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Title: HYDROTHERMAL INJECTION PROGRAM -
EAST MESA 1983-84 TEST DATA

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Attachments: EG&G Patent Docs.doc

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12/06/2006 12:34 PM

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Subject EG&G Idaho Geothermal Reports

Dale,

OSTI has been working on a project for the last year or so to collect geothermal documents. At the STIP meeting in April, I sent out a plea to the DOE labs to identify and send to OSTI any geothermal documents that we did not already have in our database. I have a problem with a group of reports from EG&G Idaho. I am not sure you are the person correct person to ask for help on this issue. If not, maybe you can direct me to the responsible individual.

Attached is a list of documents that were sent to OSTI as part of that special geothermal project. All of the documents in this list have a patent caution as well as 'Internal Technical Report' stamped on the front of the report. The date on each of the documents is well past the sunset date for patentable material. If there is no other reason for control, I would like permission to cover up the patent caution and release each as unlimited. Would we also need to cover 'Internal Technical Report'?

If you need me to, I will be happy to fax you a copy of the covers of the reports.

Please let me know if you can help me out with this problem, or advise if I should communicate with someone

12/7/2006

else - and who

Thanks ahead for your help,
Patty

Patty Simmons

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HYDROTHERMAL INJECTION PROGRAM
EAST MESA 1983-84 TEST DATA

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Geoscience

September 1984

EG&G Idaho, Inc.
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Prepared for the
U. S. Department of Energy
Idaho Operations Office

ABSTRACT

This report presents a test data index and data plots for a series of 12 drawdown and tracer injection-withdrawal tests in porous-media aquifers at the East Mesa Geothermal Field located in the Imperial Valley near El Centro, California. Test and instrumentation summaries are also provided.

The first 10 of these tests were completed during July and August 1983. The remaining 2 tests were completed in February 1984, after a 6-month quiescent period, in which tracers were left in the reservoir.

The test wells used were 56-30 and 56-19, with 38-30 supplying water for the injection phase and 52-29 used as a disposal well during the backflowing of the two test wells. Six other wells in the surrounding area were measured periodically for possible hydrologic effects during testing.

It is not the intent of this report to supply analyzed data, but to list the uninterpreted computer stored data available for analysis. The data have been examined only to the extent to ensure that they are reasonable and internally consistent.

This data is stored on permanent files at the Idaho National Engineering Laboratory (INEL) Cyber Computer Complex. The main processors for this complex are located at the Computer Science Center (CSC) in Idaho Falls, Idaho.

The Hydrothermal Injection Test program, funded by the Department of Energy, was a joint effort between EG&G Idaho, Inc., the University of Utah Research Institute (UURI) and Republic Geothermal, Inc. (RGI) of Santa Fe Springs, California.

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TEST SUMMARY

The primary objective of the test sequence was to acquire the necessary field data to characterize the porous-media aquifers that are common to the East Mesa Geothermal Field (Figure 1). This data and data collected during earlier tests on these test wells by RGI, together with data from other wells and well fields (RRGP-5 and RRGE-1 at the Raft River Geothermal Field) can be compared and analyzed to better understand fluid behavior in different types of geothermal reservoirs. These comparisons are fundamental to the conceptual modeling of reservoirs needed to assess the reservoirs potential.

The overall test plan called for a series of tracer injection-withdrawal tests on each well after the acquisition of baseline hydrologic and thermal data.

During each injection phase, the fluid from the supply well was inoculated continuously with a secondary tracer. This fluid was pumped to a pit until it reached the desired dilution rate before being valved into the test well. The injection flow was interrupted briefly for a slug injection of undiluted tracers. The slug injection generally lasted for 5 minutes and was followed immediately by the continuous tracer/fluid mixture. The concentration of these tracers was monitored as the injectant was withdrawn from the reservoir.

The tests varied in flow rates and injection, quiescent and backflow duration. Table 1 gives a summary of the test program, noting real start and end times for each test. Test parameters, nominal flow rates and duration of each phase (injection, quiescence and backflow) are listed, giving a brief overview of each test in the series.

Table 2 lists the tracers, both continuous and slug used in each test. The slug tracer injection time and duration is also given.

These tests were performed on wells 56-30 and 56-19, the supply well was 38-30 and well 52-29 was used for disposal. The interconnecting pipeline and associated wells are shown in Figure 2. A detailed description of flow paths for the various wells, along with wellhead and downhole instrumentation schematics

Figure 1. Location Map

- ▲ Test Wells
- Supply Well
- Disposal Well
- ⊙ Monitor Wells
- Other Wells

----- EAST MESA K.G.R.A. BOUNDARY

EAST MESA FIELD

TABLE 1. TEST TIME SUMMARY

<u>Test No.</u>	<u>Start Time</u>	<u>End Time</u>	<u>Test Parameters</u>	<u>Nominal Flow Flow Rate</u>	<u>Duration (hours)</u>
5630-1	07/14/83 12:40	07/15 14:00	Backflow	300	25.33
	07/15 14:00	07/16 08:50	Recovery		18.83
5630-2	07/16 08:50	07/17 08:50	Backflow	450	24.00
	07/17 08:50	07/24 13:50	Recovery		173.00
5630-3	07/24 13:50	07/25 01:20	Injection	300	11.50
	07/25 01:20	07/25 13:20	Quiescent		12.00
	07/25 13:20	07/28 08:20	Backflow	300	67.00
	07/28 08:20	07/29 10:10	Recovery		25.83
5630-4	07/29 10:10	07/29 22:10	Injection	300	12.00
	07/29 22:10		Quiescent		Long Term
5630-5	02/01/84 13:50	02/05 11:37	Backflow	300 - 370	93.78
	02/05 11:37	02/07 13:51	Quiescent		50.24
	02/07 13:51	02/09 12:00	Backflow	300 - 380	46.15
	02/07 12:00		Shut-in		Test Completed
5619-1	08/02/83 11:25	08/02 20:25	Backflow	300	9.00
	08/02 20:25	08/03 14:00	Recovery		Aborted *
	08/03 14:00	08/04 16:20	Backflow	300	26.33
	08/04 16:20	08/05 13:00	Recovery		20.67
5619-2	08/05 13:00	08/05 17:30	Backflow	500	4.5
	08/05 17:30	08/06 09:10	Recovery		Aborted *
	08/06 09:10	08/07 09:21	Backflow	500	24.18
	08/07 09:21	08/08 13:26	Recovery		28.08
5619-3	08/08 13:26	08/09 01:01	Injection	300	11.58
	08/09 01:01	08/09 13:00	Quiescent		11.98
	08/09 13:00	08/11 18:29	Backflow	300	53.48
	08/11 18:29	08/12 13:23	Recovery		18.90
5619-4	08/12 13:23	08/12 20:45	Injection	500	7.37
	08/12 20:45	08/13 09:30	Quiescent		12.75
	08/13 09:30	08/15 09:30	Backflow	500 - 450	48.00
	08/15 09:30	08/17 11:17	Recovery		49.78

TABLE 1. TEST TIME SUMMARY (cont.)

<u>Test No.</u>	<u>Start Time</u>		<u>End Time</u>	<u>Test Parameters</u>	<u>Nominal Flow Rate (gpm)</u>	<u>Duration (hours)</u>
5619-6	08/17	11:17	08/18 01:45	Injection	500	14.47
	08/18	01:45	08/18 13:50	Quiescent		12.08
	08/18	13:50	08/20 13:50	Backflow	500 - 450	48.00
	08/20	13:50	08/21 08:20	Recovery		18.50
5619-8	08/21	08:20	08/21 15:35	Injection	500	7.25
	08/21	15:35		Quiescent		Long Term
5619-9	02/05/84	13:17	02/07 12:45	Backflow	450 - 375	47.47
	02/07	12:45		Shut-in		Test Completed

- * Test 5619-1 and 2: In each test the first attempt to backflow the well led to problems, due to gas build up around the orifice plate Fl₃ (Figure A-3 Appendix A) causing erratic readings across the ΔP gauge due to large pressure drop. The orifice plate was removed during Test 5619-2. Thereafter, the flow was recorded at 5630 CV-1 FIC (Figure A-2 Appendix A) data logger and strip chart instrumentation.

TABLE 2. TRACERS USED DURING TEST

Well	Test	Tracer			
		Continuous	Slug / Beginning Time (hrs) / Duration (min)		
56-30	1	N/A	N/A		
56-30	2	N/A	N/A		
56-30	3	KCl	Borax	1.08	5
			Na ₂ F1	1.13	2
56-30	4	NaI	NaSCN	1.00	5
			Na ₂ F1	1.00	5
56-30	5	N/A	N/A		
56-19	1	N/A	N/A		
56-19	2	N/A	N/A		
56-19	3	NaI	NaSCN	1.92	5
		LiCl	Na ₂ F1	1.92	5
56-19	4	NaBr	Na ₂ F1	1.20	5
			Borax	1.20	5
56-19	6	NaI	NaSCN	1.10	4.4
			Na ₂ F1	1.10	4.4
56-19	8	NaBr	Na ₂ F1	.97	5
			Borax	.97	5
56-19	9	N/A	N/A

Figure 2. Flow Schematic for East Mesa Test Wells

and tables listing the recording equipment, their location and the source company, can be found in Appendix A.

The water chemistry facilities consisted of a portable laboratory which included a set-up for cooling the collected samples without flashing, on-site filtering and preservation of these samples, and the continuous monitoring of conductivity, temperature and fluorescence (reference 1, 2 and 3).

The laboratory at Geothermal Testing Facilities was used in support of the field lab. This laboratory included the following analytical equipment: Atomic Absorption Spectrophotometer, UV-visible spectrophotometer and a Metler analytic balance (reference 1, 2 and 3).

The following is a brief summary of the source companies and data collected by each:

Baker Production Service (contracted) - downhole temperature and spinner logs for Well 56-30.

RGI - downhole temperature and pressure logs; water chemistry data collected during the scale inhibitor tests in 1983.

UURI - all water chemistry data for tracer injection and return; baseline chemistry and Self-Potential surveys.

EG&G Idaho, Inc. - all wellhead monitoring and measurements of pressure, flow and temperature; downhole spinner, temperature and pressure logs on Well 56-19.

TEST DATA DESCRIPTION

This section presents a summary of data acquisition, interpretation and the data base entry of the wellhead, chemical and geophysical data collected at East Mesa during the 1983-84 Hydrothermal Injection Program. A description of the data files format is also included.

The wellhead and geophysical data, with the exception of RGI's Amerada data, were originally recorded on magnetic tapes, digiquartz printer tapes and a variety of stripcharts as shown on Tables A-1 and A-2, Appendix A (some of the stripcharts were used as a backup for the magnetic tapes). The data on the magnetic tapes (recorded by the Datel loggers, which are electrical and battery powered) were measured in millivolts. The tapes were then converted into engineering units by a tape reader and copied directly to the data base. Digiquartz tapes were either key-punched and then entered into data base or directly entered into the files from a terminal. The geophysical logs recorded on stripcharts were interpreted by the individual company performing the logging service. The numeric interpretations were entered directly into the appropriate files.

The RGI Amerada downhole data was scribed into blackened brass cylindrical sheets (reference #4), and interpreted with the aid of a travelling microscope. The resulting numeric interpretations of temperature and pressure deflections are then used in a generalized equation for each tool to calculate downhole pressure. This data was then entered into the data base.

The results of the chemical analysis of samples collected both downhole and those collected from in-line sample ports by UURI and RGI were directly entered into the data base.

UURI ran a series of Self-Potential surveys prior to and during different phases of testing the wells. These results are not included in the data base.

A separate file was created for each of the 12 tests and a file for the monitor wells (Table 3). The file name indicates the test well and test number, i.e., TEST56301 is well 56-30 and test 1.

TABLE 3. TABLE OF FILES

<u>Well</u>	<u>Test #</u>	<u>File Name</u>	<u>** Duration of Test (hrs.)</u>
56-30	1	TEST56301	43.66
56-30	2	TEST56302	197.00
56-30	3	TEST56303	116.33
56-30	4	TEST56304	12.00 + 6-month quiescence
56-30	5	TEST56305	190.17
56-19	1	TEST56191	73.58
56-19	2	TEST56192	72.43
56-19	3	TEST56193	95.94
56-19	4	TEST56194	117.9
56-19	5	*	N/A
56-19	6	TEST56196	93.05
56-19	7	*	N/A
56-19	8	TEST56198	7.25 + 6-month quiescence
56-19	9	TEST56199	47.47
Monitor Wells	N/A	MESAMONITOR	07/12 - 08/29/84 01/31 - 02/09/84

* Test 5 and 7 of Well 56-19 were eliminated, after a consensus of the companies involved, due to a lack of funding.

** Time includes pre-start data, injection, quiescence, backflow and recovery data.

In the following section, each test file contents are displayed on plots which are preceded by two reference tables.

The first table consists of file name, test well and test number, date of test execution and a listing of records (stored data in the file). Each record is identified by name and record number and the appropriate engineering units, the instrumentation used to measure the data and the source company. The wellhead schematic of instrumentation referenced on this table is included in Appendix A. Any discrepancies or noteworthy exceptions to the file records are also noted on this table.

The second table is a sequential listing of major operational events during or in preparation for the test taken from the field log book and the Quick Look Reports. This table lists 2 corresponding times (file/real) for each event. The real time is the actual time of day the events took place. The file time, listed in hours, has a fixed zero-time simultaneous with the beginning of the first phase of flow (injection or backflow), with the exception of test 56-19-1 and 56-19-2. In both tests, the well was being backflowed for baseline data, and the first phase for each was aborted due to instrumentation problems caused by 2 phase flow (reference Table 1). Therefore, the data collected up until the tests were stopped, is included as pre-test data. The restart of each test is the zero time for each file.

Records containing geophysical logging data are also referenced on this table next to the appropriate times of data collection. Some of geophysical records are referenced more than once due to the record containing data from more than one consecutive phase of a given test, i.e., injection, quiescence and backflow phases.

