FET 7 Dmc

who is the T&C Engineer

GL07338_8

EG&G Idaho

INTEROFFICE CORRESPONDENCE

date August 24, 1979

to RRFO Manager

from Test Planning and Coordination

subject RRGE-1 PRODUCTION TEST TO RRGI-6 and RRGI-7 INJECTION TEST - FET-7-79

Approved by:

Reservoir Eng. _____ Date _____

Design Eng. J.E. Driscoll Date 9/28/79

Environmental Eng. S.G. Spencer by mcd Date 9/28/79

RRFO Eng. R.R. Meininger Date 9/28/79

Safety Eng. C.R. Shaber, safety Rev. Date 9/28/79

Chemistry Eng. _____ Date _____

Test Planning & Coord. T.E. Wakat Date 9-28-79

Quality Review Only _____ Date 9/21/79

Authorized for Release

_____

G. M. Millar Date

REV.	RELEASE DATE

FORM EG&G-954
(Rev. 2-77)

Aug. 4/29/80

Summary of Add-on Experiments

DOE-ID has requested that EG&G's Geoscience program provide support and access to the following entities to perform add-on experiments to the RRGP-1 to RRG1-7 and RRG1-6 test.

1) Stanford University - The goethermal reservoir engineering work being conducted by Dr. Paul Kruger and associates of Stanford University is currently testing a concept of analyzing for the presence of radon gas in production waters as a tool in understanding more about geothermal reservoir systems. Stanford personnel will be collecting up to ten samples at RRGE-1 both during pulse testing and during the stabilized flow. The Geoscience Program requests RRFO's support of this activity.

2) Vetter Research - In cooperation with Terra Tek, and with the concurrence of both DOE and EG&G Safety Programs, Vetter Research will conduct a Tritium Tracer Test by injecting tracer at a rate equivalent ot 2×10^{-3} μCi per milliliter of injection water for the first 48 hours of the test. The experiment involves 28.3 curies of tritium. If the tritium supply line breaks, employees sprayed with solution should promptly remove clothing, shower, rinse and hang clothing in open air to dry - then follow plan specified in Fielding letter 265 (appended). Vetter Research has obtained all necessary State approvals and will be in total control of the injection part of the experiment. The Geoscience Program requests RRFO's support of this activity and assistance in collecting any samples deemed necessary as a follow on to this experiment.

Please contact Max R. Dolenc (6-0003) should any questions arise about RRFO interfaces on these experiments.

RRGE-1 PRODUCTION TEST TO RRGI-6 AND RRGI-7 INJECTION TEST

1.0 PURPOSE OF TEST

The primary purposes of the test are to provide information on the Raft River Known Geothermal Resource Area (KGRA) in terms of expected well performance as well as aquifer hydrologic and thermal characteristics (with emphasis on RRGE-1 and RRGI-7 data). Also, process instrumentation will be tested for development, radon sampling will be performed by Stanford University, and a trituim tracer test will be performed by Vetter Research.

2.0 RESPONSIBILITIES

2.1 Raft River Operations will have overall responsibility for conducting the test gathering, operational data, retrieving and transmitting data, installing hardware/instrumentation, and overall project safety. Manager, RRFO or his assigned designate, will have responsibility for signoffs on this procedure.

2.2 Engineering will have responsibility for design and material procurement for permanent lines and instrumentation.

2.3 Reservoir Engineering will have responsibility for data analysis and reporting for hydrologic and thermal data.

2.4 Test Planning & Coordination (T&C) will have responsibility for test plans, scheduling, construction contracts, and test coordination.

3.0 SAFETY

3.1 All personnel operating experiments at Raft River will be under the cognizance of the Raft River Field Operations Manager and subject to written site operating rules.

3.2 Any experiment or experimental procedure deemed unsafe will be shut down by the Raft River Field Operations Manager, the Raft River Experiment Coordinator or the Safety Division representative.

3.3 Raft River Field Operations is responsible for all site safety. Any unsafe condition developing through the operation of an experiment shall be reported immediately to the Manager of Raft River Operations.

3.4 Safety Manual uses required:

3.4.1 Hazardous Material Safety No. 6020.

3.4.2 Material Handling Safety No. 6030.

3.4.3 Electrical Safety No. 6040.

3.4.4 High/Pressure/Temperature System Safety No. 6060.

3.4.5 General Protective Clothing and Equipment No. 6070.

3.4.6 Fire Protection Systems No. 7030.

3.5 Any suspected leak or potential radiological exposure resulting from the Tritium Tracer Test should be handled in accordance with the attached memo from J. R. Fielding To S. G. Spencer (Fiel-265-79).

4.0 PREREQUISITES

4.1 Raft River Field Operations will ensure that all water from RRGE-1, RRGI-6, and RRGI-7 will be directly injected or transferred to a lined pond.

RRFO_____Date_____

4.2 Raft River Field Operations will ensure that no site fluid transfer, well modifications, or flow operations will interfere with flow/injection performance and/or data.

