University of Hawaii at Manoa

Hawaii Natural Energy Institute
Holmes Hall 246 • 2540 Dole Street • Honolulu, Hawaii 96822

June 24, 1991

Mr. Norman Hayashi
Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hayashi:

As required in the County of Hawaii Planning Commission's geothermal resources permit (GRP 89-1), five (5) copies of the May, 1991 monthly report are enclosed.

If you have any questions, please call me at 522-5620.

Sincerely,

Harry Olson
Principal Investigator

Enclosure: May monthly report

MAY 1991 MONTHLY REPORT

Scientific Observation Hole (SOH) Program

Geothermal Resource Permit: GRP 89-1

Lilewa, Kapoho, and Halekamahina, Hawaii

TMK: 1-2-10:01; 1-4-01:02; and 1-4-02:32

Hawaii Natural Energy Institute

University of Hawaii

June 1991

SUMMARY

Drilling continued at SOH-2 from 5,201 feet to a depth of 6,802 feet (1,601 feet) for this reporting period. Intermittent fractured and sandy intervals were encountered below 5,300 feet although 10 foot core runs and 100 percent recovery continued to a depth of 5,400 feet. Between the 5,402 and 5,462 interval, a broken sandy formation resulted in several core runs of 6-9 feet, however, recovery remained at 100 percent.

Bottom hole temperatures were registered 442°F at 5,455 feet and 445°F at 5,498 feet. Drilling fluid migration into fractured rock surrounding the borehole depressed the bottom hole temperatures measured. Core drilling with NQ (2.98" hole by 1.875" core) advanced the hole to 5,770 feet, at which point the drill rig engine broke down. Repairs were made to the engine blower shaft with a total down time of 39 hours. Drilling resumed at 6 am on May 12, 1991. Bottom hole temperatures increased steadily from 506°F at 5,802 feet to 564°F at 6,201 feet.

Due to the encouraging temperatures and fluid loss in SOH-2, a request was made and approved by the Department of Land and Natural Resources to deepen the hole below the 6,500 foot depth permitted, to a maximum depth of 7,000 feet. The SOH-2 hole was completed to the total depth of 6,802 feet at 1 am on May 29, 1991.

On the last day of this reporting period, the Blow Out

Preventor was removed while injecting water into the well, and 1,794 feet of CHD-134mm drill rods removed. The NQ tubing was then tensioned and hung from the wellhead and the completion wellhead equipment installed with a high pressure lubricator in preparation for logging, which is scheduled for June 1, 1991.

The sump material at SOH-1 and SOH-2 will be analyzed to determine if it is suitable for disposal at the County landfill or if it should be buried on site. A grading permit was issued for the SOH-3 site on May 30, 1991, and work will proceed upon notification of approval from Governor John Waihee.

I. INTRODUCTION

This document presents a monthly report to the County of Hawaii Planning Department to support the Scientific Observation Hole (SOH) program in the Kilauea Middle and Lower East Rift Zones. The SOHs are for scientific observation purposes only. The information to be gained from the SOHs will provide an assessment of subsurface geological conditions, groundwater level and composition, temperature, drilling conditions, an inventory of possible mineral and geothermal resources, and an eruptive history of the island to the depth drilled.

This report addresses: occurrence and duration of any start-up, shut-down, and operation mode of any SOH/facility; performance testing, evaluation, calibration checks, and adjustment and maintenance of the continuous emission monitor(s) that have been installed; and emission measurements.

II. BACKGROUND

The County of Hawaii Planning Commission approved, on August 8, 1989, a geothermal resource permit application (GRP 89-1) to drill Scientific Observation Holes (SOHs) in the Kilauea Middle and Lower East Rift Zone. This document presents a monthly report, as required in Condition 6:

> "The petitioner shall maintain a record in a permanent form suitable for inspection and five (5) copies shall be filed with the Planning Department on a monthly basis during drilling and for six (6) months after the completion of drilling to establish a hole specific baseline and such record shall be available to the community. The record shall include:
>
> a. Occurrence and duration of any start-up, shut-down, and operation mode of any SOH/facility.
>
> b. Performance testing, evaluation, calibration checks, and adjustment and maintenance of the continuous emission monitor(s) that have been installed.
>
> c. Emission measurements reported in units compatible with applicable standards/guidelines."

