MEAGER CREEK PROJECT
RESOURCE CHARACTERISTICS
AND
20 kW WELLHEAD TURBINE AND SEPARATOR TESTING

Research Project RP1196-90

Final Report, December 1985

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ABSTRACT

A fracture dominated geothermal resource with a reservoir temperature in excess of 195°C has been identified in the South Reservoir area of the Meager Creek Project. Geothermal fluids have been intersected in all three deep exploratory wells, although the host rocks are characterized by low overall permeability and porosity. The flash steam separator, originally designed and built for EPRI for testing at East Mesa, California, was reworked, installed and tested at Meager Creek. EPRI contracted Barber-Nichols to supply the skid-mounted turbine-generator module from existing equipment, with modifications for use with geothermal steam at Meager Creek. The test turbine-generator was installed in order to acquire initial operating experience with geothermal fluids available from the Meager Creek geothermal area. The turbine and separator were successfully operated over a period of 6 months at pressure ranges designed by EPRI, but modified in response to the site conditions. The test fluid flowrate at the wellhead was approximately 57 000 pounds per hour, with a surface temperature of 125°C. Ongoing temperature and flow testing on well MC-1 has improved the understanding of the chemical and physical parameters of the geothermal resource at Meager Creek.

Section 1

INTRODUCTION

LOCATION AND ACCESS

The Meager Creek Project area is located approximately 200 km north of Vancouver in the rugged Coast Mountains of southwest B.C. (Fig. 1). A good, gravel surfaced logging road follows the Lillooet River valley for 50 km to the Meager area from the end of the paved highway at Pemberton Meadows.

PREVIOUS WORK

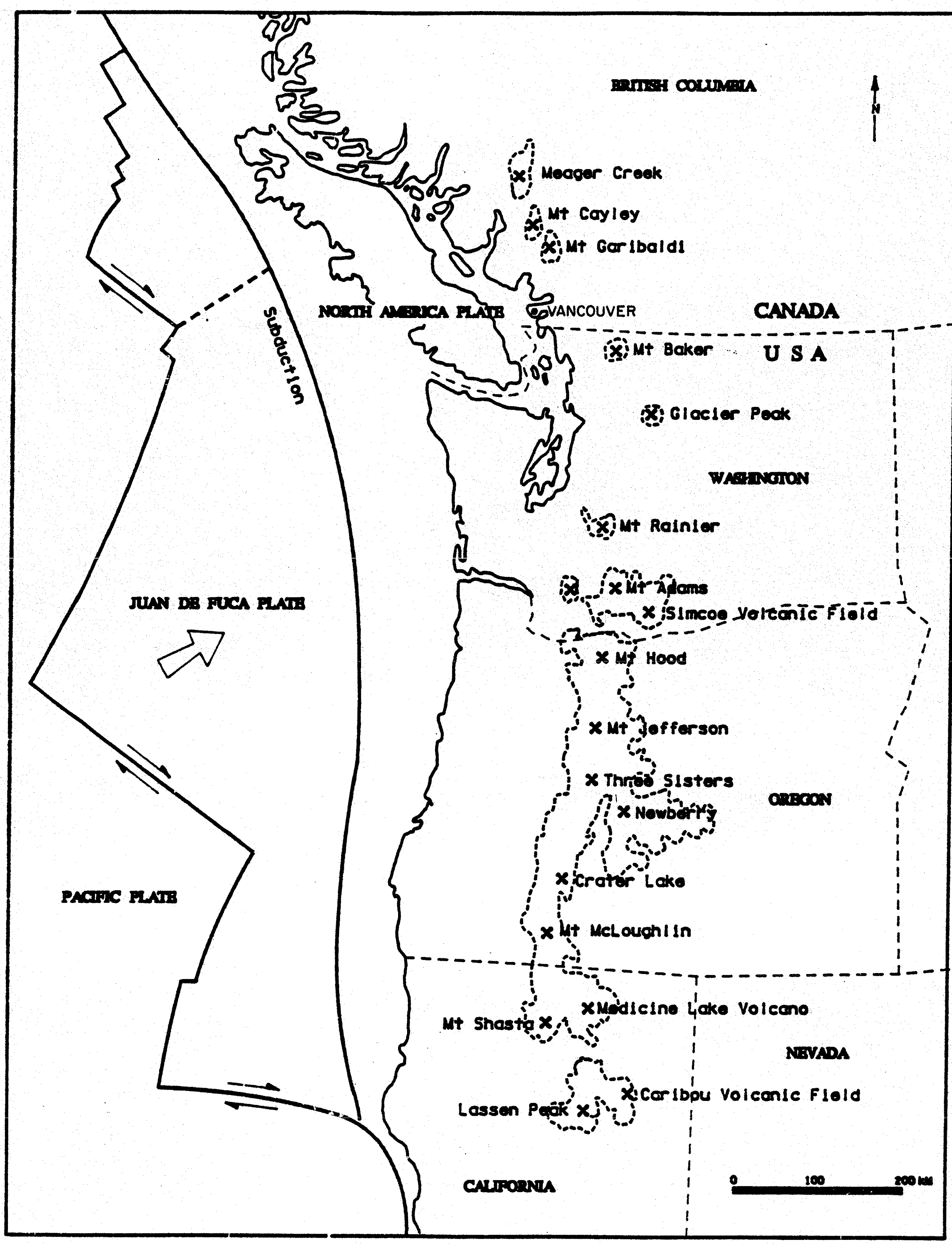
Geothermal investigations at Meager Creek have been in progress since late 1973. B.C. Hydro became involved in 1974 with a small-scale diamond drilling project designed to evaluate the thermal characteristics of the Meager Creek Hotsprings and the surrounding area (Figs. 2 and 3). Subsequent investigations identified and localized a potential resource area on the lower flanks of Pylon Peak, some 5 km upstream from the main vent of the Meager springs.

Exploration culminated with the drilling of three large diameter rotary holes during 1980 to 1982. Reaching depths of 3000 to 3500 m, the holes were drilled to assess various targets identified in earlier studies. The program resulted in one well, MC-1, capable of long-term, sustained two-phase fluid production. The two other wells, although unable to produce steam spontaneously in their present state, have assisted in the development of interpretive models for the geothermal reservoir.

WORK DONE IN 1983/84

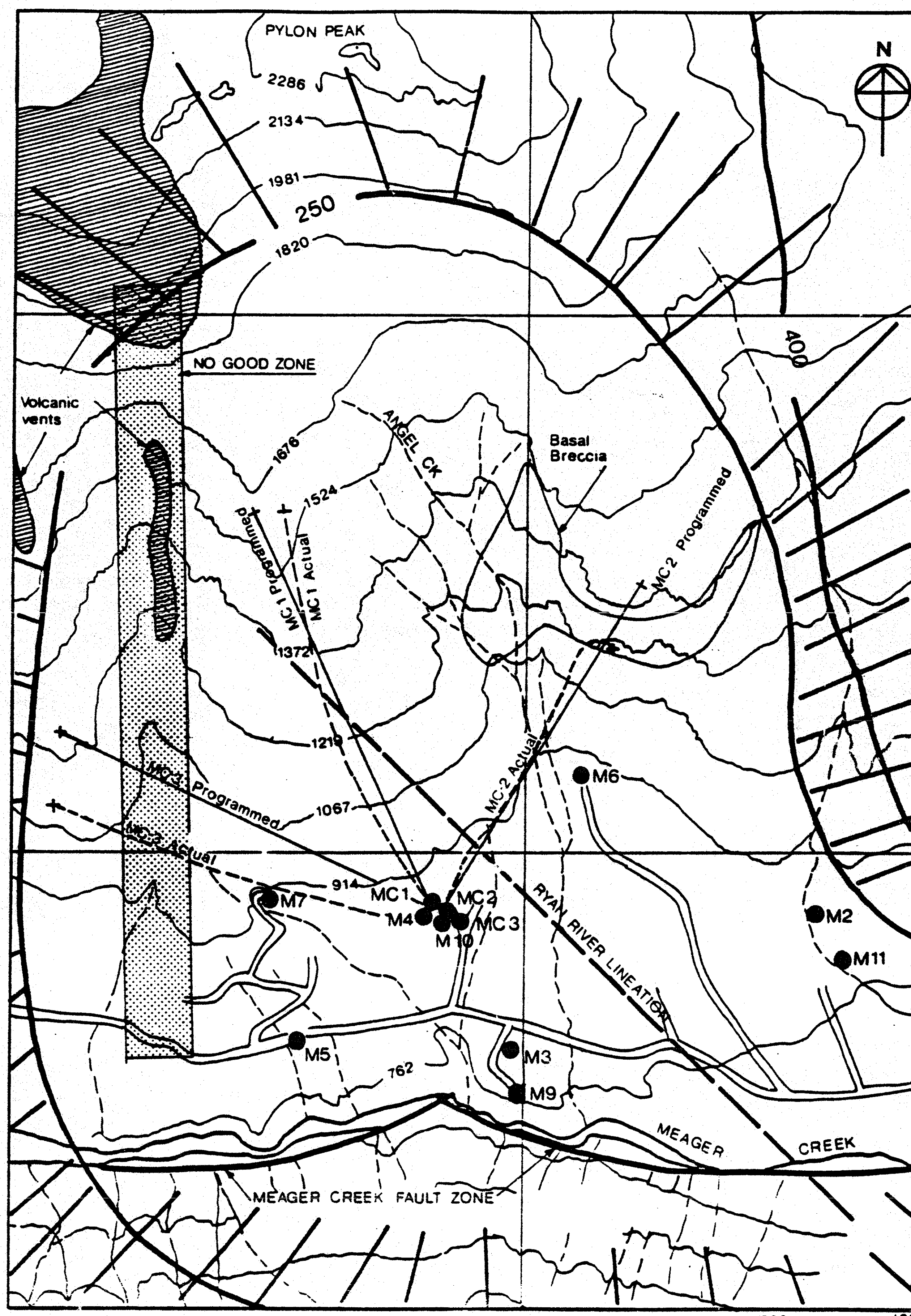
The geothermal drilling program was suspended in August 1982. Since that time, activity at the Meager Creek Project has been restricted to testing and monitoring of the three deep exploratory wells.

In July 1983 preparations began for the installation of a small turbine on the producing well MC-1. Arrangements were made with the Electric Power Research Institute (EPRI) to supply a Rotary Separator Turbine.



LOCALITY MAP AND PLATE TECTONIC SETTING OF CASCADE RANGE

FIG. 1



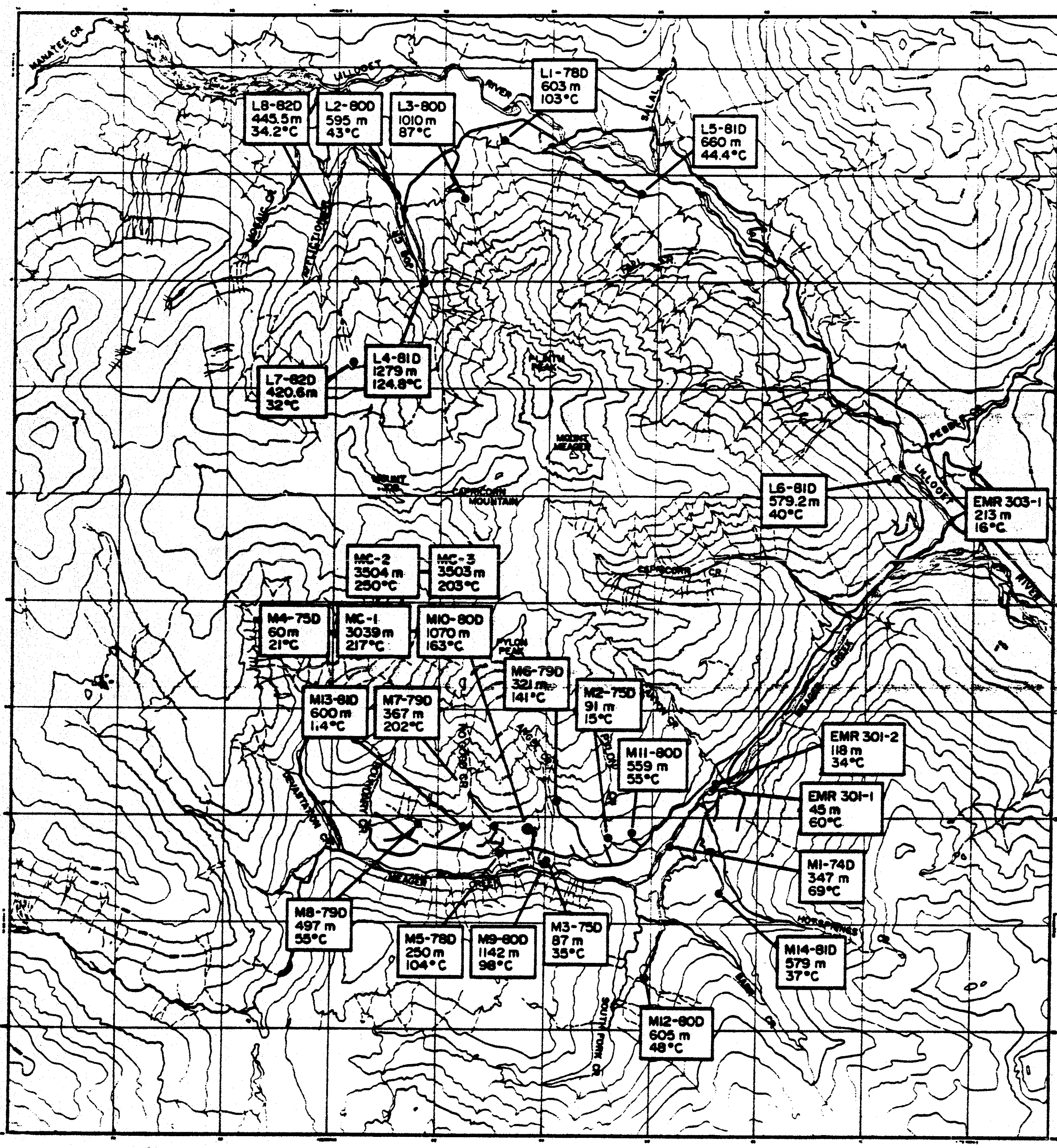
LEGEND

SCALE 1:20,000 — 0, 500, 1000m SCALE

- Programmed well tracks and targets
- Drilled well tracks and targets
- Interpreted field boundary at a depth of 300-600m
- 250 Resistivity contours in Ohm-metres

Deep exploration drilling programme targets and well tracks

FIG 2



SCALE - METRES

1000 0 1000 2000 3000 4000

LEGEND

● LOCATION OF HOLE

M3-75D	HOLE DESIGNATION
	EMR - Energy, Mines & Resources, Canada
	L - Lillooet Drainage
	M - Meager Drainage
	MC - Deep Exploration Rotary
87 m	DEPTH IN METRES
35°C	MAXIMUM HOLE TEMERATURE

SUMMARY MAP OF DRILL SITES

FIG 3

However, this equipment could not be supplied on time, and instead, Barber-Nichols Engineering of Denver, Colorado, supplied a 20 kW skid-mounted axial flow steam turbine for EPRI. This single-flash, steam turbine was installed and tested under varied conditions during spring and summer 1984. The test program was completed in October 1984. However, flooding stranded the equipment on site before it could be demobilized. The separator, turbine and generator were winterized and remained at Meager Creek until May 1985.

EPRI TURBINE SEPARATOR INSTALLATION

On-site preparations for the steam turbine began in late 1983, with the delivery of the generator, separator, and turbine to Meager Creek in mid-November. Installation proceeded slowly because of logistical difficulties imposed by the approaching winter season.

The first 3 months of the installation period were required for the reconditioning of the separator unit. The equipment supplied had been previously used and arrived at the site in only fair condition. Installation was completed by April 1984, and the testing program began shortly thereafter.

EPRI TURBINE SEPARATOR TESTING

In order to provide a reasonable working assessment of the steam turbine, a variety of tests were designed as part of a program which was conducted during summer 1984. The tests as originally laid out by EPRI could not be conducted because of the quality of the fluid at the wellhead (Table 1). However, 26 tests ranging in length from 1 to 6 hours were run, observations of temperature, pressure, flow rate and power output were made at a number of points in the separator-turbine test loop (desigated, for example, T1, P1, F6a, W8 in Fig. 11). Data from these tests are included as Appendix A. The power generated was dissipated in a load bank.

Table 1

LIST OF PROPOSED TEST RUNS
MEAGER CREEK PROJECT - WELL MC-1

Run No.	Pressure (psia)			SH (°F)	Separated Flows (lb/h)		Power (kW)	Reason for Run/Comment
	Well	Sep.	Turb.		Liquid	Steam		
1	65	60	50	7°	22 150	2 520	35	Base case/turbine design values
2	85	80	50	17°	28 230	2 510	35	80 psia run
3	110	100	50	25°	34 870	2 400	33	100 psia run
4	135	125	50	32°	23 000	1 100	11	125 psia/limited by reservoir
5	160	140	50	36°	17 780	660	4	150 psia/limited by reservoir
6	55	50	40	2°	15 820	2 040	24	50 psia/begin low pressure runs
7	45	40	30	5°	10 550	1 550	11	40 psia/limited by turbine
8	33	30	20	7°	6 210	1 050	2	30 psia/limited by turbine
9	22	20	15	11°	3 970	790	0	20 psia/limited by turbine
10	13	12	-	-	37 400	8 800	none	Atm. pressure, no turbine

Notes:

1. Steam quality at the separator is calculated for isenthalpic flash from an assumed reservoir fluid of 100 percent saturated liquid at 382°F, 355.6 Btu/lb (200 psia).
2. Turbine exhaust is to atmosphere at 12 psia pressure. Power is output of generator.
3. "SH" is amount of superheat at turbine inlet.
4. Run No. 3, 4 and 5 could be at 80 psia turbine inlet with resulting higher flows of steam and higher power output.

Section 2

RESOURCE CHARACTERISTICS

GEOLOGICAL SETTING

The Meager Volcanic Complex comprises a series of late Tertiary to Quaternary andesitic to rhyodacitic eruptive centers which intrude rocks of the Jurassic-Cretaceous Coast Plutonic Complex of southwestern B.C. Basement rocks in the vicinity of Meager Creek consist predominantly of altered, biotite quartz diorite of probable Mesozoic age with less commmon septa of metamorphic rocks. Volcanic dikes of rhyolite, dacite, and andesite transect the basement and are associated with the intrusions of the Meager Volcanic Complex.

A wide, normal fault zone, the Meager Creek Fault, strikes east-west, dips 45-50° north and appears to be the major structure providing permeability for the flow of geothermal waters.

DISCHARGE ASSESSMENT

After MC-1 was completed it was found to have a positive wellhead pressure. On 22 December 1981, the well was first discharged through the 2-inch bleedline until flashing started; a 10-inch side valve was then opened. The discharge stopped after 30 minutes of operation and the well was subsequently put on bleed to maintain wellhead pressure and continue increasing the flow temperature.

During July 1982 the well output was measured using a total flow calorimeter. The calorimeter consisted of a 6 m length of 2-inch diameter casing in which the well fluid was condensed and cooled. By measuring the condensing water and outlet water temperature and flowrate, the well fluid enthalpy and flowrate were calculated. The results indicated a flow of 32 000 lb/h. The liquid had a deep well temperature of 194°C. Because of the inability to maintain pressure to the surface and the cooling effect of near surface waters, temperature at the wellhead dropped to approximately 125°C.

By October 1982 the well could sustain discharge through a 4-inch pipe. To obtain the well output, a silencer was installed and the water flow measured with a 90° V-notch weir. The flowing surveys indicated deep well temperatures of 194°C and a wellhead pressure of 18 psig, a temperature of 106°C and a flowrate of 50 000 lb/h.

After the airlift stimulation in the fall of 1982, the discharge from the well improved to the point where it could sustain discharge for an indefinite period. The well was left discharging with periodic well maintenance (twice per year) until June 1985. The final flowrate measurements in November 1984 indicated a deep well temperature of 194°C, a flowrate of 57 200 lb/h and a wellhead pressure of 43.5 psig (300 kPag). The discharge was vented to the Meager Creek. The maximum temperature measured in MC-1 to date is 237°C at a depth of 2400 m (Fig. 4).

Well MC-2 was completed in the spring of 1982. An initial step-rate injection test showed the injectivity to be 17 percent higher than the one from MC-1. The bottom hole temperature was measured as 270°C at 3500 m depth (Fig. 5). At that time, the injectivity appeared too low to conduct any additional testing.

Well MC-3 was completed in the mid-summer of 1982 and the initial step-rate injection test showed the injectivity to be 92 percent higher than MC-1. The total circulation loss at 3025 m during the drilling was encouraging. However, the material used to regain the circulation loss was more effective than expected and this permeable zone was sealed off.

The bottom hole temperature of the well MC-3 increased by approximately 10°C (Fig. 6) over the 1-year period after drilling. Therefore, an airlift stimulation was conducted during November 1983. The permeability of the well improved. However, the flow could not be sustained at that time, the tests had to be concluded and no further testing work was done since.

WELL STATUS

The MC-1 discharge tests were conducted between November 1982 and mid-1984. Thermal fluid was discharged to a silencer/separator unit where the wellhead pressure was recorded constantly and flow rate was measured daily. Periodic temperature surveys and chemical sampling were conducted to monitor changes in the thermal regime.

During the course of production, the MC-1 well bore became obstructed by a substantial carbonate scale deposit. However, the blockage was successfully removed by mechanical means and further scale deposition was inhibited by maintaining constant pressure at the wellhead.