RRFO_____Date_____

4.3 Raft River Field Operations will ensure RRGE-1 to RRGI-6 and RRGI-7 line warm-up prior to pulse testing.

RRFO_____Date_____

4.4 RRFO will supply the Geophysical Measurements Laboratory to run temperature logs in RRGI-6 and ~~RRGI-7~~ within 48 hours of start of test, during and after testing. The laboratory shall also be used for the downhole (H.P.) probe during testing. If Lab or tools are unavailable or inoperative, delete requirements.

RRFO_____Date_____

4.5 Raft River Field Operations will ensure the availability of test site living quarters with facilities for on-site Reservoir Engineer.

RRFO_____Date_____

SITE 3 Two people
SITE 1 Two people.

4.6 RRFO will ensure that the flow rate from RRGE-2 will be held constant ±3% accuracy prior to and during 1 to 6 and 7 test. A continuous recorder will monitor RRGE-2 flow rate. Reservoir engineering will verify RRGE-2 stabilization duration is sufficient prior to start of 1 to 6 and 7 test. Water for direct applications will come from RRGE-2. Due to modifications, flow from RRGE-2 may be blocked for up to 48 hours.

Free artesian flow.

Procedures Acceptable to Res Eng followed for recording response.

4.7 Monitor Wells

4.7.1 Raft River Field Operations will ensure that the following wells are instrumented for pressure or water level data and instrumentation is recording properly on a maximum 1 hour interval at least one week prior to start of test and during testing; if instruments fail, wells are listed in order of priority for data collection.

Pressure	Water Level
RRGE-1 ✓	*MW-4
RRGI-7 ✓	MW-3
3 → RRGI-6 ✓	MW-6
RRGE-5 ✓	MW-7
4th RRGP-4 ✓	MW-5
2 — RRGE-2 ✓	
MW-1 ✓	
MW-2 ✓ guage	

7 good - 8

(no power)

*Note: MW-4 may begin to flow during or following this test. If so, shut in well and replace Stevens recorder with digiquartz.

RRFO_____Date_____

4.7.1.1 If a digiquartz system fails, replace it with one from the lowest priority well. Replace the digiquartz system on the low priority well with a pressure gauge. Prior to removing the digiquartz take one data point. Install the gauge and again take one reading. Take data readings from gauge once per shift for the remainder of the test.

4.7.1.2 If instrumentation is not possible, contact T&C Engineer and Reservoir Engineer. Explain reason on data sheet.

4.7.2 Raft River Operations will sample, at the request of the Environmental Engineer, monitor wells prior to start of pulse testing.

DELETED FOR THIS TEST

MW-1	MW-5
MW-3	MW-6
MW-2	MW-7
MW-4	

RRFO_____Date_____

4.7.3 Manually measure depth to water every other day at MW-3, MW-4, MW-5, MW-6, MW-7, RRGE-3 pit monitor well, and RRGP-5 pit monitor well (use same one at each measurements). Record on charts where applicable or on Data Sheet 7.

4.7.4 At the BLM weir, measure water level daily with either a stage recorder or staff gauge. Record on Data Sheet 7.

INSPECT & NOTE STATUS of USGS WELLS EACH SHIFT - RE.

4.7.5 A dry run, testing the tritium tracer apparatus, will be performed prior to use of tracers. DELETE

4.8 RRGE-1 Instrumentation and Hardware

4.8.1 Raft River Operations will install or verify hardware and instrumentation per dwg. 412640.

4.8.2 Raft River Operations will ensure current calibration, where applicable, and correct operational status of instrumentation on drawings. Record orifice size and orientation on comments sheet.

RRFO_____ Date_____

4.9 RRGI-6 and RRGI-7 Instrumentation

4.9.1 Raft River Operations will install or verify hardware and instrumentation per drawings 412640. Record orifice size on comments sheet.

RRFO_____ Date_____

4.9.2 Raft River Field Operations will ensure current calibration, where applicable, and correct operational status of instrumentation on drawings.

RRFO_____ Date_____

4.9.3 Raft River Field Operations will install staging, stripper and lubricator for RRGI-7 logging by Geophysical Measurement Laboratory.

4.10 Continuous temperature (resolution ± 1°F, accuracy ± 2°F) and flow (resolution ± 2 gpm, accuracy ± 3% for high flow only) recorders shall be installed and operating prior to Step 4.12. A mercury thermometer, calibrated, with o.2°C divisions shall be installed and operating at RRGE-1, RRGI-6 and RRGI-7, prior to Step 4.14. Manually measure temperature from thermometer every 8 hours and record on recorder chart with time, date, etc. (ON temperature recorders use 200-300°F partial range).

STRIP CHART RECORDERS AT RRGE-1, RRGE-2, RRGI-7 SET 6"/hr for 4 HRS AT EACH, THEN 2"/hr. for duration. TEMP & FLOW.

RRFO_____ Date_____

4.11 Raft River Field Operations/Design Support will ensure SO Test performance and deficiency resolution. SO Test will include system checkout of hardware, including pumps.