As designated, four holes are planned to be drilled along the Kilauea East Rift Zone on the Big Island of Hawaii. Three of the Big Island holes (SOHs 1, 2, and 4) are on agriculture land and have been permitted by the County of Hawaii Planning Commission. The fourth hole, designated SOH-3, is on

conservation land. SOH activities under Conservation District Use Permit (HA 12/20/85 - 1830) issued to the Estate of James Campbell have been approved.

III. SOH-1 SITE

Drilling Activity

Drilling is complete. The sump material is being analyzed to determine if it is suitable for disposal at the County landfill or if it should be buried on-site. The site will be reclaimed to its original state after testing and monitoring are completed.

Monitoring Program -

Air Quality, Meteorological, Noise and Emissions are not monitored, as drilling has been completed at this site.

IV. SOH-2 SITE

Tonto Drilling Services continued drilling activities from 5,201 feet to a depth of 6,802 feet (1,601 feet) for this reporting period. Intermittent fractured and sandy intervals were encountered below 5,300 feet, although 10 foot core runs and 100 percent recovery continued to a depth of 5,400 feet. Between 5,402 and 5,462 feet, a broken sandy formation resulted in several core runs of 6-9 feet, however, recovery remained at 100 percent.

Bottom hole temperatures have been registered 442°F at 5,455

feet, and 445°F at 5,498 feet. Drilling fluid migration into fractured rock surrounding the borehole continued to depress measured bottom hole temperatures. Core drilling with NQ (2.98" hole by 1.875" core) advanced the hole to 5,762 feet. Increasing hole temperatures resulted in minor rod vibration on several occasions, but was quickly remedied by a slight increase of torque reducer to the mud system. The overall performance of the current drilling fluids is superior to that used in similar temperature conditions at SOH-4 or in a previous high temperature core hole drilled in New Mexico.

While retrieving the core barrel at 5,762 feet, the wireline broke. The drill rods were tripped out and the core and wireline retrieved from inside the rods. The bottom end of the wireline (3/8 inch cable) exhibited rapid deterioration during the first 10 days of May as the bottom hole temperatures increased. Due to embrittlement and fraying, the bottom 30 feet of the wireline was cut off and retied to the overshot every 2-3 days. Wireline failures do not jeopardize the hole since all hardware is retained inside the drill rods, but it does require tripping the drill rods to recover the core and hardware. A new wireline has been ordered and will be installed prior to drilling SOH-3.

Core drilling resumed at 5,762 feet and advanced smoothly to 5,770 feet at which depth the drill engine died broke down. Repairs were made to the engine blower shaft with a total down time of 39 hours. Drilling resumed at 6 am on May 12, 1991. Bottom hole temperatures increased to 501°F at 5,752 feet. The

temperature gradient as reflected by the bottom hole temperatures is higher than in SOH-4. Prior to the drilling of SOH-2, SOH-4 was the hottest core drilled hole on record (586°F) and also the deepest core hole drilled for geothermal exploration purposes. Core recovery between the interval from 5,762 to 6,232 feet was 100 percent, except for four core runs of 5-8 feet in fractured rock between 5,922 and 5,980 feet. Bottom hole temperatures increased steadily from 506°F at 5,802 feet to 564°F at 6,201 feet. This equates to a temperature gradient of 14.5°F/100 feet. The 564°F bottom hole temperature recorded at 6,201 feet exceeds the highest bottom hole temperature recorded at SOH-4, which was 563°F measured at 6,546 feet, just prior to completing the hole to 6,562 feet.

While drilling at 6,388 feet, the drill rods separated at 1,880 feet. The remaining rods were tripped out and the lower section recovered on the first attempt. On May 25, 1991, at a depth of 6,583 feet the inner tube failed to latch properly and the drill rods filled with 9 feet of core. The rods were tripped out of the hole and the core recovered. The bit at this depth has cored 821 feet, but is still in excellent condition and will be used for the remainder of the hole. The previous 2 highest footage bits cored 754 feet in SOH-4 and 764 feet in this hole, SOH-2.