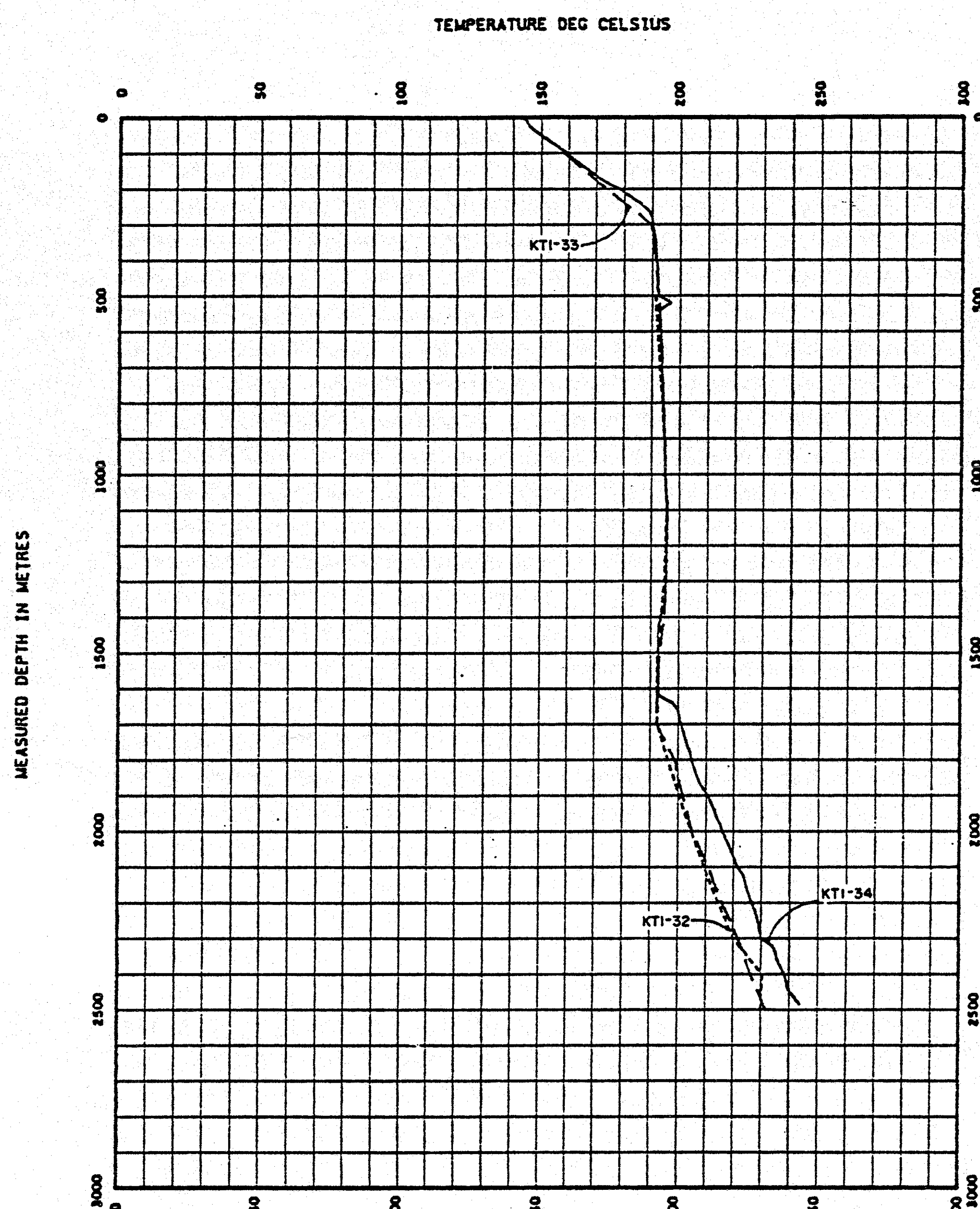


FIGURE 4 MC-1 TEMPERATURE SURVEYS 1983-84

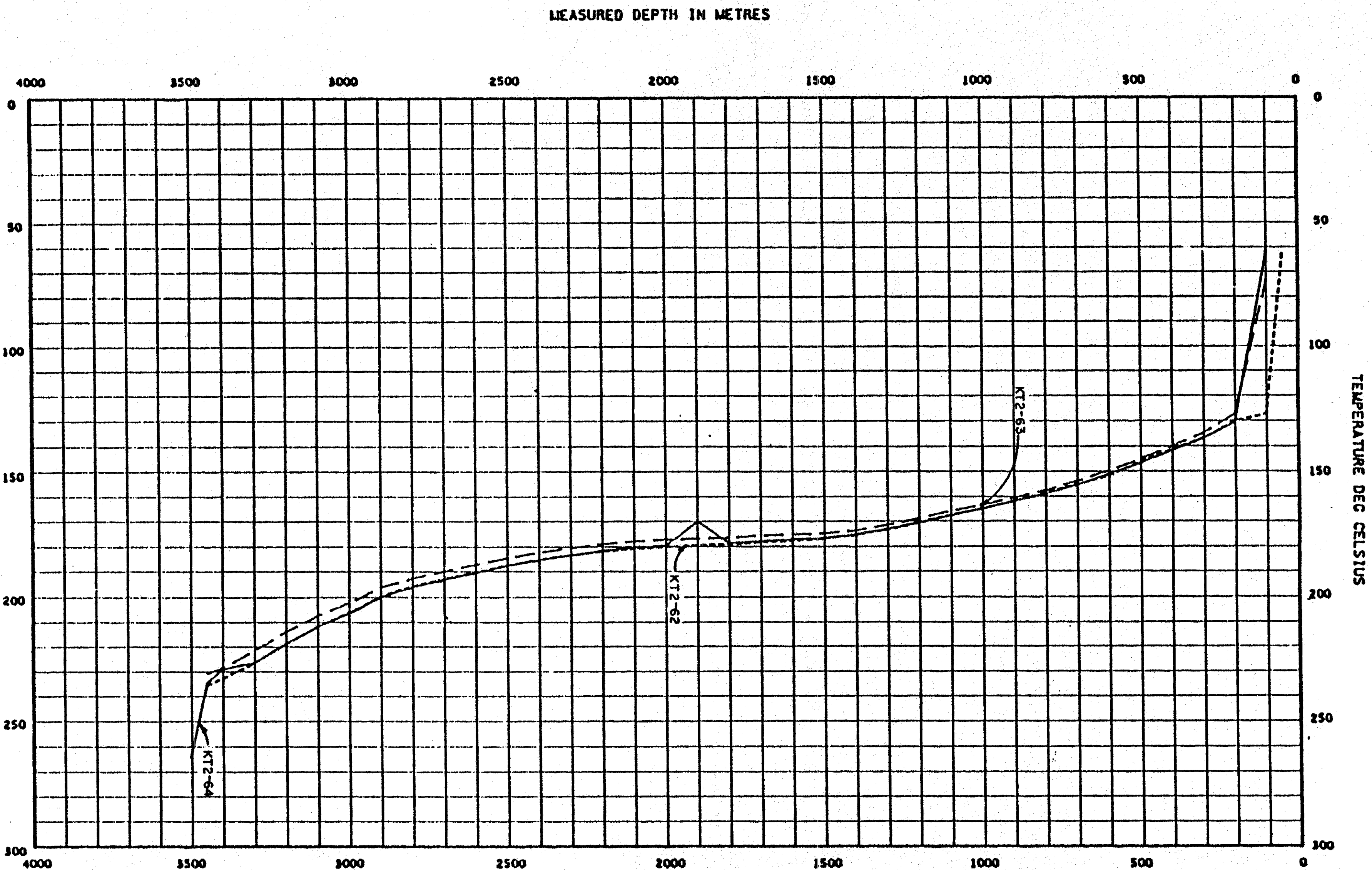


FIGURE 5 MC-2 TEMPERATURE SURVEYS 1983-84

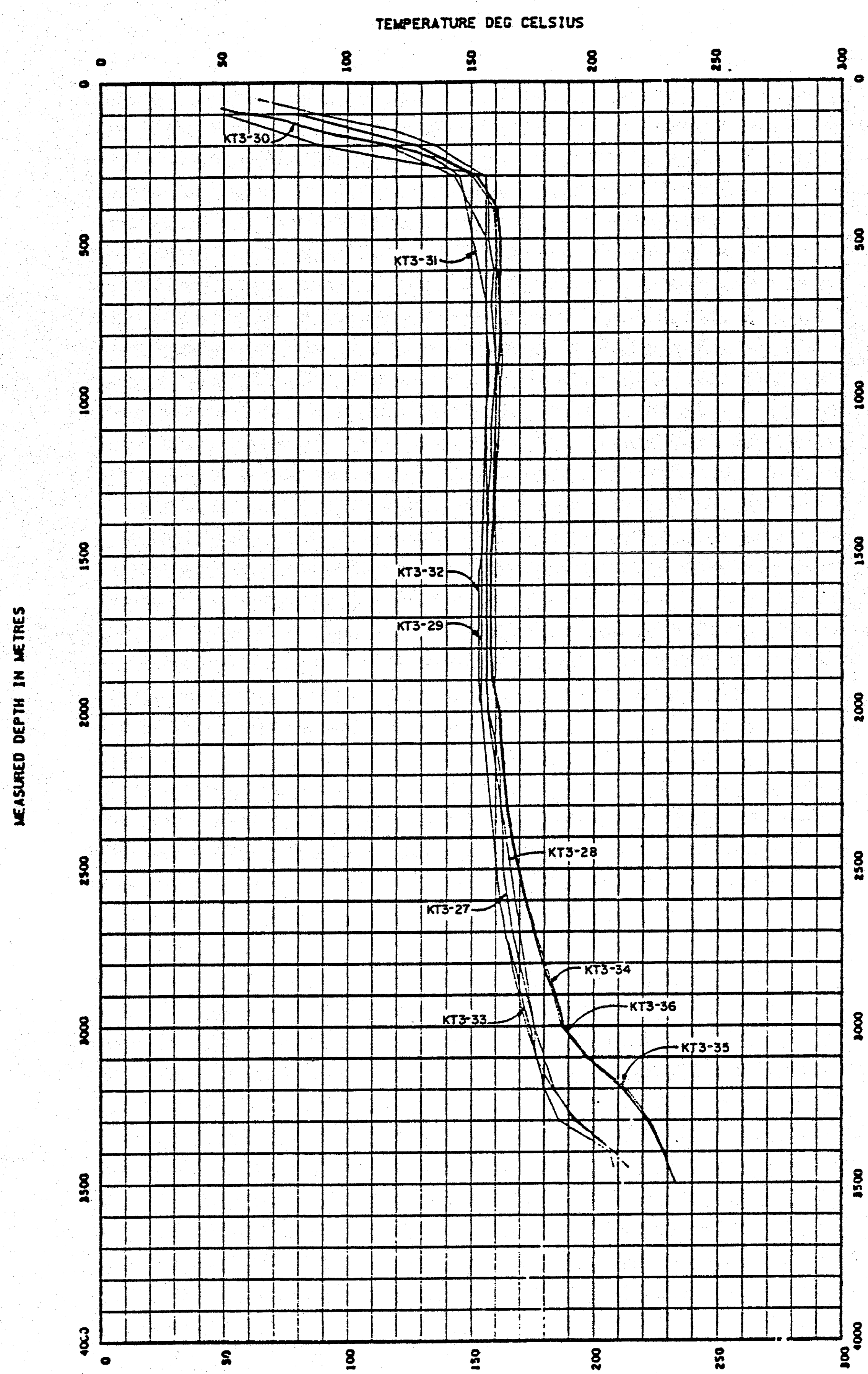


FIGURE 6 MC-3 TEMPERATURE SURVEYS 1983-84

MC-2 and MC-3 remained dormant for most of the 1983/84 period. Standing water levels in the wells were recorded regularly and periodic temperature surveys were run.

Increased temperatures and indications of improved crossflow at depth in well MC-3 prompted a flow test in early November 1983. Continual airlifting for a period of 20 hours resulted in a series of discharges achieving peak wellhead pressures of 850 kPag (123 psig). However, it is believed that cooler surface water downflow quenched the flow approximately 20 minutes after the airlift was terminated because the casing did not extend to sufficient depth.

Section 3

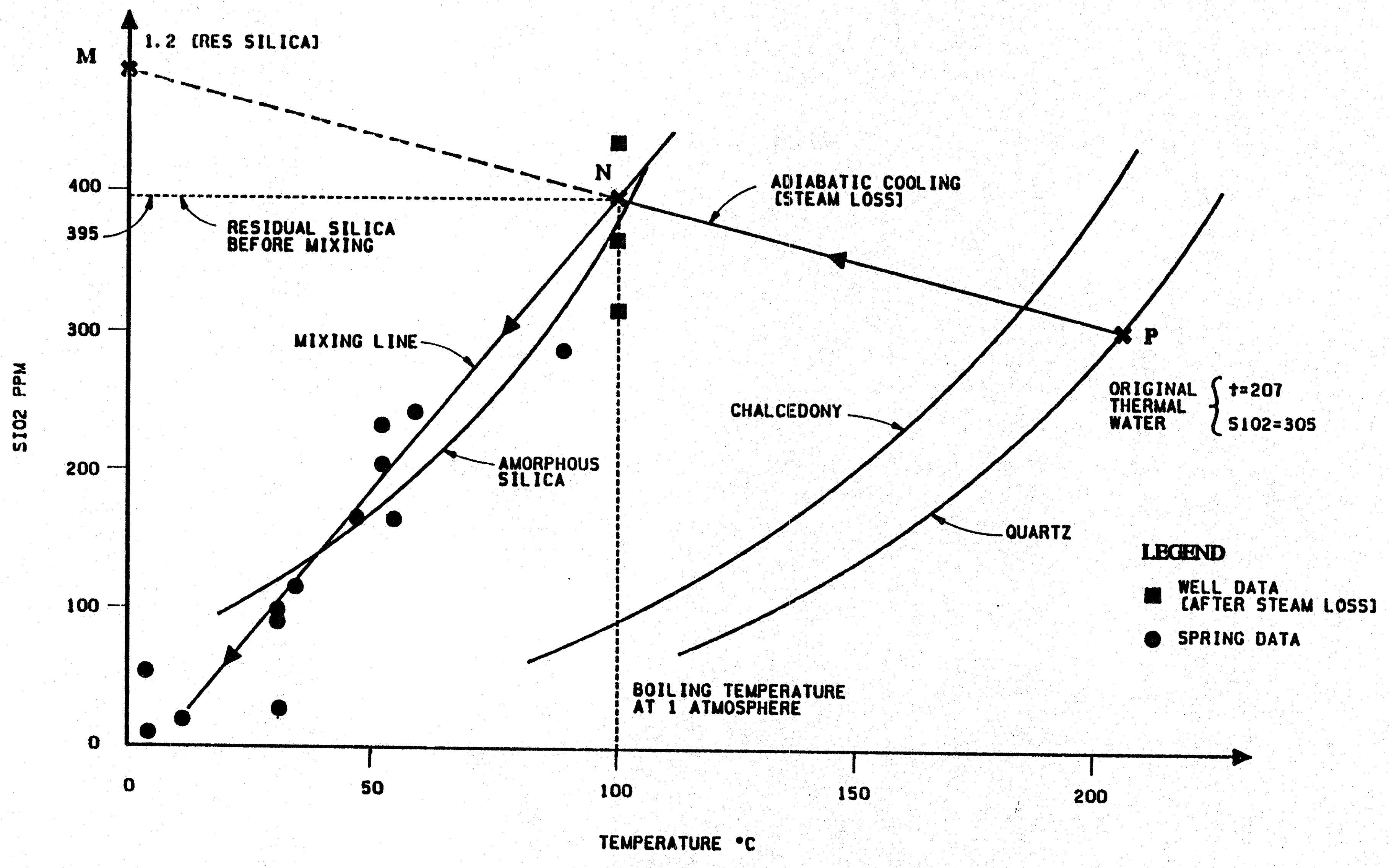
WELL CHEMISTRY

Samples of the fluids were taken approximately once a week, except during special testing, and analyses were done in B.C. Hydro's lab. In addition, an EPRI mobile chemical sampling unit was brought to the site in early August 1983, in order to evaluate various chemical parameters of the production fluid. The EPRI lab analyzed for chemical components expected to be important for scale or corrosion. This lab performed a variety of other evaluations including analyses of trace elements in waste water and steam. Toxicity determinations are listed in Appendix B.

The analyses of samples taken periodically from the production fluid of well MC-1 was reviewed by Dr. Morteza Ghomshei, working for the Meager Creek Project under a UNESCO post-doctorate fellowship. Raw water chemistry data used in the study and ionic strength versus time interpretations are presented in Appendix C. Examination of the correlations between K, Na, and Cl indicated that discharge from well MC-1 is probably a mixture between a single brine and high-chloride cool waters (Fig. 7).

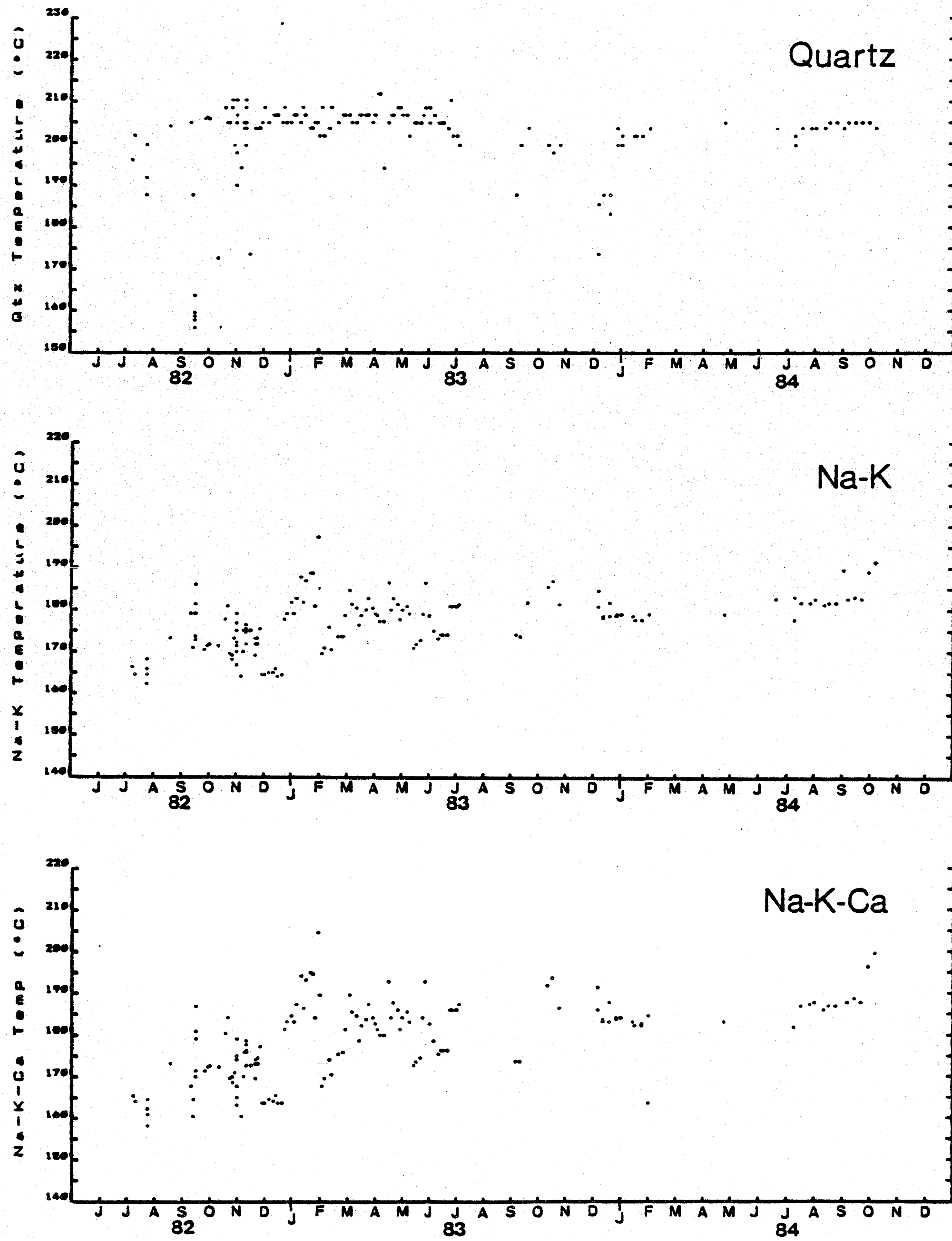
Various geochemical thermometers were assessed with some interesting results. At Meager Creek, the residual silica, SIL2, is 395 ppm prior to mixing, and construction of line PNM results in an original silica, SIL1 of 305 ppm and a temperature of 210°C where the line intersects the silica saturation curve. Although this calculated temperature is slightly higher, the results are more or less comparable to observed temperatures of 180°C to 195°C at the production level of 1200 m to 1600 m in MC-1 (Fig. 7).

Silica data from MC-1 give a quartz temperature of 200°C to 210°C (Fig. 7), similar to predictions using data from the hot springs. Surveys in MC-1 indicate a maximum of 230°C to 240°C at 2500 m, but production level temperatures are around 180°C to 195°C, which are somewhat lower than the calculated quartz temperature. However, if a correction for steam loss is considered, the predictions using the MC-1 silica geothermometer would be closer to the 185°C to 195°C predicted by the Na-K and Na-K-Ca geothermometers and the observed temperature at the production level (Fig. 8).



SILICA-TEMPERATURE CORRELATION
SURFACE AND THERMAL WATERS OF SOUTH MEAGER AREA

FIG. 7



Variation of Quartz, Na-K and Na-K-Ca
Geothermometers with Time (data from MC1)

FIG. 8

The Na/K and Na/Li geothermometers should be more accurate than quartz geothermometers. Neither is affected by steam loss or mixing with meteoric waters and there are no significant potassium or lithium temperature-dependent reactions with the environment during the relatively fast ascent of the brine. The sodium-potassium correlation for the Meager Creek hot springs extrapolates linearly to the origin (Fig. 9) which indicates the lack of potassium re-equilibrium, as depicted by the reaction:

$$Na^{+} + K\ (silicate) \rightleftharpoons K^{+} + Na\ (silicate) \qquad (3\text{-}1)$$

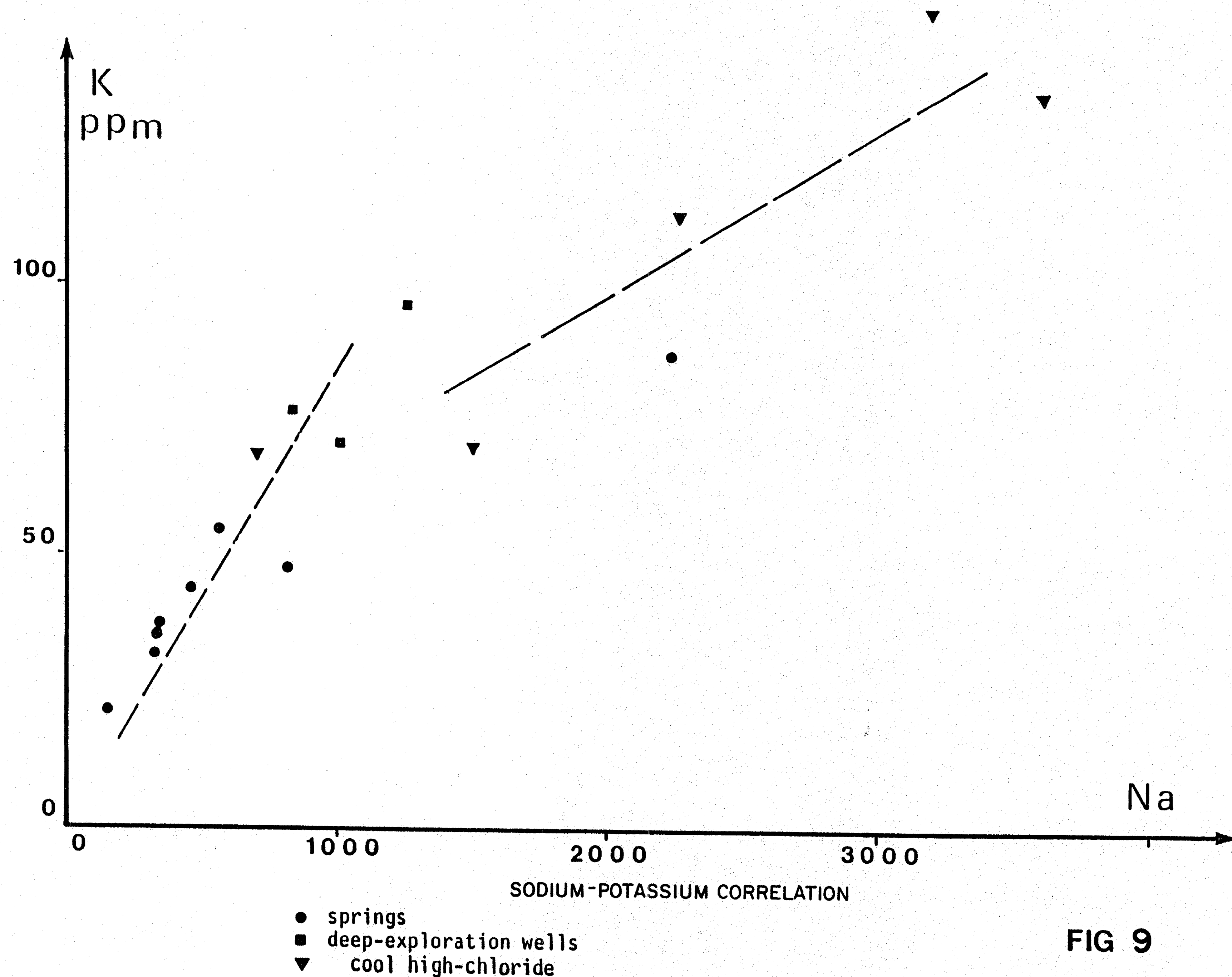
The Na/K ratio obtained from this correlation is about ten and gives a base temperature of 195°C. The Na-K correlation of MC-1 is ultimately affected by a mixing with M12 waters. As described above, the slope of the correlation line indicates an original Na/K ratio of around 9.2 and a base temperature close to 200°C, comparable with that of the hot springs. If mixing of MC-1 brine with M12 waters is disregarded, the measured Na/K ratios would yield a lower temperature of around 180°C, which is compatible with Na-K-Ca temperatures. It should be noted that mixing of MC-1 brine and M12 high-chloride waters (with a relatively high Na/K ratio of around 26 and a lower base temperature of around 115°C) would explain the decrease in Na-K temperatures for MC-1.

The sodium-lithium geothermometer gives a higher temperature than either the silica or sodium-potassium geothermometers. The data from MC-1 do not demonstrate a distinctive linear correlation between sodium and lithium. Nevertheless, when the average lithium and sodium concentrations of MC-1 brines are plotted together with data from other deep exploration wells and hot springs, a linear correlation extrapolating to the origin is observed (Fig. 10). This correlation has a Na-Li ratio of approximately 350 and a temperature of approximately 280°C using the formula:

$$T\ °C = 1195 / (\log Na/Li - 0.39) - 273 \qquad (3\text{-}2)$$

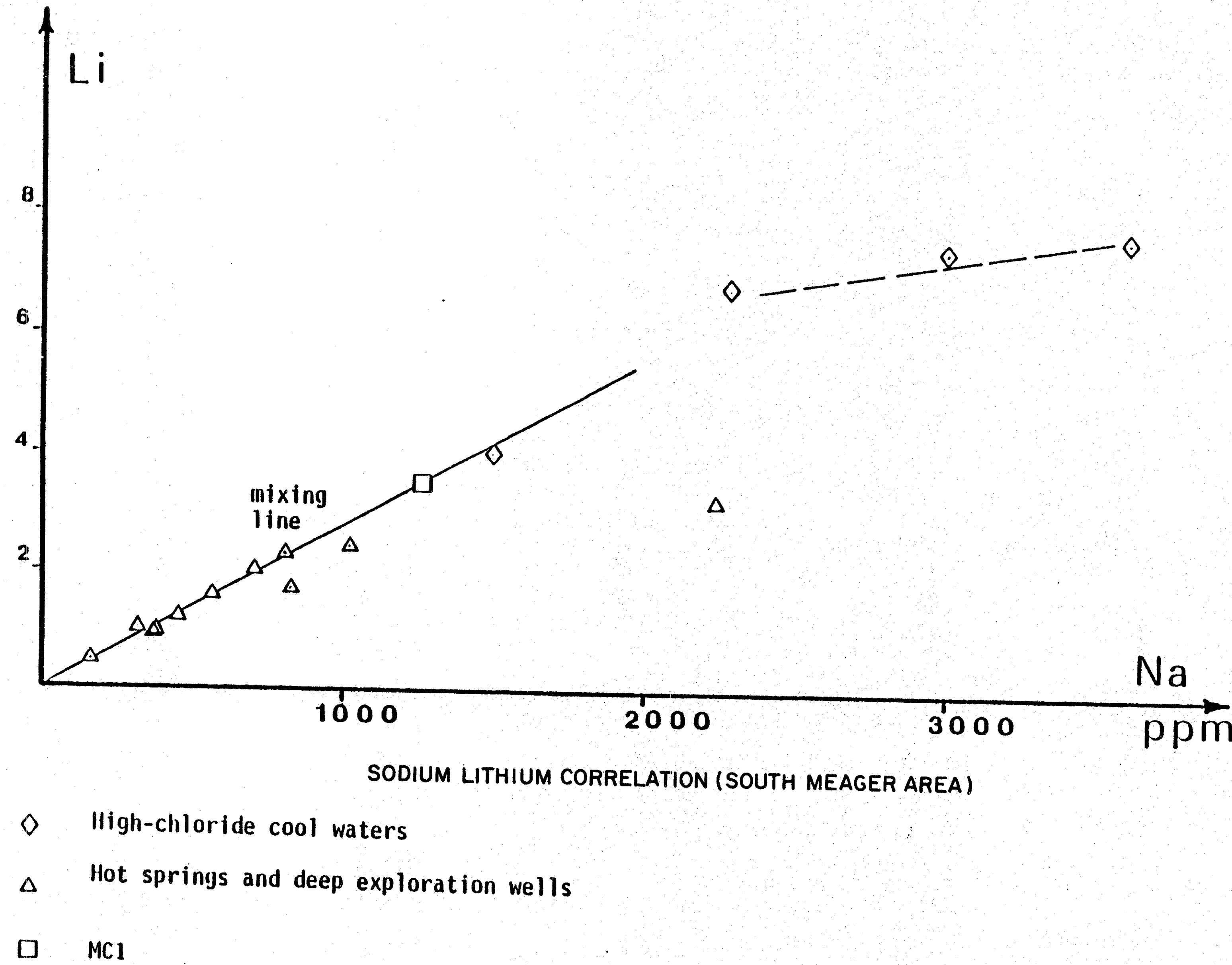
It was noted that, in contrast to the hot springs, the high chloride waters of M12-type have a Na-Li correlation which does not extrapolate to the origin. For this reason the sodium-lithium ratios of these waters are not reliable for temperature calculations. The high lithium concentration of these waters is not necessarily indicative of a geothermal origin.