RRFO_____Date_____

4.12 Raft River Field Operations will perform valve line up per Table 1.

RRFO_____Date_____

4.13 Raft River Field Operations will allow RRGE-1, RRGI-6, and RRGI-7 to warm-up by artesian flowing of 100 to 150 gpm from RRGE-1 to ~~RRGI-6~~ and RRGI-7 to a temperature over 200°F. Fill line from RRGE-1 to RRGI-6 and RRGI-7 prior to start of warm-up flow. Reservoir Engineering will verify warm-up of wells prior to termination of preheat flow. For pulse test warm-up to RRGI-6, use Data Sheet 9, flow 100-150 gpm until 200°F is reached. Take data every 4 hours.

4.13.1 Take warm-up data per Data Sheet 8, and record with time and date the following warm-up data: Wellhead pressure, temperature, and flow for wells 1(Data Sheet 2), 6 (Data Sheet 4), and 7 (Data Sheet 5) every hour from 0-10 hours and every 2 hours from 10 hours to completion of warmup. Keep all warmup Data Sheets separate from Test Data Sheets and send copies to O. J. Demuth.

CHECK THAT THIS ORIFICE WILL HANDLE 1000 gpm

4.13.2 On warm up flow at RRGI-7 bypass the pumps and run the water through the overhead line which has an orifice plate of 2.100". Prior to start up (4 hours) close the bypass and flow the water through the pumps and thus through the 3" orifice. At RRGI-6 a 2" orifice is put into place for warm-up flow. Four hours prior to testing at 6 a 3.000" plate is put back in, so that higher flow rates are monitored.

RRFO_____Date_____

4.14 RRFO will ensure that all wells not included in 1 to 6 and 7 test are held stable. Reservoir engineering will be notified prior to any adjustments.

DELETE

4.15 An injection port at valve 7V58, on the RRGI-7 well, consisting of a 1/2 inch female NPT on 1/2" valve, shall be made accessible to Vetter Research to conduct the Tritium Tracer Test.

4.16 Access to the water sample condenser port at RRGE-1 shall be made available to personnel from Stanford University for random sampling (only EG&G personnel will operate the equipment).

5.0 DETAILED TEST PROCEDURE*

5.1 Prior to Step 5.6.3 verify warm-up is complete with Reservoir Engineer and T&C Engineer.

5.2 At least 2 hours prior to step 5.6.3, install downhole [illegible] temperature probe in RRGI-7 at 3400 feet (or as deep as will remain operable within the open borehole).

5.3 Clean strainers at RRGI-6, (S6-1, S6-2, and S6-3) and RRGI-7 (7523, 7524) per plan on Table 9.

5.4 Set up for data collection per Table 2 and Data Sheets 2,3,4, and 5 Check recorders and mark charts per Figure 2. Take one set of pretest data on Data Sheets 2,3,4, and 5. Check observation well recorders.

5.5 Set up for sample collection (see Table 4).

5.5.1 Water samples of all monitor wells, RRGE-3 and RRGP-4 will be collected prior to test startup. These samples, together with samples collected by IDWR, will be held for Vetter Research who will conduct analysis.

5.5.2 During the first 72 hours of flow/injection collect 1 liter samples from the RRGI-7 flow line at the beginning of test, 0800, 1500, and 2400 hours, daily, and if conductivity changes more than 10%. Use premarked bottles. Save samples until data reduction is complete for further analysis, if required.

5.5.3 During the period from 72 hours to 500 hours collect one sample per day from the RRGI-7 flow line at 0800 hours, and if conductivity changes more than 10%.

5.5.4 All samples will be analyzed for Cl^-, F^-, Na^+, HCO_3^-, Ca++, pH and conductivity. Let samples cool to approximately 25°C before taking conductivity readings.

Chemist on day shift should analyze samples from previous 16 hour period, in the order they were sampled, immediately upon start of day shift. Chemist should complete samples from 0800 and 1500 hours by the end of the day shift on which the samples were taken.

5.5.5 If water conductivity changes more than 10%, sample from flow line and mark sample with date, time, and notation "for complete analysis". Deliver to chemistry lab by 0800 hours.

5.5.6 Collect one 20 liter sample at RRGP-1, and RRGI-7, every 24 hours in premarked bottles during 500 hour test. Chemist is to clean, and tare 2.0 micron filters prior to taking samples. Connect filters to condenser coils and run a 20 liter sample through the filter. Record time required to take sample and filter number on Data Sheet 6. Chemist will record filter and residue weight. If filter plugs before 20 liters are collected, remove filter, and record time of flow. Transport 20 liter bottle to lab, measure, and record quantity of water collected. (See Attachment 3.)

5.5.7 A Stanford University representative will be allowed access to the water sample condenser port at RRGE-1 to collect samples at the time he deems necessary, assuming no conflicts with RRFO schedules and operating under RRFO safety procedures. Samples will be collected in 500 psi, 5 liter containers supplied by Stanford University.

NOTE:

1) If at any time the testing is interrupted, immediately start collecting recovery data, consult Table 5 and contact Reservoir Engineer. Concentrate on restart only after recovery data collection has begun.

2) Describe any unusual occurrences on comments sheet. Notify T&C Engineer on next work day or as soon as possible for an emergency.

3) The pump limits for the RRGE-1 production pump are 940 to 1567 gpm.