Also included on this table are test objectives, and any events that are particular to the test. The plots which follow each set of file reference tables are labeled with the appropriate engineering units versus time (hrs.) or depth (ft.). The time and depth parameters for each test have been uniformly set for quick comparison of the data. Therefore, some of the data for certain records may not be plotted on the graphs.

The plots of the monitor wells are presented with three sets of graphs. The first set corresponds with the 56-30 test series. The zero time starts on July 12, 1983 at 00:00 hours. The second set corresponds with the 56-19 tests, August 1 through 29, 1983. The third set corresponds with the test during February 1984 with the zero time starting January 31 at 00:00 hours through February 9, 1984.

During the 1983 tests, RGI collected and analyzed samples to evaluate the performance of the various scale inhibitors. Data on calcium, bicarbonate and carbon dioxide concentrations in wellhead samples have been incorporated in the appropriate files. Curves were not drawn through the data points on the plots because of multiple values for some samples. Additional RGI data for these dissolved species as sampled at a number of locations and under a number of different conditions is given in Appendix B.

TEST SEQUENCE DATA FILES

TABLE 4 TEST 1 WELL 56-30

FILE NAME: TEST56301 DATE: 07/14-16/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>*INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
TEMP 5630-1 CVDL	1	°F/hour	T ₁	N/A	EGG
FLOW 5630-1 CVDL	2	gpm/hour	FIC	N/A	EGG
COND 5630-1 CVDL	3	arbitrary/hour (conductivity)	C ₁	N/A	EGG
PRES 5630-1 WHDQ	4	psia/hour	P ₂	N/A	EGG
TEMP 07/14 BAK	5	°F/feet	N/A	4987' - 6591'	BAKER
D/TEMP 07/14 BAK	6	Δ temp/feet	N/A	4987' - 6589'	BAKER
SPIN1 07/14 BAK	7	% flow/feet	N/A	5297' - 6437'	BAKER
SPIN2 07/14 BAK	8	% flow/feet	N/A	5287' - 6537'	BAKER
SPIN3 07/14 BAK	9	% flow/feet	N/A	5307' - 6502'	BAKER
TEMP 07/15 BAK	10	°F/feet	N/A	4987' - 6587'	BAKER
D/TEMP 07/15 BAK	11	Δ temp/feet	N/A	4987' - 6587'	BAKER
SPIN1 07/15 BAK	12	% flow/feet	N/A	5307' - 6557'	BAKER
SPIN2 07/15 BAK	13	% flow/feet	N/A	5297' - 6522'	BAKER
TEMP 07/05 1 RGI	14	°F/feet	#10007	30' - 6626'	RGI
PRES 07/05 1 RGI	15	psia/feet	#22757	30' - 6626'	RGI
PRES 07/05 2 RGI	16	psia/feet	#22768	30' - 6626'	RGI
TEMP 05/11 2 RGI	17	°F/feet	#23314	0' - 1400'	RGI
TEMP/5000/1 RGI	18	°F/hour	#10007	5000'	RGI
PRES/5000/1 RGI	19	psia/hour	#22757	5000'	RGI
PRES/5000/2 EGG	20	psia/hour	#22768	5000'	RGI

* Schematic Figure A-1 and Table A-1 Appendix A

Note: Record 20, recorded by RGI was interpreted by EGG

TABLE 4-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-30-1

<u>Date</u>	<u>Time</u>		
	File	Real	
May 11	N/A	N/A	RGI ran temperature log 0' to 1400 (Record 17)
July 05	N/A	N/A	RGI ran Amerada - Downhole temperature and pressure tool from 30' to 6626' (Records 14-16)
July 14	-5:10/07:34		Amerada tool lowered to 5000 feet
	-5.00/07:40		Data recorders on
	- .33/12:20		Filled flow line up to CV-1 control valve
	zerotime/12:40		Initiate backflow
	.08/12:45		Backflow 300 gpm
	1.82/14:29		Power outage about 1 minute
	3.00/15:40		Amerada tool being removed (Records 18 and 19)
	3.55/16:13		Amerada tool out of well and check for surface measurement
	3.88/16:33		Finished checking Amerada tool
	4.00/16:40		Baker setting up for downhole logs
	4.33/17:00		Change scan rate on data loggers, valve V-4 to well 52-29 broke, no effect on flow from 56-30
	4.50/17:40		Baker production starting downhole with spinner (Record 7)
	5.00/17:40		Baker running second spinner (Record 8)
	5.75/18:25		Baker running temperature log (Records 5 and 6)
	6.50/19:10		Baker finished running third spinner (Record 9)
	8.13/20:48		Baker finished isotope flow survey - pulling out of well
	8.58/21:15		Preparing to take downhole water samples
	9.97/22:38		Kuster sampler at 6500 feet
	10.38/23:03		Sampler coming up - no sample

Table 4-A (cont.)

July 15	14.50/03:10	Sampler out of hole - sample taken
	15.97/04:38	Kuster sampler at 5850 feet
	18.00/06:40	Sampler out of hole - no sample
	18.33/07:00	Baker production going downhole for temperature and spinner logs
	20.50/09:10	Finished logs (Records 10 - 13) going down with isotope flow meter and collar locator
	22.00/10:40	Baker finished logging
	22.58/11:15	Baker off well
	24.12/12:47	Amerada at 500 feet (Records 18 and 20)
	25.33/14:00	Well shut-in

Purpose: To establish reservoir and baseline chemistry data for Well 56-30 during low backflow rate.

Test 56-30 1

Record 1

The temperature was measured near the CV-1 valve at T_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 1

Record 2

The 300 gpm backflow was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 1

Record 3

The conductivity was measured at the wellhead with an inline probe at C₁ (Figure A-1), and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 1

Record 4

The wellhead pressure was measured at P₂ (Figure A-1) near the wellhead and recorded with a thermal printer. The plot below shows drawdown and recovery data.

Test 56-30 1

Record 5

The downhole temperature log run on July 14, by Baker, shows the temperature while traveling down the wellbore under 300 gpm backflow conditions.

Test 56-30 1

Record 6

The downhole Δ temperature log run on July 14, by Baker, shows the temperature difference as a function of depths. The temperature difference was measured between two probes mounted 2 feet apart, traveling down the wellbore during backflow of 300 gpm.

Test 56-30 1

Record 7

The spinner flow logs runs on July 14, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-30 1

Record 8

The spinner flow logs run on July 14, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-30 1

Record 9

The spinner flow logs run on July 14, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-30 1

Record 10

The downhole temperature log run on July 15, by Baker, shows the temperature while traveling down the wellbore under 300 gpm backflow conditions.

Test 56-30 1

Record 11

The downhole Δ temperature log run on July 15, by Baker, shows the temperature difference as a function of depths. The temperature difference was measured between two probes mounted 2 feet apart, traveling down the wellbore during backflow of 300 gpm.

Test 56-30 1

Record 12

The spinner flow logs run on July 15, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-30 1

Record 13

The spinner flow logs run on July 15, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-30 1

Record 14

The downhole temperature recorded with Amerada tool #10007 as traveling down the wellbore on July 5 under static well conditions.

Test 56-30 1

Record 15

The downhole pressure calculated (Ref. 4) from Amerada tool #22757 and #10007 shows the pressure as traveling down the wellbore on July 5 under static well conditions.

Test 56-30 1

Record 16

The downhole pressure calculated (Ref. 4) Amerada tool #22768 and #10007 show the pressures as traveling down the wellbore on July 5 under static well conditions.

Test 56-30 1

Record 17

The downhole temperature recorded with Amerada tool #23314 as traveling down the wellbore on July 5 under static well conditions.

Test 56-30 1

Record 18

The downhole temperature recorded with Amerada tool #10007 at wellbore depth of 5000'. The temperature was recorded during early backflow stages and then again during recovery.

Test 56-30 1

Record 19

The downhole pressure (calculated [Ref. 4] from Amerada tool #22757 and #10007) at a wellbore depth of 5000'. The pressure was recorded during early stages of backflow and then again for recovery.

PRES/5000/1 RGI

Test 56-30 1

Record 20

The downhole pressure (calculated [Ref. 4] from Amerada tool #22768 and #10007) at a wellbore depth of 5000'. The plot shows pressure during early stages of backflow. The pressure deflections were interpreted by EGG.

TABLE 5 TEST 2 WELL 56-30

FILE NAME: TEST56302 DATE: 07/16-24/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>*INSTRUMENTS/INTERVAL</u>		<u>SOURCE</u>
TEMP 5630-2 CVDL	1	°F/hour	T ₁	N/A	EGG
FLOW 5630-2 CVDL	2	gpm/hour	FIC	N/A	EGG
COND 5630-2 CVDL	3	arbitrary/hour (conductivity)	C ₁	N/A	EGG
PRES 5630-2 WHDQ	4	psia/hour	P ₂	N/A	EGG
TEMP 07/16 BAK	5	°F/feet	N/A	4987' - 6587'	BAKER
D/TEMP 07/16 BAK	6	Δ temp/feet	N/A	4987' - 6587'	BAKER
SPIN1 07/16 BAK	7	% flow/feet	N/A	5307' - 6472'	BAKER
SPIN2 07/16 BAK	8	% flow/feet	N/A	5312' - 6452'	BAKER
TEMP/5000/1 RGI	9	°F/hour	#10007	5000'	RGI
PRES/5000/2 RGI	10	psia/hour	#22768	5000'	RGI
PRES/5000/1 EGG	11	psia/hour	#22757	5000'	RGI

Schematic Figure A-1 and Table A-1 Appendix A

Note: Record 11, recorded by RGI and interpreted by EGG.

TABLE 5-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-30-2

<u>Date</u>	<u>Time</u>	
	File / Real	
July 16	-1.35/07:29	Amerada tool at 5000 feet (records 9 and 10)
	zerotime/08:50	Initiated backflow
	.10/08:56	Backflow at 450 gpm
	.77/09:36	Reduced flow to 375 gpm due to severe mechanical shocking in pipeline at RGI request
	1.25/10:05	Increase flow to 450 gpm
	3.25/12:05	Amerada tool being pulled out of hole
	4.42/13:15	Baker production logging well (records 5 and 6)
	5.00/13:50	Baker pulled temperature tool, not functioning
	10.17/19:00	Baker finished spinner logs (records 7 and 8)
	13.42/22:15	Baker taking downhole water sample at 5850 feet and 6300 feet for isotope flow survey
	14.17/23:00	Sampler up - samples contaminated with hydrocarbon and radioactive iodine
July 17	15.17/00:00	Amerada tool being lowering into well (records 9 and 11)
	18.75/03:35	Adjusted flow up to 450 gpm; it had drifted down to 440 gpm
	20.83/05:40	Flashing across orifice at CV-1 is oscillating the CV-1 control valve - switching to ΔP_2 on wellhead to make flow measurement
	24.00/08:50	Shut-in well

Purpose: To establish reservoir and baseline chemistry data for Well 56-30 at high backflow rates.

Test 56-30 2

Record 1

The temperature was measured near the CV-1 valve at T_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 2

Record 2

The 450 gpm backflow was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30-2

Record 3

The conductivity was measured at the wellhead with an inline probe at C₁ (Figure A-1), and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 2

Record 4

The wellhead pressure measured at P₂ (Figure A-1) near the wellhead and recorded with a thermal printer. The plot below shows drawdown and partial recovery data.

Test 56-30 2

Record 5

The downhole temperature log run on July 16, by Baker, shows the temperature while traveling down the wellbore under 450 gpm backflow conditions.

Test 56-30 2

Record 6

The downhole Δ temperature log run on July 16, by Baker, shows the temperature difference as a function of depths. The temperature difference was measured between two probes, mounted 2 feet apart, traveling down the wellbore during backflow of 450 gpm.

Test 56-30 2

Record 7

The spinner flow logs run on July 16, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 450 gpm.

Test 56-30 2

Record 8

The spinner flow logs run on July 16, and interpreted by Baker, are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 450 gpm.

Test 56-30 2

Record 9

The downhole temperature recorded with Amerada tool #10007 at a wellbore depth of 5000'. The temperature was recorded during early backflow stages and then again during recovery.

Test 56-30 2

Record 10

The downhole pressure (calculated [Ref. 4] from Amerada tool #22768 and #10007) at a wellbore depth of 5000'. The pressure was recorded during early stages of backflow.

Test 56-30 2

Record 11

The downhole pressure (calculated [Ref. 4] from Amerada tool #22757 and #10007) at a wellbore depth of 5000'. The plot shows pressure during recovery. The pressure deflection was interpreted by EGG.

1 PRES/5000/1 EGG

TABLE 6 TEST 3 WELL 56-30

FILE NAME: TEST56303 DATE: 07/24-28/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>*INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
TEMP 5630-3 CVDL	1	°F/hour	T ₁	N/A	EGG
FLOW 5630-3 CVDL	2	gpm/hour	FIC	N/A	EGG
COND 5630-3 CVDL	3	arbitrary/hour (conductivity)	C ₁	N/A	EGG
FLUO 5630-3 CVDL	4	arbitrary/hour (fluorescein)	?	N/A	EGG
PRES 5630-3 WHDQ	5	psia/hour	P ₂	N/A	EGG
TEMP 07/24 BAK	6	°F/feet	N/A	4987' - 6587'	BAKER
D/TEMP 07/24 BAK	7	Δtemp/feet	N/A	4987' - 6587'	BAKER
TEMP/5000/1 RGI	8	°F/hour	#10007	5000'	RGI
PRES/5000/1 RGI	9	psia/hour	#22757	5000'	RGI
PRES/5000/2 EGG	10	psia/hour	#22768	5000'	RGI

Schematic Figure A-1 and Table A-1 Appendix A

Note: Record 10 recorded by RGI and interpreted by EGG.