The relatively high sodium-lithium temperature for the South Meager geothermal system (280°C) can be considered as the maximum temperature that the geothermal



SODIUM-POTASSIUM CORRELATION

FIG 9



SODIUM LITHIUM CORRELATION (SOUTH MEAGER AREA)

FIG 10

waters have reached. Indeed, temperature measurements in well MC-1 at 2500 m approach those predicted by the Na/Li geothermometer. The difference between the calculated Na/Li temperature of 280°C and the observed 190°C at the production level (1500 m) probably reflects the geochemical signature of the primary thermochemical equilibrium attained by the thermal waters at depths exceeding 2500 m. This evidence supports the findings of Moore et al. (1983) in suggesting that a deeper and hotter reservoir may yet be discovered. Calculations of various geothermometers based on the data as analyzed by EPRI in November 1984 closely correspond with B.C. Hydro's calculations (Table 2).

If this is so, thermal fluids could have then migrated up the Meager Creek Fault zone to the production level where potassium has re-equilibrated at lower prevailing temperatures. Lithium, by contrast, has remained non-reactive to the new environment and has preserved the chemical memory of the high temperature geothermal fluid in the lower parts of the Meager Creek Fault zone.

Table 2

MEAGER CREEK GEOTHERMOMETRY
NOVEMBER 1984

Location of Samples	Geothermometer						
	Nieva & Nieva	Fournier & Truesdell	Stanford SiO_2 adiabatic	Stanford SiO_2 conductive	Na-Ca	Chalcedony	Quartz
T-1 steam	196.9	212.9	---	---	186.6	---	---
T-2 steam	200.4	208.3	---	---	190.75	---	---
P-6 brine	201.7	215.4	201	213	192.33	175.29	193.92
P-6a brine	205.2	220.5	197	211	196.65	173.04	191.88
Weir brine	198.7	211.2	228	228	188.72	187.86	205.2

Note: Calculations were based upon data from samples collected by B.C. Hydro and analyzed by EPRI.

Section 4

TURBINE AND SEPARATOR TESTING

EQUIPMENT ASSEMBLY

Separator Rework

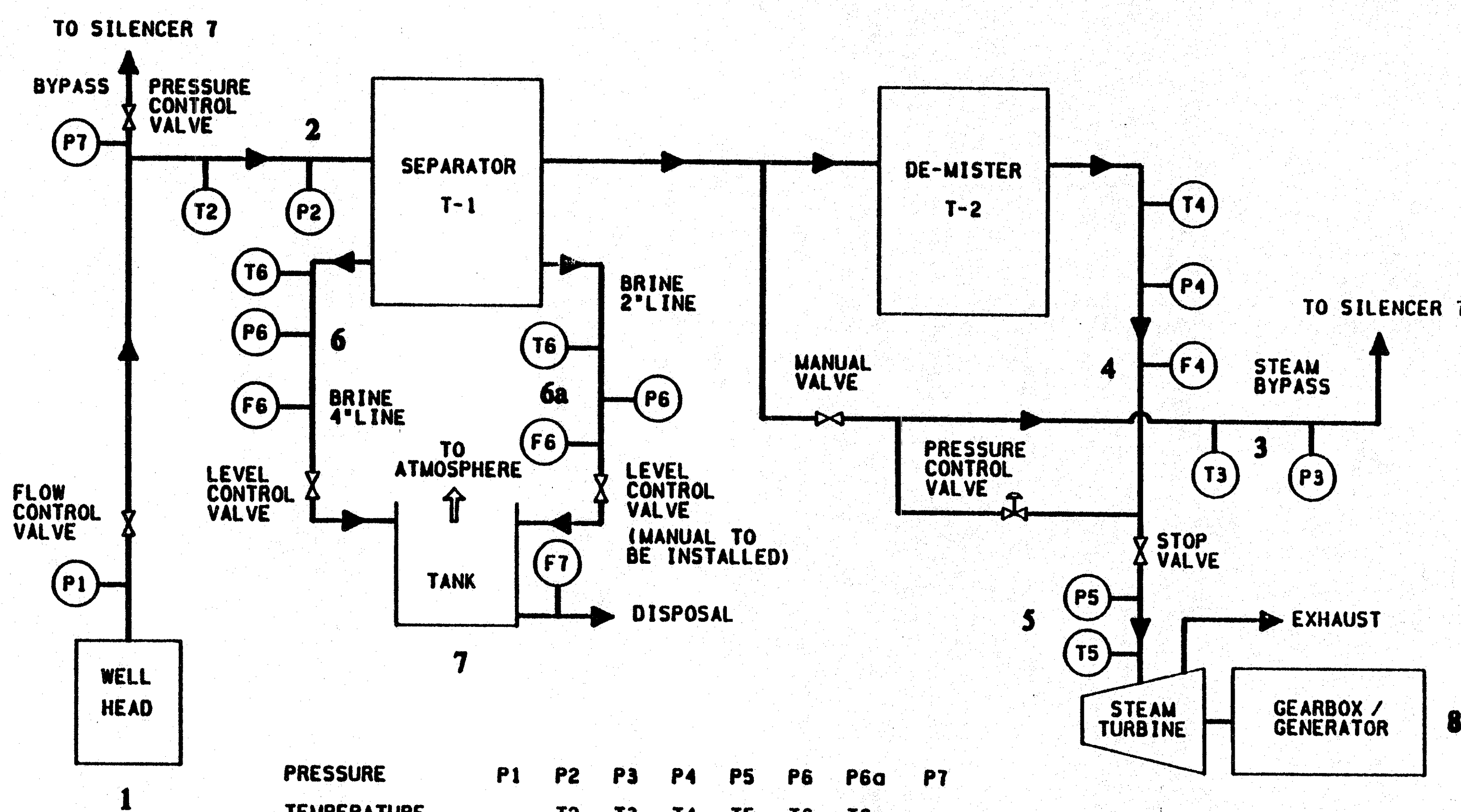
On-site preparations for the steam turbine began in late 1983 with the delivery of the generator, separator and turbine to Meager Creek in mid-November. Installation proceeded slowly because of logistical difficulties imposed by the approaching winter season.

The flash steam separator was originally designed and built by the Bechtel Group (Research and Engineering Division) for testing at East Mesa and South Brawley, California. The past performance of the separator unit was described by Mr. L. Awerbuch in the paper entitled "Geothermal Steam Separator Performance Evaluation" published in the 1983 EPRI Proceedings of the Seventh Annual Geothermal Conference and Workshop.

Since the separator had not been used for some time after its exposure to high salinity geothermal brine at South Brawley, some of the threaded pipe was rusted, all control valves were rusted shut and most hand valves were rusted in their open or closed position. Approximately 3 months were required for reconditioning the separator unit.

Rework on the separator involved some reworking of 4-inch steam lines, replacing all control valves, cleaning all hand valves, replacing most of the threaded pipe, cleaning the level and pressure controllers, installing new burst disks on the pressure vessels, rerouting of brine and steam lines, and replacing pneumatic lines.

These changes provided flow to the turbine as well as a bypass around the turbine for use during separator warmup. The flow element originally in the bypass line around the moisture separator, was moved to the turbine bypass line so that steam flow could be measured both to the turbine and through the bypass (Fig. 11).



PRESSURE	P1	P2	P3	P4	P5	P6	P6a	P7	
TEMPERATURE		T2	T3	T4	T5	T6	T6a		
FLOW				F4		F6	F6a	F7	
POWER									W8

MEAGER CREEK PROJECT
SEPARATOR-TURBINE TEST LOOP

FIG. 11

Skid-mounted Turbine Generator Assembly

The skid assembly consisted of the turbine-gearbox with an air-cooled lube system, a Kato model 60ER9F 60 kWe synchronous generator, a Vectral VPAC 5106-480-35E-LSER power controller with a Woodward 2301-8271-347 governor and two Singer 3470T electric space heaters.

The controls for starting and stopping the turbine and for protection of the gearbox were installed in the generator control panel by Barber-Nichols and described in the report (unpublished) to EPRI by Barber-Nichols Engineering Company, Contract RP1196-4, January 1984 entitled "Steam Turbine Power System Operating Manual". Since there was no control power available until after the generator was running, the controls were battery operated and used the 24 Vdc power supply in the power controller to recharge the batteries.

The turbine-generator controls consisted of a pressure switch to protect the gearbox in the event of a loss of lube pressure or flow, an overspeed switch to protect the turbine in the event of loss of load, a controls enable switch, a turbine start push button, a speed control potentiometer and indicator lights for low oil pressure and overspeed. The switches and lights were added to the front of the generator control panel with the existing meters and switches previously installed by the generator manufacturer.

All components were mounted on a skid frame to make them easily transportable to the site at Meager Creek. At Meager Creek, the skid was placed in a shed near the wellhead to protect it from geothermal brine and inclement weather.

Turbine Design and Manufacture

The short schedule required the use of the existing turbine hardware wherever possible. The hardware reused by Barber-Nichols consisted of the gearbox with high-speed shaft, bearings and seals and the turbine rotor. The new hardware comprised the nozzle plenum, nozzle block and exhaust housing. The new nozzle was required since the available nozzle did not meet the steam flow requirements at Meager Creek.

From the review of the Meager Creek MC-1 well test data, an inlet pressure of 50 psia was specified. The local atmospheric pressure (@ 2700 ft) is nominally 13.5 psia. Since the turbine was an axial flow impulse turbine, all the pressure drop occurred across the nozzle. The turbine rotor simply changed the direction of the flow of the gas with no change in gas pressure. This resulted in a pressure ratio across the nozzle of 3.70. However, since wellhead conditions were somewhat uncertain, it was decided to design the nozzle for a lower pressure ratio (PR=3, and 44 psia inlet pressure) and run it underexpanded. Running the nozzle underexpanded does not hurt nozzle performance and if the inlet pressure is lower than expected, the nozzle conditions approach the nozzle design pressure ratio.

Since the existing rotor was used, the blade height was already established as well as the nozzle height (80 percent of the blade height). The maximum steam flow was also fixed by the downhole conditions (382°F and 200 psia) and the wellhead conditions (278°F and 48 psia). Based on these parameters, the nozzle throat and exit areas were calculated. From these calculations, a partial admission nozzle block with an arc of admission of 64 percent resulted. This arc consisted of 11 rectangular nozzles with a nozzle height of 0.343 inches and a throat width of 0.2656 inches to satisfy the throat area of 1.0021 square inches which was calculated from the maximum steam flow available. The nozzles were converging - diverging with an area ratio of 1.2267.

With the nozzles designed, a plenum was then designed to fit between the nozzle block and the gearbox housing with sufficient cross-sectional area to ensure that the gas velocity in the plenum was less than mach 0.1 to reduce flow losses and ensure maximum nozzle performance.

To reduce losses and pressure drop, it was necessary to have two, 2-inch inlets into the nozzle plenum from the 3-inch turbine inlet manifold. The steam line from the separator was 4-inch schedule 40. The turbine inlet manifold and turbine stop valve were 3-inch in order to reduce the cost. The pressure drop across the 3-inch valve was only 0.3 psia. To reduce pressure drops in the long steam lines between the separator and the turbine stop valve, this line, the gate valve and the Y-strainer, were all 4-inch.

OPERATION AND PERFORMANCE

Separator

The separator, in conjunction with a pressure control valve in the separator bypass line between the wellhead and the silencer (P7), had the capability of controlling wellhead pressure between about 20-50 psia. Below 20 psia, the well was wide open and the pressure was too low to obtain a net power output from the generator. The pressure peaked at 45-50 psia, and if the well was further closed in to raise the pressure above this value, the pressure started to drop again because the flow rate was too low to overcome the heat leakage from the well casing. Eventually well flow stopped completely and it took 24 to 36 hours for the downwell pressure to rise sufficiently to start the flow again.

The separator had a level controller on the flash vessel, a level control valve in the liquid line to the brine disposal area, and pressure control valves in the separator bypass and the turbine bypass lines. When flow was established in the separator bypass to the silencer and the pressure control valve in this line was set to maintain a wellhead pressure, the pressure control valve in the turbine bypass line at the separator was set at a value slightly less than that of the valve at the silencer.

The manual flow valve at the separator was then opened to start flow through the separator. The separator bypass at the silencer would close allowing all the brine to flow to the separator because the separator pressure was less than the wellhead pressure. The level control valve and pressure control valve would start to control fluid level and pressure to provide dry steam for turbine operation as the flash vessel filled and the pressure increased. When steady flow was established in the separator and it was fully warmed up, the blowdown valve in the Y-strainer and the gate valve to the turbine were opened to start warming up the 4-inch line to the turbine.

Turbine

When the 4-inch line to the turbine was cleared of all condensate and warmed up, the gate valve in the Y-strainer as closed and the turbine valve was opened. The gate valve was then slowly opened to start the turbine. When turbine speed reached 3400 rpm, the voltage regulator was turned on and the gate valve was opened while adjusting the speed control potentiometer on the Woodward governor to achieve and maintain a generator speed of 3600 rpm (60 Hz). With the turbine running at 60 Hz, the gate valve was opened fully to achieve full power from the turbine and generator.

With the turbine running at steady-state conditions, the turbine bypass pressure control valve was then set at a pressure slightly higher than the turbine inlet pressure to ensure that all of the flow from the separator was flowing through the turbine and that the bypass was fully closed. If for some reason the turbine valve closed (low oil pressure or turbine overspeed), the bypass would then automatically reopen to bypass the turbine.

SEPARATOR AND TURBINE CONTROLLABILITY

Separator

The separator was originally designed and built to be used at East Mesa, California. It was tested and operated there and was then modified for South Brawley. At Meager Creek, the separator worked at lower brine temperatures and pressures than at South Brawley, and the steam was generated at a higher specific volume. The steam flow rate to the turbine was low enough (1900 lb/h maximum) that the high specific volume could be handled by the 4-inch line to the turbine. The maximum velocity in this line was 73 ft/s. The 2-inch liquid drain from the primary separator with the level control valve in it was not large enough to handle the two-phase flow from the separator to the silencer.

The level controller could not control the level in the separator when operated at the normal total flow rates from the well. These flow rates were required for supplying the 1900 lb/h steam flow rate to the turbine. A bypass with a hand valve was first used to handle the additional flow volume. This was later changed to a 4-inch line in parallel with the 2-inch line and the level control valve was moved to the 4-inch line. This improved controllability of the separator by allowing the level in the primary separator to be controlled by the level control valve alone in most cases. All other controls worked without modifications.

Turbine

When the turbine was first started, the speed could not be controlled and the voltage output from the generator was no greater than 310 Vac. The problem was traced to the Woodward governor. A resistor to reverse the output of the load controller had to be added. The Woodward governor was designed originally for diesel engine operation. In that application it controlled the throttle on the inlet to the diesel engine. As speed increased, the governor output decreased to close the engine throttle. However, for this steam turbine - generator application, the governor output had to be reversed in order to increase output (by increasing load on the generator) as turbine speed increased.

When this problem was corrected, the turbine and generator could be operated at the design speed and the voltage could be adjusted to 480 Vac. The generator speed could be controlled until the turbine inlet pressure was increased to about 50 psia. At this point the turbine began to overspeed because the generator output exceeded the 30 kWe capacity of the load bank and the load switching capability of the load controller. The load controller could not switch any more than 25 kWe without upsetting the voltage regulator. The generator output at the 50 psia turbine inlet pressure was estimated to be 33 kWe.

At turbine inlet pressures above 45 psia (310 kPa) the generator output was above 30 kWe and the load controller caused the voltage regulator to become unstable, in turn causing the turbine to overspeed and shut down. Because the load controller was a single stage unit, it had to switch the entire load from the generator. According to Barber-Nichols, only 45 to 50 percent of the generator output could be switched with a single load controller without causing problems with the voltage regulator. The turbine operators chose to keep the turbine inlet pressure below 40 psia to ensure this did not happen.

TURBINE PERFORMANCE

The turbine was operated at turbine inlet pressures ranging from 28 to 37 psia (195 to 255 kPa). The exhaust pressure was constant at 14.7 psia. This represented a pressure ratio variation from 2.37 to 2.76 and an insentropic velocity ratio (U/Co) variation from 0.265 to 0.280. The design pressure ratio and U/Co were 3.70 and 0.2331 respectively.

Table 1 includes the original test plan for the turbine and separator, and gives the wellhead, separator and turbine inlet pressures for ten test points. It also gives the liquid steam flow rates for each test point and the expected generator output. Since the maximum wellhead pressure was 60 psia and the turbine would "run away" at turbine pressures above 45 psia, only test points 6 and 7 of Table 1 were conducted. The generator output for test points 8 and 9 were too low to be of any value.

Fig. 12 is a plot of predicted turbine efficiency versus U/Co for turbine inlet pressures ranging from 15 to 50 psia. Since the turbine inlet pressure is measured under saturated conditions the efficiencies were corrected for wetness. To correct for wetness, the actual nozzle exit steam quality was calculated using a nozzle efficiency of 92 percent (nozzle velocity coefficient = 0.92^2). The turbine efficiency was then reduced to adjust for the moisture in the nozzle exit in order to obtain the turbine efficiency corrected for wetness.

Generator efficiency decreases with decreasing load. Tests of generator efficiency under various loads are illustrated in Fig. 13.

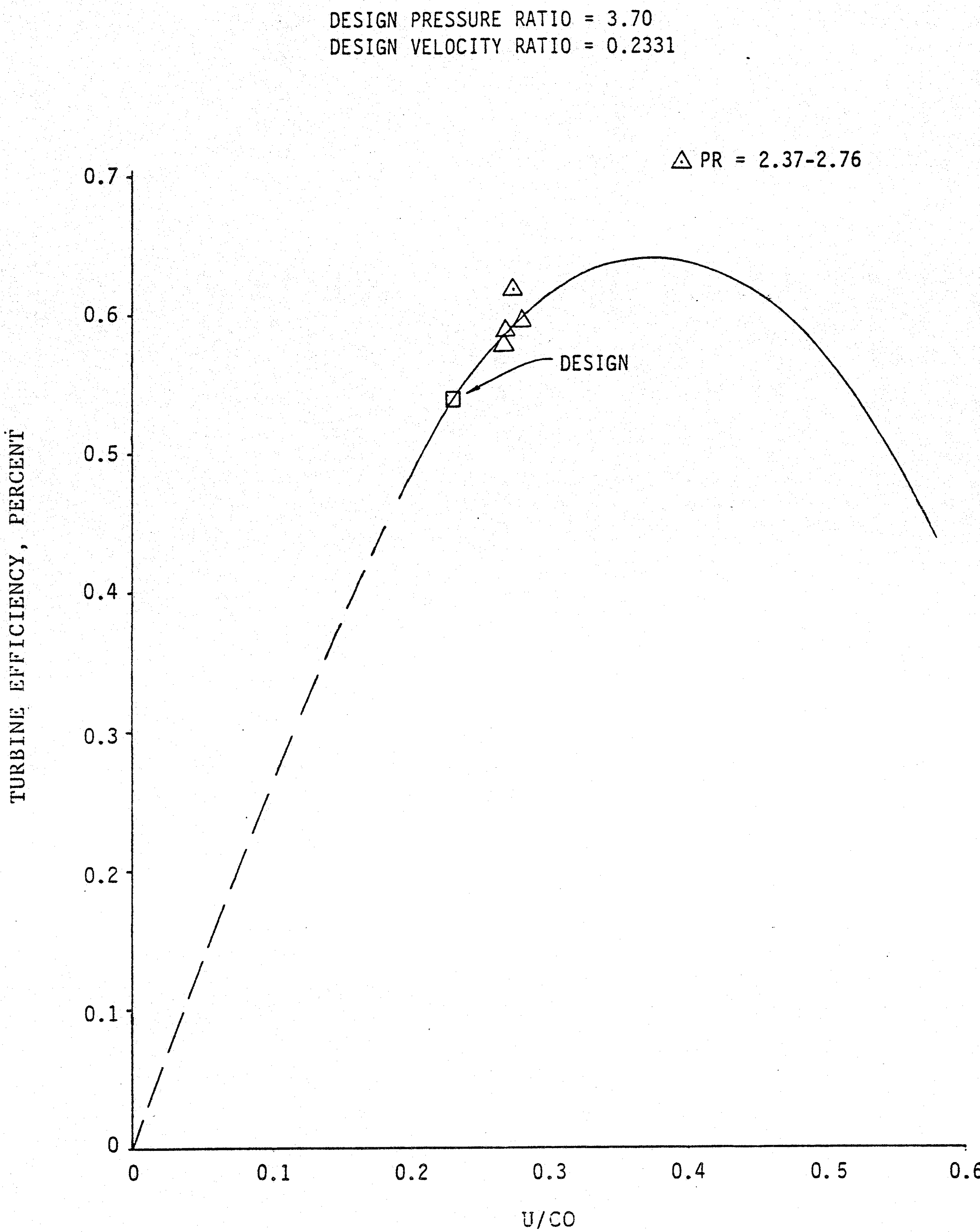


FIGURE 12 TURBINE EFFICIENCY V.S. U/CO

The effect of gearbox output shaft speeds on horsepower losses resulting from gearbox bearing and sealpower losses are illustrated in Fig. 14. The effects are plotted at three oil temperatures.

