The 6 injection wells to be approved are as follows:

(a) Franklin Aston & Dair - Yates "A" #2 NE NW Sec. 6-T18S-R30E
(b) " " " - " "A" #11 NW NE " " "
(c) Yates et al " - " [redacted] #5 NW SW " " "
(d) " " " " - " [redacted] #2 SW NW " " "
(e) " " " " - " [redacted] #3 SE NW " " "
(f) Franklin, Aston & Dair - Ballard "B" #5, NE NE Sec. 1-T18S-R29E

3. No allowable requested except as required by statewide rules.

Staff Member

MAIN OFFICE OCC

1958 OCT 13 PM 3:52

10-13-58

Box 395
Artesia, New Mexico
October 7, 1958

Mr. Elvis Utz, Examiner
New Mexico Oil and Gas Conservation Commission
Santa Fe, New Mexico

Dear Mr. Utz:

Regarding the application of the Newmont Oil Company to waterflood their leases in the Loco Hills Field, Eddy County, New Mexico, I am enclosing certain well data which Mr. Frank Darden requested that I send you. This information includes size and setting depths of surface and production casing strings, amount of cement used, and total depths for each well within and adjacent to the pilot area.

I trust that this information is sufficient; however if there is anything further that you might desire, please let me know.

Very truly yours

H. C. Porter
Project Supervisor

Newmont Oil Company

Loco Hills Field Pilot Area

Well	Surface Casing			Long String			Total Depth
	Size	Feet	Sacks	Size	Feet	Sacks	
Yates 1A	8 1/4"	437	50	7"	2702	100	2810 1/2
Yates 2A	8 1/4"	459	50	7"	2610	100	2834
Yates 3A	8 1/4"	460	50	7"	2710	100	2845
Yates 4A	8 1/4"	451	50	7"	2718	100	2850
Yates 5A	8 1/4"	443	50	7"	2694	100	2816
Yates 6A	8 1/4"	475	50	7"	2741	100	2855
Yates 8A	8 1/2"	473	50	7"	2740	100	2859
Yates 9A	8 1/2"	470	50	5 1/2"	2703	100	2825
Yates 11A	8 1/4"	451	50	7"	2745	100	2841
Yates A #1	8 1/4"	452	50	7"	2705	100	2874
Yates A #2	8 1/4"	458	50	7"	2672	100	2808
Yates A #3	8 1/4"	456	50	7"	2705	100	2845
Yates A #4	8 1/4"	455	50	7"	2730	100	2840
Yates A #5	8 1/4"	431	50	7"	2697	40	2848
Yates A #6	8 5/8"	439	50	7"	2695	100	2859
Ballard B #3	8 1/4"	463	50	7"	2632	100	2771
Ballard B #4	8 1/4"	450	50	7"	2667	100	2800
Ballard B #5	8"	481	25	7"	2666	100	2890
Ballard A #1	8 1/4"	415	50	7"	2690	100	2828
Ballard A #3	8 1/4"	450	50	7"	2665	100	2795

Case 1511

LAW OFFICES OF
CAMPBELL & RUSSELL
MAIN OFFICE OCC
PHILLIPS-WHITE BUILDING
ROSWELL, NEW MEXICO

JACK M. CAMPBELL
JOHN F. RUSSELL

TELEPHONES
MAIN 2-4641
MAIN 2-4642

21 August 1958

1958 AUG 25 AM 8:41

Mr. A. L. Porter, Jr.
New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

E Law Reorg

Dear Mr. Porter:

Enclosed please find Application of Newmont Oil Corporation relative to a pilot water flood project in the Loco Hills Pool, Eddy County, New Mexico.

Very truly yours,

CAMPBELL & RUSSELL

Jack M. Campbell

Jack M. Campbell

JMC:bb
Enclosure

Docket mailed
9-19-58
BP

BRADFORD LABORATORIES, INC.

An Associate of Hall Laboratories

HAGAN BUILDING · PITTSBURGH, PA.

ADDRESS REPLY TO:
2625 S. TREADWAY BLVD.
ABILENE, TEXAS
ORCHARD 4-2731

Abilene, Texas
August 26, 1958

Water-Flood Associates
Box 395
Artesia, New Mexico

Case No. 58T19
58T27

Attn: Mr. Harold C. Porter

Newmont Oil Company
Loco Hills Project
Ballard "A" Lease and
Harvey E. Yates, Snowden, and McSweeney Lease
(Benson Field)

SURVEY AND WATER REPORT

The attached sheets contain the results of mineral analyses, compatibility testing, and preliminary reports on bacterial counts made on water samples taken during the August 15 visit to the Loco Hills projects.

