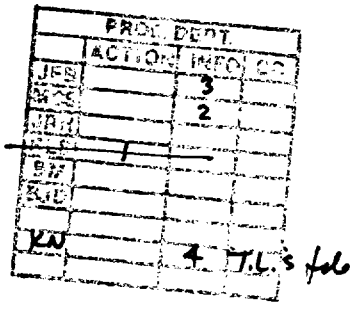
Martin Water Laboratories, Inc.
WATER CONSULTANTS SINCE 1953
BACTERIAL AND CHEMICAL ANALYSES

P.O. BOX 1468
MONAHANS, TEXAS 79756
PH. 943-3234 or 563-1040

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

August 5, 1987



Mr. Robert L. Spottswood
Manager of Engineering
Pelto Oil Company
One Allen Center, Suite 1800
500 Dallas Street
Houston, TX 77002

Dear Mr. Spottswood:

The objective of this letter is to clarify and expand on statements provided on laboratory #786154 (7-15-86) regarding compatibility between the Ogallala and San Andres waters on the Twin Lakes Pilot Waterflood project. In our interpretations of the compatibility on this report, we indicated that the two waters would not be compatible for mixing on the surface and re-injection due to oxygen in the Ogallala water and hydrogen sulfide in the San Andres water.

In the above mentioned report, we failed to address the significance of the incompatibility in the event Ogallala water alone is injected into the San Andres interval. Under these circumstances and which we understand is the case at this time, it is our carefully considered opinion that the incompatibility would clearly be insufficient to prevent the injection of Ogallala into the San Andres interval.

The above may appear to be contradictory and therefore would clearly warrant an explanation. Under the conditions of mixing the two waters on the surface and then re-injecting, elemental sulfur precipitation would occur and all of this precipitated sulfur would accumulate in and around the wellbore of the injection well. This pronounced concentrating of a relatively minor amount of elemental sulfur would be expected to cause serious obstruction of the movement of the water into the formation. Also, another vital concern would be the serious aggravation of corrosiveness of the water on equipment handling the injection. Of course, the aggravation of corrosion would be of no concern in the formation if Ogallala is injected into the San Andres. Also, the elemental sulfur that would precipitate in situ in the San Andres formation would be so widely distributed through a vast of the matrix of the San Andres that its presence would cause an infinitesimally small amount of obstruction of flow if, in fact, it caused any obstruction of the mobility of the water in the formation. In our numerous experiences with water floods where oxygen-bearing water is injected into a sulfide-bearing formation, we have never

been aware of any conclusive evidence that any detectable plugging occurs. It should be added that our experiences in this regard have many times involved two different injection waters on the same project with no evidence that the water containing oxygen causes any difference in injection rate as compared to the water that does not contain oxygen.

Yours very truly,

Waylan C. Martin

WCM/mo

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RESULT OF WATER ANALYSES

LABORATORY NO. 786154

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

SAMPLE RECEIVED 7-8-86
RESULTS REPORTED 7-15-86

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 San Andres water - taken from injection pump discharge. 7-8-86
NO. 2 Ogallala water - taken from Toton's Windmill well. 7-8-86
NO. 3 Mixture of 14% San Andres + 86% Ogallala. 7-8-86
NO. 4 Mixture of 25% San Andres + 75% Ogallala. 7-8-86

REMARKS:

CHEMICAL AND PHYSICAL PROPERTIES	NO. 1	NO. 2	NO. 3	NO. 4
Specific Gravity at 60° F.	1.1476	1.0018	1.0272	1.0407
pH When Sampled	6.4	7.4		
pH When Received	6.33	7.34	7.00	6.92
Bicarbonate as HCO_3	756	176	249	298
Supersaturation as $CaCO_3$	40	—	0	16
Undersaturation as $CaCO_3$	—	16	—	—
Total Hardness as $CaCO_3$	9,600	264	1,780	2,500
Calcium as Ca	2,920	90	528	820
Magnesium as Mg	559	10	112	109
Sodium and/or Potassium	83,081	62	11,547	19,210
Sulfate as SO_4	3,209	139	618	921
Chloride as Cl	132,095	78	18,465	30,538
Iron as Fe	1.4	0.28	0.44	0.44
Barium as Ba	0	0	0	0
Turbidity, Electric	55	1	6	10
Color as Pt	3	2	6	15
Total Solids, Calculated	222,621	555	31,519	51,895
Temperature °F.	76	62		
Carbon Dioxide, Calculated	499	12	40	63
Dissolved Oxygen, Winkler	0.0	5.2		
Hydrogen Sulfide	80.0	0.0	6.3	8.8
Resistivity, ohms/m at 77° F.	0.054	13.99	0.244	0.156
Suspended Oil	534			
Filtrable Solids as mg/l	53.3	22.4		
Volume Filtered, ml	1,100	5,200		
Calcium Carbonate Scaling Tendency	NONE	NONE	NONE	NONE
Calcium Sulfate Scaling Tendency	NONE	NONE	NONE	NONE
Results Reported As Milligrams Per Liter				
Additional Determinations And Remarks				

Form No. 3

By ___

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RESULT OF WATER ANALYSES

LABORATORY NO. 786154 (Page 2)

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

SAMPLE RECEIVED 7-8-86

RESULTS REPORTED 7-15-86

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 Mixture of 50% San Andres + 50% Ogallala. 7-8-86

NO. 2 Mixture of 75% San Andres + 25% Ogallala. 7-8-86

NO. 3 Mixture of 86% San Andres + 14% Ogallala. 7-8-86

NO. 4 ___

REMARKS:

CHEMICAL AND PHYSICAL PROPERTIES	NO. 1	NO. 2	NO. 3	NO. 4
Specific Gravity at 60° F.	1.0732	1.1139	1.1264	
pH When Sampled				
pH When Received	6.64	6.56	6.45	
Bicarbonate as HCO_3	420	622	683	
Supersaturation as $CaCO_3$	44	60	60	
Undersaturation as $CaCO_3$	—	—	—	
Total Hardness as $CaCO_3$	4,800	7,500	8,300	
Calcium as Ca	1,400	2,240	2,560	
Magnesium as Mg	316	462	462	
Sodium and/or Potassium	38,370	61,610	70,566	
Sulfate as SO_4	1,683	2,630	2,814	
Chloride as Cl	61,076	98,006	112,210	
Iron as Fe	0.80	1.0	1.0	
Barium as Ba	0	0	0	
Turbidity, Electric	19	25	30	
Color as Pt	36	33	34	
Total Solids, Calculated	103,265	165,570	189,295	
Temperature °F.				
Carbon Dioxide, Calculated	172	255	355	
Dissolved Oxygen, Winkler				
Hydrogen Sulfide	17.5	37.5	45.0	
Resistivity, ohms/m at 77° F.	0.093	0.065	0.060	
Suspended Oil				
Filtrable Solids as mg/l				
Volume Filtered, ml				
Calcium Carbonate Scaling Tendency	NONE	NONE	NONE	
Calcium Sulfate Scaling Tendency	NONE	NONE	NONE	

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks In the above compatibility study, we have identified only a single condition that results in incompatibility. This is in the form of oxygen in the Ogallala water and hydrogen sulfide in the produced water which would result in the precipitation of elemental sulfur and a severe aggravation of corrosiveness. It is distinctly apparent that the only economically feasible means of correcting this condition is to remove the oxygen from the supply water by either physical and/or chemical means prior to mixing with the produced water. This being accomplished, the waters would be expected to be compatible.

Form No. 3

By ___

cc: Mr. Dean Hinton, West Texas Consultants
1101 N. Whitaker, Odessa 79763

Waylan C. Martin, M. A.