REPORT

CURRIER 1

CHEMICAL ANALYSES AND SOME
OF THEIR APPLICATIONS

PREPARED BY

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SUBMITTED TO

MAPCO GEOTHERMAL

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1.0 INTRODUCTION

A number of flow tests have been performed at Currier #1 during and shortly after drilling the well. Vetter Research (VR) took a large number of samples during this flow test work and analyzed these samples. All analytical data is given in table form in this report.

2.0 PURPOSE OF THE FLOW TESTS AND ANALYTICAL WORK

An attempt was made to extract as much data as possible during early and short-duration flow testing. The tests were not full-fledged flow tests suitable to judge the reservoir and reservoir fluids in all required details. Instead, the tests could be called pit tests. A maximum of approximately 4500 barrels of liquid could be contained at any given time at the wellsite (pit: 2000 barrels; baker tanks: 2500 barrels). This small volume is not sufficient to conduct any long-duration flow tests. However, the pit tests are sufficient to collect samples and to analyze them in order to obtain an approximate idea (a) about the brine recovered during the tests and (b) to forecast some of the problems to be encountered during future production of the well. The main reason for conducting the flow tests and the analytical work was to arrive at a very early judgment of the commercial value of the well.

3.0 FLOW TESTING AT CURRIER #1

Several flow tests were attempted and/or conducted during November and December 1979.

3.1 DRILL STEM TEST 11/22-23/1979

Samples were collected during this unsuccessful attempt to obtain a sustained flow through the drill stem. The analytical data of the samples collected during this test are listed in Tables 1-3.

3.2 DRILL STEM TEST 12/1/1979

Another attempt to perform a DST was made on 12/1/1979. A number of samples were collected during this test and analyzed by VR. The analytical data are given in Tables 4 and 5.

3.3 UNSUCCESSFUL ATTEMPT TO FLOW THROUGH CASING: 12/11/79

Nitrogen was used to kick on the well on 12/11/1979. Unfortunately, this attempt to start flowing the well failed. Only a few samples were collected during this time. The data are given in Table 6.

3.4 SUCCESSFUL ATTEMPT TO FLOW THROUGH CASING: 12/13/1979

During the night from 12/11 to 12/12, the well started to flow by itself after the nitrogen injection system failed. Unfortunately, VR was not able to collect samples during this flow period. Approximately 3500 barrels of liquid were produced during this flow period.

A new and successful attempt was made to flow the well on 12/13/79. This time, the well came on by itself. Numerous samples were collected during this time. The brine data are listed in Tables 7-13. The data regarding the steam composition are given in Tables 14 and 15.

During this successful flow test, a large number of pressure and temperature readings were taken. These data are not included in this report but are presently being compiled by VR. At this time, we would like to mention only some flash and flow rate calculations. The flow rate of the brine leaving the separator (separator condition: 218°F) was 7700 barrels per day (determined through tank gauging). The steam flow rate (measured through a 5" square-edged orifice in the steam line) was 8700 lb/hr of steam, uncorrected for CO_2 and other non-condensables in the steam (see Tables 13 and 14).

Some rough flash calculations were also performed. Assuming a bottomhole temperature of 438°F and a separator temperature of 218°F, we calculate a 23.8% flash (not corrected for brine and steam compositions). Cooling of the surface lines is also not taken into account. This cooling effect may be substantial at the very low flow rates during this test period. If we assume the conditions mentioned above (brine flow rate: 101,000 lb/hr), we calculate a total mass flow rate of 132,600 lb/hr and steam flow rate of 31,600 lb/hr.

4.0 DATA EVALUATION

Some thousand analytical values are given in Tables 1-14. To evaluate the data in an acceptable manner will take quite a few man days. This time was not available. We suggest compiling a number of specific questions or problems and, then, trying to answer these questions or solve these problems by evaluating the data.

In this report we will treat only two examples of this type of data evaluation.

4.1 WATER COMPOSITIONS AT DIFFERENT DEPTHS

Unfortunately, the DST and through-casing flow test periods were too short to produce clean formation waters. Therefore, contaminations through drilling fluid should be subtracted from the samples to be analyzed. The first three columns in Table 15 show the most likely water compositions produced during various periods. One can see that the salinity of the water first increased and then decreased again with increasing depth.

4.2 LEAKS IN WELLBORE

One would be interested to know if the well in its present shape shows any leaks from upper portions of the hole (e.g., around casing shoes). This question is difficult to answer because we have no precise analysis of the formation water at the "open" or "completed" depth.

Tables 8-11 show the compositions of the waters discharged from the well on Dec. 13, 1979. Assuming that inflow through leaks occurs at different rates during shut-in and during flow-testing we should find varying water compositions depending whether the samples were pulled during the discharge of the first wellbore volume or at a later stage of the flow test. Indeed, the data listed in Tables 8-11 indicate such a behavior. For example, the Na ion concentration is a good indicator because it is not affected by cooling or heating processes. One can see in the tables that the Na ion concentration first increases (VR Code 0006-02-0054 to 0006-02-0058), then decreases (to the approximate values found in VR Code 0006-02-0085) and finally increases again. Our interpretation of this behavior is based on leakage of different waters into the wellbore at different times during the flow test.

TABLE 1

MAPCO, INC. - CURRIER #1

(Results expressed in mg/ℓ)