Mineral Analysis

An examination of the mineral analysis sheet reveals the Ballard shallow well was producing a brackish water of fairly high turbidity, hardness, and sulfate content. It contained a very high level of dissolved oxygen and a small amount of carbon dioxide. Much of the turbidity of this water was due to debris in the form of clays and silica. This material should decrease in the amount present as the well is "cleared" by future pumping. The iron content of this water is also quite low. Most of the iron present was in the solid or oxidized form due to the presence of high levels of dissolved oxygen. This form of iron would be easily filtered from this water.

The waters produced at the Yates et al No. 4 well and that collected at the tank battery just west of this well were essentially the same. Both were high brines of high hardness, calcium, magnesium, alkalinity and total solids. Their iron content was fairly low. The amount of dissolved hydrogen sulfide was extremely high in each water. The high turbidity of the water from the Yates No. 4 well was due to the presence of oil. At the tank battery this oil had been removed and the turbidity was greatly

reduced. Storage however had caused some of the hydrogen sulfide to become oxidized to free sulfur. The free sulfur, present in the colloidal state, is responsible for the yellow color of the water at the tank battery.

The water from the Benson Field supply well was very turbid due to the presence of oil. It contained fairly high levels of sulfates, chlorides and hardness constituents and was very high in alkalinity and hydrogen sulfide content. The amount of dissolved iron present was negligible.

Bacterial Analysis

The bacterial analysis sheets indicates the shallow well on the Ballard "A" Lease had 160,000 bacteria per milliliter. While this count is not high, it does indicate that future checks should be made on this water for any increase in the bacterial population. It further leads us to suggest that it will probably be necessary to use a chemical such as chlorine to control the growth of these bacteria throughout any injection system that might be used to pressure this water.

The extremely high hydrogen sulfide content of the Benson Field supply water and the Yates et all produced water renders aerobic bacterial growth unlikely and further hinders the growth of most sulfate reducing bacteria. Storage tanks however offer a "breeding grounds" for bacteria and the preliminary sulfate reducer counts indicate that this species is established in the tank battery west of the Yates No. 4 producing well.

Attention should be given to this condition if this water is to be used for injection in the future.

Compatibility Tests

Various proportions of the Ballard "A" Lease shallow well water, the produced water from the tank battery west of the Yates et al No. 4, produced water from producing well Yates et al No. 4, and water from the Benson Field supply well #1; were mixed and turbidity determinations made at regular time intervals as indicated on the Compatibility Test sheet.

All waters were of fairly low turbidity prior to mixing. The Benson Field supply water was of the highest turbidity while the Yates No. 4 produced water was slightly less turbid.

Turbidity readings made immediately after mixing were unchanged after the mixed waters were allowed to stand for intervals of two and four hours. After twenty four hours standing there was some increase in turbidity in most of the mixtures. This increase was due to the precipitation of small amounts of calcium

carbonate and calcium sulfate. A yellow color also developed in the mixtures in proportion to the degree of oxidation (by the dissolved oxygen in the Ballard shallow water) of the dissolved hydrogen sulfide in the Ballard produced and the Benson supply well No. 1 waters.

No gross incompatibilities were observed as a result of this testing. All waters could be mixed as in this test for the purpose of water flooding but mixing will require treatment to aid in the prevention of corrosion, scale formation, and resultant producing formation plugging.

Suspended Solids

Suspended solids as determined by filtration of a known volume of sample in the field through a membrane filter are listed on the Suspended Solids sheet. An identification of the solids is also included.

The Ballard "A" shallow well had considerable suspended material. It was mostly silica and clays with some iron in the form of iron oxide. The amount of silica will diminish as the well is pumped and finally cleared. Iron in the oxidized form will continue to be present. Proper "sizing" of the turbine pump at this well should prevent excess take-up of oxygen and reduce the amount of iron present as insoluble iron oxide.

The water from the Yates et al No. 4 producing well contained too much oil to permit any membrane filter determination to be made.

The tank battery west of this well contained insoluble iron sulfide as the major constituent with lesser amounts of silica and sulfides. The presence of insoluble iron sulfide attests to the fact some corrosion has occurred between the producing wells and in the storage tanks.

The supply water from the Benson Field supply well No. 1 contained major amounts of suspended silica and petroleum products. Trace amounts of iron and sulfides were present. Continued pumping should result in a reduction of the suspended silica but the oil will probably always be present. This must be removed before this water can be filtered and otherwise conditioned for injection purposes.