Due to the encouraging temperatures and fluid loss in SOH-2, a request was made and approved by the Department of Land and Natural Resources to deepen the hole below the 6,500 foot depth

permitted, to a maximum depth of 7,000 feet. SOH-2 was completed to the total depth of 6,802 feet at 1 am on May 29, 1991. After reaching total depth at 6,802 feet, the NQ drill rods were tripped out and the HMQ rods, which were set to 4,988 feet had separated at 4,182 feet and the lower section moved 10 feet deeper into the hole. After retrieving the upper 4,182 feet, a mechanical cutter was run in the hole and the remaining HMQ rods cut at 4,762 feet. The rods remaining from 4,762 to the 4,998 foot interval will serve to stabilize sandy sections in this interval. After retrieving the HMQ rods, NQ tubing (2.3/4" O.D. X 2-3/8" I.D.) with 3/16" X 3-1/2" slots in the open hole interval, was installed in the tubing string from 1,830 - 1,930 feet to facilitate the movement of logging tools around the dogleg at approximately 1,880 feet. The Blow Out Preventor was removed while injecting water into the well and 1,794 feet of CHD-134mm drill rods removed. The NQ tubing was then tensioned and hung from the wellhead and the completion wellhead equipment installed with a high pressure lubricator in preparation for logging, which is scheduled for June 1, 1991.

Monitoring Program - Air Quality

The air quality monitoring station provides a continuous record of atmospheric H_2S concentrations when interfaced with a data logger or chart recorder. The unit is located in a utility container on-site and power is provided by the drill rig system.

This station operated normally with minor adjustments and calibrations for this reporting period. The last data collected at this station was approximately 2:00 pm, May 30, 1991, when the rig was shut down in preparation for its move off-site (see appendix for details).

Monitoring Program - Meteorological

Continuous wind speed and directional measurements are being made with a recording wind speed/direction sensor system. A data logger and back-up pressure-sensitive recorder is being used to record the wind speed and direction data. The unit is located in a utility container on-site and power is provided by the drill rig system.

This station operated normally through the month with minor adjustment and calibration. The last data collected at this station was approximately 2:00 pm, May 30, 1991, when the rig was shut down in preparation for its move off-site (see appendix for details).

Monitoring Program - Noise

One noise monitoring station is located at the SOH-2 site during drilling and is operated by power provided by the drill rig system. This station operated normally through the month with minor adjustment and calibration. On May 6, 1991, data was lost due to an error in setting the chart speed, resulting in the chart paper running out. The last data collected at this station

was approximately 2:00 pm, May 30, 1991, when the rig was shut down in preparation for its move off-site (see appendix for details).

A second noise station is located at the Perry residence, about a third of a mile north of the SOH-2 drill site. The instrument at this station is powered by solar charged batteries and operated normally for the month with minor adjustments and calibrations. On May 8-9, 1991, two chart jams occured in 48 hours resulting in the loss of data (see appendix for details).

A third noise monitoring station is located at the Hedtke residence, about 0.4 of a mile east of the SOH-2 site. This monitor is powered by solar charged batteries and operated normally for the month with minor adjustments and calibrations. Chart jams, which are indicative of this type of monitoring equipment, continue to be a problem (see appendix for details).

Emissions Reports

An H_2S monitor is located on-site. The average H_2S level measured is about 1 ppb due to natural causes resulting from the decay of vegetation. Colortek sensor canisters are located around the perimeter of the SOH-2 drill site and are replaced weekly as a matter of routine. Note: the Coloratex cards were checked and replaced May 3, 10, and 17, but only checked not changed on May 24, 1991. The sensors showed no indication of any

emissions from the well (see appendix for details).

V. SOH-3 SITE

No drilling activity has been initiated. Access to the SOH-3 site has not been constructed, nor has the site been cleared or graded. SOH-3 is scheduled to be located at the True/Mid-Pacific alternate drill site 2 (approximately 3,000 feet north-north-west of the present drill site). The grading and grubbing application for the proposed SOH-3 site was submitted to the County of Hawaii Public Works Department on May 13, 1991. The Director of the Department of Land and Natural Resources approved the Archaeological Report for the Buffer Zone Surrounding the Proposed SOH-3 site on May 20, 1991. On May 30, 1991, a grading permit was issued by the Planning Department for the proposed SOH-3 site and work will proceed upon notification from Governor John Waihee.

VI. SOH-4 SITE

Drilling Activity

Drilling is completed. No activity was performed during this period.

Monitoring Program -

Air Quality, Meteorological, Noise and Emissions are not monitored, as drilling has been completed at this site.

APPENDIX

MAINTENANCE REPORTS

J-121 Wednesday, 5-1-9 2.00

SOH-2 H2S
Operating normally. Renewed chart.

SOH-2 MET
Operating normally. Renewed chart.

SOH-2 SOUND
Operating normally. Renewed chart. Replaced Batt.

PERRY SOUND
Operating normally. Renewed chart. Batt. O.K.