Flow Test: 11/22 Thru 11/23/79

LP CODE	SAMPLE IDENTIFICATION	pH	SPECIFIC CONDUCTANCE	SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	ALUMINUM	CHROMIUM
6-1	Pit Sample 8:50 a.m.	10.1	12,400	1790	1870	<0.07	128	1.44	0.7	1.26	2.8	3.1
6-2	11:00 a.m.	9.4	10,950	1570	1620	<0.07	109	5.98	1.6	0.95	2.5	3.9
6-3	3:15 p.m.	9.7	10,650	1530	1620	<0.07	127	6.27	1.1	2.50	1.4	5.1
6-4	Mud Tank 8:45 a.m.	10.4	*	2280	2130	<0.07	133	2.85	3.9	1.44	<0.013	5.8
6-5	11:00 a.m.	10.4	*	2200	2100	<0.07	129	1.76	4.2	1.60	2.8	5.0
6-6	3:15 p.m.	10.5	*	2640	2140	<0.07	159	2.15	4.2	1.62	2.7	6.5
6-7	Backflow #1	10.3	18,200	3200	2150		87.1	1.58	2.2	1.44	2.7	2.6
6-8	#2	9.3	21,300	4000	2120	2.83	72.8	1.59	2.5	1.73	1.9	2.1
6-9	#3	8.0	24,000	5220	2140	18.7	246	10.6	1.8	13.8	2.2	<0.06
6-10	#4	7.7	25,400	6100	2100	27.6	394	28.9	3.3	24.6	1.9	<0.06
6-11	#5	7.7	26,200	6220	1990	30.2	410	34.3	3.6	28.1	1.7	<0.06
6-12	#6	7.5	26,200	6260	1960	32.3	437	39.9	4.0	31.5	1.6	<0.06
6-13	#7	7.5	25,800	6630	1550	33.4	424	42.0	4.0	33.0	2.1	<0.06
6-14	#8	7.4	26,700	7430	1460	39.0	459	51.9	3.7	42.4	1.7	<0.06
6-15	#9	7.4	27,500	7120	1610	37.7	438	51.0	3.9	42.2	2.1	<0.06
6-16	#10	8.9	18,300	3090	2140	2.32	218	5.5	5.1	5.43	2.0	6.0
6-17	Downhole Stand #1	8.2	23,000	4590	2120	15.8	394	13.7	2.5	10.7	2.6	1.0
6-18	#2	7.7	29,000	7690	1540	41.5	599	62.3	3.4	43.6	2.3	<0.06
6-19	#3	7.4	28,700	7480	1550	41.0	412	54.0	3.4	48.9	2.0	<0.06
6-20	#4	7.4	27,500	7030	1470	37.2	468	52.1	3.0	44.6	2.4	<0.06
6-21	Sampler	7.8	25,500	5910	2000	30.5	310	27.2	2.9	25.9	2.5	<0.06
6-22	Water Sample	7.9	1,280	140	<0.2	<0.01	86.0	36.0	<0.03	2.05	0.43	<0.06

*Insufficient amount filtered sample

Metals not listed were below the following detection limits:

Al	0.3	Ag	0.03	As	1.0	Au	0.09	Be	0.01	Cd	0.07	Cr	0.11
Cu	0.02	Ga	0.7	Ge	0.8	Hg	0.3	La	0.03	Mo	0.8	Ni	0.4
Pb	0.5	PO_4	1.0	Sb	0.4	Sc	1.4	Si	1.1	Ti	0.02	V	0.03
Zn	0.07	Zr	0.05										

TABLE 2

MAPCO, INC. - CURRIER #1

(Results expressed in mg/ℓ)

FLOW TEST: 11/22 THRU 11/23/79

LAB CODE	SAMPLE IDENTIFICATION	COPPER	IRON	MANGANESE	ZINC	CHLORIDE	SULFATE	CARBONATE	BICARBONATE	PHOSPHATE	BORON	SILICA	TOTAL ORGANIC CARBON
6-1	Pit Sample 8:50 a.m.	0.55	0.21	0.041	0.41	3,700	620	216	390	2.6	6.3	76.7	693
6-2	11:00 a.m.	0.20	0.29	0.028	0.29	3,260	640	73	740	2.7	4.9	42.1	600
6-3	3:15 p.m.	0.22	3.53	0.10	0.20	3,200	542	108	500	16.7	4.8	53.5	637
6-4	Mud Tank 8:45 a.m.	1.1	4.42	0.062	0.44	5,100	456	306	258	24.7	8.29	114	1470
6-5	11:00 a.m.	0.92	1.89	0.038	0.41	4,860	392	260	203	26.7	8.17	93.7	1310
6-6	3:15 p.m.	1.1	2.38	0.051	0.55	5,960	471	343	261	65.6	9.23	106	1470
6-7	Backflow #1	0.46	1.41	0.048	0.38	6,130	1400	216	228	7.5	8.84	200	1384
6-8	#2	0.21	0.18	0.033	0.31	7,670	1310	58	673	<2	11.1	108	1280
6-9	#3	0.04	1.8	0.95	0.23	9,480	980	-	1530	<2	15.7	70.3	698
6-10	#4	0.07	27.8	5.58	0.29	10,900	726	-	1620	<2	19.0	87.7	487
6-11	#5	0.07	29.9	5.35	0.30	11,600	474	-	1560	<2	19.7	88.7	424
6-12	#6	<0.01	22.4	6.27	0.25	11,700	399	-	1540	<2	20.8	92.1	335
6-13	#7	0.09	14.8	6.30	0.26	11,600	347	-	1420	<2	21.0	82.0	255
6-14	#8	<0.01	0.96	6.92	0.23	12,700	292	-	1410	<2	22.1	84.9	233
6-15	#9	<0.01	0.11	5.85	0.24	13,000	286	-	1320	<2	21.5	79.0	191
6-16	#10	0.12	8.96	0.27	0.56	6,480	408	20.4	589	28.0	9.8	37.4	1740
6-17	Downhole Stand #1	<0.01	0.57	0.057	0.37	8,770	678	-	2130	15.2	13.2	103	766
6-18	#2	<0.01	13.9	1.98	0.26	12,900	415	-	1730	<2	23.7	108	262
6-19	#3	<0.01	16.9	2.33	0.40	13,200	315	-	965	<2	23.0	127	190
6-20	#4	<0.01	72.1	2.44	0.43	12,300	392	-	1234	<2	20.9	87.0	282
6-21	Sampler	<0.01	28.9	2.30	0.39	10,700	526	-	1170	<2	18.1	95.1	435
6-22	Water Sample	0.06	<0.1	0.097	0.27	140	311	-	150	<2	0.21	9.3	9.0

TABLE 3

MAPCO, INC. - CURRIER #1

FLOW TEST: 11/22 THRU 11/23/79

(Results expressed in mg/ℓ)

VR CODE	SAMPLE I.D.	TDS[a] (mg/ℓ)
6-0001	Pit (0850)	10,100
6-0002	Pit (1100)	8,960
6-0003	Pit (1515)	8,780
6-0004	Mud Tank (0845)	- [b]
6-0005	Mud Tank (1100)	- [b]
6-0006	Mud Tank (1515)	- [b]
6-0007	Backflow #1 (0800)	16,600
6-0008	#2 (0802)	18,900
6-0009	#3 (0805)	20,600
6-0010	#4 (0808)	21,700
6-0011	#5 (0810)	22,400
6-0012	#6 (0812)	22,100
6-0013	#7 (0814)	21,300
6-0014	#8 (0816)	23,000
6-0015	#9 (0818)	23,300
6-0016	#10 (0820)	17,800
6-0017	Downhole #1 (1045)	20,400
6-0018	#2 (1050)	24,300
6-0019	#3 (1055)	23,800
6-0020	#4 (1100)	23,000
6-0021	Sampler	20,700
6-0022	H_2O Sample	1,400

a. Samples were dried at 180° C.

b. Insufficient sample volume.

