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Appendix O

L IQUID AND GAS SAMPLING
(University of Utah Research Institute)

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CHEMICAL SAMPLING - UNIVERSITY OF UTAH RESEARCH INSTITUTE

Liquid and gas samples of the fluid from the Salton Sea Deep Hole were taken by Mike Adams and Michelle Lemieux of the University of Utah Research Institute during the long-term flow test. Three samples were taken during a one hour period from 0900 to 1000 on June 8, which corresponds to the lowest flowrate of the test. Four samples were taken during a two hour period from 0930 to 1130 on June 17, which corresponds to the highest flow-rate of the test.

The samples were taken from the brine and steam lines downstream of the separator. The liquid samples were taken by two different methods. The first method involved cooling the hot brine in a one fourth inch stainless steel tube coil prior to capturing the fluid in a preservative solution. Although this method is commonly employed, it may promote precipitation of silica in the cooling coil prior to collection. The second method was designed to prevent precipitation of silica prior to sampling. This method utilized a six inch by one eighth inch tube that was inserted directly into the preservative solution with no prior cooling. Both methods used a preservative solution of 5 wt% nitric acid for ICP analysis and 5 wt% hydrochloric acid for sulfate and ammonia. Non-diluted samples were collected for chloride, fluoride, and TDS. The acid to sample dilutions were 10 to 1.

Steam samples were collected through a one fourth inch stainless steel cooling coil. The samples were taken in evacuated

pyrex flasks that contained solutions of sodium hydroxide and cadmium chloride.

The liquid and gas samples are being analyzed to determine if differences in the chemistry of the fluid exist as a result of changing flow rates, and if silica does precipitate when a cooling coil is used during collection. Gas analyses of samples collected during the flow test are given in Table 1. Table 2 presents chemical analyses of liquid samples collected during the low flow portion of the test. The liquid samples listed in Table 2 were collected through the 1/4" cooling coil. Comparison of the silica concentrations in these analyses with those from the samples collected through the 1/8" short tube indicates that silica precipitated in the 1/4" cooling coil when sample MA-52 was taken. Silica concentrations were similar for both methods in Samples MA-50 and -51. However, the variability of the silica concentrations from sample to sample in a closely spaced time interval indicates that silica may be precipitating in the wellbore, or, more likely, the separator.

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Table 1. Gas Analyses from the Salton Sea Deep Well.
 Concentrations are in parts per million by weight. WHT = well head temperature (deg F); WHP = well head pressure (psig); SEP T = separation temperature (deg F); SEP P = separation pressure (psig); FLOWRATE = combined steam and brine flowrates (lbs/hr) measured downstream of the separator; STEAM FRACT = steam fraction in the separator.

Sample	MA-53	MA-54	MA-55	MA-61	MA-62	MA-65	MA-66
Date	6/8/88	6/8/88	6/8/88	6/16/88	6/16/88	6/16/88	6/16/88
Time	10:00	10:10	10:23	09:45	10:10	11:50	12:00
WHP	508	508	508	504	504	505	505
WHT	490	490	490	498	498	498	498
SEP P	204	214	204	216	216	237	237
SEP T	400	400	400	415	415	415	415
STEAM FRACT	0.15	0.15	0.15	0.13	0.13	0.15	0.15
TOTAL FLOW	126,108	126,108	126,108	535,756	535,756	496,075	496,075
H ₂ O	9.76E+5	9.76E+5	9.75E+5	9.84E+5	9.84E+5	9.85E+5	9.85E+5
CO ₂	2.30E+4	2.34E+4	2.45E+4	1.52E+4	1.57E+4	1.47E+4	1.47E+4
H ₂ S	1.88E+2	1.91E+2	1.96E+2	1.02E+2	1.14E+2	7.36E+1	1.36E+2
NH ₃	4.22E+2	4.28E+2	4.31E+2	4.2E+2	4.29E+2	3.45E+2	3.77E+2
Ar	3.09E-1	3.61E-1	1.04E+0	8.28E-1	1.47E-2	1.51E-1	4.84E-2
N ₂	3.65E+1	4.91E+1	4.68E+1	5.75E+1	2.7E+1	3.02E+1	2.44E+1
CH ₄	4.92E+1	5.23E+1	6.80E+1	2.40E+1	1.90E+1	2.38E+1	2.39E+1
H ₂	9.22E+0	9.69E+0	9.89E+0	2.10E+0	1.43E+0	1.96E+0	1.84E+0

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Table 2. Fluid Analyses from the Salton Sea Deep Well. The samples listed were taken through a 1/4" stainless steel cooling coil. Concentrations are in mg/kg. The conditions at the time these samples were taken were: well head temperature = 490 deg F; well head pressure = 508 psig; separation temperature = 400 deg F, separation pressure = 204 psig; combined steam and brine flow = 126,108 lbs/hr. N.D. = not detected, N.A. = not analyzed.