HEDTKE SOUND
Pen ran dry, Lost 19 hours data. Replaced pen and batteries. Renewed chart.

SUPPLEMENTARY BILLING

		HOURS	PARTS
J-123	Friday, 5-3-91	3.00	

SOH-2 H2S
Operating normally. Full calibration. No adjustments were necessary.
SOH-2 MET
Operating normally. Calibration check. Right on.
SOH-2 SOUND
Operating normally. Chart and pen O.K. Calibration check on Recorder and Meter was right on.
PERRY SOUND
Operating normally. No calibration adjustments were required for either Meter or Recorder.
HEDTKE SOUND
Operating normally. No calibration adjustments were required for Meter. Recorder was adjusted up 1 db.
COLORTEK
Colortek cards were replaced. No visible color change.

J-126 Monday, 5-6-91 2.00

SOH-2 H2S
Operating normally. No adjustments were required.
SOH-2 MET
Operating normally. Chart O.K.
SOH-2 SOUND
Chart ran out due to my leaving the recorder running at 30 cm/hr instead of 5 cm/hr. Unknown amount of data was lost. Replaced chart and pen. Operating normally.
PERRY SOUND
Operating normally. Replaced chart and pen. Batt. O.K.
HEDTKE SOUND
Operating normally. Replaced chart and pen. Batt. O.K.

J-128 Wednesday, 5-8-91 2.00

SOH-2 H2S
Operating normally. No adjustments were necessary.
SOH-2 MET
Operating normally. Chart O.K.
SOH-2 SOUND
Operating normally. Replaced battery.
PERRY SOUND
Two chart jams in 48 hours caused loss of an unknown amount of data. Replaced meter batteries.
HEDTKE SOUND
Operating normally. Replaced main battery.

J-130 Friday, 5-10-91 3.00

SOH-2 H2S
Operating normally. Replaced Lead Acetate, Renewed chart. Full Calibration. Minor Span & Optics adj.
SOH-2 MET
Operating normally. Renewed chart. Calibration O.K.
SOH-2 SOUND
Operating normally. Chart, Pen, & Batt. O.K. Full calibration. Small adjustments to meter & recorder.
PERRY SOUND
Some data loss due to previous chart jam. Chart, pen

& batteries O.K. No calibration adjustments were needed for sound meter or recorder.

HEDTKE SOUND
Operating normally. Chart, pen & Batt. O.K. Calibration required no adjustments to meter or recorder.

COLORTEK
Replaced colortek cards..No apparent color change.

J-133 Monday, 5-13-91 2.00

SOH-2 H2S
Operating normally. Minor adjust. to Span & Zero.

SOH-2 MET
Operating normally.

SOH-2 SOUND
Operating normally. Chart, pen & Batt. O.K.

PERRY SOUND
Operating normally. Chart, pen & Batt. O,K.

HEDTKE SOUND
Operating normally. Chart, pen & Batt. O.K.

J-135 Wednesday, 5-15-91 2.00

SOH-2 H2S
Operating normally. Adjusted Flow, zero & span.

SOH-2 MET
Operating normally.

SOH-2 SOUND
Operating normally. Chart, pen & Batt. O.K.

PERRY SOUND
Operating normally. Chart, pen & Batt. O.K.

HEDTKE SOUND
Chart jammed, lost several hours data.

J-137 Friday, 5-17-91 3.00

SOH-2 H2S
Operating normally. Renewed chart. Full calib. Adjusted optics and zero.

SOH-2 MET
Operating normally. Renewed chart. Calib.O.K.

SOH-2 SOUND
Operating normally. Renewed chart. Replaced Batt. Full Calib. No adjust. to meter, but chart recorder is getting very unstable when making zero adjustment indicating need for overhaul.

PERRY SOUND
Operating normally. Renewed chart. Replaced Batt. Full calibration. No adjustments required.

HEDTKE SOUND
Chart jammed. Some data lost. Renewed chart and replaced batteries. Full Calibration..Meter O.K., adjusted recorder down 1 db.

COLORTEK
Replaced colortek cards. No visible color change.

J-140 Monday, 5-20-91 2.00

SOH-2 H2S
Operating normally. No adjustments necessary.

SOH-2 MET
Operating normally. Replaced chart.

SOH-2 SOUND
Operating normally. Replaced pen, chart & batt. O.K.

PERRY SOUND

Lost 13 hours because pen ran dry. Replaced pen, chart & batt. O.K.