% LOAD	EFFICIENCY, %
100	87.6
75	85.6
50	81.5
25	70.5

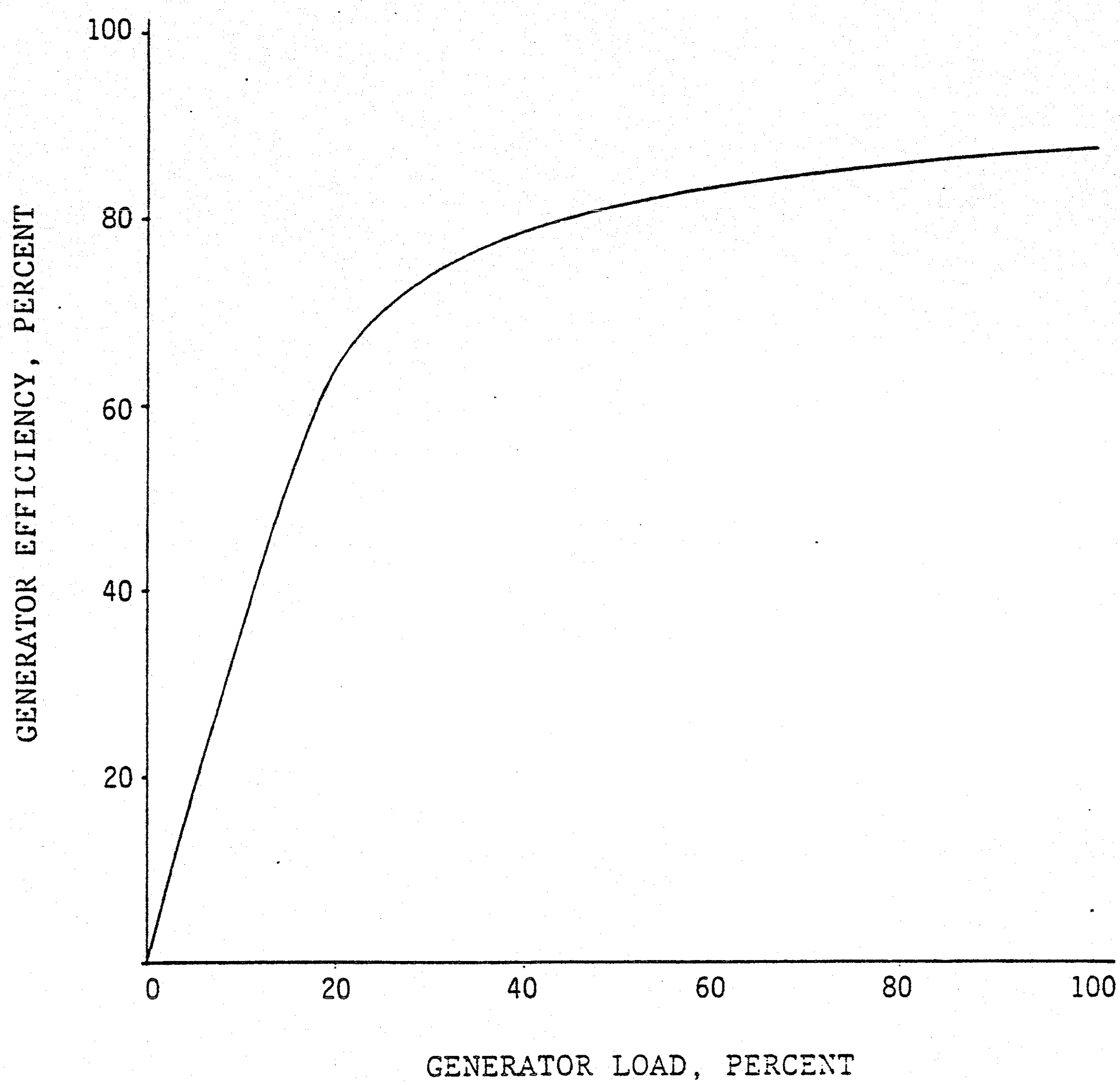
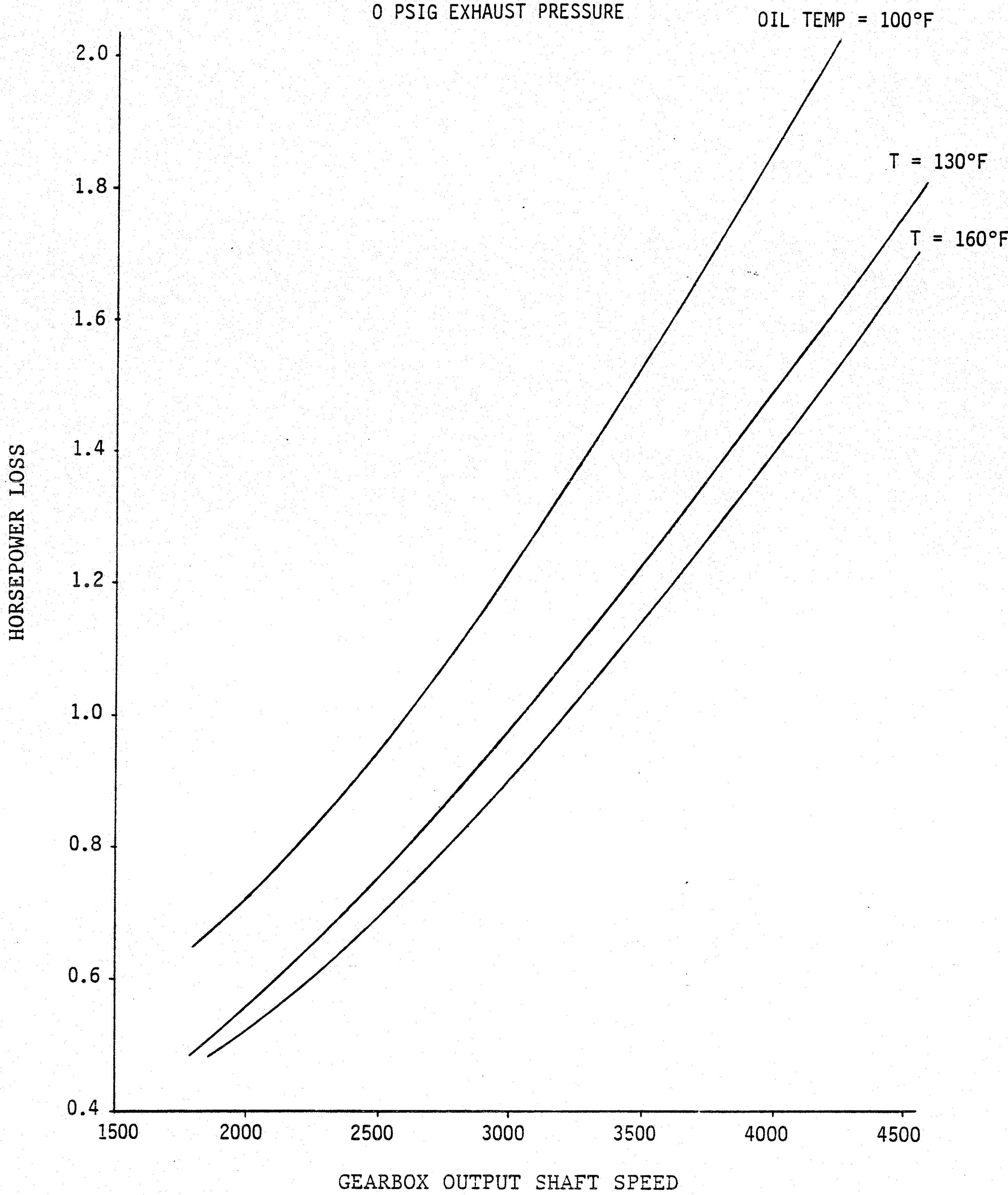


FIGURE 13   KATO 60 kWe GENERATOR EFFICIENCY

FIGURE 14

GEARBOX BEARING & SEAL POWER LOSSES

MOBILE DTE 24 OIL
GEAR RATIO 6.05:1
0 PSIG EXHAUST PRESSURE



Section 5

CONCLUSIONS

The testing and monitoring program at the south side of the Meager Mountain Volcanic Complex indicates a fracture-dominated geothermal resource with a base temperature of approximately 200°C about 1600 m from the surface. Utilization of this resource for commercial electric power generation by conventional means appears to be restricted by the flow capacity of the rock due to insufficient rock permeability. It may be possible to extract a portion of the available energy by Hot Dry Rock techniques and binary or multi-flash cycles but these technologies are not sufficiently proven at present. Further research and development work would be required to gain more understanding of the resource and of inter-well spacings, fluid flow rate and economic viability based on the state of available technologies.

Two primary exploration targets were identified from exploration at Meager Creek, the Meager Creek Zone and the No-Good Zone. These are fault related structures which control the production of geothermal fluids on the south side of the Meager Mountain Volcanic Complex.

The installation and operation of a flash steam separator and a 20 kW steam turbine generator on well MC-1 has improved the understanding of the chemical and physical parameters of the resource. The production fluids appear to be relatively free of toxic elements and calcium and silica contents are within acceptable limits. No extraordinary treatment of the geothermal production fluid should be necessary.

Section 6

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APPENDIX A

DATA FROM POWER SYSTEM TESTS 1-26

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #1

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	----	----	----	----	----------
1345	340																		Power System Test#1, 22 MAY 84
1345	340																		Separator open, turbine on
1350	285																		
1350	285																		P1,P7=[kPa] P5,wiz=[psi]
1400	245			28- 30	270					265					130		310		T3,T5=[deg F] W8=[V]
1405	235			28	270					265					130		310		LEVEL CONTROL = 3.3
1410	230-235			28	270					265					130		310		
1415	227			26	268					265					100-130		310		
1420	220-230			26	268					265					110		310		
1425	225			26	267					265					110		310		
1430	225			26	267					265					110		310		
1435	220			26	266					265					110		310		
1440	220-225			26	266					265					110		310		
1445	215			25	265					260					105		310		
1450	215			25	265					260					100		305-310		
1455	215			25	266					260					105		305-310		
1500	215			25	266					260					105		305-310		
1505	205			30	275					260					165		305		By-pass vlv clsd (Attempt to stabilize)
1510	160			20	260					260					60		305		W8 read 345 - 1 sec.(@ 1505 h)
1515	140			22	260					255					70		305		By-pass valve opened
1520	235-245			28	270					265					110		305		
1525	230			26	265					265					105		305		
1530	220			26	265					260					105		305		
1535	205			25	265					260					90		305		
1540	210			24	265					260					95		305		
1545	205-210			24	265					260					90		305		
1550	205			24	265					260					85		305		
1555	205			24	265					260					80		305		
1600																			Turbine shut down, sep shut-in

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #2

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
1320																			Silncr vlv open,bypass clsd in 100%
1325	240	205	260												150				P1,P2,P6,P5,P7=[kPa] LT setting = 3.5
1330	200	285	265	12	260				165	260					100		305		Turbine vlv opened, turbine on
1335	150	150	265	12	260				135	260					50		305		T2,T4,T5,T6=[deg F] W8=[V]
1340	120	115	265	12	260				110	260					50		305		wizlo,P3=[psi]
1345	80	80	265	8	260				60	260					50		305		
1350	50	50	240	5	240				50	220							305		Loss of brine
1400	50	50	240	5	240				50	220							305		Turb down,slncr vlv opn,sep clsd - no
1400	50	50	240	5	240				50	220							305		brine - stm only.WHP=0 well back in 23 h

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #3

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
1600																			Power System Test #3,31 MAY 84
1600	260																		WH=90 mm. LT setting = 3.5
1605																			Bypass, sep vlvs open 100%
1610	325	250	275										125		150				P1,P2,P6A,P7=[kPa]
1620	250	175	260										75		75				T2,T6a=[deg F] WIZLO,P5=[psi]
1625	210	185	260	8	230				95	240			100		70		175		Turbine on
1635	195	200	260	24	265				170	255			160		80		305		Bypass vlv clsd 5 turns = 50%
1645	200	200	265	24	265				170	255			160		60		305		
1700	200	200	265	24	265				170	260			165		70		305		
1715	200	200	265	24	265				170	260			165		70		305		
1725	200	200	265	24	265				170	260			165		70		305		
1730	210														150				Turb down, bypass opn,sep clsd

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #4

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
955	180																		Power System Test #4,05 JUN 84
955	180																		Bypass clsd 50%,sep opn,tbn on
1000	190	250	275	26	260				170	260			175		85		310		Weir height= 90 mm
1005	210	250	275	26	260				170	260			175		85		310		2" manual brine line open.Level ctrl=3.2
1010	200	210	260	25	260				170	260			170		75		310		P1,P2,P5,P6a,P7=[kPa]
1015	160	190	260	22	260				150	255			160		70		305		T2,T3,T5,T6a=[deg F] W8=[V]
1020	175	190	260	22	260				150	255			150		70		305		wizard,P3=[psi]
1025	170	190	260	21	260				150	255			150		70		305		
1030	167	190	260	21	260				150	255			150		70		305		
1035	167	190	260	21	260				150	255			150		70		305		
1040	165	190	260	21	260				150	255			150		70		305		
1045	165	190	260	21	260				150	255			150		70		305		
1047																			Turb off,sep shut,b-p opn 100%
1050	100																		
1140	100														150				

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #5

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
0845																			Power System Test #5,10 JUN 84
0845	135	190	255	20	255				150	255			150	240	90		480		B-P closed 5 turns
0850	125	190	255	19	255				150	255			150	240	90		480		
0855	110	190	255	19	255				150	255			150	240	90		480	12- 13	
0900	115	190	255	19	255				150	255			150	242	80		480	12- 13	
0905	130	195	260	19	255				150	255			150	244	75		480	12- 13	
0910	125	190	260	19	255				150	255			150	244	75		480	19	19 A with clip on meter @ L1
0915	120	190	260	19	255				150	255			150	243	75		480	19	from generator
0920	115	190	260	19	255				150	255			150	243	75		480	19	
0925	110	190	260	19	255				150	255			150	243	75		480	19	
0930	125	190	260	19	255				150	255			150	243	75		480	19	
0935	120	190	260	18	255				100	255			150	243	75		480	19	
0940	115	190	260	18	255				150	255			150	243	75		480	19	
0945	120	190	255	18	255				150	255			150	243	75		480	19	

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #6

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	----	----	----	----	----------
0825	145														100				Power System Test #6,13 JUN 84
0830																			Weir height = 80 mm
0845	95	160	255	16	250				130	225			125	250	70		480		Steam thru sep, turbine on
0850	135	180	255	18	255				145	235			140	255	75		480		P1,P2,P5,P6,P7=[kPa]
0855	120	180	255	17	255				150	235			140	255	75		480		T2,T3,T5,T6A=[deg F] W8=[V]
0900	100	170	255	17	255				140	235			130	255	60		480		WIZLO,P3=[psi]
0905	75	160	252	17	255				140	235			135	255	70		480		Well dies - system shut down
0910	45																		WH controller @ 0
0915	105																		
0925	190																		separator/turbine on
0930	95	130	245	12	242				100	240			100	245	25		480		WH controller @ 10
0935	100	140	247	12	245				100	240			100	245	25		480	16	
0940	95	140	245	13	245				100	240			100	245	25		480	16	
0950	85	130	245	12	241				95	240			95	245	20		480	16	
0955	75	130	245	12	240				95	240			95	245	20		480	14	
1000	75	130	245	12	242				95	237			95	243	20		480	14	all systems down
1005	65																		

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #7

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
1100	300	200	258	125	250				18	250			120	245	60		485	16	Power System Test #7 - 28 JUN 84
1110	300	190	255	120	250				18	250			115	245	55		485	16	P1,P2,P6a,P7=[kPa] P3,P5,wizlo=[psig]
1120	290	190	255	120	250				17	248			110	243	55		485	16	T2,T3,T5,T6a=[deg F] W8=[V] A8=[A]
1130	290	190	255	120	250				17	250			115	245	60		485	16	

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #8

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
0850	330	220	265	150	255				19	255			150	250	120		480	19	Power System Test #8 - 29 JUN 84
0900	310	220	265	150	255				18	255			150	250	120		480	19	WH=100 mm, WHP=300 kPa prior to test
0910	300	210	265	140	255				18	255			150	250	100		480	16- 18	P1,P2,P3,P6a,P7=[kPA] P5=[psig]
0920	290	210	265	140	255				18	255			150	250	100		480	16- 18	T2,T3,T5,T6a=[deg F] W8=[V] A8=[A]
0930	290	210	265	150	258				18	250			140	250	100		480	16- 18	
0940	290	220	265	150	258				18	250			150	250	110		480	16- 18	
0950	290	220	265	140	258				18	250			150	250	110		480	16- 18	
1000	280	220	265	150	258				18	250			150	250	110		480	16- 18	
1010	290	220	265	140	258				18	250			150	250	110		480	16- 18	
1020	280	220	265	140	258				18	250			150	250	110		480	16- 18	

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #9

Date: 05/27/85
Page: 1

Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
1500	265-285																		Power System Test #9 - 04 JUL 84
1515	330-350	200-240	255						18- 20	260	140-150	247	140-160	260	80-125		480-485	17- 18	Separator & Turbine on
1530	295-305	200-240	255						18- 20	255	140-160	247	145-150	250	75-125		480	17- 18	
1545	280-300	200-240	260						18- 20	255	140-160	250	145-150	250	75-125		480	17- 18	
1600	270-290	200-240	260						18- 20	255	140-160	250	147	252	75-125		480	17- 18	
1615	260-280	200-240	260						16- 20	255	140-150	250	130-140	252	65-135		480	17- 18	
1630	260-280	200-240	260						15- 19	255	130-150	250	130-140	250	65-135		480	17- 18	
1645	260-280	200-240	260						15- 19	255	130-150	250	130-140	250	65-130		480	17- 18	
1700	260-290	200-240	260						15- 19	255	130-150	250	130-140	250	65-130		480	17- 18	
1715	260-290	200-240	260						15- 19	255	130-150	250	130-140	250	65-130		480	17- 18	
2222	260-280	200-240	260						15- 19	255	130-150	250	130-140	250	65-130		480	17- 18	

Meager Creek Project - Well MC-1
BCH/EPRI Power System Test #10

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Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	W8	A8	Comments
1230	270-280														100-200	84			Power System Test #10 - 07 JUL 84
1240	300-310	150-220	255								80-100	240	70- 80	230	50-150	84			Separator open
1245	280-300	180-220	255								100-150	245	90-100	240	50-150	84	480	17- 18	
1300	270-290	200-250	260						18- 20	260	150-175	245	150	255	50-150	82	480	17- 18	Turbine on
1310	270-280	200-250	260						17- 22	260	145-155	260	145-155	255	50-125	82	480	17- 18	P1,P2,P6,P6a,P7=[kPa] P5,Wizard=[psig]
1320	270-280	200-250	260						17- 20	260	145-160	260	150-155	255	60-125	82	480	17	T2,T5,T6,T6a=[deg F] T7=[deg C]
1330	265-275	200-250	260						17- 20	260	145-160	260	150-155	255	65-130	88	480	17	WH,T-1 Flow level=[mm] W8=[V] A8=[A]
1340	265-275	200-250	263						17- 20	260	145-160	260	150-155	255	65-130	88	480	17	For F4 & F6 refer to pressure charts
1350	260-280	200-250	263						16- 22	257	150-155	260	150-157	255	60-140	88	480	17	
1400	260-280	200-250	263						16- 22	257	150-155	260	150-157	255	60-130	88	480	17	Black vlv to turb stm cracked 4 turns
1415	260-280	200-250	263						16- 21	257	150-165	260	150-155	255	65-125	88	480	17	
1430	260-280	200-250	263						16- 20	257	150-165	260	150-155	255	65-125	88	480	17- 18	T-1 flow level meas'd from
1445	260-280	200-250	263						16- 20	257	145-170	260	150-155	255	50-150	89	480	17- 18	sight glass bottom
1500	260-280	200-250	265						16- 22	257	145-170	260	150-155	255	50-130	89	480	17- 18	
1515	260-280	200-250	265						16- 20	257	145-170	260	150-155	255	50-140	88	480	17- 18	
1530	260-280	200-250	263						16- 21	257	140-170	260	150-155	255	50-140	88	480	17- 18	
1545	260-275	200-250	263						16- 21	257	140-170	260	150-160	255	60-140	88	480	17- 18	
1600	260-275	200-250	262						16- 20	257	140-170	260	150-160	255	60-140	88	480	17- 18	
1603																			Turbine off
1605	260-280														40-150				
1610	230-240														75-150				

Meager Creek Project - Well MC-1
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Time	P1	P2	T2	P3	T3	P4	T4	F4	P5	T5	P6	T6	P6a	T6a	P7	T7	WB	AB	Comments
1015	270-280															88			Power System Test #11 - 08 JUL 84
1045	320-330	150-220	255	20	60						80-110	242	65- 80	240	100-200	88			Separator open
1100	300-320	170-210	255	20- 24	62						80-110	243	65- 75	240	45-110	88			P1,P2,P6,P6a,P7=[kPa] P3,P5,Wizard=[psi]
1130	260-290	175-225	255	24- 30	63						80-140	254	85-100	245	50-130	89			T2,T5,T6,T6a=[deg F] T3,T7=[deg C]
1200	260-290	175-225	255	25	63						90-140	245	95-110	245	45-130	89			WH,T-1 Flow lvl=[mm] WB=[V] AB=[A]
1230	260-285	175-225	255	25	63						90-130	244	100-115	245	60-125	89			
1235	245-250	200-250	260	18					18- 22	250	140-170	257	140-160	252	75-130	88	480-485	17- 19	Turbine on (black stm vlv opn 100%
1245	260-280	200-240	260						18- 22	260	150-170	260	150-155	255	65-175	88	482	18- 19	13 turns)
1300	250-260	200-240	260						18- 23	260	140-180	257	150-160	255	50-165	88	480-485	18- 19	
1315	250-270	200-240	260						18- 22	260	140-180	257	145-160	255	50-160	88	480-485	18	
1330	250-270	200-240	260						18- 22	260	150-170	258	150	255	50-165	88	482	18	
1345	250-270	200-240	260						18- 22	260	150-170	258	150	255	45-165	88	482	18	
1400	250-265	200-240	260						18- 22	260	150-165	258	150-155	255	45-135	88	482-485	19	
1415	260-265	200-240	260						18- 22	260	150-170	258	150	255	45-150	88	482-485	18- 19	
1430	260-270	200-240	260						18- 22	260	145-165	258	150-155	255	45-150	87	482	18- 19	
1435	260-270	180-220	260	25	62						110-130	245	110-120	242	50-125	88			Turbine off
1445	260-270	170-220	257	25	62						110-140	245	110-120	252	50-150	88			T3 ranging 62 C to 88 C
1500	160-170														40- 60				Separator down @ 1450h
1600	220-260														80-200				

WELL MC-1

POWER SYSTEM TEST NO. 12
July 18, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °F	P5 psi	T5 °F	F6 kPa	T6 °F	P7 kPa	T7 °C	F7 mm	P6a kPa	T6a	PCV4 Setting	PCV4 Output	T1 Flow Level	W8	A8	Remarks
0900	275–290											75–160	92	70–75								
1000	320–360	180–240	258	25–35	0–62	80–110	243	–	–	100–120	244	40–150	92	70–75	100–110	240	0	8–11	260–620	–	–	Separation PCV7 @ 25 PCV6 @ 33
1015	255–285	170–230	258	25–35	70–80	75–115	245	–	–	90–130	244	30–150	92	70–75	95–115	240	0	8–12	240–680	–	–	
1020																						Turbine on – Manual Valve Full
1022	255–265	200–270	263	15*	74*	140–185	265	18–24	260	140–190	257	50–150	92	70–75*	150–160	255	50	15–20	110–600	480	17–19*	Close 2" Manual Valve
1030	255–265	200–270	262	15	75	150–180	265	19–25	260	150–200	259	45–155	92	70–75	150–200	248	50	15–21	460–610	480	18	
1045	250–265	200–260	262	15	75	150–180	265	19–25	260	150–200	259	50–100	92	65–75	150–200	248	50	15–21	440–670	480	17–20	
1100	245–260	200–265	262	15	75	150–180	265	18–25	260	150–200	259	50–155	92	70–75	150–200	248	50	15–21	450–600	480	17–19	
1130	248–260	200–260	262	15	75	150–150	265	18–25	260	150–200	260	45–160	92	75	150–200	248	50	15–20	400–620	480	17–19	
1200	250–260	198–260	262	15	75	150–182	165	18–25	261	150–200	260	45–155	92	70–75	150–200	248	50	17–20	420–630	480	18	
1230	255–275	200–270	265	15	75	155–190	265	20–25	260	150–195	260	60–150	92	70–75	160–190	248	50	17–21	380–720	480	18–19	
0100	260–270	210–250	265	15	74	145–185	265	19–25	260	150–185	260	60–160	92	70–80	160–195	248	50	15–21	260–560	480	18	
0130	260–270	210–250	265	15	74	150–182	265	19–26	260	150–185	260	60–160	92	70–80	155–195	248	50	15–20	300–500	480	18–19	
0200	250–275	210–250	265	15	74	145–175	265	20–25	260	155–185	260	60–155	92	75–80	160–200	248	50	15–20	320–615	480	18–19	
0230	260–275	210–260	265	15	74	145–185	265	20–25	260	155–185	260	60–155	92	75–80	155–200	248	50	15–20	365–620	480	18–19	
0300	260–270	210–260	265	15	74	145–185	265	20–25	261	150–190	260	60–130	92	75–80	160–190	248	50	15–20	280–600	480	18–19	
0400	255–275	210–260	265	15–20	73	155–175	265	20–25	261	150–180	260	60–180	92	75–80	155–185	248	50	15–20	300–620	480	18–19	
0500	250–270	210–250	265	15–18	73	150–180	265	20–25	261	150–180	260	75–150	92	75–85	160–180	248	50	15–20	300–600	480	18–19	
0600	250–275	210–255	265	15–20	73	150–180	265	20–25	261	150–185	260	60–130	92	75–80	160–175	248	50	15–20	330–640	480	18–19	
0700	245–265	210–260	265	18	73	145–180	265	20–24	260	150–180	260	75–125	92	70–85	155–190	248	50	15–19	330–620	480	18–19	
0800	250–265	210–255	265	18–20	73	155–180	265	20–24	260	150–180	260	65–130	92	70–75	160–180	248	50	15–20	400–580	480	18–19	
0810																						Turbine off
0830	260–272	180–240	255	28–30	0–50	90–120	245	–	–	100–140	245	70–125	92	70–80	100–140	135	0	9–10	310–610	–	–	
0845	250–275	190–240	255	28	0–50	90–120	245	–	–	100–140	245	50–135	92	75–80	110–140	135	0	9–12	420–710	–	–	
0850													92	70–75								Separator off PCV7 __
0852	240–250											90–125	92	70–80								
0915	150–160											30–60										
0945	230–150											50–125										

		°C	Baro. Press	Rel. Humidity %	Skys	Prec.
Weather	0900	22			Clear	Ø
	1200	26			Clear	Ø
	0300	28	102.75	47%	Clear	Ø
	0600	26	102.7	45%	Clear	Ø
	0900	18	102.8	52%	Clear	Ø