TABLE 6-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-30-3

<u>Date</u>	<u>Time</u>	
	File / Real	
July 24	-7.83/06:00	Initiated flow from well 38-30 to pit 56-30
	-2.92/10:55	Amerada tool at 5000 feet (records 8 - 10)
	- .58/13:15	All tracers mixed
	zerotime/13:50	Initiated injection to well 56-30, 300 gpm with continuous tracer KCl (rate 1 gpm $\pm$.06 gpm)
	1.08/14:55	Initiated tracer slug about 1750 gallons at 300 gpm
	1.13/14:58	Added fluorescein tracer to slug tracer tank T-2
	1.17/15:00	Completed tracer slug injection
	1.32/15:09	Power outage in lab trailer
	1.37/15:12	Power restored in lab trailer
	3.00/16:50	Amerada tool being removed
	3.47/17:18	Power outage in lab trailer
	3.48/17:19	Power restored to lab trailer
	3.67/17:30	Amerada tool out of well
	4.17/18:00	Baker beginning temperature logs
	5.08/18:55	Baker production finished logging (records 6 and 7)
	5.33/19:10	Adjustment to injection flow
	8.75/22:35	Baker finished isotope flow survey
July 25	10.17/00:00	Amerada tool being lowered down well
	10.50/00:20	Amerada tool at 5000 feet (records 8 - 10)
	11.50/01:20	Injection completed
	11.53/01:22	Well 56-30 shut-in
	23.50/13:20	Initiated backflow of Well 56-30
	23.52/13:21	Backflow at 300 gpm

Table 6-A (cont.)

	24.12/13:57	In-line conductivity meter failed
	24.42/14:15	In-line conductivity meter working
	27.33/17:10	Removing Amerada tool from well
July 25	28.62/18:27	Going down with Kuster sampler to 6500 feet
	30.83/20:40	Sample retrieved from 6500 feet, good sample
	31.17/21:00	Going down with Kuster sampler to 6,300 feet
	33.08/22:55	Sampler failed, no sample
July 26	42.58/08:25	Channel 2 on Gould recorder not working (temperature)
July 27	58.58/00:25	All instruments now working; flow steady (300 gpm backflow)
July 28	90.17/08:00	Wellhead temperature on stripchart reads 298°F compared to 302°F on other instruments
	90.50/08:20	Shut-in well, end of test

Purpose: To establish baseline tracer injection - withdrawal data and evaluate reservoir characteristics during injection and backflow of Well 56-30.

Test 56-30 3

Record 1

The temperature was measured near the CV-1 valve at T_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 3

Record 2

The 300 gpm injection (supply Well 38-30) and backflow was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 3

Record 3

The conductivity was measured at the wellhead with an in-line probe at C₁ (Figure A-1), and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 3

Record 4

The fluorescein was measured at the wellhead and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 3

Record 5

The wellhead pressure measured at P₂ (Figure A-1) near the wellhead and recorded with a thermal printer. The plot below shows the pressure trend during injection, quiescence and backflow.

Test 56-30 3

Record 6

The downhole temperature log run on July 24, by Baker, shows the temperature while traveling down the wellbore during 300 gpm injection conditions.

Test 56-30 3

Record 7

The downhole Δ temperature log run on July 24, by Baker, shows the temperature difference as a function of depths. The temperature difference was measured between two probes, mounted 2 feet apart, traveling down the wellbore during injection of 300 gpm.

Test 56-30 3

Record 8

The downhole temperature recorded with Amerada tool #10007 at a wellbore depth of 5000'. The temperature was recorded during early injection stage through quiescence and early backflow stage.

Test 56-30 3

Record 9

The downhole pressure (calculated [Ref.4] from Amerada tool #22757 and #10007) at a wellbore depth of 5000'. The pressure was recorded during early stages of injection and then again during early stage backflow.

Test 56-30 3

Record 10

The downhole pressure (calculated [Ref. 4] from Amerada tool #22768 and #10007) at a wellbore depth of 5000'. The pressure was recorded during early stages of injection, quiescence and then again during early stage backflow. The pressure deflection was interpreted by EGG.

TABLE 7 TEST 4 WELL 56-30

FILE NAME: TEST56304 DATE: 07/29/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>*INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
TEMP 5630-4 CVDL	1	°F/hour	T ₁	N/A	EGG
FLOW 5630-4 CVSC	2	gpm/hour	FIC	N/A	EGG
FLOW 5630-4 CVDL	3	gpm/hour	FIC	N/A	EGG
COND 5630-4 CVDL	4	arbitrary/hour (conductivity)	C ₁	N/A	EGG
FLUO 5630-4 CVDL	5	arbitrary/hour (fluorescein)	?	N/A	EGG
PRES 5630-4 WHDQ	6	psia/hour	P ₂	N/A	EGG

Schematic Figure A-1 and Table A-1 Appendix A.

Note: Records 1 and 3 are incomplete due to equipment failure, however,
Record 2 is a digitized version of Record 3 taken from the stripchart.

TABLE 7-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-30-4

<u>Date</u>	<u>Time</u>	
	File / Real	
July 29	-4.20/06:00	Flowing well 38-30 to 56-30 pit
	- .67/09:30	Calibrated continuous tracer pump
	zerotime/10:10	Initiated injection to well 56-30, (continuous tracer NaI)
	.03/10:12	Flow steady at 300 gpm
	.33/10:30	Unplugged filter
	1.00/11:10	Initiated tracer slug injection (Na ₂ Fluorescein and NaSCN)
	1.08/11:15	Terminated tracer slug injection
	4.33/14:30	Recalibrated ΔP stripchart, 0 to 25 psid (wellhead ΔP_2)
	6.00/16:10	Switch to second continuous tracer tank
	11.75/21:55	Filters plugging, CV-1 valve full open but flow is still falling off
	12.00/22:10	Shut-in well, injection completed

Purpose: To inject tracer into the reservoir in preparation for long-term quiescence.

Test 56-30 4

Record 1

The temperature was measured near the CV-1 valve at T₁ (Figure A-1) and recorded on stripchart and data logger. The plot below shows only partial data due to data logger failure.

Test 56-30 4

Record 2

The 300 gpm injection (supply well 38-30) was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows data digitized off the stripchart.

Test 56-30 4

Record 3

The 300 gpm injection (supply well 38-30) was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows partial data due to data logger failure.

Test 56-30 4

Record 4

The conductivity was measured at the wellhead with an in-line probe at C₁ (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 4

Record 5

The fluorescein was measured at the wellhead and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-30 4

Record 6

The wellhead pressure measured at P_2 (Figure A-1) near the wellhead and recorded on a thermal printer. The plot below shows the pressure during injection (supply well 38-30) and partial recovery.

TABLE 8 TEST 5 WELL 56-30

FILE NAME: TEST56305 DATE: 01/29-02/09/84

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>*INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
FLOW 5630-5 CVSC	1	gpm/hour	FIC	N/A	EGG
FLOW 5630-5 LOG	2	gpm/hour	Manual	N/A	EGG
TEMP 5630-5 CVSC	3	°F/hour	T ₁	N/A	EGG
PRES 5630-5 WHDQ	4	psia/hour	P ₂	N/A	EGG
TEMP/5000/1 RGI	5	°F/hour	#10007	5000'	RGI
TEMP/5000/2 RGI	6	°F/hour	#23314	5000'	RGI
PRES/5000/3 RGI	7	psia/hour	#2694N	5000'	RGI
TEMP 02/01 1 RGI	8	°F/hour	#10007	250' - 6300'	RGI
TEMP 02/01 2 RGI	9	°F/hour	#23314	250' - 6300'	RGI
PRES 02/01 3 RGI	10	psia/feet	#2694N	250' - 6300'	RGI

Schematic Figure A-1 and Table A-1 Appendix A.

Records 7 and 10: the pressures were calculated using values supplied from both temperature tools, then the average was taken of both calculations for final pressure values (Ref. 4).

TABLE 8-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-30-5

<u>Date</u>	<u>Time</u>	
	File / Real	
January 29	-77.83/08:00	UURI laid out S. P. grid around Well 56-30
January 30	-54.83/07:00	UURI obtained baseline S. P. data for 56-30 grid
January 31	-29.83/08:00	Began preparations for Test 56-30-5
February 1	-5.00/08:50	Starting downhole with Amerada tool (Records 7, 8, and 9)
	-4.33/09:30	Initiated 38-30 to 52-29 warm-up flow
		UURI obtained S. P. data around Well 56-30 grid
	- .57/13:16	Shut-in Well 38-30
	zerotime/13:50	Opened Well 56-30, backflow 300 gpm
	6.92/20:45	Conductivity probe taken off-line due to internal leakage
February 2	18.17/08:00	UURI obtained S. P. data for 56-30 grid
	20.17/10:00	Stripchart reading 7°F lower than actual reading
February 3	42.17/08:00	UURI obtained S. P. data for 56-30 grid
	43.17/09:00	Increased backflow to 450 gpm
February 4	67.17/09:00	Iodine tracer concentration on upward trend after flowing three days.
February 5	89.17/07:00	Switched flow pattern at 56-30 well and began pumping fluid to 56-19 pit.
	93.22/11:03	Stopped pumping to 56-19 pit
	93.78/11:37	Shut-in well 56-30
February 7	144.02/13:51	Initiated backflow at 300 gpm
	150.25/20:05	Backflow at 370 gpm
February 8	154.18/00:01	Digiquartz clock not maintaining accurate time
February 9	190.17/12:00	Shut-in Well 56-30, test completed

Purpose: To withdraw tracer/injectant after 6 months quiescence.

Test 56-30 5

Record 1

The backflow was measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart. The plot below shows the data for backflow during February 1-5 and then again for the second backflow February 7-9 when the test was completed.

Test 56-30 5

Record 2

The backflow was measured in tank T-1 (Figure A-1) after it was flashed to the atmosphere. These measurements were made manually and recorded in the log book. The plot shows backflow February 1-5 and 7-9.

Test 56-30 5

Record 3

The temperature was measured at T_1 near the CV-1 valve and recorded on stripchart. The plot shows the temperature for backflow February 1-5 and 7-9.

Test 56-30 5

Record 4

The wellhead pressure measured at P₂ (Figure A-1) near the wellhead and recorded on a thermal printer. The plot shows pressure response during backflow February 1-5 and 7-9.

Test 56-30 5

Record 5

The downhole temperature recorded with Amerada tool #10007 at a wellbore depth of 5000'. The temperature was recorded during early backflow stages for the February 1-5 test.

Test 56-30 5

Record 6

The downhole temperature recorded with Amerada tool #23314 at a wellbore depth of 5000'. The temperature was recorded during early backflow stages for the February 1-5 test.

Test 56-30 5

Record 7

The downhole pressure at the wellbore depth of 5000'. This pressure is an average of two calculations (Ref. 4). First the pressure was calculated using Amerada tools #2694N and 10007 then using #3694N and 23314, then averaged. The plot shows pressure for early stage backflow.

Test 56-30 5

Record 8

The downhole temperature recorded with Amerada tool #10007 as traveling down the wellbore during static well conditions on February 1.

Test 56-30 5

Record 9

The downhole temperature recorded with Amerada tool #23314 as traveling down the wellbore during static well conditions on February 1.

Test 56-30 5

Record 10

The downhole pressure while traveling down the wellbore during static well conditions on February 1. This data was calculated (Ref. 4) using an average of Amerada tool #2694N and #10007 then tool #2694N and 23314.

TABLE 9 TEST 1 WELL 56-19

FILE NAME: TEST56191

DATE: 08/02-04/83

RECORD NAME	#	ENGINEERING UNITS	INSTRUMENT/INTERVAL		SOURCE
FLOW 5619-1 19SC	1	gpm/hour	** F1 ₃	N/A	EGG
FLOW 5619-1 CVDL	2	gpm/hour	* FIC	N/A	EGG
TEMP 5619-1 19DL	3	°F/hour	** T ₃	N/A	EGG
TEMP 5619-1 CVDL	4	°F/hour	* T ₁	N/A	EGG
COND 5619-1 CVSC	5	arbitrary/hour (conductivity)	* C ₁	N/A	EGG
PRES 5619-1 WHDQ	6	psia/hour	** P ₄	N/A	EGG
TEMP1 08/02 EGG	7	°F/feet	Seling	0' - 2096'	EGG
PRES1 08/02 EGG	8	psia/feet	Seling	0' - 2096'	EGG
TEMP2 08/03 EGG	9	°F/feet	Seling	0' - 2000'	EGG
PRES2 08/03 EGG	10	psia/feet	Seling	0' - 2000'	EGG
SPIN 1 08/02 EGG	11	gpm/feet		2335' - 3350'	EGG
SPIN 2 08/03 EGG	12	gpm/feet		2337' - 3350'	EGG
TEMP 07/06 2 RGI	13	°F/feet	#23314	500' - 3600'	RGI
PRES 07/06 3 RGI	14	psia/feet	#2694N	500' - 3600'	RGI

* Figure A-1 and Table A-1 Appendix A

** Figure A-2 and Table A-2 Appendix A

TABLE 9-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-1

<u>Date</u>	<u>Time</u>	
	File / Real	
July 6		Amerada temperature and pressure baseline data (Records 13 and 14)
August 2	-30.00/08:00	Logging down with Seling temperature and pressure probe (Records 7 and 8)
	-28.92/09:05	System 1 data logger located at CV-1 valve, system 2 is located at 56-19 wellhead
	-28.00/10:00	Seling tool now logging at 2000 feet, data no good
	-26.58/11:25	Initiated backflow of 150 gpm
	-26.17/11:50	Increased flow to 300 gpm
	-25.23/12:46	Stopped flow to divert from 38-30 to flash tank at 52-29 (took several minutes)
	-23.20/14:48	Flow at 314 gpm
	-23.17/14:50	Seling tool logging up
	-22.50/15:30	Adjusted in-line conductivity probe to lower output
	-22.00/16:00	Going down with spinner, spinner not working
	-19.25/18:45	Spinner tool coming out of well
	-19.08/18:55	Reduced flow to 150 gpm
	-18.50/19:30	Switch wellhead pressure on Gould recorder from channel 6 to channel 3
	-18.17/19:50	Flow increased to 300 gpm
	-17.58/20:25	Shut-in well 56-19, test aborted
August 3	- 1.03/12:58	Logging down with Seling tool (Records 9 and 10)
	zerotime/14:00	Initiated backflow, 300 gpm
	2.20/16:12	In-line tank test by RGI shows 309 gpm
	3.00/17:00	Logging up with Seling tool, data no good
	4.40/18:24	Initiated slug flow at 56-19
	5.47/19:28	Picked up traces of slug flow at 56-30

TABLE 9-A (cont.)