The pump limits for the RRGI-6 injection pump are 700 gpm to 1700 gpm.

The pump limits for the RRGI-7 injection pumps are 300 gpm to 1000 gpm. Pump suction pressure operating range is 75 to 100 psi. Pump discharge limit is 500 psi.

Caution tag and lock (where possible) pump power controls.

4) If pump start to test flow time exceeds 5 minutes, allow well to recover for 30 minutes and restart test step (with approval of on-site Reservoir Engineer).

5) If pH or oxidation reduction probe fails, delete requirements. Conductivity probe failure shall be dealt with as soon as possible.

6) During the test, do not calibrate, zero instruments, or change gauges unless necessary. Contact Reservoir and T&C Engineer. Record on comments sheet and data sheet.

7) Any interruption in the tritium tracer part of the test in either flow at RRGE-1 or injection into RRGI-7, must immediately be reported to Vetter Research representative located at RRGI-7, to implement tritium injection shutdown.

5.6 Pulse Test at 1200 gpm, RRGE-1 to RRGI-7.

Flush the injection line to pond at RRGI-7 at 1000 GPM for 200 min. - recover for equivalent flush time or per Reservoir Engineer.

5.6.1 Perform or verify the valve lineup of Table 1A, as required.

5.6.2 Valve out instruments per Table 6.

5.6.3 Start pumps at RRGE-1 and RRGI-7 per Operating Procedure (Maximum starting time - 5 min. to test flow.)

NOTE: Before starting pump at RRGE-1 (including any restart):

a) Put the breaker switch on the pump control box in the off (down) position.

b) Open junction box and measure the voltage across the leads using the 0-10 volt scale.

c) If there is no voltage, pump may be started. If there is voltage, DO NOT START PUMP.

CAUTION: This operation must be done under direction of a RRFO supervisor.

5.6.4 Valve in instruments per Table 6. Digiquartz limit at RRGI-7 is 400 psia.

5.6.5 Collect data per Table 2 and 3 on Data Sheets 2, 3, and 5. If digiquartz fails, collect data per Table 8.

5.6.6 Inject at 1200 gpm $\pm$ 3% for 8 hours or until pressure reaches 450 psi. Hold flow constant ($\pm$ 1% precision). Note valve out digiquartz when pressure reaches 375 psia. (Notify Reservoir Engineer if pressure approaches 450 psig).

5.6.7 Notify Vetter Research representative 15 minutes prior to end of any part of the test Vetter Research is involved in. Shut off pumps per Operating Procedure. Mark all charts and collect recovery data per Tables 2 and 3 on Data Sheets 2, 3, and 5.

5.6.8 Clean strainers, as required, based on the limits and plan of Table 9.

RRFO_____Date_____

5.7 Pulse Test at 1500 gpm RRGE-1 and RRGI-6.

A warm up flow from 1 to 5MW to 3 is established so that cold water is put in pond at 6. Once water has come up to 200°F, flow through pumps can be established. Valve lineup is as in Table 1.

5.7.1 Valve out pressure sensitive instruments per Table 6. Verify or valve in digiquartz at RRGI-6 and RRGI-7 0-400 psia.

5.7.2 Start pumps at RRGE-1 and RRGI-6 per Operating Procedures (maximum starting time - 5 min. to test flow).

5.7.3 Valve in instruments per Table 6.

5.7.4 Collect data per Table 2 and 3 of Data Sheets 2, 3, and 4. If digiquartz fails at RRGI-6, collect data per Table 8.

5.7.6 Inject at RRGI-6, 1500 gpm ± 3% hours or until pressure reaches 450 psi. Hold flow constant (± 1% precision). Valve out digiquartz at well 6 when pressure reaches 375 psia.

5.7.7 Notify Vetter Research representative 15 minutes prior to end of test. Shutoff pumps per Operating Procedure.

CAUTION: Observe RRGE-1 drawdown. If pressure on bubbler system reaches 150 psig, or injection pressures at either well approaches 450 psig, notify Reservoir Engineer.

5.7.8 Mark recorder charts and collect recovery data per Tables 2 and 3.

RRFO Engr_____Date_____

5.8 Clean separator and strainers at RRGI-6 per plan on Table 9.

5.9 Perform pump maintenance and check. (Grease pumps, check oil, etc.)

5.10 Transmit pulse test data to T&C after recovery on 1500 gpm test.

5.11 Check all observation well recorders for time, operability, and chart speed. Mark on chart.

5.12 500 Hour Discharge and Injection at 1000 gpm, RRGE-1 to RRGI-7.

5.12.1 Valve out instruments per Table 6. Valve in digiquartz if not already on line.

5.12.2 Reset recording on instruments per Tables 2 and 3, as required.

5.12.3 Collect one set of pre-start up data on Data Sheets 2, 3, and 5.

5.12.4 Start pumps at RRGE-1, and RRGI-7 per Operating Procedures (Maximum start time - 5 min. to test flow).

5.12.5 Valve in instruments per Table 6.

5.12.6 Collect data per Tables 2 and 3 on Data Sheets 2, 3, and 5. Plot data per Figure 1. If digiquartz fails, collect data per Table 8.