POWER SYSTEM TEST NO. 13
July 19, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °F	P5 psi	T5 °F	P6 kPa	T6 °F	P6a kPa	T6a °F	P7 kPa	T7 °C	F7 mm	PCV4 Setting	PCV4 Output	T1 Flow Level	W8	A8	Remarks
0730	260-285																					
0745	330-340	200-260	262	40-45	0-62	95-115	245	–	–	110-130	250	110-140		100-200	88	70						PCV7 = Ø psi
0800	290-300	200-250	260	38-42	62	90-130	246	–	–	100-150	248	110-150	190	50-160	88	70-75	0	10	380-700	–	–	Separation PCV7 = 25; PCV6 = 3
0830	265-280	200-240	260	40-45	72-90	95-125	246	–	–	105-160	248	110-155	230	60-140	88	70-75	0	9-10	320-680	–	–	2" brine closed; 4" steam clos
0900	265-280	200-240	260	40-42	62	80-130	246	–	–	110-150	248	110-150	230	40-150	88	75-80	0	8-10	410-640	–	–	
0930	265-280	200-240	260	40	0-60	85-125	246	–	–	110-150	248	110-150	235	45-150	88	75-80	0	9-11	420-700	–	–	
1000	260-270	190-260	258	40-42	70-90	85-120	246	–	–	100-140	248	100-140	235	40-140	88	75-80	0	9-11	450-620	–	–	
1030	260-275	180-250	259	38-45	74-90	85-120	246	–	–	110-140	248	100-140	235	60-145	92	75-80	0	9-12	410-590	–	–	
1100	200-270	180-260	259	38-42	74-90	85-120	246	–	–	110-140	248	100-140	235	60-150	93	75-80	0	8-12	370-660	–	–	
1130	260-280	220-250	260	40-42	74-90	100-120	250	–	–	120-140	250	100-145	235	65-160	93	75-80	0	9-12	350-620	–	–	
1145	250-260	240-250	262	45-50	80-94	110-120	250	–	–	130-140	252	140-150	235	70-150	93	75-80	0	9-12	360-560	–	–	145 – PCV7 = 40 psi
1200	190-200	200	255	35	76-90	100-110	245	–	–	120-125	250	115-125	238	90-120	93	55-60	0	15	380-560	–	–	
1215	220-230	230-250	265	49	80-90	105-120	250	–	–	135-150	255	140-160	235	90-110	93	65-70	0	8-10	300-630	–	–	
1230	240-260	240-260	265	45-50	85-95	130-150	252	–	–	150-175	258	150-165	237	110-130	93	70-75	0	10-12	330-620	–	–	
0100	250-265	250-260	267	45-50	78-94	135-150	252	–	–	150-170	260	155-165	242	110-150	93	70-75	0	12-18	340-620	–	–	
0110													245	125-150	93	70-75	0	15-20	355-640	–	–	
0115						> 25 oversp.											50/0 blown disc					
0120						> 25 oversp.											0/50 oversp @ 25 psi turbine					Separator off 5 min.
0130						> 25 oversp.											0/30 oversp @ 25 psi turbine					Turbine – overspeed + 26 psi
0135						5											0/25 oversp @ 25 psi turbine					
																	0/20			350		
0145																	20/25 oversp @ 25 psi turbine					
0150	290-320	220-250	262	30-35	74-82	100-120	245	–	–	120-140	250	130-150										PCV7 = 25 psi
0200	270-290	190-240	260	35-40	74-84	70-110	245	–	–	110-140	246	110-130	240	50-125	93	80-90	0	10-12	370-690			
0205	270-280	220-250	265	15	73	145-175	260	20-24	260	155-185	260	155-185	235	60-125	93	75-80	0	8-12	360-710			
0230	260-280	220-250	265	15	72-80	140-170	260	20-24	260	150-190	260	155-180	240	75-140	93	70-75	50	18-20	260-680	480	17-19	Turbine on – oil
0300	250-275	220-250	265	15	74-84	110-130	260	20-24	260	150-190	260	155-185	240	60-140	93	70-75	50	17-20	310-700	480	17-19	Oil Press 55
0310	180-210												240	45-140	93	70-75	50	17-20	360-690	480	17-19	Shut Down
0330	255-275													50-130	93	70-75						
														75-150	93	70-75						

	°C	Baro. Press	Rel. Humidity %	Skys	Prec.
Weather 0730	12	102.9	55	Overcast	Ø
0900	17	102.9	53	P. Cloudy	Ø
1100	23	102.9	50	Clear	Ø
1200	24	102.9	50	Clear	Ø
0300	26	102.9	49	Clear	Ø

POWER SYSTEM TEST NO. 14
July 25, 1984

Time a.m.	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks
0905	265-280																					100-200	89	100	0			19	102.7	57.5%	
0915	350-360	250	265	22	63	50	10-12	170		21	260	150	260			265	3.3		160	250	Open	50-125	89	120	0	480	17-18				Separator/Turbine On
0930	300	240	260	22	62	50	10-12	155		20	250	150	260			260	3.3	320-680	160	250	Open	50-120	89	75-80	0	480	17-18				
0945	280-300	240	260	22	62	50	10-12	150		20	255	150	260			260	3.3	280-600	160	250	Open	50-100	89	75-80	0	480	17-18				
1000	275-290	220-240	260	22	62	50	10-12	140-150		18-20	255	140-150	260			260	3.3	550-620	140-150	250	Open	50-75	89	75-80	0	480	17-18				
1030	270-280	220-250	260	22	62	50	10-12	140-165		18-20	255	140-160	258			260	3.3	410-630	140-150	250	Open	50-100	89	70-80	25	480	17-18				
1045	270-280	220-250	260	22	62	50	10-12	140-165		20	260	140-160	258			260	3.3	320-680	140-150	250	Open	50-100	89	70-80	25	480	17-18				
1110																															Turbine/Separator Off
1115	260-270																					80-120	89	75-80							

EPRI/3

POWER SYSTEM TEST NO. 15
August 1, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks	Chart No.
0900	270-290																			Open	125-175	89	75-80	0			19	102.6	54%		
0903																				Open										Separator On	1
0915	320-340	220-270	257	40-50	74	0	10	70-100			100-130	240			238	3.3	390-530	90-110	240	Open	50-150	89	70-80	0							2
0930	285-310	200-250	257	40-50	74-78	0	10-12	80-110			90-130	240			238	3.3	310-500	100-110	240	Open	45-130	89	75-80	0							
0945	275-300	200-250	257	40-45	76-80	0	8-12	80-110			90-125	240			238	3.3	360-560	100-110	240	Open	45-140	89	75-80	0							
1000																				Open										Disc Burst. Shut Down for Repairs	
1020	330-350	220-270	257	40-50	74	0	8-12	65-110			90-130	240			238	3.3	300-580	90-110	240	Open	30-140	89	75-80	0						Separator On	3
1040	275-290	180-250	255	45-50	74	0	5-10	80-110			80-140	238			238	3.3	270-540	85	240	Open	35-140	89	75-80	25							4
1050	270-290	170-240	253	40-45	74	0	5-10	75-100			80-115	238			240	3.3	360-570	85-100	238	Open	25-130	89	75-80	25							5
1120	260-270	170-240	253	40-45	74	0	5-10	60-90			80-130	238			240	3.3	390-490	85-95	238	Open	25-125	89	70-75	25			28	102.4	50%		
1130	250-270	180-240	255	25-30	72	50	10-15	100-150	15-18	248	115-140	248			255	3.3	380-470	110	243	Open	35-125	89	70-75	25	480	15-16				Turbine Running	
1145	250-270	190-240	255	30	71	50	10-15	120-150	14-18	250	110-160	250			255	3.3	350-430	110-120	245	Open	45-120	89	70-75	25	480	16-17					6
1215	255-265	180-240	255	25	71	50	10-15	105-150	15-18	250	110-160	250			252	3.3	300-540	110-120	245	Open	40-125	89	70-75	25	480	17-18					
1245	255-265	180-240	255	25	71	50	10-15	100-155	15-18	250	110-140	250			252	3.3	240-590	110-120	245	Open	40-125	89	70-75	25	480	17-18					
0115	255-265	180-240	255	20-25	70	50	10-15	100-150	15-18	250	110-140	250			252	3.3	300-610	110-120	245	Open	35-120	89	70-75	25	480	17-18					
0145	255-265	180-240	255	22	70	50	8-15	100-150	15-18	250	110-140	250			252	3.3	330-480	105-120	245	Open	35-130	89	70-75	25	480	16-17					
0215	255-265	190-240	255	22	68	50	8-15	105-150	15-18	250	105-140	250			252	3.3	170-500	110-120	245	Open	40-130	89	70-75	25	480	16-17					
0245	255-265	170-240	255	22	68	0	5-10	105-140	15-18	250	105-140	250			252	3.3	370-640	100-120	245	Open	40-120	89	70-75	25	480	16					
0255																				Open				0						Turbine Off	
0300	245-265	190-230	255	32	66	0		100-125							247	3.3			245	Open	75-150	89	75-80	0			30	102.4	47	Separator Off	7
0315	245-260																				85-175	89		0							8
0400	245-260																														

EPRI/4

POWER SYSTEM TEST NO. 16
August 2, 1984

Time p.m.	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0445	270-290					0																110-175	89	75-80	0						
0500	350-370	240-260	262	35	?	0	10-12	90-100		-	-	110-130	250			245	3.3	400-570	105-115	240	Open	50-125	89	75-80	25	-	-	27	102.5	51%	(1) Separator On
0530	270-295	200-240	262	30	100?	0	8-12	90-115		-	-	110-130	248			245	3.3	330-620	110-115	242	Open	35-125	89	75-80	25	-	-				
0545	275-295	200-240	262	30	?	0	8-12	90-115		-	-	110-130	248			245	3.3	440-590	105-115	242	Open	50-110	89	75-80	25	-	-				
0550																															(2) Turbine On
0600	270	220-230	262	20	100	50	10-15	155-175		20	260	150-160	260			260	3.3	400-570	150-155	255	Open	50-125	89	70	25	480	17-18				
0615	270-275	220-250	262	20	100	50	10-15	155-175		19-21	260	150-170	260			260	3.3	240-480	150-160	255	Open	65-125	89	70-75	25	480	18				
0645	265-275	215-250	262	20	105	50	12-18	145-175		20-22	260	150-180	260			260	3.3	300-530	150	255	Open	75-115	89	70-75	25	480	18-19				
0715	260-270	220-250	262	20	104	50	12-18	160-175		20-22	260	150-180	260			260	3.3	220-510	150-155	255	Open	50-120	89	70-75	25	480	18-19				
0745	260-270	220-280	262	20	104	50	12-18	160-175		20-24	260	150-180	260			260	3.3	130-510	150-155	255	Open	65-125	89	70-75	25	480	18-19				
0755						0																			0	-	-				(3) Turbine Off/ Separator Off
0800	220-240																					75-175	89	75				24	102.6	50.5%	
0930	245-280																					100-175	89	75-80							

EPRI/5

POWER SYSTEM TEST NO. 17
August 9, 1984

Time p.m.	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0100	275-285				*	0																110-185	88	75-80	0			26	102.5	62%	
0130						0																			25						(1) Separator On
0135	300-340	200-240	255	45-55		0	8-10	100-120				110-140	248			245	3.3	310-700	115-135	235	Closed	50-125	88	75-80	25						
0156	280-290	190-240	255	45-55		0	8-10	100-125				105-140	248			245	3.3	180-660	110-135	235	Closed	40-125	88	75-80	25						
0200	280	200-240	255	40		50	10-12	115-145		16-18	250	120-140	250			250	3.3	440-720	115-140	234	Closed	40-130	88	75-80	25	480	15				(2) Turbine On
0215																															(3) Water Level in T1 increased to be sure full brine level over flow plate PCV6 to 2.5)
0216	280-290	210-240	258	38		50	10-15	110-140		16-18	250	120-155	250			250	2.5	680-970	135-155	238	Closed	50-120	88	75-80	25	480	15				
0245	265-290	195-250	258	38		50	10-15	120-140		16-19	250	120-150	252			250	2.5	680-900	130-150	238	Closed	45-120	88	75-80	25	480	15-16				
0315	260-285	195-250	258	38		50	9-12	120-140		15-18	250	100-150	252			250	2.5	800-1000	130-155	238	Closed	40-125	88	75-80	25	480	15	28	102.5	60%	
0345	260-280	200-250	258	40		50	9-12	120-150		15-18	250	120-155	252			250	2.5	750-950	140-160	240	Closed	40-125	88	70-75	25	480	15-16				
0415	260-275	200-250	257	40		50	9-12	120-140		15-18	250	130-155	252			250	3.0	490-810	120-150	240	Closed	30-125	88	70-75	25	480	15	28	102.5	60%	(4) Water Level Reduced (Water Overflowing to Turbine) PCV6=3.0
0445	260-280	200-250	257	40		50	9-12	120-145		15-18	250	125-155	252			250	3.0	520-760	120-145	238	Closed	35-120	88	70-75	25	480	15-16				
0448						0																									
0449																									0						Turbine Off
0451	245-260																							75							(5) Separator Off
0600	255-265																							75-80							

EPRI/6

POWER SYSTEM TEST NO. 18
August 20, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0945	270-295																				Closed	125-190	89	95-100	0			21	102.5	65%	
0955																					Closed										Separator On - Blown Burst Disc. Quick Shut Down
1007	330-345	230-270	265	25-35	130	0	15-19	160-170				150-175	260			260	3.0	470-800	160-175	140?	Closed	75-125	89	100-110	25						(1) Separator Start-Up
1020	295-315	230-270	265	22-27	130	0	15	155-175				160-170	260			260	3.0	450-780	155-170	150?	Closed	65-125	89	100-110	25						
1030																					Closed										
1034	275-290	200-250	265	20	144	50	12-15	120-130		17-20	253	120-150	255			252	3.0	460-780	125-150	175?	Closed	50-110	89	100-110	25	480	17				(2) Turbine On
1100	270-295	200-250	262	20-22	144	50	10-15	120-150		16-20	250	130-155	255			250	3.0	460-760	135-150	190?	Closed	40-115	89	95-105	25	480	17				
1130	270-295	200-250	260	22	146	50	10-15	120-140		15-19	250	120-155	252			250	3.0	600-780	130-155	190?	Closed	40-100	89	100-105	25	480	16-17				
1200	265-280	195-240	260	22	146	50	10-12	120-145		15-19	250	125-155	250			252	3.0	500-780	125-150	190?	Closed	45-110	89	100-105	25	480	17	28	102.4	54%	
1230	265-280	210-250	260	22	146	50	10-12	125-150		16-20	250	130-145	250			252	3.0	560-820	135-155	190?	Closed	60-110	89	100-110	25	480	17				
0100	265-270	200-260	260	22	146	50	9-12	115-155		16-19	250	120-150	250			250	3.0	590-770	120-160	192?	Closed	50-125	89	95-105	25	480	16-17				
0130	255-270	200-270	260	22	146	50	10-12	110-150		15-19	250	120-140	250			250	3.0	560-820	120-150	195?	Closed	45-120	89	95-100	25	480	17	29	102.4	51.5%	
0131						0																			0						Turbine Off
0133																															(3) Separator Off
0134	235-245																														
0200	255-280																					90-175	89	105							

EPRI/7

POWER SYSTEM TEST NO. 19
September 10, 1984

Time p.m.	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0215	275-290																				Closed	115-185	83	100	0			13	101.75	80	(1)
0221.50																					Closed										- Diesel Generator On
0222.30																					Closed										- Compressor On
0222.43																					Closed										- Spit Valve Open to Drain Water
0223.30																					Closed										- Spit Valve Closed
0225.34																					Closed										- 4" Manual Valve to Separator Open Full
0226.10																					Closed										(2)- Close Valve to Repair Burst Rupture Disc
0233.10																					Closed										- Reopen 4" Manual Valve
0233.26																					Closed				25						- Adjust PCV7
0234.01																															- Connect Battery Terminals
0234.20																					Closed										- Open Nitrogen Bottle
0234.50																					Closed										- Open Black Manual Valve to Turbine

EPRI/8

POWER SYSTEM TEST NO. 19 - (Cont'd)

Sheet 2 of 2

Time p.m.	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0235.01																					Closed										- Open Y-strainer to Drain Water
0235.04						50															Closed										- Adjust PCV5 to Drain Water
0235.34						0															Closed										- Close Y-strainer
0235.40						0															Closed										- Close Black Valve
0236.49						0															Closed										- Turbine Enable On
0237.01						50															Closed										- PCV4 adjusted
0237.25						50															Closed										- Black Valve Opened
0237.32						50															Closed										- Generator On
0238	330-340	240-270	262	40*	110*	50	15	135-160		18-21	255	140-160	255			255	3.0	520-820	140-165	N/A*	Closed	65-125	83	100	25	480	16				(3) First reading About 5 mins to complete Readings
0243																					Closed										
0300	290-310	200-250	257	40	110	50	10-15	120-150		16-18	250	125-150	250			252	3.0	470-690	120-155	NA	Closed	45-130	86	100-105	25	480	16	13.5	101.75	79	
0315	280-290	190-250	257	40	110	50	9-12	115-150		15-19	250	120-150	250			252	3.0	580-770	120-155	NA	Closed	45-120	86	100-105	25	480	16				
0330	270-295	195-250	257	40	110	50	9-12	115-150		15-19	250	120-150	250			252	3.0	470-860	125-150	NA	Closed	40-110	86	100-105	25	480	16				
0400	260-285	200-250	257	40	110	50	9-12	115-150		16-19	250	120-150	250			252	3.0	510-860	130-150	NA	Closed	45-120	86	100-105	25	480	16	14	101.7	79	
0430	265-280	195-260	255	40	110	50	9-12	110-150		16-19	250	125-155	250			250	3.0	540-760	125-155	NA	Closed	45-125	86	100-105	25	480	16	14.5	101.7	79	
0500	265-280	195-255	255	40	110	50	9-12	120-155		15-19	250	125-160	250			250	3.0	640-760	120-155	NA	Closed	35-120	86	100-105	25	480	16				
0530	265-280	195-255	255	40	110	50	9-12	115-150		15-19	250	125-155	250			250	3.0	580-780	120-155	NA	Closed	30-130	86	100-105	25	480	16	13.5	101.7	81	Turbine Oil Press = 55
0540																															(4) Turbine/ Separator Off
0545	190-220																					40-110									
0700	255-260																					80-165									

Note: * Gauges on P3, T3 and T6a would appear to be defective and will be replaced.

EPRI/9

POWER SYSTEM TEST NO. 20
September 11, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0415	270-295					0																125-195	86	90-95	0						(1) Gauges @ P3, T3 and T6a were replaced
0437.27	270-295																														- Diesel Generator On
0437.46																															- Compressor On
0438.09																															- Spit Valve Open
0438.26																															- Spit Valve Closed
0439.41																															(2)- Open 4" Manual to Steam Separator
0439.57																									25						- Adjust PCV7
0440.42																															- Connect Battery Terminals
0440.55																															- Open Nitrogen Bottles
0441.12																															- Open Manual Valve to Turbine (Black)
0441.20																															- Open Y-strainer
0441.42						50	-	-																							- Adjust PCV4 to Drain Water in Steam Line
0441.56						0																									- Close Y-strainer
0442.01																															- Close Black Valve

POWER SYSTEM TEST NO. 20 - (Cont'd)

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
0442.49)																															- Turbine Enable On
)																															
)						50																									- Adjust PCV4 - Open Black Valve
)																															
)																															
0443.16						50																									- Generator On
0443.20						50																									- Turbine to Full Power
0443.23	330-360	230-270	262	0*	205*	50	12-15	140-155		17-19	255	140-160	255			255	3.0	510-760	140-165	34*	Closed	55-125	91	105-110	25	480	16-17				First Readings
0449.01																															5.36 mins to complete Readings
0500	280-310	220-255	260	0	207	50	10-14	110-150		16-19	252	130-150	252			252	3.0	560-700	130-155	44	Closed	40-125	90	105-110	25	480	16-17	15	101.5	79	
0530	270-290	210-260	258	0	208	50	10-14	120-155		16-19	251	120-155	250			252	3.0	510-870	130-150	57	Closed	40-120	90	100-105	25	480	16-17	14.5	101.5	79	
0600	270-285	220-260	260	0	208	50	10-14	155-175		15-19	250	150-180	255			255	3.0	500-720	160-175	60	Closed	60-110	90	105-110	25	480	16	14	101.5	79	(3) Opened Steam Bypass - 5 s to Purge Accumulated Water (Will Incorporate this Step in Future Tests)
0630	260-295	220-270	265	0	185	50	15-20	140-180		22	260	145-175	258			255	3.0	520-740	160-175	64	Closed	60-110	90	100-110	25	480	18	13	101.6	79	
0700	265-290	230-265	265	0	130	50	15-20	150-180		20-22	260	150-185	258			255	3.0	460-800	160-185	70	Closed	65-105	88	105-110	25	480	18-19	13	101.6	80	
0726	265-285	230-265	265	0	130	50	15-20	150-180		20-22	260	150-185	258			255	3.0	480-760	160-185	72	Closed	60-110	88	105-110	25	480	18-19				(4) Turbine/ Separator Off
0730	265-285					0															Closed	60-110	88	100-110	0						
0735	240-250					0															Open	100-125	88	105	0						(5) To Drain Water (Brine) from T-1
0745	180-205					0															Closed	50-120	88	85-90	0						

EPRI/11

POWER SYSTEM TEST NO. 21
September 13, 1984

PURPOSE - OBSERVE AND RECORD WELL RESPONSE AND RECOVERY

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos
0950	275-295					0	-										-	-				120-185	89	94-98	0			12	103.0	83	(1)
1004						0	15-20										3.0				Closed				25						(2) Separator On
1004.30	300-320																														
1006.06	330-360																														
1007.00	335-365																														
1007.30	340-355																														
1008.00	345-365																														
1008.30	330-370																														
1009.00	335-365																														
1009.30	335-360																														
1010.00	335-350																														
1011.00	330-345																														
1012	325-335																														
1013	322-337																														
1014	315-332																														
1015	315-320																														
1016	310-330																														
1017	300-320																														
1018	300-315																					65-115	93	110-115	25						
1021	290-305																														
1022	290-300																														
1023	285-300																														
1024	280-298	240-270	262	<5	205	0	12-18	155-175		-	-	150-180	260			260	3.0	530-750	160-175	78	Closed	60-120	93	103-110	25	-	-				
1030	275-295	230-280	262	<5	205	0	12-18	155-180		-	-	150-180	260			260	3.0	520-720	160-175	81	Closed	80-115	93	104-110	25	-	-				
1035	270-295					50																									(3) Turbine On Full

EPRI/12

POWER SYSTEM TEST NO. 21 - (Cont'd)

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F
1037.16						50							
1037.90	275-290	240-270	262	<5	205	50	12-18	155-180		20-24	260	155-180	260
1042.47	280-290	235-270	262	<5	205	50	14-18	160-180		22-24	260	150-180	260
1100	280-295	240-275	262	<5	205	50	15-18	150-175		20-22	260	155-180	262
1130	275-290	240-275	262	<5	205	50	15-19	150-175		20-23	260	155-185	262
1145	270-285	240-275	262	<5	205	50	14-19	155-185		20-23	260	150-170	262
1150.28													
1151.00	250-270												
1152.40	225-230												
1153	218-222												
1153.30	212-218												
1154	210-215												
1154.30	205-210												
1155	195-205												
1155.30	200-205												
1156	195-200												
1157	195-200												
1159	190-202												
1201	195-210												
1202	195-210												
1204	210-220												
1206	220-225												
1208	235-245												
1212	240-260												
1216	255-270												
1218	255-275												

Time	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
1037.16																		
1037.90			260	3.0	440-790	170-200	84	Closed	80-120	92	100-110	25	480	18				
1042.47			262	3.0	450-800	160-190	86	Closed	75-115	92	100-105	25	480	18				
1100			262	3.0	450-740	165-190	90	Closed	60-120	91.5	103-110	25	480	18-19	16	103.0	79.5	
1130			262	3.0	510-750	155-180	91	Closed	65-120	91.5	105-110	25	480	19				
1145			262	3.0	520-730	155-185	91	Closed	65-120	91	105-110	25	480	19				
1150.28									120-150									(4) Turbine Off/ Separator Off
1151.00								Open				0						
1152.40										91	105-110							
1153									75-120									
1153.30									60-105									
1154									65-105									
1154.30									45-105									
1155									60-90									
1155.30									50-90									
1156									75-90									
1157									55-80	86	75-80							
1159									55-80									
1201									50-100									
1202									50-115									
1204									65-130									
1206									80-130									
1208									110-160	88	90-95							
1212									90-170	88	90-95							
1216									100-170									
1218									100-150									

POWER SYSTEM TEST NO. 21 - (Cont'd)

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos
1220	255-270																					115-170									
1222	255-270																					110-170									
1224	255-270																					110-170									
1226	255-275																					110-170	88	92-98							
1230	260-270																					110-180									
1235	260-272																					100-180									
1240	262-275																					100-180									
1245	260-275																					100-190	88	90-96							
1255	265-280																														
0100	265-280																					110-190	88	90-95							
0115	270-285																														
0120	270-285																					110-190	88	90-95							
0125	270-288																														
0145	270-290																					125-200	88	90-95							

