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RE: PRELIMINARY GEOCHEMICAL EVALUATION OF
FIRST 68-8 FLOW TEST, 7-8-88 to 7-9-88

Tables 1 and 2 summarize geochemical data from the initial 68-8 flow test on July 7 and 8, 1988. The flow test began at 12:40 p.m. on July 8. Field chloride measurements of samples flashed to atmospheric pressure increased from less than 50 ppm initially to 800 ppm after 2-1/2 hours. At this point I began collecting complete geochemical samples. Chloride continued to increase from 839 to 1970 ppm between the first and last samples (Table 1). Waters are strongly NaCl, with high silica (up to 710 ppm) and notable arsenic (up to 6.0 ppm). The maximum TDS was 4131 ppm. Total gas and H₂S are low (555 and 30 avg. ppmw in steam, respectively).

The quartz and cation geothermometers are in excellent agreement throughout the sampling period. They increase from 441°F to 483°F (average). The maximum calculated temperature is still significantly lower than the 510°F measured in 1986 at the casing shoe. Although the quartz geothermometer could potentially be depressed by either dilution or by flashing-induced silica deposition, the Na-K-Ca geothermometer is not appreciably affected by either process.

The increasing TDS, the agreement between silica and cation geothermometers, and the increasing but relatively low calculated temperatures for the samples suggest the following preliminary conclusions:

- 1) The well produced progressively hotter and more saline fluids with time.
- 2) Prior to production, fluids were in local thermal and chemical equilibrium with rock, but apparently in large-scale thermal disequilibrium with the reservoir.

- 3a) The lower temperatures and salinities might have resulted from mixing with cold waters lost to the formation prior to production. However, this implies a surprisingly rapid rate of geothermometer re-equilibration.
- 3b) An alternative to 3a is that there is a lower temperature lower salinity zone which either must be masked by wellbore flow during shut-in or which exists above the casing shoe. (Given the predominance of vertical fractures seen in the cores, this does not necessarily imply bad casing.)
- 3c) A third alternative, which I reject, is that the geothermometers do not work here.
- 4) Assuming the validity of either 3a or 3b, pure reservoir fluid should have an appreciably higher enthalpy than the actual produced fluid, and a higher potential flow rate.

Table 1. First and Last Sample Analyses

	<u>15:15 7/8</u>	<u>09:00 7/9</u>
pH	8.7	8.2
Na	537	1154
K	83	185
Ca	24	22
Mg	n.d.	0.21
Fe	3.08	0.08
SiO ₂	499	710
B	7.5	16
Li	3.4	7.9
Sr	0.17	0.15
As	1.1	6.0
Sb	n.d.	0.95
Cl	839	1970
SO ₄	93	41
HCO ₃	31	33
CO ₃	8	n.d.
F	1.3	1.9

Samples were flashed to atmospheric pressure.

Table 2. Summary of 68-8 Flow Test Geochemistry

<u>No.</u>	<u>Date</u>	<u>Time</u>	<u>Tqtz</u>	<u>Tnkc</u>	<u>Tgas</u>	<u>TDS</u> ¹	<u>PPMwt Gas</u> ²	<u>H2S</u> ²
2	7/8	15:15	439	442	-	2115	-	-
3	7/8	17:15	448	451	-	2590	-	-
4	7/8	19:15	457	457	-	3018	-	-
5	7/8	20:15	462	459	-	3446	-	-
6	7/9	00:15	477	469	487	3901	549	31
7	7/9	03:15	482	475	-	3971	-	-
8	7/9	07:00	482	480	-	4018	-	-
9	7/9	09:00	486	480	444	4131	561	29

1. TDS of atmospheric-flashed water.

2. Of steam from flow line.