August 3	6.83/20:50	Going downhole with Kuster sampler
	7.08/21:05	Sampler out, clock broken
August 4	18.33/08:20	Spinner survey started
	20.67/10:40	Spinner survey completed (Record 12)
	21.75/11:45	Seling tool not working
	24.00/14:00	Decreased flow to 20 gpm
	26.33/16:20	Shut-in flow, test 56-19-1 completed

Purpose: To establish baseline reservoir and chemistry data for Well 56-19 during a low backflow rate and recovery.

Test 56-19 1

Record 1

The 300 gpm backflow was measured across the orifice ΔP_3 (Figure A-2) at Well 56-19, and recorded on stripchart and data logger. The plot below shows the data digitized from the stripchart. The first attempt was aborted.

Test 56-19 1

Record 2

The 300 gpm backflow from 56-19 was also measured across the orifice near ΔP_1 , at Well 56-30 (Figure A-1). The plot below shows data from the data logger. The first attempt was aborted.

Test 56-19 1

Record 3

The temperature was measured at T_3 (Figure A-2) at Well 56-19 and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-19 1

Record 4

The temperature was measured near the CV-1 Valve (Figure A-1) at T₁ Well 56-30. The data below is taken from the data logger.

Test 56-19 1

Record 5

The conductivity was measured at C_1 (Figure A-1) on the sample line L-4 to the lab trailer at Well 56-30. The data below is taken from the stripchart.

Test 56-19 1

Record 6

The wellhead pressure measured at P₄ (Figure A-2) and recorded by a thermal printer. The plot below shows the pressure response during first attempt backflow, recovery and test restart backflow and partial recovery.

Test 56-19 1

Record 7

The downhole temperature was measured while traveling down the wellbore under static well conditions just prior to first attempt backflow on 08/02.

Test 56-19 1

Record 8

The downhole pressure was measured while traveling down the wellbore under static well conditions just prior to the first attempt at backflowing on 08/02.

Test 56-19 1

Record 9

The downhole temperature was measured as traveling down the wellbore just prior to the test restart on 08/03.

Test 56-19 1

Record 10

The downhole pressure was measured as traveling down the wellbore just prior to test restart on 08/03.

Test 56-19 1

Record 11

The spinner flow logs run on August 2, and interpreted by EGG are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-19 1

Record 12

The spinner flow log run on August 3, and interpreted by EGG are plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 300 gpm.

Test 56-19 1

Record 13

The downhole temperature log run on July 6 with Amerada tool #23314 as traveling down the wellbore under static well conditions.

Test 56-19 1

Record 14

The downhole pressure (calculated [Ref. 4] from Amerada tool #2694N and #23314) as traveling down the wellbore on July 6 and under static well conditions.

TABLE 10 TEST 2 WELL 56-19

FILE NAME: TEST56192 DATE: 08/05-07/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
FLOW 5619-2 CVSC	1	gpm/hour	* FIC	N/A	EGG
TEMP 5619-2 CVSC	2	°F/hour	* T ₁	N/A	EGG
FLOW 5619-2 19SC	3	gpm/hour	** F ₁₃	N/A	EGG
TEMP 5619-2 19DL	4	°F/hour	** T ₃	N/A	EGG
COND 5619-2 CVDL	5	arbitrary/hour (conductivity)	* C ₁	N/A	EGG
PRES 5619-2 WHDQ	6	psia/hour	** P ₄	N/A	EGG
TEMP/2450/2 RGI	7	°F/hour	#23314	2450'	RGI
PRES/2450/4 RGI	8	psia/hour	#21368	2450'	RGI
PRES/2450/3 EGG	9	psia/hour	#2694N	2450'	RGI

* Figure A-1 and Table A-1 Appendix A

** Figure A-2 and Table A-2 Appendix A

Note: Record 9, RGI log interpreted by EGG.

TABLE 10-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-2

<u>Date</u>	<u>Time</u>	
	File / Real	
August 5	-21.48/11:41	Amerada tool at 2450 feet
	-20.17/13:00	Initiate backflow, 500 gpm
	-17.67/15:30	Closed CV-1 valve momentarily
	-17.02/16:09	Amerada tool coming out of hole (Records 7 and 8)
	-15.67/17:30	Shut-in well 56-19, test aborted; problem with maintaining flow rate
	-11.65/21:31	Concluded to take out orifice plate at 56-19 (there will no longer be a flow measurement taken at 56-19 wellhead, all flow measurement will come from CV-1 valve)
Aug. 6	zerotime/09:10	Initiated backflow, 600 gpm
	.08/09:15	Backflow rate of 600 gpm cannot be maintained
	.17/09:20	Reduced flow to 500 gpm
	2.18/11:21	Performed slug flow test for 1 hour
	9.80/18:58	Downhole sample taken at 3200 feet
	10.82/19:59	Sampler out of hole
	13.33/22:30	Going downhole with Amerada tool (Records 7, 8 and 9)
Aug. 7	24.18/09:21	Shut-in well 56-19 except for 20 gpm

Purpose: To establish baseline reservoir and chemistry data during high rate backflow and recovery.

Test 56-19 2

Record 1

The backflow was measured downstream at Well 56-30 across the orifice at ΔP_1 (Figure A-1). The first attempt at backflow was aborted. The plot below shows both phases of backflow. The first was taken from the stripchart and the second starting at 0 hours is from the data logger.

Test 56-19 2

Record 2

The temperature was measured downstream at Well 56-30 at T_1 near the CV-1 valve (Figure A-1). The first attempt at backflow was aborted. The plot below shows both phases of backflow temperature. The first was taken from the stripchart and the second, starting with 0 hours is taken from the data logger.

Test 56-19 2

Record 3

The backflow was measured across the orifice at ΔP_3 (Figure A-2). The data shown below was taken from the stripchart and is for the first attempt to backflow the well. After which the orifice plate was removed due to gas build-up. Measurements were made at the instrumentation set-up at Well 56-30 for the remaining 56-19 tests.

Test 56-19 2

Record 4

The temperature was measured at T₃ (Figure A-2). The data shown below was recorded by the data loggers, and shows the backflow temperature for both phase of backflow, the first attempt was aborted.

Test 56-19 2

Record 5

The conductivity was measured at Well 56-30 at C₁ on the sample line L-4 (Figure A-1). The data below shows the results of a slug tracer that was injected into the backflow fluid at Well 56-19 (Figure A-2), for the pipeline dispersion test.

Test 56-19 2

Record 6

The wellhead pressure measured at P_4 (Figure A-2) shows the pressure response during both backflow stages and recovery between and after. The data was recorded on a thermal printer.

Test 56-19 2

Record 7

The downhole temperature measured with Amerada tool 23314 at a wellbore depth of 2450'. The measurements made during the first phase of backflow (-20 hours), and again prior to and during the test restart on 08/06.

Test 56-19 2

Record 8

The downhole pressure (calculated [Ref. 4] from Amerada tool #21368 and #23314) at a wellbore depth of 2450'. The pressure shown below is during the first attempt at backflow, recovery and again during test restart on 08/06.

Test 56-19 2

Record 9

The downhole pressure (calculated [Ref. 4] from Amerada tool #2694N and #23314) at a wellbore depth of 2450'. The pressure deflections of the RGI log were interpreted by EGG. The plot below shows only the restart of the test.

TABLE 11 TEST 3 WELL 56-19

FILE NAME: TEST56193 DATE: 08/08-11/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
TEMP 5619-3 CVDL	1	°F/hour	* T ₁	N/A	EGG
TEMP 5619-3 19DL	2	°F/hour	** T ₃	N/A	EGG
FLOW 5619-3 CVDL	3	gpm/hour	* FIC	N/A	EGG
COND 5619-3 19DL	4	arbitrary/hour (conductivity)	** C ₄	N/A	EGG
PRES 5619-3 WHDQ	5	psia/hour	** P ₄	N/A	EGG
CA 5619-3 RGI	6	ppm/hour	Lab Trailer	N/A	RGI
HCO ₃ 5619-3 RGI	7	ppm/hour	Lab Trailer	N/A	RGI
CO ₂ 5619-3 RGI	9	ppm/hour	Lab Trailer	N/A	RGI
TEMP/2450/2 RGI	9	psia/hour	#23314	2450'	RGI
PRES/2450/3 EGG	10	psia/hour	#2694N	2450'	RGI
PRES/2450/4 EGG	11	psia/hour	#21368	2450'	RGI

* Figure A-1 and Table A-1 Appendix A

** Figure A-2 and Table A-2 Appendix A

Note: Record 10 and 11 are EGG interpretation of RGI's logs.

TABLE 11-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-3

<u>Date</u>	<u>Time</u>	
	File / Real	
	- 5.75/07:41	Initiated flow from Well 38-30 to 56-30 pit for warm-up and line flush
August 8	- 1.88/11:27	Amerada tool at 2450 feet (Records 9 - 11)
	- 1.15/12:17	Begin flow of continuous tracer into 56-19 pit, Well 38-30 supplying water
	zerotime/13:26	Diverted flow to Well 56-19 (UURI time maximum response seen at 13:28) 300 gpm injection
	1.92/15:21	Initiated tracer slug flow
	2.00/15:26	Stopped slug flow
August 9	11.58/01:01	Injection flow to well 56-19 shut-in and diverted to pit
	12.60/02:02	Closed-in Well 38-30
	23.57/13:00	Opened Well 56-19 to backflow
	23.70/13:08	Backflow at 300 gpm
	26.57/16:00	RGI out of hole, all 3 Amerada failed
	26.82/16:15	Logging well with spinner
	28.57/18:00	Spinner failed
	32.73/22:10	Sampler at 3100 feet
August 10	42.82/08:15	Fluorimeter put on recorder, UURI to check (not calibrated)
August 11	68.07/09:30	Changed scale on fluorimeter
	77.05/18:29	Shut-in well 56-19

Purpose: To establish baseline tracer injection and backflow data and to evaluate reservoir characteristics during injection and backflow of Well 56-19.

Test 56-19 3

Record 1

The temperature during injection (supply well 38-30) and backflow was measured at Well 56-30 at T_1 (Figure A-1). The data below was taken from the data logger.

Test 56-19 3

Record 2

The temperature during injection (supply well 38-30) and backflow was measured at T₃ (Figure A-2). The data below was taken from the data logger.

Test 56-19 3

Record 3

The injection (supply well 38-30) and backflow was measured across the orifice at ΔP_1 (Figure A-1). The data below was taken by the data logger.

Test 56-19 3

Record 4

The conductivity measured at C₄ (Figure A-2), Well 56-19 and recorded by the data logger. The data below shows a lot of noise and not much of the curve.

Test 56-19 3

Record 5

The wellhead pressure measured at P_4 (Figure A-2) and recorded by thermal printer. The data below shows the pressure response during injection (supply well 38-30), quiescence and backflow and partial recovery.

Test 56-19 3

Record 6

The calcium data below was collected in lab trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 3

Record 7

The bicarbonate data below was collected in the Lab Trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 3

Record 8

The carbon dioxide data below was collected in the Lab Trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 3

Record 9

The downhole temperature was measured by Amerada tool #23314 at a wellbore depth of 2450'. However, this data is questionable due to instrumentation problems.

Test 56-19 3

Record 10

The downhole pressure (calculated [Ref. 4] from Amerada tool #2694N and 23314) was measured at a wellbore depth of 2450'. However, according to RGI comments, the reliability of this data is questionable due to instrumentation problems.

Test 56-19 3

Record 11

The downhole pressure (calculated [Ref. 4] from Amerada tool #21368 and #23314) was measured at a wellbore depth of 2450' however, the data is questionable due to instrumentation problems.

TABLE 12 TEST 4 WELL 56-19

FILE NAME: TEST56194 DATE: 08/12-15/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
FLOW 5619-4 CVDL	1	gpm/hour	* FIC	N/A	EGG
TEMP 5619-4 CVDL	2	°F/hour	* T ₁	N/A	EGG
TEMP 5619-4 19DL	3	°F/hour	** T ₃	N/A	EGG
PRES 5619-4 WHDQ	4	psia/hour	**P ₄	N/A	EGG
CA 5619-4 RGI	5	ppm/hour	Trailer Lab		EGG
HC03 5619-4 RGI	6	ppm/hour	Trailer Lab		EGG
CO2 5619-4 RGI	7	ppm/hour	Trailer Lab		EGG
SPIN 08/13 EGG	8	% flow/feet	Spinner	2336' - 3260'	EGG
PRES/2450/4 EGG	9	psia/hour	21368	2450'	RGI
PRES/2000/4 EGG	10	psia/hour	21368	2000'	RGI
PRES/2000/4 RGI	11	psia/hour	21368	2000'	RGI

* Figure A-1 and Table A-1 Appendix A

** Figure A-2 and Table A-2 Appendix A

Note: Records 9 and 10 are EGG interpretation of RGI logs

TABLE 12-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-4

<u>Date</u>	<u>Time</u>	
	File / Real	
August 12	- 7.38/06:00	Start warm-up flow
	- 1.25/12:08	Amerada tool downhole (Record 9)
	- .88/12:30	Started chemicals
	- .78/12:36	Chemical rate stable (continuous tracer)
	zerotime/13:23	Diverted flow from pit to Well 56-19, 500 gpm
	1.20/14:35	Injected slug tracer
	1.28/14:40	Completed slug injection
	2.12/15:30	Amerada tool out of hole
	4.12/17:30	Spinner tool failed
	6.12/19:30	Amerada tool downhole (Record 9)
	6.87/20:15	Completed continuous tracer injection
	7.37/20:45	Completed injection
August 13	19.12/08:30	Amerada tool out of hole and back downhole again
	20.12/09:30	Initiated backflow from Well 56-19 at 500 gpm
	26.62/16:00	Completed spinner log (Record 8)
August 14	42.78/08:10	Backflow steady at 500 gpm
	43.37/08:45	Check for leaking of sample bomb at 600 feet downhole; out of hole for surface check, no leaks
	44.40/09:47	Going downhole with sampler
	45.32/10:42	Sampler at 3000 feet
	46.87/12:15	Sample collected, actual depth of sample questionable
	48.13/13:31	Reduced flow to 450 gpm
	57.45/22:50	Amerada tool at 2000 feet (Records 10 and 11)

Table 12-A (cont.)