EPRI/14

POWER SYSTEM TEST NO. 22
September 18, 1984

PURPOSE - TO DETERMINE FLOW RATE @ 100% THRU SEPARATOR

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	PCV4 Setting	PCV4 Output	P4 kPa	F4	P5 psi	T5 °F	P6 kPa	T6 °F	F6	F6a	T4 °F	PCV6 Setting	Flow Level mm	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Remarks Chart Ref. Nos.
1100	275-295					0															Closed	125-180	87	95	0	-	-				(1) Flow Rate - Using 5 Gal. Vessel @ V-North - 5 Sample Rates Average 16,118 L/hr
1112	275-300					0																125-180	87	97	0	-	-				
1116																															
1117																															(2) Separator On - Steam to Turbine Bypass Open to Drai
1118	345-370	230-270	262		205	0	10-15	110-120	248	-	-	120-140	250				3.0	580-750	120-145	54	Closed	125-160	92	115	25	-	-	21	102.4	77	
1130	305-320	200-240	260	5-10	205	0	8-12	110-130	248	-	-	115-145	250				3.0	550-705	120-145	69	Closed	60-110	92	110-115	25	-	-				
1138																															
1139	280-290	260-270	272	25	208	0	15-18	130-140	257	-	-	160-170	260				3.0	570-690	180-210	76	Closed	150-160	92	82	60 (max)	-	-				* Flow Rate - Average 5 Sample Rates = 13,818 L/hr
1146	240-270	250-270	268	20-25	212	0	13-17	115-140	250	-	-	135-155	260				3.0	500-720	150-165	80	Closed	125-150	92	90-95	60	-	-				
1200	260-280	250-275	270	20-27	212	0	14-17	130-150	255	-	-	150-190	262				3.0	510-750	170-185	82	Closed	145-170	92	95-100	60	-	-	22.5	102.4	77	
1230	275-290	270-290	272	25-40	215	0	15-18	140-160	255	-	-	170-200	265				3.0	500-740	170-195	90	Closed	140-175	92	100±2	60	-	-				Flow Rate - Average 5 Sample Rates - 19,129 L/hr
1251																															
1255	275-295	275-290	272	35-40	215	0	15-19	135-160	255	-	-	170-200	265				3.0	530-720	170-195	90	Closed	130-170	92	100-105	60	-	-				
1257																															
1258	270-285																				Open	100-150	91	90	0						(3) 4" Manual Closed - Separator Off
0200	270-290																					135-180	88	92-97				23.5	102.4	75	

EPRI/15

POWER SYSTEM TEST NO. 23
September 20, 1984

PURPOSE – TO DETERMINE FLOW RATE @ 100% THRU SEPARATOR

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °C	F4	PCV4 Setting	PCV4 Output	P5 psi	T5 °F	P6 kPa	T6 °F	Flow Level mm	PCV6 Setting	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Chart Ref #5	Remarks
0945	275-300																		Closed	140-180	87	94-98	0	–	–				1	* Note New Data Format. Flow Rate @ Silencer = 18,290 L/hr (Weir Box
0957																													2	Separator On
1000	320-340	280-320	275	35-40	215	150-170	260		0	20-25	–	–	180-220	265	530-690	3.0	190-230	40	Closed	180-220	92	96-102	60 (max)	–	–					Flow Rate @ Weir = 19,500 L/hr
1015	280-300	280-310	275	28-38	215	140-170	260		0	18-22	–	–	170-200	265	500-730	3.0	170-210	68	Closed	150-200	92	97-103	60	–	–					
1030	280-295	270-290	275	28-35	215	145-170	260		0	18-21	–	–	170-190	265	515-770	3.0	180-200	81	Closed	150-190	92	93-104	60	–	–					Flow Rate @ Weir Box = 18,830 L/hr
1100	280-295	280-290	275	30-35	215	150-170	260		0	18-20	–	–	170-195	265	520-710	3.0	175-200	87	Closed	150-190	93	96-105	60	–	–					Flow Rate @ Weir Box = 19,264 L/hr (Flow Rates Measured by Averaging 5 Sample Rates
1108																														
1115	260-275																			120-150	88	92-98	0			11.5	101.8	80		5 Gal (22.7 L) vs. Time (Segs) at V-Notch Discharge
																													3	Separator Off

Flow Rates:
90 mm = 16,646 L/hr
100 mm = 21,662 L/hr
110 mm = 27,491 L/hr

EPRI/16

POWER SYSTEM TEST NO. 24

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °C	F4	PCV4 Setting	PCV4 Output	P5 psi	T5 °F	P6 kPa	T6 °F	Flow Level mm	PCV6 Setting	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Chart Ref #5	Remarks
1130	275-295								0	0									Closed	120-190	88	95-100	0			15	102.5	70		
1133																													1	Separator On
1134	340-380	240-280	262	20-25	210	120-150	252		50	10-12			130-150	255	510-730	3.0	130-150	30	Closed	50-120	92	115-120	25	-	-					
1150	290-310	200-260	260	18-22	-	120-150	252		50	10-12			125-150	255	580-730	3.0	130-150	58	Closed	50-100	91	105-110	25	-	-					
1155																													2	Separator Off - Repair Burst - Disc
1203																													3	Separator On/ Turbine On
1207																														
1208	285-310	250-280	265	12	205	165-190	260		50	15-18	20-23	260	170-190	260	440-810	3.0	170-190	70	Closed	60-100	91	105-115	25	480	17-18					
1225									0																				4	Turbine Off
1239									50																				5	Turbine On
1245									0										Open				0						6	Separator/Turbine Off

EPRI/17

POWER SYSTEM TEST NO. 25
September 30, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °C	F4	PCV4 Setting	PCV4 Output	P5 psi	T5 °F	P6 kPa	T6 °F	Flow Level mm	PCV6 Setting	P6a kPa	T6a °F	Manual 2" Valve	P7 kPa	T7 °C	F7 mm	PVC7 Setting	W8 V	A8 Amps	Air Temp °C	Baro Press kPa	Rel Humidity	Chart Ref #5	Remarks
1144	280-290																				0	95-100	0			16	102.8	65		
1145	280-290																			50-75	92	110	0							Separator On
1147	350	220-250	255	35	210	90	240						100	240	520-730	0	100	125		50-75	92	110	0							
1150	340	240	255	35	210	90	240						100	240	590-730	3	100	150		50-75	92	110	0							
1200	295	210	250	30	210	85	240						80	240	590-730	3	100	155		40-60	92	100	0							
1215	290	210	250	30	210	80	240		50	10-12			80	240	590-730	3	100	160		30-50	92	100	20							Turbine On
1230	290	180-200	245	30	210	70	235		50	10-12	20	250	80	235	450-800	3	80-100	166		30-50	92	95-100	20	480	18					
1245	285	210	250	20	210	150	240		50	10-12	20	250	150	245		3	150	170		30-50	92	95-100	20	480	18					
1300	280-290	210-220	250	20	210	150	250		50	10-15	20	255	150	255		3	150	180		70-90	92	95-100	20	480	18					
1315	290	210	250	15	210	150	250		50	12-18	20	255	150	255		3	150	185		60-90	92	95-100	20	480	18					
1330	290	210	250	15	210	150	250		50	14-18	20	255	150	255		3	150	185		60-90	92	95-100	20	480	18					
1345	280-290	210	250	10	210	150	250		50	14-18	20	255	155	255		3	150	190		60-90	92	95-100	20	480	18					
1400	290	210	250	10	210	150	250		50	14-18	20	255	150	255		3	150	190		60-90	92	95-100	20	480	18					
1410	220																					85								Turbine Off
1420	250																					85								Well dropped off and then
1500	280																					95								recovered within 1½ hr
1515	290																					95								

POWER SYSTEM TEST NO. 26
November 11, 1984

Time	P1 kPa	P2 kPa	T2 °F	P3 kPa	T3 °C	P4 kPa	T4 °C	P5 psi	T5 °F	P6 kPa	T6 °F	P6a kPa	T6a °F	P7 kPa	T7 °C	F7 mm	Flow Level mm	PCV4 Setting	PCV4 Output	PCV6 Setting	PCV7 Setting	WB V	A8 Amps	Chart Ref #	Remarks
0850	265–275													75–125	86	100	N/A	0			0				
0856																					25				Separator On
0900	265–280	280–300	268	25	210	200–210	268	–	–	190–200	265	200	121	90–125	86	95–105	–	0		3.0	25	–	–		
0915	260–285	290–310	268	28	210	200–210	268	–	–	195–210	265	195–205	121	75–125	86	100–105	–	0	20	3.0	25	–	–		
0930	285–300	280–300	270	26	210	200–210	268	–	–	195–200	265	195–205	121	80–120	86	100–105	N/A	0	20–22	3.0	25	–	–		
0945	265–285	260–280	268	25–27	210	190–200	268	–	–	190–195	266	190	121	75–110	86	95–100	N/A	0	19–20	3.0	25	–	–		
0948																					60				
0950																									
0955	170–280	260–270	265	45	215	120	250	–	–	140–160	250	150	118	150–175				0	15	3.0	60				
1015	255–270	280–290	270	45	212	130–145	252	–	–	150–160	250	150–160	118	130–170	86	95–100	N/A	0	15–20	3.0	60	–	–		
1030	255–280	280–295	270	42	212	130–150	255	–	–	160–170	250	160	118	130–160	88	95	N/A	0	15–18	3.0	60	–	–		
1045	260–280	280–300	270	40–45	212	130–150	255	–	–	160–170	250	160	118	120–165	92	92–95	N/A	0	15–18	3.0	60	–	–		
1050																									Turbine On
1055	150–160	250	268	20	210			16–18	250	150	250	100		110	92	95	N/A	5	20	3.0	60	480	16		(Overspeeding)
								8	230													480	12		
1102																									
1104	60																								
1106	210																								

EPRI/19

APPENDIX B

EPRI CHEMISTRY DATA

TOL 10

EPRI

SPECIAL TEST DATA

ON

GEOTHERMAL FLUID CHEMISTRY

FOR

Site: Meagre Creek, British Columbia

Well: MCG-1

CONTENT:

* System Diagram
* Chemical Analysis Request(s)
* Chemical Analysis Report(s)

DATE: August 1983

Prepared by: Rockwell International as a result of field operations of EPRI's Mobile Geothermal Chemistry Lab., RP741-1

Special Test, Well MCG-1   Brine, Stream and Solids

Samples were collected on 29 July 1983; the well was flowing under stable conditions at approximately thirty percent of full flow. A sampling port (A) was available and used for collection of brine samples. The fluid sampling system was attached at port A, but no noncondensable gas was measured, indicating that the steam fraction was going to the muffler and not to port A. Only brine samples were collected at the wellhead; these included raw, acidified, flow, and sulfide samples.

The liquid fraction from the muffler was allowed to form a stream and flow down the hillside. Four raw samples were collected from the stream:

2015	~20 yards from well
2016	~75 yards from well
2017	just before the road
2018	pond near well.

Two solid samples were collected:

2019	weir box
2020	stream.

The diagram on the next page demonstrates the location of the sampling sites and flow streams.

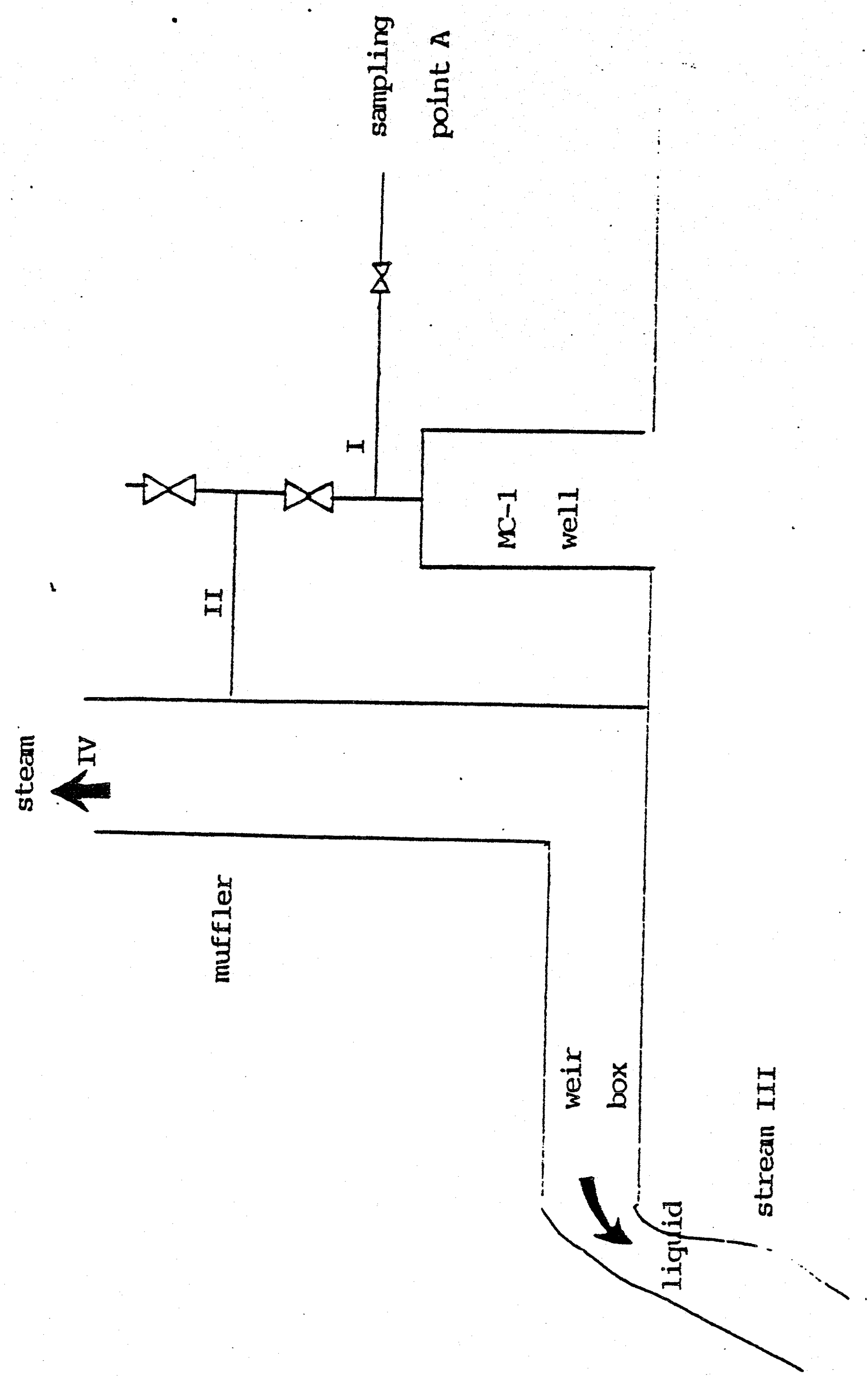
All values reported represent the samples as collected, prior to stabilization, dilution or analysis.

CHEMICAL ANALYSIS REQUEST - CHEMLAB

REQUEST NO: 83 - 8,9 TOL: 10

SITE Meagre Creek, British Columbia

System Diagram



CHEMICAL ANALYSIS REPORT - CHEMLAB

Key to Symbols

Units

mg/kg = milligrams/kg

ppm = parts/million

(M/M) = mass ratio

mv = millivolts

NTU = National Turbidity Units

μmho/cm = micromho/centimeter

N.D. = Not detected

E_H = Oxidation-reduction potential with respect to the standard hydrogen electrode

L = liter

T = temperature

P = pressure

AA = atomic absorption

API = American Petroleum Institute

V = volume

kg = kilogram

g/ml = grams/milliliter

ZnAc = zinc acetate

Sample Type

H_2S	--	Trapped in zinc acetate with ΔT sampling. Collected in polyethylene bottle.
CO_2	--	Trapped in NaOH with ΔT sampling. Collected in polyethyelene bottle.
Si	--	Diluted without pre-cooling 1 part sample to 9 parts distilled water ice. Collected in polyethylene bottle.
R	--	Raw sample with ΔT sampling collected in acid washed and thoroughly rinsed polyethylene bottle.
A	--	Acidified.10 ml conc. HNO_3 + 990 ml sample with ΔT sampling. Collected in acid washed polyethylene bottle.
G	--	Gas sample. Collected by ΔP sampling in teflon-lined stainless steel bomb unless otherwise noted.
C	--	Condensate sample. Taken by ΔP sampling from boiling water condenser separator.
F	--	Flow through sampling probe. Sample analyzed at time of sampling.
FSS	--	Fluid sampling system was used to collect T, P, and flow data in calculations
S	--	Deposited Scale

Sample Modes

ΔT	--	Temperature drop
ΔP	--	Pressure drop
Scale	--	Scrapings

CHEMICAL ANALYSIS REPORT - CHEMLAB

TOL 10

SITE Meagre Creek, British Columbia

Test Special

Sample				Flow Stream				Chronology		
Source	No.	Type	Mode	No.	T °C	P psig	F. Rate %	Date 83	Time	Note Book
EPRI	2000	R	ΔT	I	94	56	∿30	7-29	1253	XVIII, 50
EPRI	2001	A	ΔT	I	94	56	∿30	7-29	1301	XVIII, 50
EPRI	2002	F	ΔT	I	94	37	∿30	7-29	1225-1240	XVIII, 49
EPRI	2003	SAOB	ΔT	I	94	56	∿30	7-29	1253	XVIII, 50
EPRI	2004	SAOB	ΔT	I	94	56	∿30	7-29	1254	XVIII, 50
EPRI	2005	SAOB	ΔT	I	94	56	∿30	7-29	1256	XVIII, 50
EPRI	2006	CO_2	ΔT	I	94	56	∿30	7-29	1246	XVIII, 50
EPRI	2007	CO_2	ΔT	I	94	52	∿30	7-29	1248	XVIII, 50
EPRI	2008	CO_2	ΔT	I	94	52	∿30	7-29	1250	XVIII, 50
EPRI	2009A	Si	ΔP	I	94	52	∿30	7-29	1000	XVIII, 50
EPRI	2009B	Si	ΔP	I	94	52	∿30	7-29	1001	XVIII, 50
EPRI	2010	CO_2-blk	--	--	--	--	--	7-29	1250	XVIII, 50
EPRI	2011	Si-blk	--	--	--	--	--	7-29		XVIII, 50
EPRI	2012	Si-blk	--	--	--	--	--	7-29	1000	XVIII, 50
EPRI	2015	R	--	III	44	amb	--	7-29	1000	XVIII, 50
EPRI	2016	R	--	III	36	amb	--	7-29	1330	XVIII, 50
EPRI	2017	R	--	III	28	amb	--	7-29	1335	XVIII, 50
EPRI	2018	R	--	III	61	amb	--	7-29	1337	XVIII, 50
EPRI	2019	S	--	III	--	amb	--	7-29	1339	XVIII, 50
EPRI	2020	S	--	III	--	amb	--	7-29	1444	XVIII, 50
								7-29	1451	XVIII, 50

CHEMICAL ANALYSIS REPORT

CHEMLAB

KIND OF TEST: special, solids

SAMPLE NUMBER: 2019

LOCATION: weir box

DATE	METHOD	MAJOR CONSTITUENTS	MINOR CONSTITUENTS
9-9	XRD	$CaCO_3$	Fe_3O_4
	XRF	Ca	Fe, Sr

COMMENTS: $CaCO_3$ - aragonite and calcite present

Fe_3O_4 - magnetite

XRF scans elements Al - U only (Na, Mg, O not accessible)

CHEMICAL ANALYSIS REPORT - CHEMLAB

Kind of Test: Special, brine

SAMPLE			ANALYSIS				QUALITY CONTROL			NOTEBOOK
No.	Type	Mode	Date 83	Analyte	Value/ Sample	Units	Method	Detection Limit	Measurement Accuracy	Reference
2000	R	ΔT	8-9	TDS	3410	mg/1	Gravimetry	20	130(3)	XVIII, 62
2002	F	ΔT	7-29	conductivity @28 °C	5.5×10^3	umho/cm	Wheatstone Bridge	--	0.6×10^3(3)	XVIII, 49
2002	F	ΔT	7-29	pH @ 32°C	6.58	--	Glass Electrode	--	0.05(1)	XVIII, 49
2002	F	ΔT	7-29	E_H @ 28°C	-52	mV	Redox Electrode	--	5(1)	XVIII, 49
2002	F	ΔT	7-29	Dissolved O_2	5	ppb	DO Kits	1	1(3)	XVIII, 49
2001	A	ΔT	8-15	As	0.801	mg/1	AAS	0.004	0.036(3)	XVIII, 71
2000	R	ΔT	8-8	B	14.8	mg/1	Colorimetry	0.5	1.1(3)	XVIII, 57
2001	A	ΔT	8-9	Ca	33.6	mg/1	AAS	0.03	1.2(3)	XVIII, 61
2000	R	ΔT	8-3	Cl	1690	mg/1	Coulometric Titration	350	20(5)	XX, 32
2001	A	ΔT	8-10	Fe	0.20	mg/1	AAS	0.10	0.1(3)	XVIII, 65
2001	A	ΔT	8-10	K	101	mg/1	AAS	0.03	1	XVIII, 60
2001	A	ΔT	8-9	Mg	1.09	mg/1	AAS	0.005	0.01(3)	XVIII, 58
2001	A	ΔT	8-9	Na	1140	mg/1	AAS	0.02	10(3)	XVIII, 64
2003-5	SAOB	ΔT	8-2	$S^=$, total	0.64	mg/1	Ion Selective Electrode	0.5	0.25(3)	XVIII, 53
2000	R	ΔT	8-11	Si	154	mg/1	AAS	2	1(3)	XVIII, 68

CHEMICAL ANALYSIS REPORT

CHEMLAB

KIND OF TEST: special, solids

SAMPLE NUMBER: 2020

LOCATION: stream

DATE	METHOD	MAJOR CONSTITUENTS	MINOR CONSTITUENTS
9-9	XRF	Ca, Si	Fe

COMMENTS: XRD showed no crystalline phases present; solid appears to be an amorphous silicate

XRF scans elements Al - U only (Na, Mg, O not accessible)

CHEMICAL ANALYSIS REPORT - CHEMLAB

Kind of Test: Special, stream

SAMPLE			ANALYSIS				QUALITY CONTROL			NOTEBOOK
No.	Type	Mode	Date 83	Analyte	Value/ Sample	Units	Method	Detection Limit	Measurement Accuracy	Reference
2015	R	-	8-8	B	18.2	mg/l	Colorimetry	0.5	1.4(1)	XVIII, 57
2016	R	-	8-8	B	17.3	mg/l	Colorimetry	0.5	1.3(1)	XVIII, 57
2017	R	-	8-8	B	9.9	mg/l	Colorimetry	0.5	0.7(1)	XVIII, 57
2018	R	-	8-8	B	16.4	mg/l	Colorimetry	0.5	1.2(1)	XVIII, 57
2015	R	-	8-3	Cl	1990	mg/l	Coulometric Titration	350	10(3)	XX, 32
2016	R	-	8-3	Cl	2060	mg/l	Coulometric Titration	350	10(3)	XX, 32
2017	R	-	8-3	Cl	1250	mg/l	Coulometric Titration	350	40(4)	XX, 32
2018	R	-	8-3	Cl	1840	mg/l	Coulometric Titration	350	20(4)	XX, 32

APPENDIX C

GEOCHEMICAL ANALYSIS RESULTS

MEAGER CREEK GEOTHERMAL PROJECT WELL MC-2 GEOCHEMICAL ANALYSIS RESULTS

DATE: 15 JUN 84

Sample Number	Comments	pH	Silica	Cl	F	SO_4	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO_2	NH_4
02/06/82				970.00											
03/06/82	unpreserved		230.0					7.8	720.0	74.0	28.0	4.2	2.30		
03/06/82	pH @ 21.4C	8.5	240.0	999.00	0.80	200.0	<.05	5.6	740.0	72.0	33.0	4.3	2.30	106.0	<.5
06/06/82	pH @ 23C	8.5		960.00										106.0	
08/06/82	unpreserved		210.0					7.7	700.0	72.0	27.0	3.7	2.30		
08/06/82	pH @ 23.6C	8.3		960.00										109.0	
21/10/82 2400			170.0	720.00					520.0	53.0	29.0				
22/10/82 0800		8.8	260.0	580.00	0.80	180.0	0.26	3.1	400.0	28.0	50.0	1.5	1.20	30.0	<.5
23/10/82 1000		8.6	430.0	1070.00	1.50	160.0	0.23	6.8	700.0	58.0	58.0	1.7	2.00	42.0	<.5
23/10/82 0200			340.0	870.00					580.0	49.0	810.0				
23/10/82 2400			430.0	1220.00					77.0	73.0	50.0				
24/10/82 1400	pH @ 20.6C	2.4	440.0	1340.00	1.50	160.0	0.17	9.4	820.0	77.0	55.0	1.8	2.30	11.0	<.5
25/10/82 0600	pH @ 20.8C	8.7	470.0	1490.00	1.60	150.0	0.47	10.5	950.0	93.0	49.0	0.6	2.60	32.0	<.5
25/10/82 0200			480.0	1390.00					890.0	84.0	56.0				
13/11/82 1000	pH @ 21.3C	8.3	270.0	1820.00	1.50	180.0	0.58	12.7	1160.0	92.0	130.0	6.6	3.10	41.0	<.5
13/11/82 1145		7.8	240.0	7100.00	2.30	960.0	0.22	20.1	2120.0	200.0	450.0	6.5	6.40	56.0	1.9
13/11/82 1400		9.1	320.0	3010.00	2.60	420.0	0.95	19.9	2010.0	180.0	140.0	6.3	5.20	31.0	<.5
13/11/82 1600		8.5	410.0	1760.00	1.80	160.0	0.75	12.8	1110.0	92.0	100.0	9.1	3.00	42.0	<.5
13/11/82 1800		8.5	430.0	1990.00	2.20	190.0	0.77	12.9	1190.0	104.0	180.0	17.0	13.20	25.0	<.5
13/11/82 1900		7.8	130.0	8350.00	7.20	1400.0	0.60	52.0	5250.0	450.0	760.0	2.2	15.00	58.0	<.5

