

RECEIVED MAY 14 1984

P.O. BOX 1468
MONAHAN, TEXAS 79756
PH 843-3234 OR 563-1040

Martin Water Laboratories, Inc.

708 W INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

RESULT OF WATER ANALYSES

TO: Mr. John Walker LABORATORY NO. 58461
P.O. Box 2203, Roswell, NM 88201 SAMPLE RECEIVED 5-2-84
RESULTS REPORTED 5-9-84

COMPANY Stevens Operating Corporation LEASE O'Brien
FIELD OR POOL Twin Lakes
SECTION BLOCK SURVEY COUNTY Chaves STATE NM
SOURCE OF SAMPLE AND DATE TAKEN:

NO. 1 Raw water - taken from Section 35 water well. 5-2-84

NO. 2

NO. 3

NO. 4

REMARKS: Dakota

CHEMICAL AND PHYSICAL PROPERTIES				
	NO. 1	NO. 2	NO. 3	NO. 4
Specific Gravity at 60° F.	1.0232			
pH When Sampled	7.5			
pH When Received	7.45			
Bicarbonate as HCO ₃	390			
Supersaturation as CaCO ₃				
Undersaturation as CaCO ₃				
Total Hardness as CaCO ₃	5,500			
Calcium as Ca	580			
Magnesium as Mg	984			
Sodium and/or Potassium	6,605			
Sulfate as SO ₄	9,735			
Chloride as Cl	6,676			
Iron as Fe	9.3			
Barium as Ba				
Turbidity, Electric				
Color as Pt				
Total Solids, Calculated	24,970			
Temperature °F.	62			
Carbon Dioxide, Calculated				
Dissolved Oxygen, Winkler				
Hydrogen Sulfide	0.0			
Resistivity, ohms/m at 77° F.	0.30			
Suspended Oil				
Filtrable Solids as mg/l				
Volume Filtered, ml				



Results Reported As Milligrams Per Liter

Additional Determinations And Remarks The objective herein is to evaluate compatibility between this water and the San Andres water as represented on analysis #58456. We have encountered a distinct concern in that the sulfate is unusually high in this water; and when combined with San Andres, there would be some mild precipitation of calcium sulfate. The iron herein would also precipitate as iron sulfide, but this is of questionable concern because it is likely due to corrosion in the water well and could be prevented. However, in summary, we would not recommend injecting this water into the San Andres interval or mixing with San Andres on the surface due to concern with calcium sulfate precipitation and scaling potential.

Form No. 3

By Waylan C. Martin, M.A.

709 W INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

RESULT OF WATER ANALYSES

TO: Mr. Welton D. Moore
P.O. Box 1417, Roswell, NM

LABORATORY NO. 585360
SAMPLE RECEIVED 5-21-85
RESULTS REPORTED 5-28-85

COMPANY Pelto Oil Company LEASE Twin Lakes Pilot Waterflood
FIELD OR POOL Twin Lakes
SECTION BLOCK SURVEY COUNTY Chaves STATE NM

SOURCE OF SAMPLE AND DATE TAKEN:

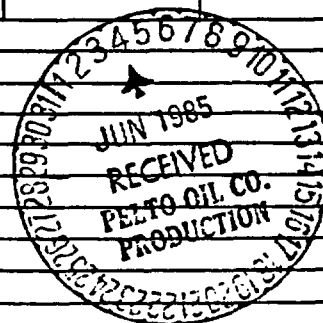
NO. 1	Raw water - taken from water supply well #1. 5-21-85	SW of F#6
NO. 2	Raw water - taken from water supply well #2. 5-21-85	Near F#7
NO. 3	Produced water - taken from salt water disposal #1 transfer pump. 5-21-85	
NO. 4	Produced water - taken from salt water disposal #2 transfer pump. 5-21-85	