5.12.7 Pump and inject at 1000 gpm ± 3% for 500 hours. Hold flow constant (±1%). Note: - - - If injection pressure reaches 375 psia on digiquartz, valve it out. If injection pressure approaches 450 psig, notify Reservoir Engineer.

5.12.8 Mark charts, check monitor wells and perform pump maintenance once per shift. Mark charts per example, Figure 2. Measure observation well water levels, as required (Steps 4.6.3 - 4.6.5).

5.12.9 After 48 hours of injection, remove the downhole probe as required by Reservoir Engineering.

5.12.10 After 200 hours into long term pumping and prior to well shut in, run a temperature log in RRGI-7 if requested by Reservoir Engineering.

5.12.11 Transmit data weekly to Test Planning & Coordination, EG&G Bldg.

5.12.12 Reinstall the downhole pressure/temperature probe at RRGI-7 at 3700 feet or at previous depth within 24 hours prior to shut-in.

5.12.13 Within 2 hours prior to shut down, mark all charts, collect one full set of pre-shutdown data, and check observation wells.

5.12.14 After 500 hours of pumping/injection, shut off pumps per Operating Procedure.

5.12.15 Mark all charts and collect recovery data per Tables 2 and 3 on Data Sheets 2, 3, and 5.

5.12.16 Shut in RRGE-1, and RRGI-7.

5.12.17 Transmit production/injection data weekly to T&C, EG&G Bldg.

5.12.18 After 48 hours remove the downhole probe as requested by Reservoir Engineering.

5.12.19 After 100 hours of recovery or as determined by Reservoir Engineer, and prior to the end of the test, run a temperature log in RRGI-7.

RRFO _____ Date _____

5.13 Transmit all remaining data to T&C Engr.

5.14 Transmit all untested water samples to the chemist.

5.15 Perform area clean up.

5.16 If wellhead pressure at RRG1-7 approaches 450 psi, contact reservoir engineering for direction.

RRFO Manager_____

Date_____

TABLE 1 - VALVE LINEUP

Closed	Open
1V4	1V1
1V8	1V2
1V9	1V3
	1V5
3V6	1V6 - optional
3V9	1V7
3V15	1V13
3V16	1V14
3V17	1V15
3V18	
3V19	3V10
	3V11
4V7	3V13
4V10	3V20
5V8	5V10
5V12	
5V13	6V1
5V14	6V2
	6V3
6V5	6V4
6V12	6V7
6V14	6V8
	6V9
	6V10
	6V11

TABLE 1 VALVE LINEUP (CONTINUED)

Closed	Open
7V5	7V1
7V13*	7V2
7V17**	7V3
7V19**	7V4
7V20	7AV6
7V26	7V7
7V27	7V9
7V28	7V10
7V29	7V11
7V30	7V12*
7V31	7V14
7V32	7V16
7V33	7V59
7V34	7V60
7V35	7V61
7V58	7V62
7V72	7V63
7V73	7V65
	7V66
	7V67
	7V68
	7V69

*This option (7V12 open, 7V13 closed) may be used to bring strainer 7S24 into operation immediately if necessary.

** Used depending on which pump is used.

TABLE 1A - VALVE LINEUP

OPEN	CLOSED
1V1	1V8
1V2	1V11
1V3	1V13
1V5	3V6
1V6	3V9
1V7	3V16
1V15	3V17
1AV32*	3V18
3V10	3V19
3V15	3V11
3V20	3V12
3V13	

*1AV32 is automatic valve to Pond #1. It is open initially to prevent high pressuring, but is slowly closed so that all the water goes to #6.

PRODUCE RRGP-5
INJECT RRGI-6

TABLE 2

MAXIMUM DATA COLLECTION INTERVALS ON RRGE-1 FOR PULSE AND 500 HOUR TESTS

TIME FROM TO / INSTRUMENT	0 MIN. / 5 MIN.	5 MIN. / 60 MIN.	1 HR. / 5 HRS.	5 HR. / 100 HRS.	100 HRS. / 500 HRS.	RECOVERY
BUBBLER (1-9)	10 SEC. (BUBBLER AS QUICKLY AS POSSIBLE)	1 MIN.	10 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
DOWNHOLE PUMP PRESSURE(1-13)	1 Min.	1 MIN.	10 MIN.	1 HR.	4 HRS.	NONE
TEMPERATURE (1-17A) (1-19)	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
WELLHEAD PRESS. GAUGE(1-18)	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
LINE PRESSURE (1-31)	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
PUMP CURRENT*	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE

*See Attachment 2 for recorder information and maintenance.