August 15 68.12/09:30 Well 56-19 shut-in, backflow completed

Purpose: To establish baseline tracer injection and backflow data and to evaluate reservoir characteristic during injection and backflow for well 56-19 at higher flow rates.

Test 56-19 4

Record 1

The injection and backflow were measured across the orifice at ΔP_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data from the data logger.

Test 56-19 4

Record 2

The temperature was measured near the CV-1 valve at T_1 (Figure A-1) and recorded on stripchart and data logger. The plot below shows the data taken from the data logger.

Test 56-19 4

Record 3

The temperature was measured near the 56-19 wellhead at T_{10} (Figure A-2) and recorded on stripchart and data logger. The plot below shows the data from the data logger, during injection quiescence and backflow.

Test 56-19 4

Record 4

The wellhead pressure was measured near 56-19 wellhead at P₄ (Figure A-2) and recorded with a thermal printer. The plot below shows pressure responses to injection, quiescences, backflow and partial recovery.

Test 56-19 4

Record 5

The calcium data below was collected in the lab trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 4

Record 6

The bicarbonate data below was collected in the lab trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 4

Record 7

The carbon dioxide data below was collected in the lab trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 4

Record 8

The spinner flow log run on August 13, and interpreted by EGG is plotted as a profile to show the depths associated with the percentage of well flow while backflowing at 500 gpm.

Test 56-19 4

Record 9

The downhole pressure (calculated [Ref. 4] from Amerada tool #21368 and #23314) at a wellbore depth of 2450'. The pressure was recorded during early stages of injection and then again during quiescence. The pressure deflections were interpreted by EGG.

PRES/2480/4 EGG

Test 56-19 4

Record 10

The downhole pressure (calculated [Ref. 4] from Amerada tool #21368 and #23314) at a wellbore depth of 2000'. The pressure was recorded during early stages of backflow at 500 gpm. The pressure deflections were interpreted by EGG.

Test 56-19 4

Record 11

The downhole pressure (calculated [Ref. 4] from Amerada tool #21368 and #23314) at a wellbore depth of 2000'. The pressure was recorded during later stages of backflow and for recovery.

TABLE 13 TEST 6 WELL 56-19

FILE NAME: TEST56196 DATE: 08/17-20/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>	<u>SOURCE</u>
TEMP 5619-6 19DL	1	°F/hour	** T ₃ N/A	EGG
FLOW 5619-6 CVSC	2	gpm/hour	* FIC N/A	EGG
FLUO 5619-6 CVSC	3	arbitrary/hour (fluorescein)	N/A	EGG
COND 5619-6 CVSC	4	arbitrary/hour (conductivity)	* C ₁ N/A	EGG
PRES 5619-6 WHDQ	5	psia/hour	** P ₄ N/A	RGI
CA 5619-6 RGI	7	ppm/hour	Lab Trailer N/A	RGI
HCO3 5619-6 RGI	7	ppm/hour	Lab Trailer N/A	RGI
CO2 5619-6 RGI	8	ppm/hour	Lab Trailer N/A	RGI
SPIN1 08/20 EGG	9	% flow/feet	2450' - 3182'	EGG
SPIN2 08/20 EGG	10	% flow/feet	2335' - 3100'	EGG
SPIN3 08/20 EGG	11	% flow/feet	2337' - 3350'	EGG

TABLE 13-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-6

<u>Date</u>	<u>Time</u>	
	File / Real	
August 17	- 1.07/10:13	Initiate flow to 56-19 pit
	- 1.03/10:15	Injection of continuous tracer
	zerotime/11:17	Diverted flow to Well 56-19
	1.10/12:23	Injected slug tracer
	1.17/12:27	Completed injection of slug tracer Ran spinner logs (Records 9 and 10)
	1.95/13:14	Tracer slug observed at 56-19
August 18	14.47/01:45	Completed injection to Well 56-19
	26.55/13:50	Initiated backflow at 500 gpm Ran spinner log (Record 11)
August 20	65.30/04:35	Reduced flow to 450 gpm
	74.55/13:50	Completed backflow of Well 56-19

Purpose: To determine the effects of injecting a larger volume of fluid into the reservoir at a high flow rate.

Test 56-19 6

Record 1

The wellhead temperature during injection (supply well 38-30) and backflow measured at T₁₀ (Figure A-2). The plot below shows data from the data logger.

Test 56-19 6

Record 2

The injection (supply well 38-30) and backflow rate measured across the orifice at ΔP_1 (Figure A-1) at Well 56-30 and recorded on stripchart.

Test 56-19 6

Record 3

The fluorescein measured at Well 56-30 and recorded on stripchart.

Test 56-19 6

Record 4

The conductivity measured at C_1 (Figure A) on the sample line L-4, and recorded on stripchart.

Test 56-19 6

Record 5

The wellhead pressure measured at P₄ (Figure A-2) shows the pressure response during injection, quiescence, backflow and partial recovery and was recorded by thermal printer.

Test 56-19 6

Record 6

The calcium data below was collected in the Lab Trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 6

Record 7

The biocarbonate data below was collected in the Lab Trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 6

Record 8

The carbon dioxide data below was collected in the Lab Trailer (Figure A-3) and analyzed by RGI in conjunction with their scale inhibitor tests.

Test 56-19 6

Record 9

The spinner flow data below is plotted as a profile to show the depths associated with the percentage of well flow during 500 gpm injection.

Test 56-19 6

Record 10

The spinner flow data below is plotted as a profile to show the depths associated with the percentage of well flow during 500 gpm injection.

Test 56-19 6

Record 11

The spinner flow data below is plotted as a profile to show the depths associated with the percentage of well flow during 500 gpm backflow.

TABLE 14 TEST 8 WELL 56-19

FILE NAME: TEST56198 DATE: 08/21/83

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
TEMP 5619-8 CVSC	1	°F/hour	* T ₁	N/A	EGG
TEMP 5619-8 19DL	2	°F/hour	** T ₃	N/A	EGG
FLOW 5619-8 CVSC	3	gpm/hour	* FIC	N/A	EGG
COND 5619-8 CVSC	4	arbitrary/hour (conductivity)	* C ₁	N/A	EGG
FLUO 5619-8 CVSC	5	arbitrary/hour (fluorescein)		N/A	EGG
PRES 5619-8 WHDQ	6	psia/hour	** P ₄	N/A	EGG
SPIN 08/21 EGG	7	% flow/feet	N/A	2334' - 3350'	EGG

TABLE 14-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-8

<u>Date</u>	<u>Time</u>	
	File / Real	
August 21 -	1.77/06:34	Flowing 500 gpm to 56-19 pit
	- .83/07:30	Continuous tracer injection started into the line
	zerotime/08:20	Initiated injection into Well 56-19
	.97/09:18	Injected slug tracer
	1.05/09:23	Completed injection of slug tracer
	1.17/09:30	EG&G running spinner log
	2.67/11:00	Finished spinner log (Record 7)
	7.25/15:35	Completed injection to Well 56-19 shut-in well for long-term quiescence

Purpose: To inject tracer into the reservoir in preparation for a long-term quiescence.

Test 56-19 8

Record 1

The injection temperature measured at T_1 (Figure A-1). The fluid was supplied by Well 38-30. The data below was taken from the stripchart.

Test 56-19 8

Record 2

The injection temperature was measured at the wellhead on T₃
The data below was recorded by the data logger.

Test 56-19 8

Record 3

The injection flow measured across the orifice at ΔP_1 (Figure A-1). The data below shows flow going to the pit at 56-19 prior to well injection. Data taken from stripchart.

Test 56-19 8

Record 4

The conductivity measured at C₁ (Figure A-1) on sample line L-4.
The data was taken from the stripchart.

Test 56-19 8

Record 5

The fluorescein shown below was recorded on stripchart
at well 56-30.

Record 56-19 8

Record 6

The wellhead pressure was measured at P₄ (Figure A-2) and recorded by a thermal printer.

Test 56-19 8

Record 7

The spinner flow log is plotted as a profile to show the depths associated with the percentage of well flow during injection.

TABLE 15 TEST 9 WELL 56-19

FILE NAME: TEST56199 DATE: 02/04-07/84

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>	<u>SOURCE</u>
TEMP 5619-9 CVSC	1	°F/hour	* T ₁ N/A	EGG
FLOW 5619-9 CVSC	2	gpm/hour	* FIC N/A	EGG
FLOW 5619-9 LOG	3	gpm/hour	Log Book N/A	EGG
PRES 5619-9 WHDQ	4	psia/hour	** P ₄ N/A	EGG
TEMP 02/02 1 RGI	5	°F/feet	#10007 500' - 3300'	RGI
TEMP 02/02 2 RGI	6	°F/feet	#23314 500' - 3300'	RGI
PRES 02/02 3 RGI	7	psia/feet	#2694N 500' - 3300'	RGI

* Figure A-1 and Table A-1 Appendix A

** Figure A-2 and Table A-2 Appendix A

Note: Record 3, manually recorded measurements of the flow after fluid was flashed to the atmosphere.

TABLE 15-A SEQUENCE OF MAJOR OPERATIONS -- TEST 56-19-9

<u>Date</u>	<u>Time</u>	
	File / Real	
Feb. 2		Amerada data obtained for baseline (Records 5 - 7)
Feb. 4	-29.28/08:00	UURI obtained baseline S. P. data around well 56-19
Feb. 5	- 6.28/07:00	UURI obtained S. P. data around 56-19 with backflow from 56-30 re-directed to 56-19 pit.
	zerotime/13:17	Initiated backflow at 450 gpm, having problems with flow control valve
Feb. 6	18.72/08:00	Digiquartz clock not maintaining accurate time, flow steadily decreasing due to problems with flow control valve, valve now manually controlled, conductivity probe failed
Feb. 7	42.72/08:00	Decisions was made to close in 56-19 due to poor tracer returns and continue flowing 56-30
	47.47/12:45	Shut-in Well 56-19, test completed

Purpose: To withdraw tracers after six months quiescence.

Test 56-19 9

Record 1

The temperature during backflow was measured downstream at T₁ (Figure A-1) well 56-30. The data below was taken from the stripchart, and only certain portions were digitized.

Test 56-19 9

Record 2

The backflow was measured downstream at Well 56-30 across the orifice at ΔP_1 (Figure A-1). The data below was recorded on stripchart.

Test 56-19 9

Record 3

The backflow data below was measured manually after the geothermal fluid was flashed to the atmosphere in tank T-1 (Figure A-1). The measurement entries were taken from the field logbook.

FLOW 5619-9 LOG

Test 56-19 9

Record 4

The wellhead pressure measured at P₄ (Figure A-2) was recorded by a thermal printer. The data below is incomplete due to equipment malfunction.

Test 56-19 9

Record 5

The downhole temperature shown below was measured on 02/02 by Amerada tool #10007 while traveling down the wellbore.

Test 56-19 9

Record 6

The downhole temperature shown below was measured on 02/02 by Amerada tool #23314 while traveling down the wellbore.

Test 56-19 9

Record 7

The downhole pressure shown below was calculated (Ref. 4) first for Amerada tool #2694N and #10007, then for #2694N and 23314. The two pressure calculations were averaged for a pressure measurement while traveling down the wellbore on 02/02/84.