NOTES: "<" designates below detection limit. All values in ppm (mg/l)

Analysis by B.C. Hydro - Surrey Research Lab

MEAGER CREEK GEOTHERMAL PROJECT

WELL MC-3 GEOCHEMICAL ANALYSIS RESULTS

DATE: 15 JUN 84

Sample Number	Comments	pH	Silica	Cl	F	SO_4	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO_2	NH_4
15/10/82 1700			170.0	770.00					590.0	44.0	26.0				
16/10/82 1900		9.1	340.0	850.00	1.70	420.0	0.06	6.0	770.0	52.0	32.0	0.8	1.70	101.0	<.5
16/10/82 0100		8.8	300.0	740.00	1.20	350.0	<.05	4.8	660.0	44.0	15.0	0.7	1.50	107.0	<.5
16/10/82 1000			300.0	820.00					750.0	55.0	24.0				
19/10/82 2000			250.0	1370.00					1060.0	76.0	41.0				
20/10/82 1600		9.6	450.0	1360.00	2.60	590.0	0.26	10.4	1180.0	78.0	106.0	2.7	2.40	39.0	<.5
20/10/82 1000			270.0	1430.00					1090.0	84.0	32.0				
21/10/82 1000		8.5	260.0	470.00	1.20	400.0	0.30	9.6	1130.0	79.0	26.0	2.9	2.60	114.0	<.5
21/10/82 2400			340.0	1090.00					930.0	69.0	25.0				
21/10/82 1400			320.0	980.00					840.0	63.0	52.0				
25/10/82 2000	pH @ 21C	8.3	240.0	250.00	0.70	370.0	<.05	1.6	290.0	27.0	50.0	1.9	0.70	68.0	<.5
26/10/82 0400	pH @ 20.9C	8.4	290.0	450.00	1.00	390.0	<.05	3.3	450.0	37.0	26.0	1.8	1.00	87.0	<.5
26/10/82 2000		9.3	380.0	900.00	1.80	550.0	0.12	6.1	810.0	61.0	118.0	2.3	1.70	91.0	<.5
26/10/82 1200			290.0	674.00					620.0	46.0	25.0				
27/10/82 0900	pH @ 21C	8.7	320.0	750.00	1.20	390.0	0.06	5.1	630.0	51.0	28.0	2.4	1.40	111.0	<.5
27/10/82 2000			240.0	1270.00					1000.0	64.0	40.0				
28/10/82 1000	pH @ 21.2C	9.1	290.0	960.00	1.20	390.0	0.13	7.1	800.0	59.0	12.0	0.9	1.70	61.0	<.5
02/11/82 1400	pH @ 21.3C	8.8	320.0	950.00	1.30	360.0	0.16	6.7	770.0	57.0	20.0	1.6	1.80	101.0	<.5
02/11/82 2200		8.6	330.0	960.00	1.40	390.0	0.14	7.3	800.0	58.0	25.0	2.2	1.90	112.0	<.5
09/11/82 1200		8.8	340.0	1330.00	1.30	340.0	0.42	8.9	960.0	70.0	19.0	1.4	2.30	107.0	<.5
09/11/82 2000		9.0	280.0	1270.00	1.70	390.0	0.40	9.3	970.0	66.0	29.0	1.9	2.30	90.0	<.5
09/11/82 1600			320.0	1240.00					970.0	69.0	16.0				
11/11/82 1436	pH @ 21.3C	8.9	300.0	1280.00	1.40	350.0	0.33	9.9	970.0	71.0	13.0	0.8	2.30	120.0	<.5
11/11/82 1834		9.0	240.0	1370.00	1.90	410.0	0.43	9.7	1010.0	71.0	35.0	1.3	2.40	71.0	<.5
11/11/82 1248			290.0	1440.00					1150.0	76.0	17.0				
11/11/82 1634			320.0	1210.00					970.0	68.0	12.0				

NOTES: "<" designates below detection limit   All values in ppm (mg/l)

Analysis by B.C. Hydro - Surrey Research Lab

MEAGER CREEK GEOTHERMAL PROJECT
GEOCHEMICAL ANALYSIS RESULTS

Location	Sample Number	Parameter	Comments	pH	Silica	Cl	F	SO	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO	Hg	NH
MC-1	WM-32	WEBER SEP	pH @ 19.6C	6.7	87.0	1060.00	0.15	950.0	0.07	9.2	820.0	48.0	410.0	97.0	1.70	990.0		-.5
MC-1	WM-35	WEBER SEP	pH @ 21.0C	7.0	140.0	870.00	0.40	400.0	0.09	7.2	700.0	69.0	3.0	65.0	2.00	966.0		-.5
MC-1	WM-36	WEBER SEP	pH @ 19.7C	7.7	21.0	0.55	-.10	-5.0	-.01	-1.0	24.0	1.6	15.0	3.5	-.10	50.0		-.5
MC-1	15/03/82					1230.00												
MC-1	17/03/82		pH @ 21.1C	8.4	430.0	1440.00	2.90	210.0	0.39	7.9	1050.0	74.0	26.0	0.2	2.50	74.0		-.5
MC-1	24/03/82					1270.00												
MC-1	31/03/82					1310.00												
MC-1	04/04/82					1260.00												
MC-1	20/04/82					1410.00												
MC-1	10/06/82					1570.00												
MC-1	07/07/82		pH @ 20.2C	8.3	320.0	1660.00	2.10	160.0	0.75	11.0	1130.0	84.0	36.0	0.2	3.30	80.0		0.8
MC-1	09/07/82	WEBER SEP		6.3	350.0	1640.00	2.20	150.0	0.65	10.8	1100.0	80.0	31.0	0.4	3.10	53.0		0.9
MC-1	22/07/82 a.m. 1		pH @ 22.6C	8.6	300.0	1770.00	2.20	160.0	0.07	9.7	1160.0	82.0	43.0	0.2	2.90	64.0		-.5
MC-1	22/07/82 p.m. 2			8.5	300.0	1520.00	2.00	140.0	0.05	8.6	980.0	74.0	42.0	0.5	2.50	54.0		-.5
MC-1	22/07/82 WEB #1	WEBER SEP		7.9	280.0	1680.00	2.20	150.0	0.08	9.3	1100.0	80.0	44.0	0.2	2.80	79.0		-.5
MC-1	22/07/82 WEB #2	WEBER SEP		8.2	340.0	1690.00	2.20	150.0	0.13	9.2	1110.0	82.0	46.0	0.3	2.80	71.0		-.5
MC-1	17/08/82 1000		pH @ 20.2C	8.3	363.0	1780.00	2.10	140.0	0.77	11.8	1100.0	88.0	39.0	0.6	2.90	52.0		0.5
MC-1	10/09/82 0900		pH @ 20C	8.3	370.0	1360.00	1.40	210.0	0.76	9.8	870.0	74.0	134.0	1.4	2.50	245.0		-.5
MC-1	12/09/82 0400		pH @ 20.3C	8.1	324.0	2130.00	2.30	220.0	0.39	14.6	1400.0	102.0	60.0	0.3	3.40	119.0		-.5
MC-1	13/09/82 1300		pH @ 20.6C	7.5	280.0	2190.00	2.20	150.0	0.98	14.8	1350.0	105.0	91.0	0.6	13.60	32.0		-.5
MC-1	14/09/82 1030		pH @ 22.3C	8.5	171.0	1940.00	2.60	140.0	0.56	14.0	1320.0	106.0	73.0	0.6	3.30	70.0		0.5
MC-1	14/09/82 1100			8.3	168.0	1980.00	2.80	140.0	0.64	13.6	1310.0	114.0	62.0	0.4	3.30	50.0		-.5
MC-1	14/09/82 1200			8.2	159.0	2000.00	2.70	150.0	0.73	14.1	1330.0	106.0	54.0	0.4	3.50	50.0		-.5
MC-1	14/09/82 1100	WEBER SEP		8.0	185.0	1790.00	2.60	120.0	0.59	12.1	1140.0	104.0	55.0	0.4	3.20	50.0		0.7
MC-1	14/09/82 1130	WEBER SEP		8.2	165.0	1910.00	2.70	130.0	0.73	13.6	1220.0	104.0	53.0	0.4	3.20	48.0		0.5
MC-1	25/09/82		pH @ 19.9C	8.4	373.0	1930.00	2.20	150.0	0.62	13.1	1210.0	94.0	36.0	0.6	3.20	46.0		0.6
MC-1	27/09/82		pH @ 20.1C	8.5	376.0	1940.00	2.00	140.0	0.58	12.4	1210.0	95.0	37.0	0.8	3.10	41.0		-.5
MC-1	01/10/82		pH @ 19.3C	8.3	374.0	1990.00	2.30	140.0	0.80	13.4	1260.0	99.0	37.0	1.0	3.30	57.0		-.5
MC-1	09/10/82	WEIRBOX	pH @ 19.2C	8.3	217.0	1930.00	2.30	130.0	0.84	13.0	1250.0	98.0	37.0	1.0	3.30	50.0		0.5
MC-1	18/10/82 1200			8.4	390.0	2070.00	2.10	130.0	0.89	13.0	1290.0	100.0	38.0	0.8	3.40	46.0		-.5
MC-1	21/10/82 1200				370.0	1990.00					1200.0	104.0	39.0					
MC-1	23/10/82 1200			8.3	370.0	1990.00	2.10	120.0	0.77	12.8	1260.0	97.0	40.0	0.8	3.30	52.0		-.5
MC-1	24/10/82 1200			8.2	390.0	2030.00	2.00	130.0	0.30	13.2	1320.0	100.0	37.0	1.0	3.40	69.0		-.5
MC-1	25/10/82 1200			8.2	400.0	2040.00	2.10	130.0	0.70	13.8	1320.0	101.0	37.0	1.0	3.40	68.0		-.5
MC-1	28/10/82 2400			8.7	340.0	1090.00	1.80	170.0	0.11	7.6	740.0	59.0	33.0	0.8	2.00	51.0		-.5

NOTES: "-" designates below detection limit

All values in ppm (mg/l)

Location	Sample Number	Parameter	Comments	pH	Silica	Cl	F	SO	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO	Hg	NH
MC-1	29/10/82 0800			8.2	370.0	1720.00	1.90	160.0	0.07	11.6	1130.0	92.0	47.0	1.0	2.90	52.0		-.5
MC-1	29/10/82 2400			8.7	400.0	2210.00	2.30	190.0	0.23	14.5	1440.0	114.0	82.0	1.5	3.70	54.0		-.5
MC-1	29/10/82 1600				400.0	1830.00					1190.0	99.0	59.0					
MC-1	30/10/82 0800			8.6	290.0	2020.00	2.00	170.0	0.20	13.7	1310.0	101.0	74.0	4.6	3.40	51.0		-.5
MC-1	30/10/82 2400			8.4	330.0	2210.00	2.60	190.0	0.10	15.0	1420.0	106.0	64.0	20.0	3.60	63.0		-.5
MC-1	30/10/82 1600				380.0	2070.00					1330.0	104.0	87.0					
MC-1	31/10/82 0830			8.1	330.0	2270.00	2.80	170.0	0.32	15.4	1480.0	126.0	65.0	23.0	3.90	61.0		-.5
MC-1	06/11/82 1200				310.0	1660.00					1050.0	76.0	41.0					
MC-1	07/11/82 1200		pH @ 21.3C	8.4	360.0	1940.00	1.90	150.0	0.79	12.6	1190.0	97.0	41.0	1.2	3.30	43.0		-.5
MC-1	08/11/82 1200				370.0	2010.00					1270.0	98.0	40.0					
MC-1	09/11/82 1200		pH @ 21.3C	8.2	340.0	1870.00	1.80	130.0	0.85	11.9	1170.0	95.0	37.0	1.2	3.20	46.0		-.5
MC-1	10/11/82 1213				400.0	2200.00					1420.0	112.0	44.0					
MC-1	11/11/82 0715		pH @ 21.3C	8.3	370.0	1990.00	1.90	140.0	1.00	12.8	1210.0	100.0	37.0	1.2	3.30	45.0		-.5
MC-1	11/11/82 0945	BLEEDLINE		8.3	390.0	2030.00	2.00	130.0	1.00	13.4	1220.0	100.0	37.0	1.3	3.50	48.0		-.5
MC-1	11/11/82 0945	WEIRBOX		8.3	360.0	1940.00	1.90	130.0	0.88	12.2	1180.0	96.0	36.0	1.2	3.30	45.0		0.5
MC-1	15/11/82 1200			8.1	220.0	1210.00	1.30	86.0	0.49	8.1	750.0	61.0	36.0	1.7	1.90	46.0		-.5
MC-1	19/11/82 1100				360.0	2010.00					1240.0	99.0	39.0					
MC-1	20/11/82 1100		pH @ 21.3C	8.3	360.0	1980.00	2.00	130.0	0.89	13.1	1270.0	100.0	37.0	1.2	3.20	45.0		-.5
MC-1	21/11/82 1100				360.0	1990.00					1240.0	95.0	36.0					
MC-1	23/11/82 1100		pH @ 21.3C	8.3	360.0	1970.00	2.00	130.0	1.00	12.8	1270.0	100.0	36.0	1.3	3.20	44.0		-.5
MC-1	23/11/82 1400	WEBER SEP		7.0	260.0	1490.00	1.50	96.0	0.65	10.3	940.0	75.0	27.0	0.9	2.40	54.0		1.0
MC-1	24/11/82 1100				360.0	1990.00					1260.0	103.0	37.0					
MC-1	28/11/82 A.M.	WHP 137	pH @ 21C	8.3	370.0	1990.00	2.00	140.0	0.88	13.3	1280.0	93.0	36.0	1.3	3.30	39.0		-.5
MC-1	01/12/82 P.M.	WHP 137		8.3	390.0	1990.00	2.00	130.0	0.88	13.3	1280.0	93.0	37.1	1.4	3.30	40.0		-.5
MC-1	06/12/82 1400	WHP 136		8.2	370.0	1990.00	2.00	140.0	0.87	13.5	1270.0	93.0	36.5	1.4	3.30	41.0		-.5
MC-1	09/12/82 1400	WHP 137		8.3	380.0	2000.00	2.00	140.0	1.00	13.8	1260.0	92.0	36.5	1.4	3.20	37.0		-.5
MC-1	12/12/82 1000	WHP 138		8.3	380.0	2080.00	2.00	140.0	0.96	13.4	1260.0	93.0	36.0	1.4	3.30	39.0		-.5
MC-1	15/12/82 0900	WHP 138		8.4	380.0	1990.00	2.00	140.0	0.96	13.8	1270.0	92.0	35.5	1.4	3.30	38.0		-.5
MC-1	19/12/82 0900	WHP 140		8.3	370.0	1990.00	2.00	140.0	0.93	13.6	1280.0	93.0	36.0	1.4	3.40	38.0		-.5
MC-1	23/12/82 0900		pH @ 21.6C	8.3	390.0	2000.00	2.10	130.0	0.85	14.0	1310.0	110.0	36.0	1.6	3.20	44.0		-.5
MC-1	26/12/82 1200			8.3	370.0	1990.00	2.10	130.0	1.00	13.4	1290.0	110.0	37.0	1.5	3.30	44.0		-.5
MC-1	29/12/82 1200			8.3	370.0	2010.00	2.10	140.0	0.92	13.6	1290.0	113.0	46.0	1.4	3.30	44.0		-.5
MC-1	02/01/83 1600			8.7	380.0	1980.00	2.10	140.0	0.84	13.6	1290.0	110.0	37.0	1.4	3.20	66.0		-.5
MC-1	05/01/83 1300		pH @ 21.3C	8.2	380.0	1980.00	1.90	130.0	1.10	14.0	1270.0	112.0	36.0	1.4	3.10	45.0		-.5
MC-1	09/01/83 0900			8.2	370.0	1970.00	1.90	120.0	1.00	13.5	1270.0	118.0	36.0	1.4	3.10	45.0		-.5

NOTES: "-" designates below detection limit   All values in ppm (mg/l)

MEAGER CREEK GEOTHERMAL PROJECT
GEOCHEMICAL ANALYSIS RESULTS

Location	Sample Number	Parameter	Comments	pH	Silica	Cl	F	SO	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO	Hg	NH
MC-1	13/01/83 1500			8.2	390.0	1990.00	2.00	120.0	0.92	14.0	1280.0	112.0	36.0	1.3	3.10	45.0		-.5
MC-1	16/01/83 1500			8.2	380.0	1990.00	2.00	120.0	1.10	13.8	1280.0	118.0	36.0	1.3	3.20	45.0		-.5
MC-1	20/01/83 1300			8.3	360.0	1960.00	1.90	120.0	1.10	13.9	1280.0	120.0	38.0	1.3	3.10	45.0		-.5
MC-1	30/01/83 0900			8.4	350.0	2100.00	2.10	130.0	1.10	15.0	1380.0	125.0	45.0	1.2	3.30	47.0		-.5
MC-1	02/02/83 1200			8.6	390.0	2280.00	2.50	130.0	1.10	15.1	1520.0	117.0	58.0	0.7	3.90	8.6		-.5
MC-1	06/02/83 1730			8.5	350.0	1930.00	2.20	140.0	1.00	13.6	1360.0	106.0	52.0	0.4	3.40	38.0		-.5
MC-1	09/02/83 1500			7.1	360.0	1870.00	1.90	120.0	1.00	12.7	1180.0	97.0	55.0	3.8	3.20	126.0		-.5
MC-1	13/02/83 2030			8.6	390.0	2220.00	2.30	140.0	1.10	15.1	1420.0	110.0	45.0	0.2	3.70	40.0		-.5
MC-1	19/02/83 1200			8.4	370.0	2090.00	2.20	150.0	1.10	14.0	1320.0	106.0	39.0	1.1	3.60	42.0		-.5
MC-1	24/02/83 0900			8.4	380.0	2100.00	2.20	140.0	1.10	14.1	1330.0	107.0	38.0	1.3	3.60	35.0		-.5
MC-1	27/02/83 0900			8.4	380.0	2080.00	2.10	160.0	1.00	14.0	1290.0	109.0	38.0	1.4	3.60	35.0		-.5
MC-1	02/03/83 1330		pH @ 21C	8.4	380.0	2060.00	2.80	130.0	1.00	14.4	1300.0	117.0	39.0	1.5	3.40	33.0		-.5
MC-1	06/03/83 0900			8.3	370.0	2040.00	2.70	130.0	1.00	14.3	1330.0	116.0	39.0	1.5	3.40	36.0		-.5
MC-1	09/03/83 0900			8.4	370.0	2030.00	2.70	130.0	1.00	14.0	1320.0	114.0	39.0	1.5	3.40	34.0		-.5
MC-1	13/03/83 0900			8.4	380.0	2060.00	2.80	130.0	1.00	13.9	1320.0	109.0	40.0	1.4	3.40	35.0		-.5
MC-1	16/03/83 0900			8.4	380.0	2050.00	2.70	130.0	1.00	13.6	1310.0	111.0	38.0	1.5	3.30	34.0		-.5
MC-1	20/03/83 0900			8.4	380.0	2040.00	2.70	130.0	0.90	14.5	1280.0	110.0	39.0	1.5	3.40	34.0		-.5
MC-1	23/03/83 0900			8.4	380.0	2040.00	2.70	130.0	1.00	13.8	1290.0	114.0	39.0	1.5	3.40	34.0		-.5
MC-1	27/03/83 0900			8.4	370.0	2030.00	2.70	130.0	0.90	14.6	1310.0	113.0	40.0	1.5	3.30	34.0		-.5
MC-1	30/03/83			8.5	380.0	2060.00	2.00	140.0	0.80	15.0	1290.0	110.0	38.6	1.3	3.40	40.0		-.5
MC-1	03/04/83			8.5	410.0	2230.00	2.20	140.0	0.90	16.0	1420.0	120.0	41.9	0.5	3.50	42.0		-.5
MC-1	06/04/83			8.4	410.0	2130.00	2.20	130.0	0.70	15.0	1320.0	110.0	38.8	0.4	3.50	42.0		-.5
MC-1	10/04/83			8.4	310.0	2060.00	2.00	140.0	0.80	14.0	1320.0	110.0	37.6	1.4	3.40	43.0		-.5
MC-1	14/04/83			8.4	370.0	2030.00	2.00	140.0	0.70	14.0	1310.0	120.0	36.2	1.5	3.40	43.0		-.5
MC-1	18/04/83			8.4	380.0	2040.00	2.00	140.0	0.80	13.0	1280.0	110.0	36.2	1.6	3.30	43.0		-.5
MC-1	21/04/83			8.4	380.0	2020.00	1.90	140.0	0.90	14.0	1360.0	120.0	37.9	1.6	3.30	44.0		-.5
MC-1	24/04/83			8.4	390.0	2010.00	1.90	140.0	1.00	14.0	1260.0	110.0	36.0	1.6	3.30	43.0		-.5
MC-1	27/04/83			8.4	390.0	2020.00	1.90	140.0	1.00	14.0	1310.0	110.0	36.5	1.6	3.40	42.0		-.5
MC-1	01/05/83			8.4	380.0	2010.00	1.90	140.0	0.90	14.0	1280.0	110.0	36.1	1.6	3.30	43.0		-.5
MC-1	04/05/83			8.4	380.0	2010.00	1.90	130.0	1.10	15.0	1270.0	110.0	34.2	1.6	3.30	40.0		-.5
MC-1	08/05/83			8.4	350.0	2000.00	1.90	140.0	0.90	15.0	1290.0	110.0	36.0	1.6	3.40	43.0		-.5
MC-1	12/05/83 0930		pH @ 22C	8.4	370.0	2000.00	2.20	140.0	1.00	14.0	1280.0	100.0	35.0	1.5	3.20	43.0		-.5

NOTES: "-" designates below detection limit

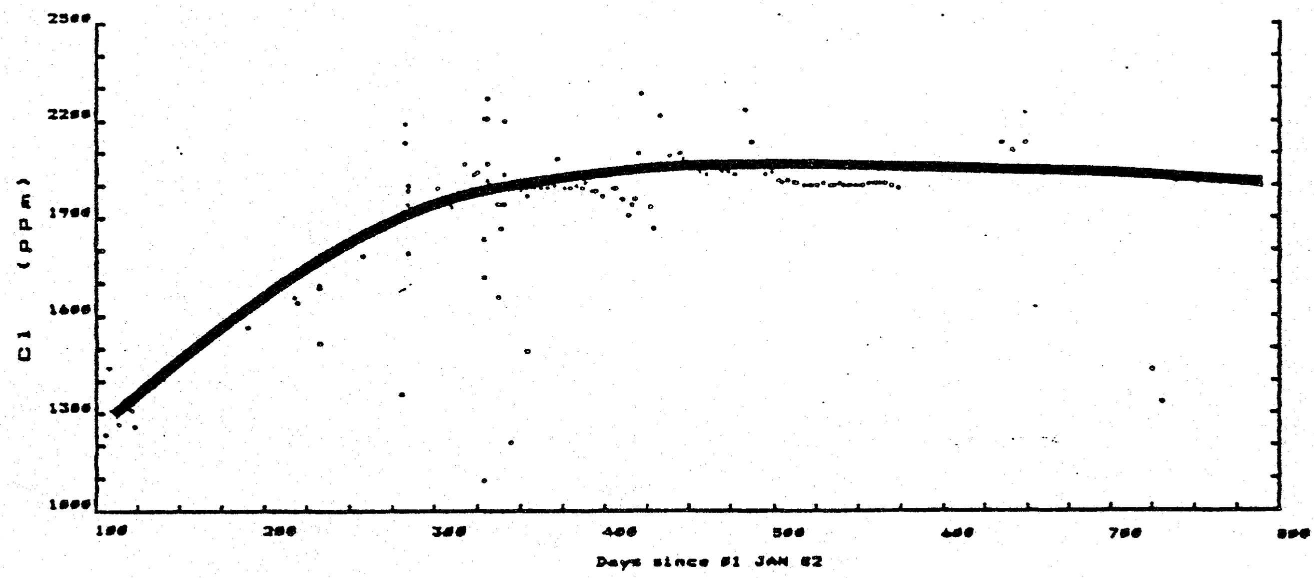
All values in ppm (mg/l)