TABLE 4

MAPCO, INC. - CURRIER #1

(Results expressed in mg/ℓ)

Flow Test: 12/1/79

LAB CODE	SAMPLE IDENTIFICATION			SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	ALUMINUM	CHROMIUM	COPPER	IRON	MANGANESE
6-23	#1	RU	7:45 a.m.	9,120	767	64.5	230	24.2	12.0	69.7	1.32	0.69	0.47	87	8.27
6-24	#2	RA	8:00 a.m.	9,520	817	65.2	277	26.9	15.9	75.3	5.37	0.58	0.67	195	9.27
6-25	#3	RU	8:00 a.m.	9,070	870	62.9	222	27.8	11.4	69.2	1.20	0.13	0.025	42	6.45
6-26	#4	RU	8:15 a.m.	9,810	795	72.5	250	26.0	17.9	80.9	1.41	0.18	<0.02	72	5.68
6-27	#5	RA	8:30 a.m.	9,940	790	64.2	291	23.4	16.8	82.4	3.18	0.48	0.16	165	3.96
6-28	#6	RU	8:30 a.m.	9,770	769	61.7	242	19.0	14.8	76.7	<0.3	0.05	<0.02	34	1.96
6-29	#7	RU	8:45 a.m.	9,880	779	63.2	245	20.1	13.7	78.6	0.83	0.08	<0.02	23	1.70
6-30	#8	RA	9:00 a.m.	9,840	773	63.1	262	23.1	17.8	81.3	<0.3	0.40	<0.02	89	2.05
6-31	#9	RU	9:00 a.m.	9,890	773	64.4	247	21.5	16.9	81.4	<0.3	0.21	<0.02	16	1.50
6-32	#10	RU	9:15 a.m.	10,000	781	65.8	249	21.1	16.4	80.6	<0.3	0.24	<0.02	12	1.31
6-33	#11	RU	9:30 a.m.	10,100	781	65.6	251	20.5	16.6	81.8	<0.3	0.16	<0.02	0.8	1.17
6-34	#12	RA	9:30 a.m.	10,000	773	63.8	256	20.8	17.2	82.5	<0.3	0.29	<0.02	58	1.41
6-35	#13	RU	9:45 a.m.	10,100	775	64.4	255	19.7	16.2	82.5	<0.3	0.11	<0.02	0.7	1.78
6-36	#14	RU	10:00 a.m.	10,000	780	63.7	250	20.8	14.0	82.0	<0.3	0.24	<0.02	1.3	1.06
6-37	#15	RA	10:00 a.m.	9,980	786	62.9	280	24.6	15.9	84.0	<0.3	0.34	<0.02	55	1.43
6-38	#16	RU	10:15 a.m.	9,810	769	63.1	247	20.9	15.2	79.6	<0.3	0.21	<0.02	1.7	0.99
6-39	#17	RU	10:30 a.m.	10,300	806	67.2	258	22.0	15.8	83.8	<0.3	0.40	<0.02	3.2	1.00
6-40	#18	RA	10:30 a.m.	9,950	772	63.6	257	21.4	16.3	80.6	<0.3	0.40	<0.02	41	1.22
6-41	Mud Out		11/28/79	3,590	1620	0.1	415	9.4	<0.3	9.4	2.74	1.16	0.15	53	0.74
6-42	Mud In		11/28/79	3,410	1710	0.1	528	19.2	<0.3	7.1	4.16	1.45	0.13	23	1.09

Metals not listed were below the following detection limits:

Al	0.3	Ag	0.03	As	1.0	Au	0.09	Be	0.01	Cd	0.07	Cr	0.11	Cu	0.02	Ga	0.7	Ge	0.8
Hg	0.3	La	0.03	Mo	0.8	Ni	0.4	Pb	0.5	PO_4	1.0	Sb	0.4	Se	1.4	Su	1.1	Ti	0.02
V	0.03	Zn	0.07	Zr	0.05														

TABLE 5

MAPCO, INC. - CURRIER #1

(Results expressed in mg/ℓ)

FLOW TEST: 12/1/79

LAB CODE	SAMPLE IDENTIFICATION			ZINC	CHLORIDE	CARBONATE	BICARBONATE	PHOSPHATE	BORON	SILICA	TOTAL ORGANIC CARBON	pH	TOTAL DISSOLVED SOLIDS	SPECIFIC CONDUCTANCE
6-23	#1	RU	7:45 a.m.	4.16	15,800	-	-	<1	34.2	162	97	6.65	27,700	33,300
6-24	#2	RA	8:00 a.m.	4.68	-	-	-	<1	33.6	247	32	-	28,100	-
6-25	#3	RU	8:00 a.m.	3.64	15,300	-	813	<1	29.6	191	125	6.67	27,200	33,000
6-26	#4	RU	8:15 a.m.	3.34	16,600	-	864	<1	31.4	230	10	6.65	28,100	34,500
6-27	#5	RA	8:30 a.m.	1.06	-	-	-	<1	30.0	288	8	-	29,500	-
6-28	#6	RU	8:30 a.m.	<0.07	16,800	-	676	<1	30.9	227	45	6.81	28,700	34,500
6-29	#7	RU	8:45 a.m.	0.52	16,500	-	683	<1	28.6	232	51	6.77	28,900	34,000
6-30	#8	RA	9:00 a.m.	0.46	-	-	-	3.07	29.0	282	18	-	29,300	-
6-31	#9	RU	9:00 a.m.	0.66	16,800	-	635	<1	28.9	231	50	6.95	28,600	34,000
6-32	#10	RU	9:15 a.m.	0.12	16,400	-	739	<1	28.9	232	25	6.80	28,900	34,500
6-33	#11	RU	9:30 a.m.	0.18	17,100	-	709	<1	29.4	231	23	7.02	29,300	33,000
6-34	#12	RA	9:30 a.m.	0.22	-	-	-	<1	28.1	282	10	-	29,200	-
6-35	#13	RU	9:45 a.m.	0.24	17,600	-	635	<1	28.2	239	30	6.97	29,300	35,300
6-36	#14	RU	10:00 a.m.	0.19	17,300	-	629	<1	26.9	241	1	7.04	29,000	35,000
6-37	#15	RA	10:00 a.m.	0.35	-	-	-	<1	27.8	285	7	-	29,300	-
6-38	#16	RU	10:15 a.m.	0.17	17,200	-	582	1.27	27.3	238	42	7.28	29,100	35,000
6-39	#17	RU	10:30 a.m.	0.27	17,000	-	593	<1	27.2	250	35	7.02	29,700	36,200
6-40	#18	RA	10:30 a.m.	0.35	-	-	-	1.08	25.9	279	23	-	29,700	-
6-41	MUD OUT		11/28/79	0.80	3,680	29	529	59.1	5.8	24.3	4603	9.10	19,000	14,200
6-42	MUD IN		11/28/79	0.65	4,170	12	588	68.9	4.59	13.0	4754	8.66	22,100	-