TABLE 16 TEST N/A WELL MONITOR & TEST WELLS
 FILE NAME: MESAMONITOR DATE: 07/12-08/29/83 & 01/31-02/09/84

<u>RECORD NAME</u>	<u>#</u>	<u>ENGINEERING UNITS</u>	<u>INSTRUMENT/INTERVAL</u>		<u>SOURCE</u>
WELL 56-30	1	psia/hour	*P ₂	56-30 Series	EGG
WELL 38-30	2	psia/hour	**Wellhead	56-30 Series	EGG
WELL 58-30	3	psia/hour	**Wellhead	56-30 Series	EGG
WELL 56-19	4	psia/hour	***P ₄	56-30 Series	EGG
WELL 74-30	5	psia/hour	**Wellhead	56-30 Series	EGG
WELL 16-29	6	psia/hour	**Wellhead	56-30 Series	EGG
WELL 52-29	7	psia/hour	**Wellhead	56-30 Series	EGG
WELL 18-28	8	psia/hour	**Wellhead	56-30 Series	EGG
WELL 78-30	9	psia/hour	**Wellhead	56-30 Series	EGG
WELL 16-30	10	psia/hour	**Wellhead	56-30 Series	EGG
WELL 56-19	11	psia/hour	***P ₄	56-19 Series	EGG
WELL 56-30	12	psia/hour	*P ₂	56-19 Series	EGG
WELL 38-30	13	psia/hour	**Wellhead	56-19 Series	EGG
WELL 58-30	14	psia/hour	**Wellhead	56-19 Series	EGG
WELL 16-29	15	psia/hour	**Wellhead	56-19 Series	EGG
WELL 52-29	16	psia/hour	**Wellhead	56-19 Series	EGG
WELL 18-28	17	psia/hour	**Wellhead	56-19 Series	EGG
WELL 78-30	18	psia/hour	**Wellhead	56-19 Series	EGG
WELL 16-30	19	psia/hour	**Wellhead	56-19 Series	EGG
WELL 74-30	20	psia/hour	**Wellhead	56-19 Series	EGG
WELL 56-30	21	psia/hour	*P ₂	1984 Series	EGG
WELL 16-29	22	psia/hour	**Wellhead	1984 Series	EGG
WELL 52-29	23	psia/hour	**Wellhead	1984 Series	EGG
WELL 18-28	24	psia/hour	**Wellhead	1984 Series	EGG
WELL 78-30	25	psia/hour	**Wellhead	1984 Series	EGG
WELL 58-30	26	psia/hour	**Wellhead	1984 Series	EGG
WELL 38-30	27	psia/hour	**Wellhead	1984 Series	EGG
WELL 16-30	28	psia/hour	**Wellhead	1984 Series	EGG
WELL 74-30	29	psia/hour	**Wellhead	1984 Series	EGG
WELL 56-19	30	psia/hour	***P ₄	1984 Series	EGG

* Figure A-1 and Table A-1 Appendix A

** Figure 1

*** Figure A-2 and Table A-2 Appendix A

TABLE 16-A SEQUENCE OF MAJOR EVENTS

<u>Date</u>	<u>Time</u>	
	File / Real	
July 9/83	-64.0 /10:00	First pressure reading for Well 56-30 (Record 1)
July 12	8.0 /08:00	First pressure readings for Wells 56-19, 74-30, 16-29, 52-29, 18-28, 78-30 and 16-30 (Records 4-10)
	20.0 /20:00	First pressure reading for Well 38-30 (Record 2)
July 13	24.0 /00:00	First pressure reading for Well 58-30 (Record 3)
July 14	60.67/12:40	Initiated backflow at Well 56-30, 300 gpm
July 15	86.00/14:00	Well 56-30 shut-in, completed backflow
July 16	104.83/08:50	Initiated backflow at Well 56-30, 450 gpm
July 17	128.83/08:50	Well 56-30 shut-in, completed backflow
July 24	301.83/13:50	Initiated injection flow from Well 38-30 to Well 56-30 at 300 gpm
July 25	313.33/01:25	Well 56-30 shut in, injection completed
	325.33/13:20	Initiated backflow at Well 56-30, 300 gpm
July 28	392.33/08:20	Well 56-30 shut-in, completed backflow
July 29	418.17/10:10	Initiated injection flow from Well 38-30 to Well 56-30, 300 gpm
	430.17/22:10	Well 56-30 shut-in, for long-term quiescence
July 31	456.00/00:00	Pressure readings for 56-19 test series started at Wells 56-30, 38-30 and 58-30 (Records 12-14)
Aug 01	482.00/02:00	Pressure readings for 56-19 test series started at Wells 16-29, 52-29, 18-28, 78-30, 16-30, 74-30 (Records 15-20)
	492.00/12:00	Pressure reading at Well 56-19 starts (Record 11)
Aug 02	515.42/11:25	Initiated backflow at Well 56-19, 300 gpm
	542.42/20:25	Test aborted, Well 56-19 shut-in
Aug 03	542.00/14:00	Test restart, Well 56-19 backflow, 300 gpm
Aug 04	568.33/16:20	Well 56-19 shut-in, completed backflow

TABLE 16-A (cont.)

Aug 05	589.00/13:00	Initiated backflow at Well 56-19, 500 gpm
	593.50/17:30	Test aborted, Well 56-19 shut-in
Aug 06	609.17/09:10	Test restart, Well 56-19 backflow, 500 gpm
Aug 07	633.35/09:21	Well 56-19 shut-in, completed backflow
Aug 08	661.43/13:26	Initiated injection flow from Well 38-30 to Well 56-19, 300 gpm
Aug 09	673.01/01:01	Well 56-19 shut-in, injection completed
	684.99/13:00	Initiated backflow at Well 56-19, 300 gpm
Aug 11	738.47/18:29	Well 56-19 shut-in, backflow completed
Aug 12	757.38/13:23	Initiated injection flow from Well 38-30 to Well 56-19, 500 gpm
	764.74/20:45	Well 56-19 shut-in, injection completed
Aug 13	777.49/09:30	Initiated backflow at Well 56-19, 500 gpm
Aug 15	825.49/09:30	Well 56-19 shut-in, backflow completed
Aug 17	875.28/11:17	Initiated injection flow from Well 38-30 to Well 56-19, 500 gpm
Aug 18	889.74/01:45	Well 56-19 shut-in, injection completed
	901.82/13:50	Initiated backflow at Well 56-19, 500 gpm
Aug 20	949.82/13:50	Well 56-19 shut-in, backflow completed
Aug 21	968.32/08:20	Initiated injection flow from Well 38-30 to Well 56-19, 500 gpm
	975.57/15:35	Well 56-19 shut-in, long-term quiescence
Jan 31/84	16.00/16:00	Pressure reading taken at Wells 16-29, 52-29, 18-28, 78-30, 58-30, 38-30, 16-30 and 74-30 (Records 22-29)
Feb 01	37.78/13:47	Pressure reading taken at Well 56-30 (Record 21)
	37.83/13:50	Initiated backflow at Well 56-30
Feb 05	131.61/11:37	Well 56-30 shut-in
	132.66/12:40	Pressure reading taken at Well 56-19 (Record 30)

TABLE 16-A (cont.

	133.28/13:17	Initiated backflow at Well 56-19
Feb 07	180.75/12:45	Well 56-19 shut-in, test completed
	181.85/13:51	Reopened Well 56-30 to backflow
Feb 09	228.00/12:00	Well 56-30 shut-in, test completed

MESAMONITOR

Record 1

Well 56-30 wellhead pressure during Test 56-30; 1, 2, 3, and 4.
Data recorded by thermal printer, measurements made at P₂, (Figure A-1).

MESAMONITOR

Record 2

Well 38-30 wellhead pressure during Test 56-30; 1, 2, 3, and 4.
Data recorded by thermal printer, measurements made at wellhead.
Well 38-30 supplied the injectant fluid during test 3 and 4.

MESAMONITOR

Record 3

Well 58-30 wellhead pressure recorded by thermal printer at wellhead during Test 56-30; 1, 2, 3, and 4.

MESAMONITOR

Record 4

Well 56-19 wellhead pressure during Tests 56-30; 1, 2, 3, and 4.
Data recorded by thermal printer, measurements made at P₄ (Figure A-2).

MESAMONITOR

Record 5

Well 74-30 wellhead pressure measured periodically throughout the 56-30 Test Series, and recorded manually.

MESAMONITOR

Record 6

Well 16-29 wellhead pressure measured periodically throughout the 56-30 Test Series and recorded manually.

MESAMONITOR

Record 7

Well 52-29 wellhead pressure measured periodically throughout the 56-30 Test Series, and recorded manually. Well 52-29 was used as a disposal well during Test 56-30; 1, 2, and 3.

MESAMONITOR

Record 8

Well 18-28 wellhead pressure measured periodically throughout the 56-30 Test Series, and recorded manually.

MESAMONITOR

Record 9

Well 78-30 wellhead pressure measured periodically throughout the 56-30 Test Series and recorded manually.

MESAMONITOR

Record 10

Well 16-30 wellhead pressure measured periodically throughout the 56-30 Test Series, and recorded manually.

MESAMONITOR

Record 11

Well 56-19 wellhead pressure, measured at P₄ (Figure A-2) and recorded by a thermal printer, during 56-19 Test Series.

MESAMONITOR

Record 12

Well 56-30 wellhead pressure measured periodically throughout the 56-19 Test Series, and recorded manually.

MESAMONITOR

Record 13

Well 38-30 wellhead pressure measured periodically throughout the 56-19 Test Series, and recorded manually.

MESAMONITOR

Record 14

Well 58-30 wellhead pressure measured periodically throughout the 56-19 Test Series, and recorded manually.

MESAMONITOR

Record 15

Well 16-29 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually.

MESAMONITOR

Record 16

Well 52-29 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually. Well 52-29 was used as a disposal well during tests 56-19; 1-6.

MESAMONITOR

Record 17

Well 18-28 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually.

MESAMONITOR

Record 18

Well 78-30 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually.

MESAMONITOR

Record 19

Well 16-30 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually.

MESAMONITOR

Record 20

Well 74-80 wellhead pressure measured periodically throughout the 56-19 Test Series and recorded manually.

MESAMONITOR

Record 21

Well 56-30 wellhead pressure, measured at P₂ (Figure A-1) and recorded by thermal printer, during 1984 Test Series.

MESAMONITOR

Record 22

Well 16-29 wellhead pressure measured periodically throughout the 1984 Test Series and recorded manually.

MESAMONITOR

Record 23

Well 52-29 wellhead pressure measured periodically throughout the 1984 Test Series, and recorded manually. Well 52-29 used as a disposal well.

MESAMONITOR

Record 24

Well 18-28 wellhead pressure measured periodically throughout the 1984 Test Series, and recorded manually.

MESAMONITOR

Record 25

Well 78-30 wellhead pressure measured periodically throughout the 1984 Test Series, and recorded manually.

MESAMONITOR

Record 26

Well 58-30 wellhead pressure measured periodically throughout the 1984 Test Series and recorded manually.

MESAMONITOR

Record 27

Well 38-30 wellhead pressure measured periodically throughout the 1984 Test Series and recorded manually.

MESAMONITOR

Record 28

Well 16-30 wellhead pressure measured periodically throughout the 1984 Test Series and recorded manually.

MESAMONITOR

Record 29

Well 74-30 wellhead pressure measured periodically throughout the 1984 Test Series, and recorded manually.

MESAMONITOR

Record 30

Well 56-19 wellhead pressure, measured at P₄ (Figure A-2) and recorded by thermal printer, during 1984 Test Series.

REFERENCES

- 1 Ramstahler, J. H., June 1983. Test Specification Injection Test Program - Republic Geothermal, Inc. East Mesa Geothermal Wellfield - Issue #1 - Test 1 through 4, Well 56-30.
- 2 Ramstahler, J. H., July 1983. Test Specification Injection Test Program - Republic Geothermal, Inc. East Mesa Geothermal Wellfield - Issue #2 - Test 1 through 8, Well 56-19; Test 5, Well 56-30.
- 3 Ramstahler, J. H., January 1984. Test Specification Injection Test Program - Republic Geothermal, Inc. East Mesa Geothermal Wellfield - Issue #3 - Test 9, Well 56-19; Test 5, Well 56-30.
- 4 Michels, D. E., February 1984. Precision Use of Amerada-type Pressure Gauges for Geothermal Applications, TR-117, Republic Geothermal, Inc.

APPENDIX A
Flow and Instrumentation Description

APPENDIX A

This appendix includes a detailed description of the flow paths used during the East Mesa tests in 1983 and 84. Also included are flow and instrumentation schematics and tables listing the instrumentation type, range and accuracy. The recording equipment and method of recording for instruments shown on the schematics is also given. Table A-3 lists the downhole tools used by each company.

During test 56-30, 1-5 the backflow from Well 56-30 flowed through the system (Figure A-1) via V-41, V-30 and CV-1. CV-1 controlled the backflow rate. The flow then proceeded through V-5, V-6 and EV-7 into the separator S-1 where it was flashed to 6-10 psig. The steam exited to the steam stack via V-32 (manually controlled pressure in S-1) and the liquid portion exited S-1 via CV-29 (automatically controls liquid level in S-1) to tank T-1 where it is then flashed to the atmosphere. The fluid in T-1 was then pumped using pump 1 or 2 via V-4 to Well 52-29.

During test 56-30, 3-4, fluid supplied from Well 38-30, via line L-1 (Figure 2) entered the system (Figure A-1) via EV-7, was flashed in separator S-1, steam exited to the steam stack via V-32 (which manually controlled the pressure in S-1 to 6-10 psig). The fluid in S-1 exited via CV-29 (which controlled the liquid level in S-1) to tank T-1 where it was flashed to the atmosphere. The fluid in tank T-1 was mixed with tracers from tank T-4 or T-5 between the discharge of Pump 4 and the suction side of pump 1 or 2, then via V-2 to CV-1 controlling the injection rate.

The tracer/fluid mixture was sampled at sample port S₅ to determine the correct concentration then disposed of to the pit via V-40 (if the dilution was not correct) or through filters F-1 or F-2 and then on to Well 56-30 via V-41. During slug injection, V-33 and V-28 were closed and V-10 opened. The undiluted tracers in tank T-2 were pumped through the system by pump 1 or 2 using the same flow path directly to V-41 and downwell. Upon completion of the slug injection, V-10 was closed and V-33 and V-28 open to continue the tracer/fluid injection.