MEAGER CREEK GEOTHERMAL PROJECT
GEOCHEMICAL ANALYSIS RESULTS

Location	Sample Number	Parameter	Comments	pH	Silica	Cl	F	SO	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO	Hg	NH
MC-1	05/06/83 0900			8.3	380.0	2000.00	2.20	130.0	1.00	14.0	1350.0	110.0	34.0	1.5	3.20	42.0		-.5
MC-1	09/06/83 0900		pH @ 22C	8.4	370.0	2000.00	2.20	120.0	1.20	14.0	1250.0	100.0	34.0	1.5	3.20	44.0		-.5
MC-1	12/06/83 0900			8.4	370.0	2000.00	2.20	150.0	1.00	14.0	1240.0	100.0	34.0	1.5	3.20	41.0		-.5
MC-1	16/06/83			8.3	370.0	2010.00	2.20	150.0	1.00	14.0	1240.0	100.0	34.0	1.5	3.30	44.0		-.5
MC-1	19/06/83			8.4	360.0	2010.00	2.20	150.0	1.00	14.0	1240.0	100.0	34.0	1.5	3.30	44.0		-.5
MC-1	22/06/83		pH @ 20 C	8.4	400.0	2010.00	2.10	150.0	0.90	14.0	1270.0	110.0	33.0	1.7	3.30	43.0		0.3
MC-1	26/06/83			8.3	350.0	2010.00	2.10	160.0	0.80	14.0	1270.0	110.0	33.0	1.6	3.30	42.0		0.3
MC-1	29/06/83			8.4	350.0	2000.00	2.10	150.0	0.70	14.0	1270.0	110.0	33.0	1.6	3.40	41.0		0.3
MC-1	03/07/83			8.4	340.0	1990.00	2.00	150.0	0.70	14.0	1260.0	110.0	32.0	1.6	3.40	41.0		0.3
MC-1	04/09/83			8.2	280.0	2130.00	2.40	150.0	1.00	15.0	1360.0	110.0	53.0	0.7	3.60	69.0		0.3
MC-1	11/09/83		pH @ 25 C	8.3	340.0	2110.00	2.50	120.0	0.90	15.0	1370.0	110.0	49.0	1.0	3.50	61.0		0.1
MC-1	18/09/83			8.3	360.0	2130.00	2.60	130.0	1.00	15.0	1370.0	120.0	50.0	1.0	3.50	58.0		0.1
MC-1	09/10/83			8.4	340.0	2040.00	2.50	130.0	0.90	14.0	1320.0	120.0	36.0	1.4	3.50	39.0		0.1
MC-1	16/10/83			8.4	330.0	2030.00	2.40	130.0	0.90	14.0	1300.0	120.0	36.0	1.5	3.50	38.0		0.1
MC-1	23/10/83			8.3	340.0	2030.00	2.50	140.0	0.80	14.0	1260.0	110.0	35.0	1.5	3.50	38.0		0.1
MC-1	05/12/83 0900		PH @ 23 C	8.5	220.0	1430.00	2.00	88.0	0.90	14.0	1330.0	120.0	34.0	1.4	3.40	29.0		0.1
MC-1	05/12/83		DUPLICATE, pH@21C	8.3	270.0	2030.00	1.60	140.0	0.70	11.0	1040.0	90.0	26.0	1.1	2.80	36.0		0.2
MC-1	11/12/83 0900		PH @ 23 C	8.5	280.0	1330.00	1.70	83.0	0.70	12.0	1090.0	92.0	27.0	1.1	2.90	28.0		-.1
MC-1	11/12/83		DUPLICATE, pH@21C	8.3	320.0	2020.00	1.80	150.0	0.70	12.0	1180.0	100.0	29.0	1.3	3.10	36.0		0.1
MC-1	18/12/83 0900		PH @ 23 C	8.4	280.0	2010.00	1.70	130.0	0.70	12.0	1050.0	89.0	27.0	1.1	2.80	43.0		0.1
MC-1	18/12/83		DUPLICATE, pH@21C	8.3	260.0	1550.00	1.50	120.0	0.70	10.0	980.0	86.0	25.0	1.1	2.70	29.0		0.1
MC-1	25/12/83 0900		PH @ 23 C	8.4	340.0	2020.00	2.10	130.0	0.80	15.0	1300.0	110.0	31.0	1.4	3.30	42.0		0.1
MC-1	25/12/83		DUPLICATE, pH@21C	8.3	360.0	2030.00	2.00	140.0	0.80	13.0	1290.0	110.0	33.0	1.4	3.50	38.0		0.1
MC-1	01/01/84 0900		PH @ 23 C	8.4	340.0	2010.00	2.10	130.0	0.80	14.0	1290.0	110.0	32.0	1.3	3.40	42.0		0.1
MC-1	01/01/84		DUPLICATE, pH@21C	8.4	350.0	2030.00	2.00	140.0	0.80	13.0	1290.0	110.0	32.0	1.4	3.50	35.0		0.1
MC-1	12/01/84 0900		PH @ 23 C	8.4	350.0	2010.00	2.10	130.0	0.90	14.0	1300.0	110.0	32.0	1.4	3.30	42.0		0.1
MC-1	15/01/84		pH @ 21 C	8.3	350.0	2030.00	2.00	140.0	0.80	14.0	1310.0	110.0	33.0	1.4	3.50	36.0		0.1
MC-1	22/01/84 0900		PH @ 23 C	8.4	350.0	2020.00	2.10	130.0	0.80	14.0	1310.0	110.0	31.0	1.3	3.30	41.0		0.1
MC-1	22/01/84		DUPLICATE, pH @ 21 C	8.4	350.0	2020.00	2.00	140.0	0.90	14.0	1310.0	110.0	33.0	1.3	3.50	36.0		0.1
MC-1	29/01/84 0900		PH @ 23 C	8.4	360.0	2010.00	2.10	130.0	0.90	15.0	1290.0	110.0	31.0	1.3	3.30	42.0		0.1
MC-1	29/01/84		DUPLICATE, pH @ 21 C	8.2	310.0	2010.00	2.00	140.0	0.90	13.0	1230.0	91.0	46.0	1.0	3.20	36.0		0.2

MEAGER CREEK GEOTHERMAL PROJECT
GEOCHEMICAL ANALYSIS RESULTS

Location	Sample Number	Parameter	Comments	pH	Silica	Cl	F	SO	As	B	Na	K	Ca	Mg	Li	Total Carbonate as CO	Hg	NH
MC-1	15/07/84			8.6	360.0	2140.00	2.00	130.0	1.00	15.0	1370.0	120.0	37.0	0.8	3.40	21.0		0.2
MC-1	25/07/84			8.6	360.0	2160.00	2.20	130.0	1.00	15.0	1370.0	120.0	35.0	0.8	3.40	18.0		0.1
MC-1	31/07/84			8.4	360.0	2150.00	2.10	130.0	1.00	15.0	1360.0	120.0	38.0	0.8	3.40	29.0		0.2
MC-1	09/08/84			8.4	360.0	2150.00	2.20	130.0	1.00	15.0	1380.0	120.0	38.0	0.8	3.40	28.0		0.1
MC-1	15/08/84		pH @ 22 C	8.4	370.0	2140.00	2.30	120.0	1.00	15.0	1370.0	120.0	38.0	0.9	3.40	26.0		0.2
MC-1	23/08/84			8.4	370.0	2150.00	2.30	120.0	0.90	15.0	1370.0	120.0	38.0	0.9	3.50	36.0		0.1
MC-1	31/08/84			8.4	360.0	2150.00	2.30	120.0	1.00	16.0	1370.0	130.0	37.0	0.9	3.50	36.0		0.1
MC-1	06/09/84			8.4	370.0	2140.00	2.30	120.0	0.90	15.0	1360.0	120.0	38.0	0.9	3.50	36.0		-.1
MC-1	13/09/84			8.6	370.0	2140.00	2.30	120.0	0.90	15.0	1350.0	120.0	37.0	0.8	3.50	26.0		-.1
MC-1	20/09/84			8.4	370.0	2140.00	2.30	120.0	1.00	15.0	1360.0	120.0	38.0	0.8	3.50	34.0		-.1
MC-1	28/09/84			8.4	370.0	2140.00	2.30	120.0	0.90	15.0	1380.0	130.0	37.0	0.8	3.50	35.0		-.1
MC-1	04/10/84			8.4	360.0	2140.00	2.30	120.0	0.09	14.0	1350.0	130.0	37.0	0.9	3.50	35.0		-.1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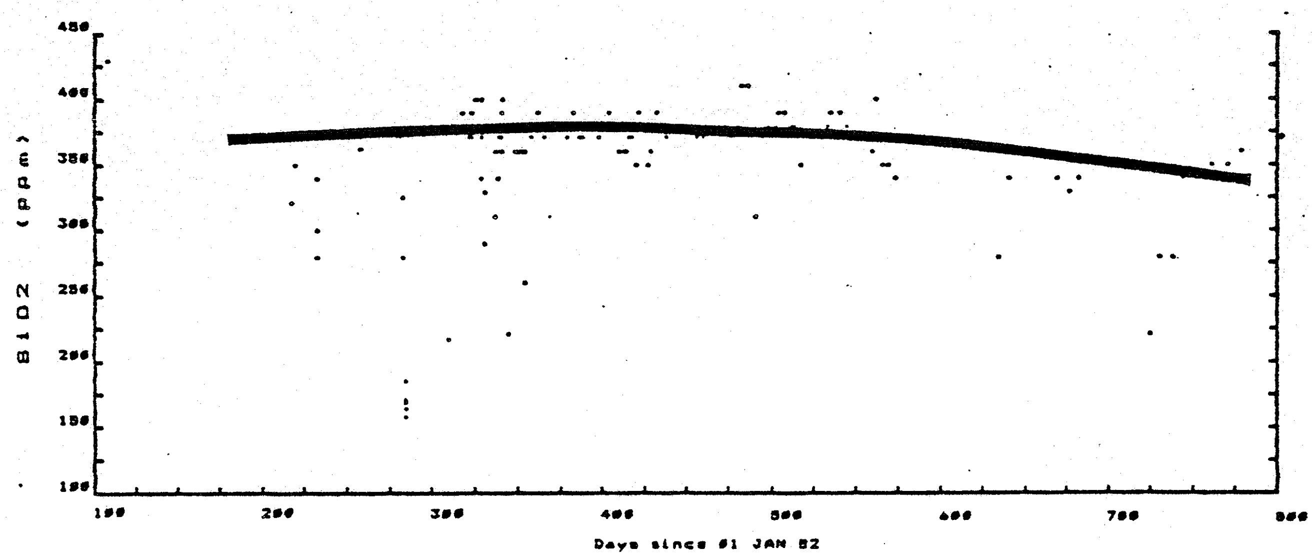
1600
1300
1000
100
200
300
400
500
600
700
800
Days since 01 JAN 82


SiO2 (ppm)
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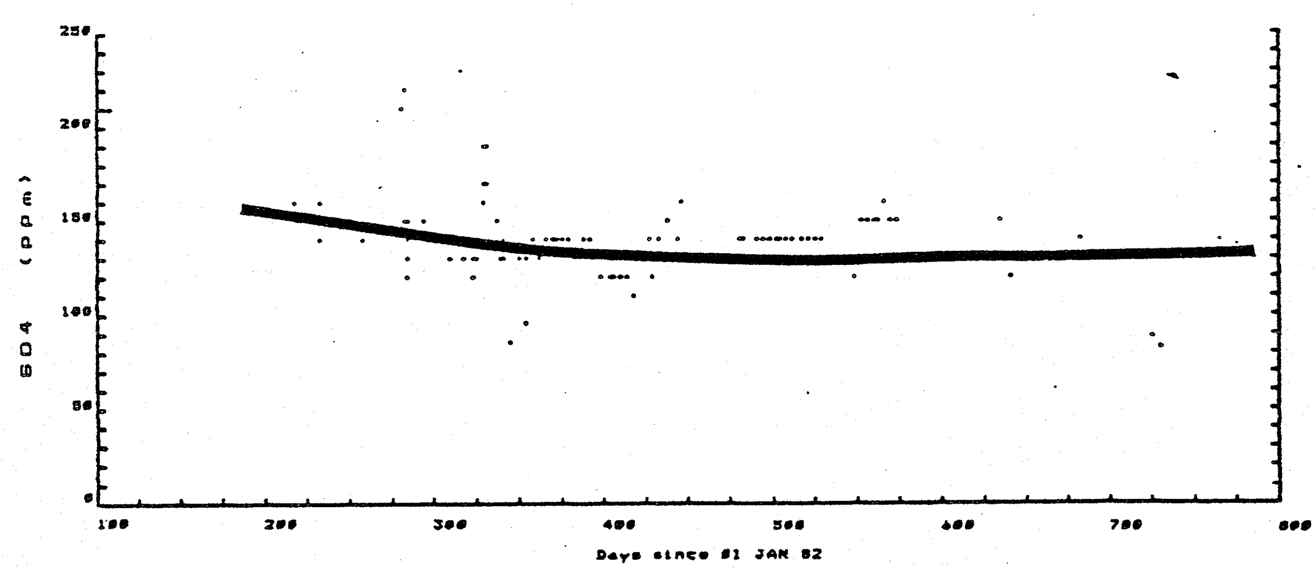
400
350
300
250
200
150
100
100
200
300
400
500
600
700
800
Days since 01 JAN 82


SO4 (ppm)
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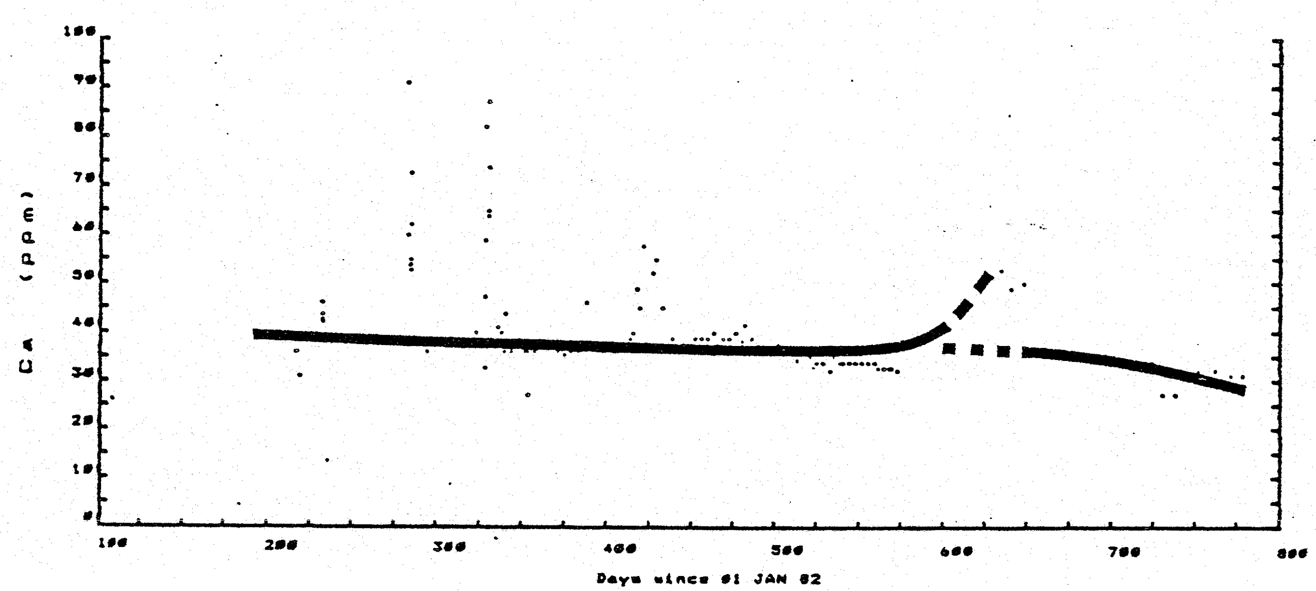
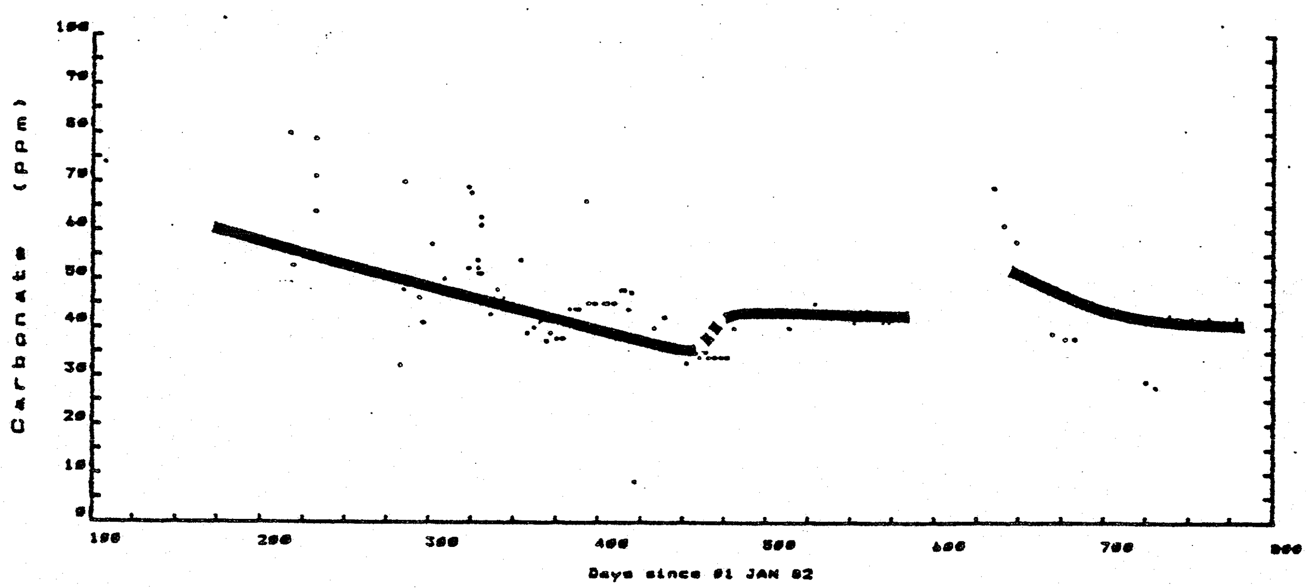
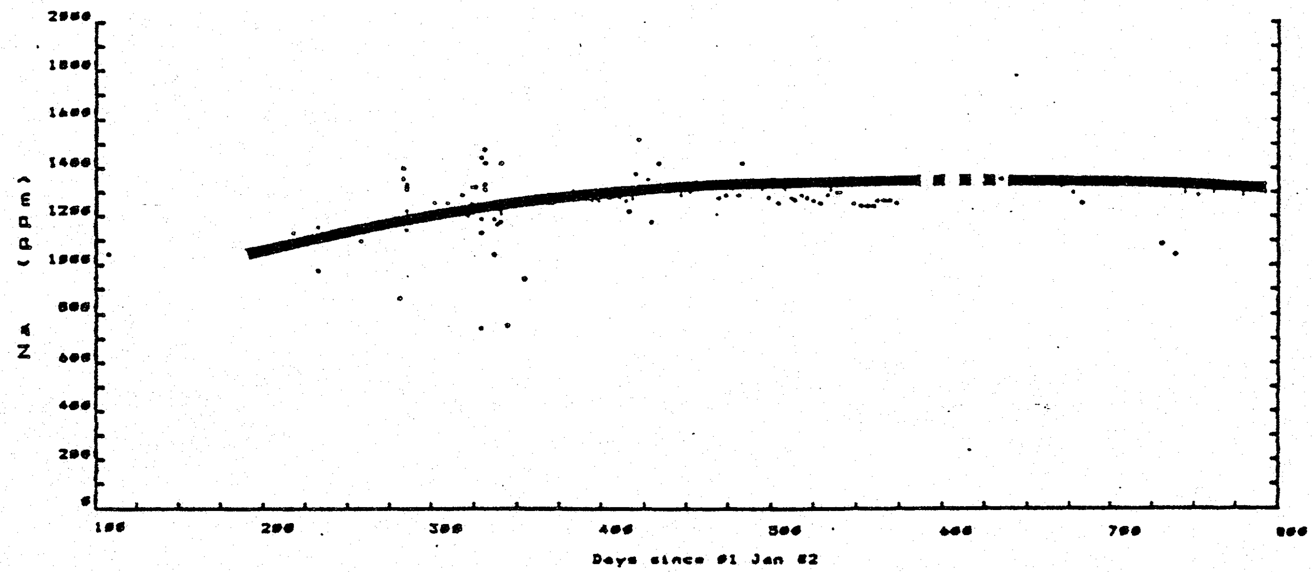
100
200
300
400
500
600
700
800
Days since 01 JAN 82

Calcium

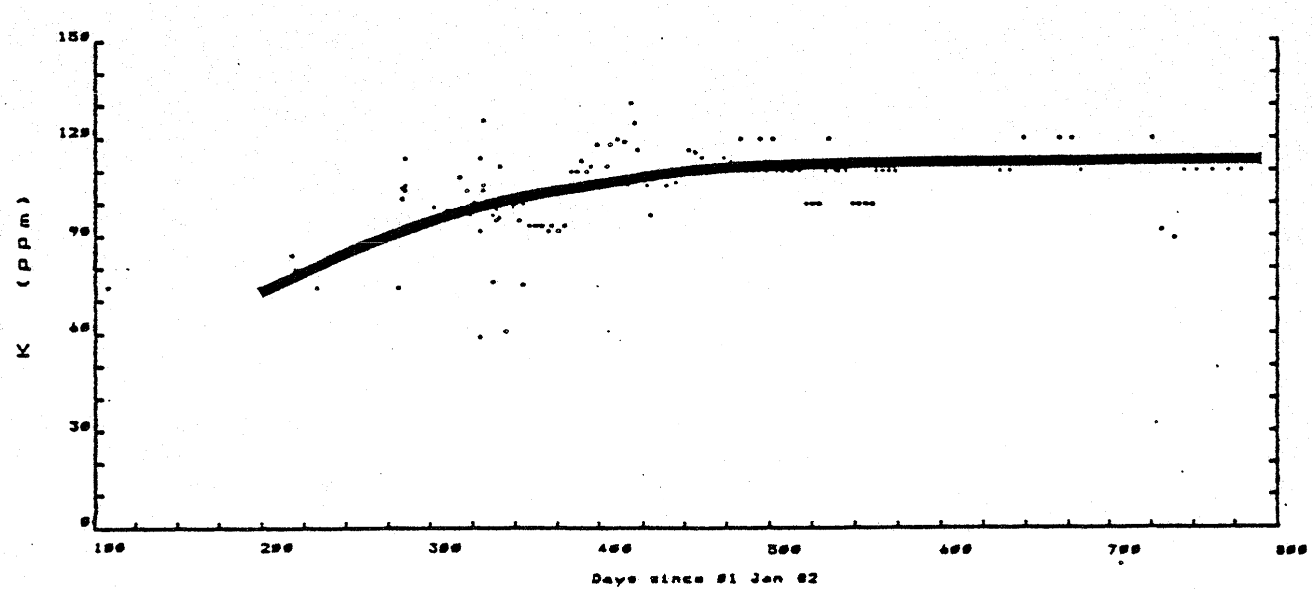


Total Carbonate as CO2





2000
1800
1600
1400
1200
1000
800
600
400
200
0
Na (ppm)
100
200
300
400
500
600
700
800
Days since 01 Jan 82



150
120
90
60
30
0
K (ppm)
100
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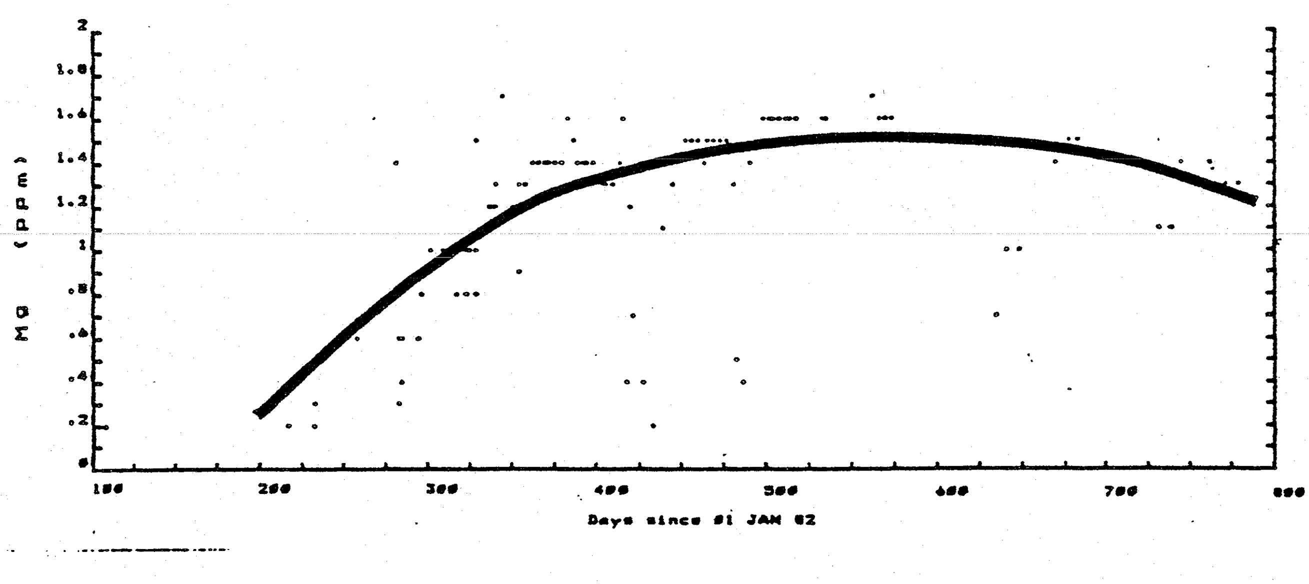
300
400
500
600
700
800
Days since 01 Jan 82



2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.2
0
Mg (ppm)
100
200
300
400
500
600
700
800
Days since 01 JAN 82