TABLE 3

MAXIMUM DATA COLLECTION INTERVALS ON RRGI-6 AND RRGI 7 FOR PULSE AND 500 HOUR TESTS

TIME FROM / TO / INSTRUMENT	0 MIN. / 5 MIN.	5 MIN. / 60 MIN.	1 HR. / 5 HRS.	5 HR. / 100 HRS.	100 HRS. / 500 HRS.	RECOVERY
PRESSURE TRANSDUCER	10 SEC.	1 MIN.	10 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
DOWNHOLE PROBE	10 SEC.	1 MIN.	10 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
TEMPERATURE	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
OXIDATION REDUCTION	1 HR.	1 HR.	1 HR.	6 HRS.	6 HRS.	NONE
CONDUCTIVITY	1 HR.	1 HR.	1 HR.	6 HRS.	6 HRS.	NONE
pH	1 HR.	1 HR.	1 HR.	6 HRS.	6 HRS.	NONE
FLOW FR 6-10, 7-39	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
STRAINER DP'S PDI 6-11, 6-12, 7-13, 7-14	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
PUMP SUCTION PI 6-18, 7-30	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
PUMP DISCHARGE PI 6-15, 7-15	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
INJECTION PRESSURE GAUGE PI 6-1, PI 6-3	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	REPEAT FROM TIME 0
VALVE POSITION PI 7-2, PY 7-4	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE
OIL TEMPERATURE	10 MIN.	10 MIN.	20 MIN.	1 HR.	4 HRS.	NONE

PRODUCE RRGP-1
INJECT RRGI-6
and RRGI-7

TABLE 4

MAXIMUM SAMPLE INTERVAL FOR FLOW LINE SAMPLES

TIME: FROM / TO	PULSE TESTS AND 0 HRS. / 72 HRS.	72 HRS. / 500 HRS.
RRGP-5 SAMPLE COLLECTION INTERVALS	Collect 1 liter samples at 0800, 1500, and 2400 hours and if a 10% conductivity change occurs.	Collect 1 liter sample at 0800 and if a 10% conductivity change occurs.
	Collect one 20 liter filtered sample every 24 hours at RRGI-6, RRGI-7 and RRGP-1.	Collect one 20 liter filtered sample every 24 hours at RRGI-6 RRGI-7 and RRGP-1.

Analyze all samples for Cl^-, F^-, Na^+, HCO_3^-, Ca^{++}, pH, and conductivity.

TABLE 5

RESERVOIR ENGINEERING
SCHEDULE OF RECOVERY DATA
FOR INTERRUPTED TESTS

TIME SINCE PUMPING OR INJECTION STARTED	
0 - 2 HOURS	TERMINATE TEST AND START RECOVERY IF ANY INTERRUPTION GREATER THAN 30 SECONDS
2 - 6 HOURS	TERMINATE TEST AND START RECOVERY IF INTERRUPTIONS GREATER THAN 5 MINUTES
6 - 24 HOURS	TERMINATE TEST AND START RECOVERY IF INTERRUPTIONS GREATER THAN 20 MINUTES
1 - 3 DAYS	TERMINATE TEST AND START RECOVERY IF INTERRUPTIONS GREATER THAN 1-1/4 HOUR
3 - 21 DAYS	TERMINATE TEST AND START RECOVERY IF INTERRUPTIONS GREATER THAN 4 HOURS

These periods are too long to be acceptable - See the 5-6 test.

TABLE 6

VALVE OUT INSTRUMENTS AS FOLLOWS:

INSTRUMENT	VALVE	ROOT VALVES VALVE POSITION	TIME	DATE	INITIAL
PhT6-20	N/A	SHUT			
O/RT 6-21	N/A	SHUT			
CT 6-22	N/A	SHUT			
CT 6-13	N/A	SHUT			
PT 6-2	N/A	SHUT			

Valve In Instruments as Follows:

INSTRUMENT	VALVE	ROOT VALVES VALVE POSITION	TIME	DATE	INITIAL
PhT 6-20	N/A	OPEN			
O/RT	N/A	OPEN			
CT 6-22	N/A	OPEN			
CT 6-13	N/A	OPEN			
PT 6-2	N/A	OPEN (after bore pressure is below 375 psia)			

TABLE 7

INSTRUMENT CALIBRATION/OPERATION STATUS

INITIALS & DATE	INSTRUMENT	INSTRUMENT NO.	CALIBRATED DATE	OPERATIONAL STATUS

TABLE 8

DATA COLLECTION INTERVALS ON PI 6-1, and PI-7-2,

FOR USE ON RRGP-1, RRGI-6, and RRGI-7 WELLHEAD PRESSURE GAUGES IF DIGIQUARTZ FAILS. (Digiquartz pressures shall be limited to below 400 psi at RRGI-6 and RRGI-7 and 900 psi at RRGE-1 or they shall be valved out.)

TO BE USED FOR FLOW/INJECTION AND RECOVERY DATA

TIME: FROM TO	0 1 MIN.	1 MIN. 5 MIN.	5 MIN. 10 MIN.	10 MIN. 30 MIN.	30 MIN. 60 MIN.
DATA COLLECTION INTERVAL	15 SECS. OR AS RAPIDLY AS POSSIBLE	30 SECS.	1 MIN.	5 MIN.	10 MIN.

TIME: FROM TO	60 MIN. 5 HRS.	5 HRS. 200 HRS.	200 HRS. 500 HRS.			
	20 MIN.	1 HR.	4 HRS.			