REMARKS: 1. Dakota 2. Santa Rosa 900' 3. & 4. San Andres

CHEMICAL AND PHYSICAL PROPERTIES				
	NO. 1	NO. 2	NO. 3	NO. 4
Specific Gravity at 60° F.	1.0228	1.0133	1.1483	1.1453
pH When Sampled	7.3	7.7	6.9	6.9
pH When Received	6.85	7.62	6.32	6.35
Bicarbonate as HCO ₃	415	185	976	1,098
Supersaturation as CaCO ₃	12	2	180	180
Undersaturation as CaCO ₃	---	---	---	---
Total Hardness as CaCO ₃	5,350	1,020	12,400	13,800
Calcium as Ca	568	196	3,200	3,440
Magnesium as Mg	955	129	1,069	1,264
Sodium and/or Potassium	5,608	3,906	88,552	81,480
Sulfate as SO ₄	8,548	3,945	3,682	3,630
Chloride as Cl	5,895	3,728	142,038	132,095
Iron as Fe	0.43	5.5	2.8	0.04
Barium as Ba	0	0	0	0
Turbidity, Electric	0	9	60	12
Color as Pt	0	0	0	0
Total Solids, Calculated	21,988	12,090	239,517	223,006
Temperature °F.	66	68	76	88
Carbon Dioxide, Calculated	34	6	205	231
Dissolved Oxygen, Winkler	0.8	0.0	0.0	0.0
Hydrogen Sulfide	0.0	0.0	62.5	62.5
Resistivity, ohms/m at 77° F.	0.340	0.550	0.052	0.053
Suspended Oil			440	9
Filtrable Solids as mg/l	0.68	7.7	77.6	11.7
Volume Filtered, ml	10,000	4,000	700	2,000

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks



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Martin Water Laboratories, Inc.
WATER CONSULTANTS SINCE 1953
BACTERIAL AND CHEMICAL ANALYSES

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

May 28, 1985

Mr. Welton D. Moore
Pelto Oil Company
P.O. Box 1417
Roswell, NM 88201

Subject: Recommendations relative to laboratory #585360 and #B58565 (5-28-85),
Twin Lakes Pilot Waterflood.

Dear Mr. Moore:

The objective of this study is primarily to evaluate compatibilities of the waters involved in the above listed analyses and also study their current status in regard to their potential use for injection purposes. It is our understanding that the combining of these waters for injection purposes will be somewhat of a temporary project until more source water is available. The conditions we have encountered which we classify as pertinent to the above objective are as follows:

1. The primary concern we have encountered in this study regarding compatibility is focused on the commingled produced water from the White Lake Ranch salt water disposal. This water has a significant supersaturation with calcium sulfate, and it alone would be expected to deposit at least some calcium sulfate scale in an injection system. This significant scaling potential would carry over when it is combined with any of the other waters except for a marginal condition when combined with the Santa Rosa water. Also, a mixture of the disposal water and the Dakota water would be expected to result in a severe precipitation and scaling from calcium sulfate. Therefore, in regard to the White Lake Ranch disposal water, we are confident that it would be prohibitive to mix with the Dakota water and would perpetuate an already significant potential for calcium sulfate scaling if it is mixed with any of the waters except Santa Rosa. It should be clarified that we could not be confident that this disposal water consistently has a calcium sulfate scaling tendency as it is a mixture of waters, and the scaling tendency is probably the result of incompatibility. Therefore, this problem may not be continuously in existence.
2. It should be clarified that the Santa Rosa water well #2 was not being pumped and was only operated for approximately one-half hour to acquire this sample. We feel confident that the iron and higher filtrable solids probably were the result of this well not being

cleaned up as yet. This is significant in that the iron content in this water would precipitate as iron sulfide when mixed with either of the San Andres waters or the White Lake Ranch disposal water. However, controlling the iron content in this water well would eliminate this potential incompatibility.