TABLE 6

MAPCO, INC. - CURRIER #1
FLOW TEST: 12/11/79

LR CODE	SAMPLE IDENTIFICATION	SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	COBALT	CHROMIUM	IRON	MANGANESE	ZINC
0006-02-0049	Flowline to pit 11:50	428	114	0.12	51.8	1.82	0.076	0.84	<0.009	<0.011	1.20	0.059	0.119
0006-02-0050	Flowline to pit 4:25	5540	721	17.1	254	20.4	0.70	21.7	<0.09	<0.011	<0.03	0.103	0.07
0006-02-0051	Flowline to pit 4:25 acidified	5970	756	15.1	385	27.7	1.39	24.8	0.295	0.315	58.9	1.63	0.264
0006-02-0052	Liner Circ Mud In 12/8/79	2680	636	<0.13	293	27.2	1.93	5.22	0.237	0.786	35.4	1.23	0.718
0006-02-0053	Liner Circ Mud Out 12/8/79	2603	824	1.41	1313	116	4.40	12.6	0.649	0.989	180	0.793	0.207

		CHLORIDE	SULFATE	BICARBONATE	CARBONATE	PHOSPHATE	BORON	SILICA	pH	TDS	Sp. Con
0006-02-0049	Flowline to pit 11:50	380	480	230	202	<0.1	0.38	64.1	8.84	1,730	2,400
0006-02-0050	Flowline to pit 4:25	9150	225	785	-	<1.0	29.9	236	8.20	17,000	27,600
0006-02-0051	Flowline to pit 4:25 RA	-	233	-	-	<1.0	29.9	370	-	-	-
0006-02-0052	Liner Circ Mud In 12/8/79	2450	640	2400	400	<1.0	1.75	370	9.5	12,900[a]	[b]
0006-02-0053	Liner Circ Mud Out 12/8/79	2810	680	2610	635	<1.0	1.32	350	9.5	19,500[a]	[b]

a. Samples contain significant amounts of organic carbon
b. Insufficient quantity to perform test

Metals not listed were below the following detection limits:

Al 0.3	Ag 0.03	As 1.0	Au 0.09	Be 0.01	Cd 0.07	Cu 0.02	Ga 0.7	Ge 0.8	Hg 0.3
La 0.03	Mo 0.8	Ni 0.4	Pb 0.5	Sb 0.4	Se 1.4	Sn 1.1	Ti 0.02	V 0.03	Zr 0.05

TABLE 7
MAPCO, INC. - CURRIER #1
Flow Test: 12/11/79
(Results expressed in mg/ℓ)

UR CODE	SAMPLE IDENTIFICATION			SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	COBALT	CHROMIUM	IRON	MANGANESE
0006-02-0147	Brine Line	@2226	RA	6435	624	22.8	311	24.1	5.1	32.1	<0.1	<0.1	15.74	0.74
0006-02-0148	Brine Line	@2249	RA	6743	644	24.0	315	20.6	6.1	38.7	<0.1	<0.1	12.8	0.53
0006-02-0149	Brine Line	@2310	RA	6420	614	23.2	252	18.7	5.3	31.0	<0.1	<0.1	10.9	0.42
0006-02-0150	Brine Line	@2312	RU	6552	628	23.8	247	17.6	4.3	34.7	<0.1	<0.1	<	0.11
0006-02-0151	Brine Line	@2325	RA	6566	630	24.5	270	20.5	4.0	34.2	<0.1	<0.1	12.9	0.49
0006-02-0152	Brine Line	@2400	RA	6515	617	24.1	324	21.3	4.0	35.4	<0.1	<0.1	14.3	0.67
0006-02-0153	Steam Line	@2230	RU	7.5	2.5	0.05	1.7	0.04	0.09	0.07	<0.1	<0.1	0.18	0.019

				pH	SPEC. COND	CHLORIDE	BORON	SILICA
0006-02-0147	Brine Line	@2226	RA	-	-	-	18.1	314
0006-02-0148	Brine Line	@2249	RA	-	-	-	20.3	311
0006-02-0149	Brine Line	@2310	RA	-	-	-	18.1	274
0006-02-0150	Brine Line	@2312	RU	8.00	32,200	11,700	19.2	179
0006-02-0151	Brine Line	@2325	RA	-	-	-	16.2	293
0006-02-0152	Brine Line	@2400	RA	-	-	-	18.4	285
0006-02-0153	Steam Line	@2230	RU	6.20	1,025	103	0.80	<1