FIGURE A-1. WELL 56-30 FLOW AND INSTRUMENTATION SCHEMATICS

Figure A-2. Well 56-19 Flow and Instrumentation Schematic

Data Form

- - Stored in data base
- - Not stored/back-up
- - Stored in data base/partial

Instrument	Schematic	Type	Range	Accuracy	Method of Recording	Source	56-30-1	56-30-2	56-30-3	56-30-4	56-30-5	56-19-1	56-19-2	56-19-3	56-19-4	56-19-6	56-19-8	56-19-9
FIC	A-1	Flow Measurement and Control	200 - 650 gpm	± 3% full scale	Datel Logger 1 Log book entry Stripcharts	EG&G	●	●	●	○	●	●	○	●	●			●
ΔP ₁	A-1	Differential Pressure Gauge	0 - 25 psid	± 1% full scale	Manual	EG&G	■	■	■									
P ₁	A-1	Pressure Transducer	0 - 200 psig	± 1% full scale	Datel Logger 1 Stripcharts	EG&G	■	■	■									
P ₅	A-1	Pressure Gauge	0 - 750 psig	± 1% full scale	Manual	EG&G	■	■	■									
T ₁	A-1	Temperature Transducer	0 - 320° F	± 1% full scale	Datel Logger 1 Stripcharts	EG&G	●	●	●	○	●	○	○	●	●	●		●
T ₅	A-1	Temperature Gauge			Manual	EG&G	■	■	■									
T ₂	A-1	Temperature Transducer	0 - 320° F	± 1% full scale	Datel Logger 2 Stripcharts	EG&G			■									
T ₉	A-1	Temperature Gauge			Manual	EG&G	■	■	■									
P ₂	A-1	Pressure Transducer	0 - 150 psig	± 1% full scale	Datel Logger 2 Stripcharts Digiquartz	EG&G	●	●	●	●	●							
P ₆	A-1	Pressure Gauge	0 - 750 psig	± 1% full scale	Manual	EG&G	■	■	■									
P ₃	A-1	Pressure Gauge			Manual	EG&G	■	■	■									
FI ₁	A-1	Flow Indicator			Manual			■										
FI ₂	A-1	Flow Indicator	200-650 gpm	± 3% full scale	Datel Logger 2 Stripcharts	EG&G	■	■	■	■								
ΔP ₂	A-1	Differential Pressure Gauge	0 - 25 psid	± 1% full scale	Manual	EG&G	■	■	■									

Table A-1. Instrumentation and Associated Recording Equipment for 56-30 Well Site and Source for Equipment

Data Form

- - Stored in data base
- - Not stored/back-up
- - Stored in data base/partial

Instrument Schematic	Type	Range	Accuracy	Method of Recording	Source	56-30-1	56-30-2	56-30-3	56-30-4	56-30-5	56-19-1	56-19-2	56-19-3	56-19-4	56-19-6	56-19-8	56-19-9
**C ₁	A-1	Conductivity Probe		Datel Logger Stripchart	EG&G	● ■	● ■	● ■	● ■		●	● ■			●	●	
T ₇	A-1	Temperature Gauge	0 - 350° F	Manual	EG&G	■											
T ₈	A-1	Temperature Gauge	0 - 350° F	Manual													
fluor-meter	A-1			Datel Logger 2 Stripchart	EG&G		● ■	● ■	● ■				■	■	●	●	
S ₁ /S _{1A}	A-1																
S ₂	A-1																
S ₃	A-1																
S ₄	A-1																
S ₅	A-1																
P ₈ /p ₉	A-1	Filter ΔP Gauge		Manual	EG&G		■										

** During test 56-19 C₁ was moved to the Datel Logger and stripchart stationed at CV-1 valve

Table A-1. (cont.)

Data Form

- - Stored in data base
- - Not stored/back-up
- - Stored in data base/partial

Instrument	Schematic	Type	Range	Accuracy	Method of Recording	Source	56-30-1	56-30-2	56-30-3	56-30-4	56-30-5	56-19-1	56-19-2	56-19-3	56-19-4	56-19-6	56-19-8	56-19-9
F13	A-2	Flow	200 - 650 gpm	± 3% full scale	* Datel Logger 2 Stripcharts							●	○					
ΔP3	A-2	Differential Pressure Gauge	0 - 25 psid	± 1% full scale	Manual							■	■					
T3	A-2	Temperature Transducer	0 - 300° F	± 1% full scale	* Datel Logger 2 Stripcharts							●	●	●	●	●	●	
T10	A-2	Temperature Gauge										■	■					
P4	A-2	Pressure Transducer	0 - 150 Psig	± 1% full scale	* Datel Logger 2 Digiquartz Stripcharts							●	●	●	●	●	●	●
P7	A-2	Pressure Gauge	0 - 750 Psig		Manual							■	■					
C4	A-2	Conductivity Probe			* Datel Logger 2 Stripcharts									●	■			
T4	A-2	Temperature Gauge	0 - 300° F		Manual													
S6	A-2	Sample Port			Manual													
S7	A-2	Sample Port			Manual													
S8	A-2	Sample Port			Manual													

* Moved Datel Logger (System 2) from 56-30 Wellhead to 56-19 Wellhead

Table A-2. Instrumentation and Associated Recording Equipment for 56-19 Well Site and Source for Equipment

During test 56-19, 1-9, (Figure A-2) the well was backflowed through V-51 and V-49 to well site 56-30 via line L-3 (Figure 2). At well site 56-30 (Figure A-1) the fluid flowed through V-18, CV-1, V-30, V-31, EV-7 into separator S-1. Here the liquid was flashed with the steam going to the steam stack via V-32 (manually controlled the pressure in S-1 to 6-10 psig). The liquid portion then exited via CV-29 (automatically controlled the liquid level in S-1) to tank T-1 from there it was pumped to Well 52-29 via pump 1 or 2 and V-4.

During test 56-19-2 (prior to the second attempt), the orifice plate Fl3 (Figure A-2) was removed. This reduced the high to low pressure drop across the orifice plate which caused the erratic flow.

During test 56-19, 3, 4, 6, and 8, fluid was supplied by Well 38-30 (Figure 2) via line L-1 to the system at 56-30 (Figure A-1) via V-6, EV-7 into separator S-1, where the steam exited to the steam stack via V-32 (which manually controlled the pressure in separator S-1 at 6-10 psig). The liquid in S-1 exited via CV-29 (automatically controlled liquid level in S-1) to tank T-1 where it was flashed to the atmosphere. The fluid in tank T-1 was mixed with tracers from tank T-4 or T-5 between the discharge side of pump 4 and V-28 and the suction side of pump 1 or 2, then via V-3, CV-1, V-18 into line L-3 (Figure 2).

The tracer/fluid mixture was sampled at Well 56-19 (Figure A-2) at sample port S7 and then the flow was either diverted via V-44 to the pit or to the wellhead via filters F-1 or F-2 and V-51. During slug injection (Figure A-1) V-33 and V-28 were closed and V-10 opened. The undiluted tracers in tank T-2 were pumped to Well 56-19 using the same flow path directly to V-51, located at 56-19 (Figure A-2). Upon completion of the slug injection, V-10 (Figure A-1) was closed and V-33 and V-28 opened to continue the tracer/fluid injection to Well 56-19.

Figures A-3. Flow Schematic of Geothermal Fluid Sample & Monitoring System

COMPANY	TOOL	TYPE	56-30 1	56-30 2	56-30 3	56-30 4	56-30 5	56-19 1	56-19 2	56-19 3	56-19 4	56-19 6	56-19 8	56-19 9
Baker	(commercial)	temperature	4	2	2									
Baker	(commercial)	spinner	5	2										
Baker	(commercial)	isotopic flow meter	2	1	1									
EGG	Seling	temperature						2						
EGG	Seling	pressure						2						
EGG		spinner						2			1	3	1	
RGI	Amerada	temperature #10007	2	1	1		2							1
RGI	Amerada	temperature #23314	1				2	1	1	1				1
RGI	Amerada	pressure #22757	2	1	1									
RGI	Amerada	pressure #22768	2	1	1									
RGI	Amerada	pressure #2694N					2	1	1	1				1
RGI	Amerada	pressure #21368							1	1	3			
UURI	Kuster	water sampler												

Table A-3. Downhole Instrumentation Used for Test and Number of Logs

APPENDIX B
Listing of RGI Inhibitor Data
Excluded from Data Base

EAST MESA INJECTION STUDIES
JULY AND AUGUST 1983

CHRONOLOGIC LIST OF SAMPLES
COLLECTED AND ANALYZED BY D. E. MICHELS

<u>Container</u>	<u>Day</u>	<u>Hour</u>	<u>Fluid From Well</u>	<u>Ca</u>	<u>HCO₃</u>	<u>CO₂</u>	<u>Experiment DEM No.</u>	<u>Notebook Page</u>	<u>Comments</u>
1	July 14	1300	56-30	11.7			1	7	Input to pit, system not flashing
2	14	1407	56-30	5.24 (pf = 4.82)*			1	7	Input to pit
3	14	1442	56-30	7.45			1	7	Tap in trailer
4	14	1700	56-30	4.80 (pf = 4.42)			1	7	Separator brine line FTA
5	15	0650	56-30	6.56			1	7	Tap in trailer
6	15	0658	56-30	5.39 (pf = 4.96)			1	7	Separator brine line
7	16	1020	56-30	6.48			2	10	Tap in trailer F-247**
8	16	1022	56-30	4.96 (pf = 4.49)			2	10	Separator brine line F-247
1	16	1510	56-30	6.08 (pf = 5.51)			2	10	Separator brine line F-247
2	16	1512	56-30	6.69			2	10	Tap in trailer F-247
3	16	1630	56-30	5.57 (pf = 5.05)			2	10	Separator brine line F-280
4	16	1640	56-30	6.18			2	10	Tap in trailer F-280
5	16	1722	56-30	5.57 (pf = 5.05)			2	10	Separator brine line F-280
6	16	1720	56-30	6.48			2	10	Tap in trailer F-280

* pf represents the calculable pre-flash concentration presuming no loss of Ca and flash to atmosphere from 300 to 310°F

** Scale inhibitors used were Pfizer F-247 and F-280 and Monsanto Dequest 2000 and 2060

<u>Container</u>	<u>Day</u>	<u>Hour</u>	<u>Fluid From Well</u>	<u>Ca</u>	<u>HCO₃</u>	<u>CO₂</u>	<u>Experiment DEM No.</u>	<u>Notebook Page</u>	<u>Comments</u>
1	16	1940	56-30	6.75			2	11	Tap in trailer, no inhibitor
2	16	1942	56-30	1.34			2	11	Separator brine line, no inhibitor
3	16	2007	56-30	6.86			2	11	Tap in trailer, no inhibitor
4	16	2009	56-30	1.13			2	11	Separator brine line, no inhibitor
5	16	2046	56-30	1.13			2	11	Separator brine line, no inhibitor
6	16	2047	56-30	6.43			2	11	Tap in trailer, no inhibitor
8	24	1028	38-30	6.81			3	12	Separator brine line Dequest 2000
1	24	1130	38-30	7.28			3	12	Chilled from flowline upstream of inhibitor injector
2	24	1130	38-30	7.39			3	12	Chilled from flowline upstream of inhibitor injector
3	24	1135	38-30	7.16			3	12	Separator brine line Dequest 2000
7	24	0950	38-30	3.17			3	12	Separator brine line, no inhibitor
1	25	1333	Backflow 56-30	9.94			3	16,17	Discharge into pit
2	25	1346	56-30	8.32			3	16,17	Discharge into pit
3	25	1353	56-30	8.10			3	16,17	Discharge into pit
4	25	1403	56-30	7.46			3	16,17	Discharge into pit
5	25	1419	56-30	5.30			3	16,17	Separator brine line FTA

Container	Day	Hour	Fluid From Well	Ca	HCO ₃	CO ₂	Experiment DEM No.	Notebook Page	Comments
6	25	1430	56-30	4.65			3	16,17	Separator brine line FTA
7	25	1446	56-30	4.65			3	16,17	Separator brine line FTA
8	25	1459	56-30	4.43 4.87			3	16,17	Separator brine line FTA
9	25	1518	56-30	4.00			3	16,17	Tap in trailer
10	25	1520	56-30	4.33			3	16,17	Separator brine line
11	25	1523	56-30	4.00			3	16,17	Tap in trailer
12	25	1550	56-30	3.68			3	16,17	Tap in trailer
13	25	1620	56-30	3.80			3	16,17	Tap in trailer
1	25	1644	56-30	5.09 5.27			3	16,17	Tap in trailer
2	25	1706	56-30	3.78			3	16,17	Tap in trailer
3	25	1726	56-30	3.78			3	16,17	Tap in trailer
4	25	1758	56-30	3.68			3	16,17	Tap in trailer
5	25	1816	56-30	3.10			3	16,17	Tap in trailer
6	25	1945	56-30	2.86			3	16,17	Tap in trailer
7	25	2106	56-30	2.70 2.93			3	16,17	Tap in trailer
8	25	2115	56-30	2.84 2.86			3	18	Tap in trailer
1	25	2243	56-30	2.70 2.86			3	18	Tap in trailer
2	25	2340	56-30	2.70 2.68			3	18	Tap in trailer

Container	Day	Hour	Fluid From Well	Ca	HCO ₃	CO ₂	Experiment DEM No.	Notebook Page	Comments
13	26	0020	56-30	2.52 2.59			3	18	Tap in trailer
13	26	0120	56-30	2.39	767 777		3	19,25 37	Same as UURI A74
1	26	0320	56-30	3.06			3	19,25	Same as UURI A75
2	26	0520	56-30	3.19	879		3	19,25 37	Same as UURI A76
4	26	0630	56-30	2.43 2.32			3	18	Tap in trailer
8	26	0720	56-30	2.25	909		3	19,25 37	Same as UURI A77
4	26	0930	56-30	2.52	879		3	19,25 37	Tap in trailer
5	26	1320	56-30	3.76	816		3	19,35 36	Tap in trailer
6	27	0120	56-30	4.32	683		3	19,25 36	Tap in trailer
9	27	0720	56-30	4.60	652		3	19,25 36	Tap in trailer
11	27	1320	56-30	4.97	638		3	19,25 36	Tap in trailer
7	28	2120	56-30	4.18	630		3	19,25 36	tap in trailer
1a	Aug 2	1800	56-19		1152 ^{***} 1220 [*]		5	23,36	FTA
1b	2	1802	56-19			305 ^{***} 563 [*]	5	23,36 23	NaOH stabilized
2a	2	1840	56-19		1220 [*]		5	23	FTA
2b	2	1845	56-19			498 ^{***} 572 [*]	5	23,36	NaOH stabilized
14	3	1743	56-19	16.7			6	29	Flowline, above inhibitor injection point. One-phase, chilled