3. It is noted there is an excessive amount of oil and accompanying filtrable solids in the disposal water at #1 transfer pump. The microscopic study of the filtrable solids failed to reveal any single implication of excessive interface material or bottom sediment but tended to imply that there was some type of upset back in separation facilities that has caused this condition. We are therefore assuming that this was likely a temporary condition, but it would need to be avoided if this water is to be used for injection purposes.
4. We found the two San Andres waters to be marginal in regard to potential calcium carbonate scaling but do not feel that the evidence herein is indicating any immediate concern. We found no potential of this condition in any of the other waters.
5. In studying these waters for potential calcium sulfate scaling, we find the San Andres to be marginal; no scaling potential in the Santa Rosa; very slight supersaturation in the Dakota water; and as discussed in the above item #1, a significant supersaturation in the White Lake Ranch disposal water. We do not feel that the slight supersaturation of the Dakota water is sufficient to be of any concern in its handling.
6. With the exception of the above discussed concern with the Santa Rosa water well and the San Andres water at #1 transfer pump, we do not see any concern regarding injection quality. As discussed above, we feel that these two conditions were both temporary and would not be expected to be of any concern in the actual injection system.
7. We interpret the results of the bacterial analyses to be decidedly favorable in that none of the waters are showing any significant bacterial activity. There was a mild count in water well #2; but as stated above, this well has not been as yet completely cleaned up; therefore, we would not expect any bacterial problem in this water if it is kept air-free.

In summary of the above, we find the primary concern to be in the use of the White Lake Ranch disposal water in an effort to mix all the waters involved herein. This water has a potential calcium sulfate scaling tendency as is which would carry over into a mixture with the San Andres water and be severe in combination with the Dakota

Mr. Welton D. Moore

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May 28, 1985

water. Therefore, this White Lake Ranch disposal water should be left out of the mixture. However, it might be possible to leave the Dakota water out of the mixture and include the White Lake disposal water, but in this case it may be necessary to use scale inhibition treatment to prevent calcium sulfate scaling. It is realized that the volume of water involved in these different sources would have a significant influence on how these waters are combined and which ones might be best left out of the system. Consequently, we would like for you to feel free to contact us for possible alternatives that may accomodate the various volumes available. Also, it should be clarified that it will be vital to maintain all these waters air-free. Therefore, we would strongly recommend that gas seals be used on all vessels handling any or all of these waters.

Yours very truly,



Waylan C. Martin

WCM/mo

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Martin Water Laboratories, Inc.
WATER CONSULTANTS SINCE 1953
BACTERIAL AND CHEMICAL ANALYSES

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

To: Mr. Welton D. Moore
P.O. Box 1417
Roswell, New Mexico

Laboratory No. B58565
Sample received 5-21-85
Results reported 5-28-85

Company: Pelto Oil Company
County: Chaves, NM
Field: Twin Lakes
Lease: Twin Lakes Pilot Waterflood

Source of sample and date taken:

- #1. Raw water - taken from water supply well #1. 5-21-85
- #2. Raw water - taken from water supply well #2. 5-21-85
- #3. Produced water - taken from salt water disposal #1 transfer pump. 5-21-85

	#1	#2	#3
Iron bacteria	Not detected	Not detected	Not detected
Sulfur bacteria	380	130	Not detected
Sulfate-reducing bacteria ...	Not detected	Not detected	Not detected
Other aerobes	170	8,500	Not detected
Other anaerobes	250	280	Not detected
Fungi (& aciduric bacteria) ..	Not detected	Not detected	Not detected
Algae	Not detected	Not detected	Not detected
Protozoa	Not detected	Not detected	Not detected
Total count	800	8,910	NONE
pH.....	7.3	7.7	6.9
Temperature	66	68	76

Note: All numerical results are reported as the number of cells per milliliter of the sample as determined by plate counts; except iron, algae, and protozoa, which are determined microscopically.

Source of sample and date taken:

#4. Produced water - taken from salt water disposal #2 transfer pump. 5-21-85

#5. Commingled Produced water - taken from raw water tank @ White Lake Ranch SWD. 5-21-85

	<u>#4</u>	<u>#5</u>
Iron bacteria	Not detected	Not detected
Sulfur bacteria	Not detected	Not detected
Sulfate-reducing bacteria ...	Not detected	Not detected
Other aerobes	Not detected	Not detected
Other anaerobes	Not detected	760
Fungi (& aciduric bacteria) ..	Not detected	Not detected
Algae	Not detected	Not detected
Protozoa	Not detected	Not detected
Total count	NONE	760
pH.....	6.9	6.9
Temperature	88	78

Note: All numerical results are reported as the number of cells per milliliter of the sample as determined by plate counts; except iron, algae, and protozoa, which are determined microscopically.

Remarks: Letter of recommendation attached.


Waylan C. Martin, M.A.