TABLE 8

MAPCO, INC. - CURRIER #1

FLOW TEST: 12/13/79

UR CODE	SAMPLE IDENTIFICATION	SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	COBALT	CHROMIUM	IRON	MANGANESE
0006-02-0054	#1 to pit	6260	588	23.3	273	19.2	6.0	33.9	<0.1	<0.11	44.6	1.87
0006-02-0055	#2 to pit	6320	597	24.1	253	18.3	5.4	33.5	<0.1	<0.11	90.4	2.14
0006-02-0056	#3 to pit	6343	588	20.5	225	19.0	4.8	28.7	<0.1	<0.11	124	1.98
0006-02-0057	#4 to pit	6401	605	25.8	237	18.7	5.1	32.6	<0.1	<0.11	107	2.39
0006-02-0058	#5 to pit	6732	635	28.0	250	18.2	6.7	34.0	<0.1	<0.11	120	2.56
0006-02-0059	#6 to pit.....0718	6475	608	26.7	234	18.5	6.0	32.0	<0.1	<0.11	97.2	2.48
0006-02-0060	#7 to pit.....0720	6686	632	27.6	243	18.7	5.8	33.7	<0.1	<0.11	107	2.48
0006-02-0061	#8 to pit.....0722	6425	609	25.5	232	19.4	6.4	32.7	0.23	<0.11	89.3	2.29
0006-02-0062	#9 Tailpipe.....0724	6436	610	26.5	224	19.0	7.5	31.7	0.13	<0.11	89.0	2.30
0006-02-0063	#10 Tailpipe.....0726	6370	604	25.8	224	17.8	6.4	30.3	0.38	<0.11	77.2	2.20
0006-02-0064	#12 Tailpipe.....0730	6093	574	23.7	221	22.0	6.4	31.4	0.12	<0.11	18.2	2.01
0006-02-0065	#13 Tailpipe.....0732	6289	595	24.7	232	20.8	5.2	32.0	0.21	<0.11	66.4	2.04
0006-02-0066	#14 Tailpipe.....0734	6114	574	23.7	224	21.0	6.2	30.0	0.18	<0.11	39.0	2.01
0006-02-0067	#15 Tailpipe.....0736	6149	583	23.3	217	21.5	5.6	31.4	0.11	<0.11	32.3	2.12
0006-02-0068	#16 Tailpipe.....0738	6254	594	24.6	229	22.9	6.6	31.0	0.14	<0.11	66.7	2.41
0006-02-0069	#17 Tailpipe.....0740	6245	592	25.8	212	21.9	5.4	30.3	0.21	<0.11	47.3	1.91
0006-02-0070	#18 Tailpipe.....RA	6041	573	24.3	226	21.5	8.8	30.3	0.34	<0.11	123	2.25
0006-02-0071	#19 Tailpipe.....0744	5969	563	23.6	209	21.8	8.3	28.8	0.23	<0.11	<0.03	2.61
0006-02-0072	#20 Tailpipe.....0746	6264	595	25.4	209	22.1	8.2	30.0	0.37	<0.11	31.5	1.93
0006-02-0073	#21 Tailpipe RA....0746	6118	577	23.8	218	21.9	8.6	29.2	0.63	<0.11	122	2.15
0006-02-0074	#22 Tailpipe.....0748	6275	591	25.6	218	22.5	9.0	30.0	0.47	<0.11	39.1	2.56
0006-02-0075	#23 Tailpipe.....0750	6331	598	24.7	213	21.9	9.2	30.2	0.57	<0.11	16.1	1.91
0006-02-0076	#24 Tailpipe.....0752	6191	584	22.7	214	22.7	9.6	28.5	0.65	<0.11	37.4	2.32
0006-02-0077	#25 Tailpipe.....RA	6484	619	25.9	221	23.6	9.4	31.1	0.83	<0.11	129	2.10
0006-02-0078	#26 Tailpipe.....0754	6498	619	25.9	208	22.1	9.6	28.9	0.64	<0.11	32.3	1.87
0006-02-0079	#27 Tailpipe.....0756	6252	592	24.7	201	21.8	8.1	27.7	0.64	<0.11	10.5	1.77
0006-02-0080	#28 Tailpipe.....0758	6212	589	25.1	189	22.1	7.5	26.7	0.73	<0.11	19.4	1.70
0006-02-0081	#29 Tailpipe.....	6260	594	24.2	210	24.4	7.7	28.9	0.94	<0.11	117	1.90
0006-02-0082	#30 Tailpipe.....0800	5965	562	22.8	197	21.9	7.6	27.4	0.86	<0.11	24.1	1.61
0006-02-0083	#31 Tailpipe.....0802	6037	576	22.3	188	19.4	8.7	27.0	0.1	<0.11	26.2	1.42
0006-02-0084	#32 Tailpipe.....0804	5733	490	21.5	164	19.3	6.8	24.0	0.48	<0.11	23.6	1.30
0006-02-0085	#33 Tailpipe.....0805	5642	489	21.3	167	18.5	6.4	23.9	0.49	<0.11	42.8	1.87
0006-02-0086	#34 Tailpipe.....0806	6006	571	22.4	180	19.7	8.9	24.4	0.41	<0.11	104	1.48
0006-02-0087	#35 Tailpipe.....0806	5936	558	23.3	163	18.8	8.5	24.6	0.26	<0.11	19.0	1.29
0006-02-0088	#36 Tailpipe.....0808	5775	491	22.3	167	18.9	10.4	23.9	0.27	<0.11	16.6	1.31
0006-02-0089	#37 Tailpipe.....0810	5840	492	22.2	178	19.3	11.0	25.3	0.1	<0.11	8.41	1.36
0006-02-0090	#38 Tailpipe.....0812	5710	489	22.0	165	18.6	9.4	23.9	0.34	<0.11	0.39	1.25
0006-02-0091	#39 Tailpipe 203°F 0814	5754	491	22.5	162	18.3	9.6	23.0	0.22	<0.11	7.62	1.28
0006-02-0092	#40 Tailpipe.....0816	5816	492	22.2	156	18.1	8.3	22.4	0.38	<0.11	15.0	1.33
0006-02-0093	#41 Tailpipe.....0818	5900	559	23.2	162	19.4	8.9	24.5	0.27	<0.11	13.9	1.32
0006-02-0094	#42 Tailpipe.....	5711	490	21.7	160	19.4	8.3	22.7	0.32	<0.11	10.5	1.29