TABLE 9

TO CLEAN STRAINERS AT RRGI-6

Clean S6-1 if PDI-6-19 reads greater than 4.5.
Clean S6-2 if PDI 6-11 reads greater than 2.0.
Clean S6-3 if PDI 6-12 reads greater than 2.0.

Pump Suction Strainer S6-1.

1) Hook-up hose to connection at the bottom of the strainer.

2) Run hose into tank and anchor securely to prevent hose from coming out of tank.

3) Open valve on bottom of strainer (above hose connection).

4) Allow to drain and depressurize to clean strainer.

5) Close connection valve below strainer.

6) Drain, disconnect, and store hose.

7) Dispose of water in tank into a lined pond.

Pump Discharge Strainers S6-2 and S6-3.

1) Valve out strainer (shut 6V8 and 6V7, for S-2 and 6V10 and 6V9 for S-3) (if water is flowing in the line, valve out and clean each strainer individually).

2) Unbolt strainer cover - allow to depressurize before removing.

3) Remove cover. Take caution with heat and escaping steam. Wear protective clothing.

4) Allow basket to cool.

5) Pull out basket.

6) Hose down basket to remove grit in filter.

7) Reinsert clean basket. If filter cloth or basket is broken, replace with a new one.

8) Cover and tighten down.

9) Valve in strainer (open 6V8 and 6V7 for S-2, 6V10 and 6V9 for S-3).

Collect at: 10 Min intervals 0-1 Hr
(Bubbler - as rapidly as possible)

20 Min intervals 1-5 Hr
(Bubbler - 10 Min intervals)

1 Hr intervals 5-100 Hr

4 Hr intervals 100-500 Hr

DATA SHEET 2

RRGE-1

TIME	DATE	INITIALS	DOWNHOLE PUMP PRESSURE	BUBBLER PRESSURE	N_2 SUPPLY	FLOW	TEMPERATURE			LINE PRES.	ANNULUS PRES.	PUMP DISCHARGE/ WELLHEAD PRESSURE	PUMP CURREN
							WELLHEAD		DOWNHOLE				
							RTD	THERMO-METER					
						FR 1-34	TR	TI	TI	PI	PI	PI	

PRODUCE RRGP-5
INJECT RRGI-6

DATA SHEET 3

COLLECT AT: 1 Hr. intervals from 0 to 5 Hours
6 Hr. intervals from 5 to 500 Hrs.

DATE & INITIALS	TIME	CONDUCTIVITY CI6-13	pH PHI 6-20	OXIDATION REDUCTION O/RT 6-21	CONDUCTIVITY CI 6-22

Collect at: 10 Min intervals 0-1 Hr
20 Min intervals 1-5 Hr
1 Hr intervals 5-100 Hr
4 Hr intervals 100-500 Hr

DATA SHEET 4
RRGI-6

TIME	DATE	INITIALS	TEMPERATURE RTD TR 6-5		FLOW FR 6-8	VALVE POSITION % 6AV6	STRAINER DP PDI 6-11	PDI 6-12	PDI 6-19	PUMP SUCTION PI 6-18	PUMP DISCHARGE PI 6-15	INJECTION PRESSURE PI 6-1	PI 6-3

Collect at: 10 Min intervals 0-1 Hr
20 Min intervals 1-5 Hr
1 Hr intervals 5-100 Hr
4 Hr intervals 100-500 Hr

DATA SHEET 5
RRGI-7

TIME	DATE	INITIALS	TEMPERATURE RTD TR		FLOW FR	VALVE POSITION % 6AV6	STRAINER DP PDI	PDI	PDI	PUMP SUCTION PI	PUMP DISCHARGE PI	INJECTION PRESSURE PI	PI

DATA SHEET 5

Date_____Name_____

Wellhead
Pressure
(Heise gauges)

Gauge #	Time	Interval	Gauge Reading

DATA SHEET 6

FILTER NUMBER	SAMPLE QUANTITY LITERS	SAMPLE TIME HRS. AND MIN.	FILTER WEIGHT GRAMS	RESIDUE WEIGHT GRAMS	DATE AND TIME

DATA SHEET 7

Observation Well Depth to Water

Date	PIT MONITOR WELL RRGE-3	PIT MONITOR WELL RRGP-5	WELL S-23-NE	WELL S-24-NWNE	WELL S-24-NWSW	WELL S-24-SW	BLM (Water Depth in weir)

DATA SHEET 8

NOTES:
1. Synchronize time with strip chart time
2. Record time to nearest minute
3. Collect Data at 1 hour intervals 0 to 10 hours; 2 hour intervals