Sample	MA-50	MA-51	MA-52
Na	60789	60479	59568
K	18944	19208	18944
Ca	30777	30325	29984
Mg	47.7	50.4	48.2
Fe	1893	1874	1846
SiO ₂	575	441	386
B	448	456	449
Li	238	240	236
Sr	459	461	456
Zn	565	579	565
Ag	1.34	N.D.	1.88
As	15.6	19.5	17.8
Ba	253	262	256
Cd	2.55	2.72	2.56
Cu	3.74	3.25	3.01
Mn	1634	1660	1637
Pb	118	124	122
NH ₄	395	N.A.	412
HCO ₃	10.0	N.D.	N.D.
Cl	163000	162000	162000
F	3.19	2.94	2.91
SO ₄	N.D.	N.D.	N.D.
Br	103	110	104
I	5.00	6.70	2.9
Density	1.22	1.22	1.22

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Fluid Chem
Report

2nd sample
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6/16/88 (table 1)
or
6/17/88 (pg. 1)

August 31, 1988

Charles R. Snyder
P.O. Box 3965
San Francisco, CA 94119
Mail Code 50/15/D10

Dear Charles:

Please find enclosed a camera-ready copy abstract and results to date of our research on the fluid from the Salton Sea Deep Hole. I hope that this is sufficient for your purposes. If you have any questions, feel free to call me at (801) 524-3435.

Sincerely,

Michael C. Adams
Geochemist

CHEMICAL SAMPLING - UNIVERSITY OF UTAH RESEARCH INSTITUTE

Liquid and gas samples of the fluid from the Salton Sea Deep Hole were taken by Mike Adams and Michelle Lemieux of the University of Utah Research Institute during the long-term flow test. Three samples were taken during a one hour period from 0900 to 1000 on June 8, which corresponds to the lowest flowrate of the test. Four samples were taken during a two hour period from 0930 to 1130 on June 17, which corresponds to the highest flow-rate of the test.

The samples were taken from the brine and steam lines downstream of the separator. The liquid samples were taken by two different methods. The first method involved cooling the hot brine in a one fourth inch stainless steel tube coil prior to capturing the fluid in a preservative solution. Although this method is commonly employed it may promote precipitation of silica in the cooling coil prior to collection. The second method was designed to prevent precipitation of silica prior to sampling. This method utilized a six inch by one eighth inch tube that was inserted directly into the preservative solution with no prior cooling. Both methods used a preservative solution of 5 wt% nitric acid for ICP analysis, 5 wt% hydrochloric acid for sulfate and ammonia, a non-diluted sample for chloride, fluoride, and TDS. The acid to sample dilutions in the samples were 10 to 1.

Steam samples were taken through a one fourth inch stainless steel cooling coil. The samples were taken in evacuated pyrex flasks that contained solutions of sodium hydroxide and cadmium chloride.

The liquid and gas samples are being analyzed to determine if differences in the chemistry of the fluid exist as a result of changing flow rates, and if silica does precipitate when a cooling coil is used during collection. At this time only the gas samples and the liquid samples from the low-flow portion of the test have been analyzed, and are summarized in Tables 1 and 2. The liquid samples listed in Table 2 were collected through the 1/4" cooling coil. Comparison of the silica concentrations in these analyses with those from the samples collected through the 1/8" short tube indicates that silica precipitated in the 1/4" cooling coil when sample MA-52 was taken. Silica concentrations were similar for both methods in Samples MA-50 and -51. However, the variability of the silica concentrations from sample to sample in a closely spaced time interval indicates that silica may be precipitating in the wellbore, or, more likely, the separator.

Table 1. Gas Analyses from the Salton Sea Deep Well. Concentrations are in parts per million by weight. WHT = well head temperature (deg F); WHP = well head pressure (psig); SEP T = separation temperature (deg F); SEP P = separation pressure (psig); FLOWRATE = combined steam and brine flowrates (lbs/hr) measured downstream of the separator.

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CH ₄	4.92E+1	5.23E+1	6.80E+1	2.40E+1	1.90E+1	2.38E+1	2.39E+1
H ₂	9.22E+0	9.69E+0	9.89E+0	2.10E+0	1.43E+0	1.96E+0	1.84E+0

YA
 Table 2. Fluid Analyses from the Salton Sea Deep Well. The samples listed were taken through a 4" stainless steel cooling coil. Concentrations are in mg/kg. The conditions at the time these samples were taken were: well head temperature = 490 deg F; well head pressure = 508 psig; separation temperature = 400 deg F, separation pressure = 204 psig; combined steam and brine flow = 126,108 lbs/hr.

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SO ₄	N.D.	N.D.	N.D.
Br	103	110	104
I	5.00	6.70	2.9
Density	1.22	1.22	1.22