TABLE 9

MAPCO, INC. - CURRIER #1

FLOW TEST: 12/13/79

VR CODE	SAMPLE IDENTIFICATION		pH	SPEC. COND	CHLORIDE	BORON	SILICA	TOC
0006-02-0054	#1 to pit		6.38	28,700	11,000	21.8	263	57
0006-02-0055	#2 to pit		6.46	28,700	10,900	21.4	279	75
0006-02-0056	#3 to pit		6.48	28,700	10,800	21.3	267	80
0006-02-0057	#4 to pit		6.48	28,700	10,900	22.0	268	88
0006-02-0058	#5 to pit		6.47	28,700	10,800	22.0	668	90
0006-02-0059	#6 to pit	0718	6.38	28,700	10,800	21.9	249	85
0006-02-0060	#7 to pit	0720	6.43	28,800	10,800	21.1	259	86
0006-02-0061	#8 to pit	0722	6.44	28,800	10,700	20.3	252	87
0006-02-0062	#9 Tailpipe	0724	6.49	28,800	10,700	20.4	252	87
0006-02-0063	#10 Tailpipe	0726	6.49	28,800	10,700	20.0	246	83
0006-02-0064	#12 Tailpipe	0730	6.39	28,800	10,900	20.8	212	81
0006-02-0065	#13 Tailpipe	0732	6.52	29,100	10,800	20.4	252	86
0006-02-0066	#14 Tailpipe	0734	6.41	29,100	10,800	20.8	233	80
0006-02-0067	#15 Tailpipe	0736	6.45	29,100	10,900	21.5	226	81
0006-02-0068	#16 Tailpipe	0738	6.49	29,100	10,600	21.0	253	77
0006-02-0069	#17 Tailpipe	0740	6.54	29,100	10,800	20.8	243	74
0006-02-0070	#18 Tailpipe	RA	-	-	-	22.5	297	68
0006-02-0071	#19 Tailpipe	0744	7.10	29,200	10,800	20.8	191	74
0006-02-0072	#20 Tailpipe	0746	6.45	29,200	11,000	21.8	233	85
0006-02-0073	#21 Tailpipe RA	0746	-	-	-	21.7	292	80
0006-02-0074	#22 Tailpipe	0748	6.48	28,700	10,800	20.3	232	82
0006-02-0075	#23 Tailpipe	0750	6.40	29,100	10,700	21.9	219	85
0006-02-0076	#24 Tailpipe	0752	6.52	29,100	10,700	20.6	221	86
0006-02-0077	#25 Tailpipe	RA	-	-	-	21.9	312	72
0006-02-0078	#26 Tailpipe	0754	6.56	29,100	10,800	21.1	226	107
0006-02-0079	#27 Tailpipe	0756	6.48	29,100	10,800	20.9	199	86
0006-02-0080	#28 Tailpipe	0758	6.51	29,100	10,700	22.3	209	82
0006-02-0081	#29 Tailpipe		-	-	-	22.8	298	66
0006-02-0082	#30 Tailpipe	0800	6.60	29,300	10,900	22.	207	81
0006-02-0083	#31 Tailpipe	0802	6.59	29,300	10,900	21.8	209	83
0006-02-0084	#32 Tailpipe	0804	6.63	29,300	10,900	21.0	190	73
0006-02-0085	#33 Tailpipe	0805	6.40	29,000	10,800	21.4	202	90
0006-02-0086	#34 Tailpipe	0806	-	-	-	20.8	274	68
0006-02-0087	#35 Tailpipe	0806	6.63	29,300	10,900	21.1	194	194
0006-02-0088	#36 Tailpipe	0808	6.64	29,300	11,100	21.2	187	73
0006-02-0089	#37 Tailpipe	0810	6.64	29,300	10,400	20.9	178	64
0006-02-0090	#38 Tailpipe	0812	6.63	29,200	10,800	20.7	166	91
0006-02-0091	#39 Tailpipe 203°F	0814	6.64	29,200	11,300	20.6	182	86
0006-02-0092	#40 Tailpipe	0816	6.66	29,200	10,800	20.7	189	84
0006-02-0093	#41 Tailpipe	0818	6.69	29,200	10,800	20.6	188	85
0006-02-0094	#42 Tailpipe		6.69	29,200	10,900	20.6	181	82