Recommendations

The shallow supply well on the Ballard "A" Lease was producing a water that, for the Loco Hills Area, is considered an excellent flooding medium. Water from this well will require a minimum of treatment and conditioning. The following suggestions are offered to outline general treating considerations for this water.

1. The oxygen pick up of the Ballard shallow water can be greatly reduced by sizing the supply pump so that a complete draw-down or "vortex whorl" does not occur at the pump suction.

2. Being a shallow well some oxygen will be present and this will render the water quite corrosive. To aid in prevention of future troubles we would suggest that corrosion resistant material be used throughout the injection system.

3. No elaborate precautions should be taken to keep the system air free since the supply water will contain some oxygen.

4. Adequate filtration should be provided to accomplish efficient iron, bacteria, and silt removal.

5. The use of a stabilizing chemical such as a complex hexameta-phosphate is indicated to prevent carbonate and sulfate deposition ahead of the injection sand face.

6. The use of a bactericide may be necessary. Future analysis and testing when the system is installed and operational will permit a better evaluation of the potential bacterial problem. The use of chlorine as a bactericide would afford the additional advantage of aiding in iron removal.

7. To secure good iron removal it may be necessary to use caustic soda or lime to raise the pH value of the water. The level to which the pH value can be raised is dependent in part on the type of formation to be water flooded. We would like to confer with you on this point later.

8. It would be advisable to design the plant and start injection on the basis of using a maximum volume of (if not all) Ballard "A" shallow well supply water. As the produced fluids increased and disposal of the produced brine became a problem, it would be possible to vary the water treating program so that a sizable proportion of produced brine would be mixed and injected with the shallow supply water. The use of a good corrosion inhibitor should help attain necessary protection of plant equipment not suited to corrosion protection by the choice of composition of material.

The water from the Benson Field would be the most difficult water to condition for injection purposes. It would be very corrosive to metal surfaces and its high alkalinity and hardness levels would necessitate elaborate treatment to secure a stable water if handled in an open system. This water could be handled in a closed system but corrosion and scale formation (deposition of calcium salts) would still be a problem. The use of an alkali to obtain controlled deposition of calcium salts would result in a high pH water. This water would be unsuitable for injection into a Bentonite or other type clay producing formation that would tend to swell upon contact with an elevated pH water.

The oxidation of the extremely high levels of hydrogen sulfide in the Ballard "A" produced water and the Benson Field supply water would result in the formation of insoluble sulfur. The sulfur is formed as a colloidal dispersion and in this form causes no trouble. Changes in pH (especially lowering the pH with acid) can result in the formation of amorphous sulfur from the colloidal dispersion. Amorphous sulfur is a flocular, insoluble precipitate that would plug any injection sand face in a short time if present in sufficient quantities. An examination of your core analyses and records would permit a better prediction of the probability of this undesirable reaction taking place on your project.

Summary

Of the waters tested, the Ballard "A" Lease shallow well offers the best prospects of furnishing a water suitable for injection purposes. It would be possible with proper plant design to provide for a mixing of this water with some Ballard Lease produced brine. However, if large volumes of produced brine are expected it would be better initially to handle them in a separate closed system.

The Benson Field supply water would be the most difficult, of the waters tested, to condition for injection. Like the Ballard produced brine it is high in hydrogen sulfide content and very corrosive. Of the waters tested it is the least stable as to the deposition of calcium salts. Its presence in the compatibility test mixtures resulted in most cases in higher twenty-four hour turbidity readings. Laboratory tests show this water to form the greatest amount of calcium sulfate upon standing. The high hydrogen sulfide content of this water (and the Ballard "A" produced brine) would be very difficult to lower to near zero levels even by aeration. For this reason it would be best to handle this water in a closed or semi-closed system.

Conclusion

We are deeply grateful to Mr. Hal Porter for his help in locating and securing necessary water samples. It is always a pleasure to work with energetic cooperative personnel.

Should you have any questions regarding this report or the analyses reported herein, please feel free to call on us.

We look forward to being of further service to your organization in the near future. We would greatly appreciate the opportunity of assisting you as much as possible in the design of your proposed water conditioning plant.

Very truly yours,

A. W. Baumgartner

AWB/pl
cc: Mr. Harold C. Porter (5)
File (1)

Case No. 58T27

BRADFORD LABORATORIES, INC.