Initials	Date	Time	Temperatures at (5V10)		
			Water	Steel Pipe	Transite

Initials	Date	Time	Temperatures at (3V10,11)	
			Steel Pipe	Transite

WELL NO.______ WARMUP DATA SHEET 9

DATE	TIME	TEMP.	WELLHEAD PRESS.	ΔP	FLOW	INITIALS		COMMENTS

FIGURE 1

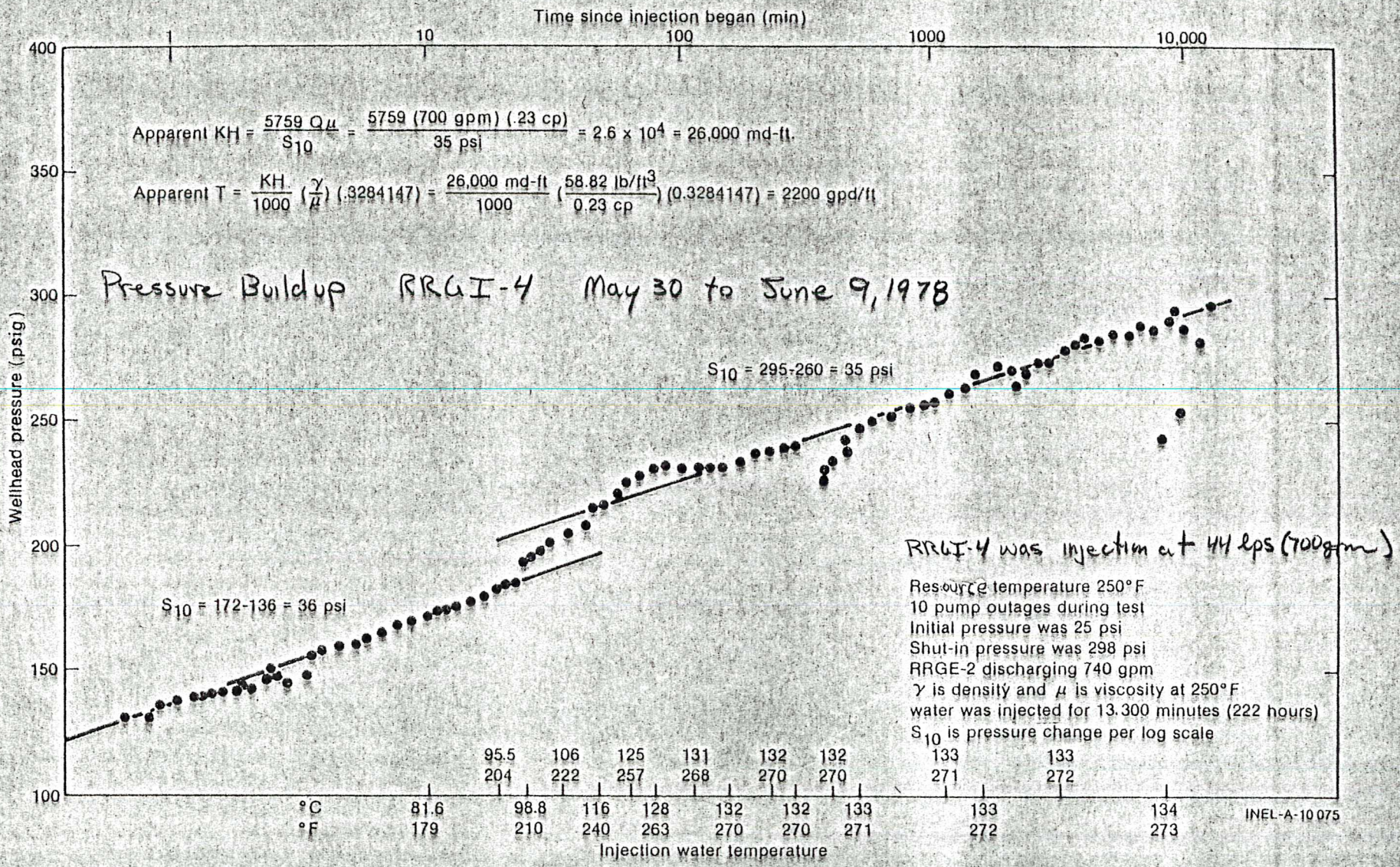
Time since injection began (min)
1
10
100
1000
10,000
400
350
300
250
200
150
100
Wellhead pressure (psig)
Apparent KH = 5759 Qμ / S10 = 5759 (700 gpm) (.23 cp) / 35 psi = 2.6 x 10^4 = 26,000 md-ft.
Apparent T = KH/1000 (γ/μ) (.3284147) = 26,000 md-ft/1000 (58.82 lb/ft^3 / 0.23 cp) (0.3284147) = 2200 gpd/ft
Pressure Buildup RRGI-4 May 30 to June 9, 1978
S10 = 295-260 = 35 psi
S10 = 172-136 = 36 psi
RRGI-4 was injectim at 44 lps (700gpm)
Resource temperature 250°F
10 pump outages during test
Initial pressure was 25 psi
Shut-in pressure was 298 psi
RRGE-2 discharging 740 gpm
γ is density and μ is viscosity at 250°F
water was injected for 13,300 minutes (222 hours)
S10 is pressure change per log scale
95.5 106 125 131 132 132 133 133
204 222 257 268 270 270 271 272
°C 81.6 98.8 116 128 132 132 133 133 134
°F 179 210 240 263 270 270 271 272 273
Injection water temperature
INEL-A-10 075

FIGURE 2

TEST NO.

WELL NO.

DATE /TIME

INITIALS

DATA BEING COLLECTED

INSTRUMENT

DATA UNITS

CHART SCALE

DATA INTERVALS