TABLE 10
MAPCO, INC. - CURRIER #1
FLOW TEST: 12/13/79

VR CODE	SAMPLE IDENTIFICATION		SODIUM	POTASSIUM	LITHIUM	CALCIUM	MAGNESIUM	BARIUM	STRONTIUM	COBALT	CHROMIUM	IRON	MANGANESE
0006-02-0095	#43 Tailpipe	0822	5917	558	23.6	167	19.5	9.1	25.2	0.33	<0.1	8.38	1.31
0006-02-0096	#44 Tailpipe RA	0824	5871	555	21.8	164	21.4	10.4	23.2	0.35	<0.1	97.4	1.54
0006-02-0097	#45 Tailpipe	0826	5702	491	22.2	139	20.7	9.4	21.7	0.42	<0.1	14.0	1.29
0006-02-0098	#46 Tailpipe	0828	5857	555	23.4	147	21.1	7.7	22.9	0.47	<0.1	1.38	1.20
0006-02-0099	#47 Tailpipe	0830	5878	560	22.8	155	21.6	7.9	24.7	0.46	<0.1	0.73	1.17
0006-02-0100	#48 Tailpipe	0832	5863	559	22.4	153	22.0	9.4	24.3	0.40	<0.1	0.33	1.11
0006-02-0101	#49 Tailpipe	0834	5707	491	22.4	153	21.6	9.2	23.6	0.40	<0.1	0.24	0.88
0006-02-0102	#50 Tailpipe	0836	5590	489	22.3	151	22.0	10.0	23.3	0.59	<0.1	0.51	0.96
0006-02-0103	#51 Tailpipe	0838	5891	558	23.9	154	23.2	9.8	23.4	0.50	<0.1	1.16	0.95
0006-02-0104	#52 Tailpipe	0840	5937	561	24.0	151	24.3	9.8	22.7	0.63	<0.1	0.73	0.96
0006-02-0105	#53 Tailpipe	0842	5895	559	23.6	157	23.2	9.6	24.09	0.60	<0.1	1.25	0.94
0006-02-0106	#54 Flow to pit	0844 RA	5880	555	23.5	170	26.0	10.0	25.1	0.71	<0.1	69.5	1.23
0006-02-0107	#55 Flow to pit	0844	6007	566	24.6	167	25.3	9.4	24.7	0.66	<0.1	1.69	0.95
0006-02-0108	#56 Flow to pit	0846	6065	555	24.8	177	27.3	10.8	26.4	0.56	<0.1	1.16	0.91
0006-02-0109	#57 Flow to pit	0848	6211	491	25.7	174	32.3	8.5	25.7	0.50	<0.1	0.21	0.93
0006-02-0110	#58 Flow to pit	0850	7656	636	28.3	214	36.7	8.7	29.1	0.71	<0.1	0.41	1.07
0006-02-0111	#59 Flow to pit	0852	7616	651	35.6	251	51.5	11.2	35.5	0.83	<0.1	0.42	1.30
0006-02-0112	#60 Flow to pit	0854	8436	724	40.7	341	75.0	14.0	43.5	0.96	<0.1	< 0.03	1.39
0006-02-0113	#61 Flow to pit	0856	8579	645	36.3	292	57.4	6.0	35.2	0.35	<0.1	< 0.03	1.06
0006-02-0114	#62 Flow to pit	0858	8045	667	36.3	285	56.1	5.6	32.7	0.45	<0.1	0.052	0.87
0006-02-0115	#63 Flow to pit	0900	7904	666	34.0	281	53.8	5.4	32.9	0.51	<0.1	< 0.03	0.71
0006-02-0116	#64 Flow to pit	0902	7858	667	34.0	275	53.8	4.8	30.2	0.31	<0.1	0.03	0.67
0006-02-0117	#66 Flow to pit	0904	7922	671	33.0	252	51.1	4.4	29.0	0.25	<0.1	0.082	0.57
0006-02-0126	#1 Flow to tank	1045	6840	644	24.1	250	18.5	5.6	32.5	<0.1	<0.1	1.25	0.22
0006-02-0127	#2 Flow to tank	1045 RA	6840	663	24.5	262	20.2	7.5	38.9	<0.1	<0.1	9.66	0.45
0006-02-0128	#3 Flow to tank	1115 RA	6985	673	24.4	334	19.3	6.8	42.8	<0.1	<0.1	10.8	0.44
0006-02-0129	#4 Flow to tank	1115 RU	7123	692	25.4	293	18.5	6.3	38.1	<0.1	<0.1	0.61	0.284
0006-02-0130	#5 Flow to tank	1145 RA	7043	659	25.0	327	22.3	5.7	39.9	<0.1	<0.1	8.79	0.49
0006-02-0131	#6 Flow to tank	1145 RU	7373	706	26.4	352	20.4	7.5	43.5	<0.1	<0.1	0.65	0.30
0006-02-0132	#7 Flow to tank	1215 RU	7385	698	26.6	332	18.7	8.8	42.7	<0.1	<0.1	<0.03	0.184
0006-02-0133	#8 Flow to tank	1215 RA	7217	681	26.1	324	21.3	8.2	40.4	<0.1	<0.1	11.6	0.47
0006-02-0134	#9 Flow to tank	1245 RA	7200	689	25.8	336	20.7	8.7	42.8	<0.1	0.12	7.82	0.43
0006-02-0135	#10 Flow to tank	1245 RU	7209	687	25.9	316	20.2	9.3	41.8	<0.1	0.24	0.51	0.25
0006-02-0136	#11 Flow to tank	1315 RU	7233	692	26.3	273	20.4	7.8	38.1	<0.1	0.20	1.65	0.17
0006-02-0137	#12 Flow to tank	1315 RA	7060	674	25.7	325	21.6	8.5	39.5	<0.1	<0.1	7.75	0.34
0006-20-0138	#13 Flow to tank	1345 RU	7271	689	26.5	325	22.0	8.5	42.5	<0.1	0.13	<0.03	0.18
0006-02-0139	#14 Flow to tank	1345 RA	7050	664	25.5	312	22.6	7.7	40.0	<0.1	0.15	7.39	0.35
0006-02-0140	#15 Flow to tank	1415 RA	7059	652	25.3	299	21.4	7.7	39.7	<0.1	0.17	5.10	0.28
0006-02-0141	#16 Flow to tank	1415 RU	7042	654	25.0	313	20.0	7.4	40.3	<0.1	0.25	<0.03	0.16
0006-02-0142	#17 Flow to tank	1450 RA	7061	640	26.3	317	22.2	7.9	41.2	<0.1	<0.1	5.59	0.28
0006-02-0143	#18 Flow to tank	1450 RU	7050	635	25.7	280	20.7	6.7	37.4	<0.1	<0.1	<0.03	0.18