Associate of Hall Laboratories

WATER ANALYSIS RESULTS

CLIENT: Newmont Oil Company

Sample No.		x1	x2	x3
Date Sampled		8/15/58	8/15/58	8/15/58
Time Sampled		10:00 A.M.	12:20 PM	1:15 PM
Date Received				
Time Received				
Location: BALLARD "A" LEASE		Loco Hills Field, Sec. 1, R-29-E Supply Well #1	Yates No. 4 N.E. S.W., Sec. 6, T1S S. R-30-E	Gun Barrel Just West of R-30-E. (West of Yates No.4)
Appearance When Sampled		Hazy, Red Color	Turbid, Oily	Yellow Color
Appearance After Standing		Clear Orange ppt.	Sl. Hazy	Yellow Color
Odor		None	Oily, H_2S	H_2S
Taste		Sl. Salty	Salty	Salty
Temperature	°F	71.0	88.0	98.0
pH		7.3	7.9	8.3
Carbon Dioxide	ppm CO_2	10.0	>100	>100
Dissolved Oxygen	ppm O_2	9.7	0	0
Residual Chlorine	ppm Cl_2	N.D.	N.D.	N.D.
Turbidity	ppm	47	V. Turbid	0.7
Manganese	ppm Mn	0.0	0.0	0.0
Iron (Total)	ppm Fe	1.5	0.4	0.7
Alkalinity to Phenolphthalein	ppm $CaCO_3$	0	150	200
Alkalinity to Methyl Orange	ppm $CaCO_3$	102	1,925	1,900
Sulfates	ppm SO_4	2,340	5,420	5,500
Chlorides	ppm Cl	4,960	79,000	80,000
Total Hardness	ppm $CaCO_3$	3,800	19,600	19,600
Silica	ppm SiO_2	21.3	2.8	2.7
Calcium	ppm Ca	980	2,160	2,160
Magnesium	ppm Mg	328	3,450	3,450
Complex Phosphate ~~Dissolved Iron~~	ppm Fe	Less than.01	0.1	0.1
Total Solids (Gravimetric)	ppm	12,850	147,000	147,400
~~Equilibrium Determination~~				
~~Phenolphthalein Alkalinity~~		0	320	650
~~Methyl Orange Alkalinity~~		104	1,724	1,325
~~Hydrogen Sulfide~~	ppm H_2S	0.0	1,270	1,270

17.1 ppm equal 1 grain per U. S. gallon. - "nd" means not determined.

COMMENTS

Case No. 58T19

BRADFORD LABORATORIES, INC.

Associate of Hall Laboratories

WATER ANALYSIS RESULTS

CLIENT: Newmont Oil Company

Sample No.		#1			
Date Sampled		8/15/58			
Time Sampled		2:15 P.M.			
Date Received					
Time Received					
Location: HARVEY E. YATES, SNOWDEN, AND McSWEENEY LEASE (BENSON FIELD)		Harvey E. Yates, Snowden, & McSweeney Supply Well #1			
Appearance When Sampled		Oily, Very Turbid, Gassy			
Appearance After Standing		Oily, Hazy,			
Odor		H_2S			
Taste		Salty			
Temperature	°F	82.0			
pH		6.5			
Carbon Dioxide	ppm CO_2	>400			
Dissolved Oxygen	ppm O_2	0			
Residual Chlorine	ppm Cl_2	N.D.			
Turbidity	ppm	Very Turbid			
Manganese	ppm Mn	0.0			
Iron (Total)	ppm Fe	0.05			
Alkalinity to Phenolphthalein	ppm $CaCO_3$	0			
Alkalinity to Methyl Orange	ppm $CaCO_3$	1,032			
Sulfates	ppm SO_4	1,370			
Chlorides	ppm Cl	9,600			
Total Hardness	ppm $CaCO_3$	3,300			
Silica	ppm SiO_2	2.9			
Calcium	ppm Ca	600			
Magnesium	ppm Mg	437			
~~Dissolved Iron~~	ppm Fe	0.05			
Total Solids (Gravimetric)	ppm	19,200			
Equilibrium Determination:					
Phenolphthalein Alkalinity		0			
Methyl Orange Alkalinity		672			
~~Hydrogen Sulfide~~	ppm H_2S	790			

17.1 ppm equal 1 grain per U. S. gallon. - "nd" means not determined.

COMMENTS

Case No. 58T27

BRADFORD LABORATORIES, INC.