* Based on HACH cartridge system

*** Based on burette titration

Container	Day	Hour	Fluid From Well	Ca	HCO ₃	CO ₂	Experiment DEM No.	Notebook Page	Comments
15	3	1741	56-19	17.9			6	29	Separator brine line
C1	3	2027	56-19	17.6			6	29	56-19 WH, chilled
16	3	2035	56-19	18.6			6	29	Separator brine line
17	4	1017	56-19	17.9, 18.1 21.2, 21.5, 15.9	1172		6	30, 37	At 52-29 wellhead
15	4	1024	56-19	18.2	1158		6	30, 36	Flowline at scale inhibitor injection point
14	4	1028	56-19	17.9	1167		6	30, 36	Separator brine line
16	4	1040	56-19	17.9 17.9	1148 1155		6	30, 36	56-19 wellhead
C-1	4	1053	56-19	17.9	1183		6	30, 36	Separator brine line
18	4	1225	56-19	17.2	1152		6	30, 37	Flowline at inhibitor injection point
19	4	1228	56-19	17.9	1170		6	30, 37	Pump casing
20	4	1236	56-19	20.9, 21.4 20.4	1167		6	30, 37	At 52-29 wellhead
21	6	1630	56-19			348	8	34	Coordinated with gas samples from elbow vent at 56-19 site
22	6	1630	56-19		1167		8	34	
	6	1801	56-19	18.43	1205 1205		8	36, 52	Downhole sample 3200 ft in 56-19
19	8	1542	38-30	3.60			9	38	At 56-19 wellhead
C-6	8	1606	38-30	5.83	721		9	38, 40	Separator brine line
C-3	8	1608	38-30	6.75			9	38	Pump casing

Container	Day	Hour	Fluid From Well	Ca	HCO ₃	CO ₂	Experiment DEM No.	Notebook Page	Comments
1	8	1636	38-30	4.40 4.63	728		9	38,52	At 56-19 wellhead
C-5	8	1712	38-30	1.96 2.44	724		9	38,40	Separator brine line, no inhibitor
C-4	8	1715	38-30	3.03	708		9	38	Pump casing, no inhibitor
C-2	8	1725	38-30	5.96, 6.60, 3.08		573	9	38,52	Upstream of separator, 1-phase liquid, chilled NaOH stabilized
20	8	1726	38-30	6.61, 6.87	662		9	38,52	Mate to C-2, chilled, No NaOH
17	8	1735	38-30	6.75	724		9	38	Separator brine line
C-1	8	1740	38-30	4.49			9	38	At 56-19 wellhead
4	8	2024	38-30	8.11			9	41,60	Separator brine line
14	8	2025	38-30	11.27			9	41,60	Pump casing
18	8	2032	38-30	10.08			9	41,60	At 56-19 wellhead
6	9	0732	38-30	2.78			9	41,60	Separator brine line, well shut in
5	9	1145	38-30	9.10			9	41,60	At 56-19 wellhead, well shut in
1-63	9,10 11	1349- 1506	56-19	See separate listing			9	42-51	Backflow
1-67	13,14	0954- 1600	56-19	See separate listing			10	53-61 & 67	Backflow
1	17	1036	38-30	1.03, 1.13	844		11	63,65	Separator brine line, no inhibitor
2	17	1038	38-30	1.13	839		11	63,65	Pump casing, no inhibitor

Container	Day	Hour	Fluid From Well	Ca	HCO ₃	CO ₂	Experiment DEM No.	Notebook Page	Comments
3	17	1057	38-30	1.13			11	63,65	Separator brine line, no inhibitor
4	17	1058	38-30	.82			11	63	Pump casing, no inhibitor
5	17	1117	38-30	4.31			11	63	Separator brine line; inhibitor on at 1115, Dequest 2000
6	17	1125	38-30	4.82	824		11	63	Separator brine line
7	17	1347	38-30,	6.36,6.15, 6.15	672		11	63,65	Flowline, no flash, chilled, mate to 8
8	17	1350	38-30			521	11	63,65	NaOH
9	17	1352	38-30	5.50			11	63	Separator brine line (inhibitor had been off an indefinite time)
10	17	1353	38-30	4.85,4.75			11	63	Pump casing,
11	17	1400	38-30	2.80			11	63	Wellhead at 56-19
12	17	1405	38-30			541	11	65	Flowline - NaOH 9.5/50
13	17	1406	38-30	6.36,6.15	673		11	65	Mate to 12
14	17	1641	38-30	5.06,4.95	651, 651		11	65,66	Flowline cooled to 180°F; shut in had gas cap
15	17	1644	38-30	4.29			11	66	Separator brine line
16	17	1645	38-30	5.95			11	66	Pump casing
17	17	1648	38-30			408	11	65	Flowline; NaOH 10/48, mate to 14; gas break out active in line
18	17	1654	38-30	6.50			11	65,66	Wellhead at 56-19
1	18	1213	38-30	1.64			11	68	Collected after shut-in after injection; control valve at 56-30 site

<u>Container</u>	<u>Day</u>	<u>Hour</u>	<u>Fluid From Well</u>	<u>Ca</u>	<u>HCO₃</u>	<u>CO₂</u>	<u>Experiment DEM No.</u>	<u>Notebook Page</u>	<u>Comments</u>
2	18	1215	38-30	5.77			11	68	Upstream of inhibitor injection point
3	18	1220	38-30	2.20			11		South vent on mid flowline
4	18	1220	38-30	2.42			11		North vent on mid flowline
5	18	1224	38-30	2.64			11		Vent at elbow at 56-19 site
6	18	1226	38-30	1.41			11		Wellhead at 56-19
1-74	18,19, 20	1407- 1302	56-19	See separate listing			11		Backflow
A-BN	21	0900- 1349	38-30	See separate listing			12		Inhibitor tests

FTA means the liquid sample was allowed to flash to atmospheric pressure without conductive cooling.

<u>Sample *</u>	<u>Elapsed Hours</u>	<u>Ca</u>	<u>HCO₃</u>	<u>CO₂</u>
A280	6.00	3.96	741	
A281	6.50	3.96	747	
A282	7.00	4.58	769	
A283	8.00	5.00	786	
A284	8.50	5.21	803	
A285	9.00	5.52	828	
A286	9.50	5.83	860	
A287	10.00	6.67, 6.46	895	
A288	11.00	7.71	938	
A298		18.1	1161	
A299		19.2		
A300		19.4	1153	
A301		19.4		
A302		19.0	1147	
A303		19.4	1147	

*Auxiliary samples from UURI Collection from tap in trailer at 56-30 site, (elapsed hours adjusted to wellhead position)

DOSE - RESPONSE

BECKETT CACO₃ LUMINOMETER

EAST ARIAZ FIELD

NOV. 1960

1. IN THE FIELD LABORATORY

2. IN THE LABORATORY AFTER 100 HOURS

DEQUEST 2060

PLAIN WATER

DEQUEST 2060

PLAIN WATER

FLOCON 260

FLOCON 260

DEQUEST 2060

B-10

ppm Ca

HOURS

DEQUEST 2060

PLAIN WATER

TABLE 1
INHIBITOR DOSE SCHEDULE

<u>Hours*</u>	<u>Stage</u>	<u>Inhibitor</u>	<u>ppm Dose</u>	<u>Ca Concentration Avg. $\pm$ s.d.</u>	<u>No. Samples</u>
-2.0	0	2060	2.94	6.04 $\pm$.05	2
0.0	I	None	0.00	6.6 - 2.2	13
0.48	IIA	2060	2.24	2.9 - 6.0	4
0.66	IIB	2060	3.8	6.55 $\pm$.10	4
0.95	IIC	2060	6.3	6.51 $\pm$ 0.0	2
1.10	IID	2060	1.65	6.54 $\pm$.06	3
1.36	III	None	0.00	6.14 $\pm$.24	2
1.51	IVA	280	0.35	4.8 - 5.5	2
1.94	IVB	280	0.9	6.11 $\pm$.43	3
2.32	IVC	280	3.7-2.6	6.26 $\pm$.07	2
2.68	IVD	280	8.8	6.49 $\pm$.08	3
3.18	VA	247	0.6	6.37 $\pm$.07	4
3.63	VB	247	1.1	6.32 $\pm$.05	2
3.85	VC	247	1.5	6.46 $\pm$.05	2
4.17	VD	247	6.6	6.49 $\pm$.07	3
4.40	VE	247	4.5	6.42 $\pm$ 0.0	2
4.70	VF	247	2.6	6.38	1
4.85	VI	2000	Interruption	6.38 $\pm$ 0.0	2
5.37	VIIA	2000	0.65	6.43 $\pm$ 0.008	3
5.80	VIIB	2000	0.9-1.4	6.38 $\pm$.06	4
6.22	VIIC	2000	6.7	6.40 $\pm$.32	2
6.43	VIID	2000	3.4	5.87 $\pm$.42	4
6.72					

* Times is measured at the inhibitor injection point. To find Stage boundaries at the steam separator add 0.03 hours.

TABLE 2

CALCIUM CONCENTRATIONS IN THE
PRESENCE OF SCALE INHIBITORS

Experiment 12, Using Fluid from 38-30
Sample Point is Brineline Off Separator
With Flashing to Atmosphere

<u>Sample</u>	<u>Elapsed Hours*</u>	<u>Stage</u>	<u>ppm Ca</u>	<u>Inhibitor</u>	<u>Dose (ppm)</u>
A	0.00	0	6.07	2060	3.0
B**	0.033	0	6.00	2060	3.0
C	.100	I	6.63	None	-
D	.117	I	6.47	None	-
E	.135	I	5.47	None	-
F	.150	I	4.73	None	-
G	.167	I	4.15, 4.43	None	-
H	.183	I	4.00	None	-
I	.217	I	3.34	None	-
J	.250	I	2.88	None	-
K	.283	I	2.65	None	-
L	.333	I	2.37	None	-
M	.383	I	2.19, 2.28	None	-
N	.433	I	2.30, 2.59	None	-
O	.500	I	2.21	None	-
P	.517	IIA	2.91	2060	2.6
Q	.533	IIA	Lost		
R	.550	IIA	5.03	2060	2.6
S	.568	IIA	5.85	2060	2.6
T	.600	IIA	6.02	2060	2.6
U	.700	IIB	6.42	2060	3.6
V	.792	IIB	6.63	2060	3.6
W	.917	IIB	6.63	2060	3.6
X	.945	IIB	6.51	2060	6.2
Y	1.033	IIC	6.51	2060	6.2
Z	1.113	IIC	6.51	2060	6.2
AA	1.183	IID	6.51	2060	1.7
AB	1.292	IID	6.51	2060	1.7
AC	1.342	IID	6.61	2060	1.7
AD	1.458	III	6.31	None	-

<u>Sample</u>	<u>Elapsed Hours*</u>	<u>Stage</u>	<u>ppm Ca</u>	<u>Inhibitor</u>	<u>Dose (ppm)</u>
AE	1.513	III	5.97	None	-
AF	1.650	IVA	5.23	F-280	0.5
AG	1.933	IVA	4.83	F-280	0.5
AI	1.992	IVB	5.52, 5.71	F-280	1.0
AH	2.067	IVB	6.31	F-280	1.0
AJ	2.283	IVB	6.41	F-280	1.0
AK	2.388	IVC	6.21	F-280	3.5
AN	2.608	IVC	6.31	F-280	3.5
AO	2.750	IVD	6.41	F-280	8.8
AP	2.875	IVD	6.56	F-280	8.8
AR	3.083	IVD	6.49	F-280	8.8
AS	3.246	VA	6.42	F-247	0.6
BA	3.317	VA	6.35	F-247	0.6
BB	3.517	VA	6.28	F-247	1.1
BC	3.600	VA	6.42	F-247	1.1
BD	3.683	VB	6.35	F-247	1.1
BE	3.817	VB	6.28	F-247	1.1
BF	3.950	VC	6.42	F-247	1.5
BH	4.133	VC	6.49	F-247	1.5
BI	4.217	VD	6.42	F-247	6.6
BJ	4.317	VD	6.56	F-247	6.6
BK	4.383	VD	6.49	F-247	6.6
BL	4.542	VE	6.42	F-247	4.5
BM	4.667	VE	6.42	F-247	4.5
BN	4.817	VF	6.38	F-247	2.6
CB	4.933	VI	6.38	2000	0.6
CC	5.167	VI	6.38	2000	Undefined
CD	5.517	VIIA	6.38	2000	0.7
CE	5.617	VIIA	6.52	2000	0.7
CF	5.767	VIIA	6.38	2000	0.7
CG	5.850	VIIB	6.38	2000	1.2
CH	5.992	VIIB	6.31	2000	1.2
CI	6.133	VIIB	6.38, 6.52	2000	1.2
CJ	6.200	VIIB	6.45	2000	1.2
CK	6.275	VIIC	6.62	2000	6.7
CM	6.408	VIIC	6.17	2000	6.7
CN	6.492	VIID	6.27	2000	3.4
CO	6.617	VIID	6.17	2000	3.4
CP	6.683	VIID	5.64	2000	3.4
CQ	6.717	VIID	5.39	2000	3.4

<u>Sample</u>	<u>Elapsed Hours*</u>	<u>Stage</u>	<u>ppm Ca</u>	<u>Inhibitor</u>	<u>Dose (ppm)</u>
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Chilled, unflushed samples taken from the main flowline above the point of inhibitor injection.

AL	2.517	IVC	6.56
AQ	2.983	IVD	6.28
BG	4.050	VC	6.21
CA	4.900	VI	6.21
CL	6.367	VIIC	6.07

- Time is measured at the inhibitor injection port.

Mean travel and residence time of fluid from inhibitor injection port through the separator to the brineline sampling port is approximately 0.030 hours.

- Sample B was taken from the casing of the transfer pump. Residence time between separator and pump is about one hour.