TABLE 11
MAPCO, INC. - CURRIER #1
Flow Test: 12/13/79

VR CODE	SAMPLE IDENTIFICATION		pH	SPEC. COND	CHLORIDE	BORON	SILICA	TOC
0006-02-0095	#43	Tailpipe 0822	6.68	29,300	10,800	20.7	187	82
0006-02-0096	#44	Tailpipe RA 0824	-	-	-	20.5	248	181
0006-02-0097	#45	Tailpipe 0826	6.63	29,300	10,900	20.4	184	68
0006-02-0098	#46	Tailpipe 0828	6.71	29,300	10,800	20.0	168	75
0006-02-0099	#47	Tailpipe 0830	6.66	29,300	10,900	20.0	175	80
0006-02-0100	#48	Tailpipe 0832	6.72	29,300	10,800	20.7	181	81
0006-02-0101	#49	Tailpipe 0834 filter	8.11	29,300	10,700	20.6	170	72
0006-02-0102	#50	Tailpipe 0836	6.76	29,300	11,200	20.0	164	67
0006-02-0103	#51	Tailpipe 0838	6.79	29,600	11,100	20.1	177	70
0006-02-0104	#52	Tailpipe 0840	6.79	29,600	11,100	20.1	178	82
0006-02-0105	#53	Tailpipe 0842	6.78	29,700	11,200	19.8	172	80
0006-02-0106	#54	Flow to pit 0844 RA	-	-	-	20.1	251	70
0006-02-0107	#55	Flow to pit 0844	6.88	30,050	11,400	20.1	168	77
0006-02-0108	#56	Flow to pit 0846	6.92	30,700	11,500	20.1	161	74
0006-02-0109	#57	Flow to pit 0848	6.92	32,200	12,000	19.9	173	40
0006-02-0110	#58	Flow to pit 0850	6.95	33,500	12,900	19.9	160	49
0006-02-0111	#59	Flow to pit 0852	6.97	34,900	13,600	20.7	155	77
0006-02-0112	#60	Flow to pit 0854	7.00	37,200	14,600	21.0	152	55
0006-02-0113	#61	Flow to pit 0856	6.99	38,400	15,500	25.3	118	22
0006-02-0114	#62	Flow to pit 0858	7.00	37,800	15,100	25.3	120	35
0006-02-0115	#63	Flow to pit 0900	7.07	37,600	15,000	25.3	133	30
0006-02-0116	#64	Flow to pit 0902	6.84	37,600	14,700	20.6	174	35
0006-02-0117	#66	Flow to pit 0904	6.87	37,000	14,800	22.2	180	34
0006-02-0126	#1	Flow to tank 1045	7.72	32,400	12,000	18.3	232	56
0006-02-0127	#2	Flow to tank 1045 RA	-	-	-	23.9	342	50
0006-02-0128	#3	Flow to tank 1115 RA	-	-	-	23.9	362	44
0006-02-0129	#4	Flow to tank 1115 RU	7.38	32,600	12,400	23.3	248	73
0006-02-0130	#5	Flow to tank 1145 RA	-	-	-	22.2	337	42
0006-02-0131	#6	Flow to tank 1145 RU	7.31	33,000	12,500	25.8	304	79
0006-02-0132	#7	Flow to tank 1215 RU	7.66	33,300	12,400	24.7	273	68
0006-02-0133	#8	Flow to tank 1215 RA	-	-	-	24.4	362	58
0006-02-0134	#9	Flow to tank 1245 RA	-	-	-	27.3	368	70
0006-02-0135	#10	Flow to tank 1245 RU	7.6	33,000	12,700	23.9	269	70
0006-02-0136	#11	Flow to tank 1315 RU	7.53	33,000	12,600	19.1	247	80
0006-02-0137	#12	Flow to tank 1315 RA	-	33,700	-	20.5	331	52
0006-02-0138	#13	Flow to tank 1345 RU	7.64	33,700	12,500	23.0	254	70
0006-02-0139	#14	Flow to tank 1345 RA	-	-	-	21.3	333	55
0006-02-0140	#15	Flow to tank 1415 RA	-	-	-	20.0	311	55
0006-02-0141	#16	Flow to tank 1415 RU	7.58	33,900	12,500	19.4	241	58
0006-02-0142	#17	Flow to tank 1450 RA	-	-	-	20.5	328	46
0006-02-0143	#18	Flow to tank 1450 RU	7.34	34,100	12,500	18.6	261	52

TABLE 12

MAPCO, INC. - CURRIER #1

Flow Test: 12/13/79

Metals not listed were below the following detection limits:

Al 0.3 Ag 0.03 As 1.0 Au 0.09 Be 0.01 Cd 0.07 Cr 0.11 Cu 0.02 Ga 0.7 Ge 0.8 Hg 0.3 La 0.03

Mo 0.8 Ni 0.4 Pb 0.5 Po_4 1.0 Sb 0.4 Se 1.4 Sn 1.1 Ti 0.02 V 0.03 Zn 0.07 Zr 0.05

TABLE 13

MAPCO, INC. - CURRIER #1

CARBON DIOXIDE ANALYSIS

(Flowtest: December 13, 1979)

Sample No.	Sample Station	Time	Vol. NaOH	Vol. Sample	mg CO_2/ml condensate in Sample Collected*	Wt % CO_2 in Steam
6-118	Blank					
6-119	5**	10:30	1250	62	111	11.1
6-120	5**	10:51	1250	62	98	9.8
6-121	5**	11:56	1250	125	83	8.3
6-122	5**	12:42	1250	125	82	8.2
6-123	5**	1:26	1250	125	86	8.6
6-124	5**	2:30	1250	125	89	8.9
6-125	4***	2:54	750	509	.42	-

*Result corrected for blank

**Steam Line

***Brine Line from separator

TABLE 14

MAPCO, INC. - CURRIER #1

Flow Test: 12/13/79

NON-CONDENSABLES AFTER CO_2 EXTRACTION

VR CODE	SAMPLE TAKEN	ml non-condensables after CO_2 extraction per 1000 ml condensate	Vol % non-condensable after CO_2 extraction in steam**
0006-02-0144	12/13/79; 12:15 pm	5,968*	4.85×10^{-3}
0006-02-0145	12/13/79; 13:00 pm	7,070	5.75×10^{-3}
0006-02-0146	12/13/79; 14:22 pm	8,614	7.00×10^{-3}

*VALUE MOST LIKELY TOO LOW BECAUSE OF VOLUMETRIC MEASUREMENT PROBLEMS IN SPARGER

**ASSUMING IDEAL GAS BEHAVIOR

TABLE 15

MAPCO, INC. - CURRIER #1

"TYPICAL" WATER ANALYSES OF SAMPLES FROM VARIOUS FLOW TESTS

(Criteria: Highest TDS; Lowest CR; Lowest TOC)

(Results expressed in mg/ℓ)

ION	TEST: 11/22-23/79 Backflow #9 VR CODE 0006-02-0015	TEST: 12/1/79 #11 RV VR CODE 0006-02-0033	TEST: 12/13/79 #18 Flow To Tank VR CODE 0006-02-0143	TEST: 12/13/79 #61 Flow To Pit VR CODE 0006-02-0113
Na	7,120	10,100	7,050	8,579
K	1,610	781	635	645
Li	37.7	65.6	25.7	36.3
CO	438	251	280	292
Mg	51.0	20.5	20.7	57.4
Ba	3.9	16.6	6.7	6.0
Sr	42.2	81.8	37.4	35.2
Al	2.1	<0.3	<0.3	<0.03
Cr	<0.06	0.16	<0.1	<0.1
Cn	<0.01	<0.02	<0.02	<0.02
Fe	0.11	0.8	<0.03	<0.03
Mn	5.85	1.17	0.18	1.06
Zn	0.24	0.18	<0.07	<0.07
B	21.5	29.4	18.6	25.3
Cl	13,000	17,100	12,500	15,500
SO_4	286	*	*	*
PO_4	<2.0	<1.0	<1.0	<1.0
SiO_2	79.0	231	261	118
TOC	191	23	52	22
TDS	23,300	29,300	20,900**	25,300**

*N.D.

**Calculated