BRADFORD, PENNSYLVANIA — EVANSVILLE, INDIANA

BACTERIAL ANALYSIS RESULTS

CLIENT: Newmont Oil Company

Sample No.	B1	B2	B3	
Date Sampled	8/15/58	8/15/58	8/15/58	
Time Sampled	9:30 A.M.	11:45 A.M.	12:45 PM	
Date Analyzed	8/16/58	8/16/58	8/16/58	
Time Analyzed	7:30 A.M.	7:30 A.M.	7:30 A.M.	
Location BALLARD "A" LEASE	New Shallow Supply Well	Yates NO 4 Producing Well	Gun Barrel Just West of Yates No. 4	
Total No. Aerobic Colonies on Agar 30° C — 24 hrs.	158,000	0	0	
Total No. Aerobic Colonies on Agar 30° C — ~~120 hrs~~ 7 Days	160,000	0	0	
Total No. Anaerobic Colonies on Agar — 24 hrs.				
Total No. Anaerobic Colonies on Agar — 120 hrs.				
Sulfate Reducers 9 Days	0	0	30	

COMMENTS:

The Aerobic count is final.

The Sulfate Reducer count is preliminary.

The final Sulfate Reducer count will be completed about September 6th and a report will be sent at that time.

Case No. 58T19

BRADFORD LABORATORIES, INC.

BRADFORD, PENNSYLVANIA EVANSVILLE, INDIANA

BACTERIAL ANALYSIS RESULTS

CLIENT: Newmont Oil Company

Sample No.	B1			
Date Sampled	8/15/58			
Time Sampled	2:30 PM			
Date Analyzed	8/16/58			
Time Analyzed	7:30 AM			
Location HARVEY E YATES, SNOWDEN AND McSWEENEY LEASE	Supply Well #1			
Total No. Aerobic Colonies on Agar 30° C — 24 hrs.	0			
Total No. Aerobic Colonies on Agar 30° C — ~~120 hrs~~ 7 Days	0			
Total No. Anaerobic Colonies on Agar — 24 hrs.				
Total No. Anaerobic Colonies on Agar — 120 hrs.				
Sulfate Reducers - 9 Days	0			

COMMENTS:

The Aerobic count is final.

The Sulfate Reducer count is preliminary.

The final Sulfate Reducer count will be completed about September 6th and a report will be sent at that time.

BRADFORD LABORATORIES, INC.

COMPATIBILITY TEST SHEET

Sample Number	Proportion of each water* used to make mixtures (percent used)				Turbidity (ppm) after Time			
	x1	x2	x3	x4	1 Hr.	2 Hr.	4 Hr.	24 Hr.
1	100				0.55	no detectable change	no detectable change	1.85
2		100			2.15	"	"	1.85
3			100		0.55	"	"	0.55
4				100	4.0	"	"	3.60
5	50	25		25	4.40	"	"	4.40
6	50		25	25	3.25	"	"	3.60
7	25	50		25	3.60	"	"	4.40
8	25		50	25	2.85	"	"	2.85
9	25	25		50	3.25	"	"	4.00
10	25		25	50	2.85	"	"	3.85
11	50	50			2.15	"	"	2.75
12	50		50		1.60	"	"	2.85
13	50			50	3.60	"	"	4.40
14		50		50	3.25	"	"	3.75
15			50	50	3.05	"	"	3.60

*NOTE:

x1--Shallow Supply Well Water - Ballard "A" Lease

x2--Produced water from Yates et al No. 4 - Ballard "A" Lease

x3--Produced water from Tank Battery west of Yates et at No. 4 Well - Ballard "A" Lease

x4--Supply Well #1 water - Benson Field, Harvey E. Yates, Snowden and McSweeney Lease

BRADFORD LABORATORIES, INC.

SUSPENDED SOLIDS
(by Membrane Filter determination)

Sample No.		Mf 1	Mf 2	Mf 3
Location:		Supply Well #1 Ballard "A" Lease	Tank Battery West of Yates No. 4	Supply Well #1 Harvey E. Yates, Snowden, and McSweeney Lease
Total Suspended Solids	ppm	53.4	12.2	20.4
Identification of Suspended Solids				
Silica as SiO_2		Major	Low-Minor	Major
Iron as Fe_2O_3		Minor	Major	Trace
Sulfides as S^{--}		None	Low-Minor	Trace
Manganese as Mn		None	None	None
Sulfur as S		None	None	None
Organic Material as petroleum compounds		None	None	Major

NOTE: Quantitative Terms and their Equivalents

Terms	Percent Constituent
Major	greater than 30%
Low-Major	20-30
High-Minor	15-20
Minor	8-15
Low-Minor	4-8
Trace	1-4