HEDTKE SOUND

Lost 67 hours due to major chart jam. Replaced pen, chart & batt. O.K.

J-142 Wednesday, 5-22-91 2.00

SOH-2 H2S

Operating normally. No adjustments necessary.

SOH-2 MET

Operating normally. No adjustments necessary.

SOH-2 SOUND

Operating normally. Replaced chart.

PERRY SOUND

Operating normally. No adjustments necessary.

HEDTKE SOUND

Lost 44 hours data due to several chart jams. Cleaned and adjusted chart drive, but was unable to localize a specific fault. Replaced main batt.

J-144 Friday, 5-24-91 3.00

SOH-2 H2S

Operating normally. Renewed chart and replaced Lead-Acetate. Full calibration, but no adjustments were necessary.

SOH-2 MET

Operating normally. Renewed chart. Calibration O.K.

SOH-2 SOUND

Operating normally. Replaced batt. Calibration check required minor adjustment to recorder, none to meter.

PERRY SOUND

Operating normally. Replaced chart and Meter batts. Calibration checked - No adjustments were necessary.

HEDTKE SOUND

Operating normally. 1 minor jam. Chart and pen O.K. Calibration checked. Adjusted recorder up 1 db. No adjustments required for sound meter.

COLORTEK CARDS

No visible color change. Did not replace cards today.

J-147 Monday, 5-27-91 2.00

SOH-2 H2S

Operating normally. No adjustments necessary.

SOH-2 MET

Operating normally. Chart O.K.

SOH-2 SOUND

Operating normally. Chart & pen O.K. No adjustments.

PERRY SOUND

Inoperative due to chart jam. Some data lost. Batt.O.K.

HEDTKE SOUND

Operating normally. Replaced Meter batteries.

J-149 Wednesday, 5-29-91 2.00

SOH-2 H2S

Operating normally. No adjustments necessary.

SOH-2 MET

Operating normally. Chart O.K.

SOH-2 SOUND

Operating normally. Chart, pen & Batt. O.K.

PERRY SOUND

Several chart jams. Collected only about 6 hours data. Adjusted chart drive. Chart, pen & batt. O.K.

HEDTKE SOUND

Operating normally. One of the batteries seems unable to retain a charge. Replaced meter batteries.

J-151 Friday, 5-31-91 2.00

SOH-2 H2S

Inoperative...No power...Drilling finished.. Last data collected was about 2:00PM, 5-30-91. Power will be intermittant from now until Rig is moved to new location at HGP-A, so any additional data will not be valid because time correlation will be unknown.

SOH-2 MET

Same as above

SOH-2 SOUND

Same as above, but left station running because of battery backup "might" be sufficient to capture some additional data.

PERRY SOUND

Chart jammed again. Several hours lost. Was definately able to localize problem to chart paper, not recorder. Replaced meter batteries and Recalibrated equipment. No adjustments necessary.

HEDTKE SOUND

Operating normally. Replaced chart & Pen. Replaced main and meter batteries. Recalibrated instruments. No adjustment required for meter or recorder.

SOH-2 Met Station
5-1-91 to 5-31-91

Time	W/D	W/S	W/D	W/S	W/D	W/S	W/D	W/S
	0501		0502		0503		0504	
0000	45	3	45	5	270	2	290	3
0001	45	2	45	5	270	3	270	3
0002	45	2	45	4	275	3	270	3
0003	45	2	40	3	270	3	270	3
0004	230	2	35	3	265	3	270	3
0005	260	3	50	3	270	3	270	4
0006	265	4	60	2	265	3	270	3
0007	265	3	55	5	60	4	280	4
0008	270	3	40	6	40	5	340	4
0009	25	3	40	7	45	7	20	6
0010	35	5	45	8	40	8	10	7
0011	40	6	45	9	45	10	20	8
0012	50	8	40	9	45	10	20	9
0013	60	9	45	9	45	10	30	10
0014	65	10	40	9	40	9	40	10
0015	70	10	45	9	35	9	15	8
0016	65	9	45	8	40	9	35	6
0017	55	8	40	8	30	7	30	7
0018	50	7	40	7	20	5	40	5
0019	45	5	35	5	20	4	40	4
0020	45	6	25	3	15	5	35	4
0021	45	5	25	3	10	5	30	4
0022	50	6	20	2	20	5	45	8
0023	50	7	310	2	360	4	45	8
	0505		0506		0507		0508	
0000	45	8	35	5	300	4	295	4
0001	40	7	40	5	270	5	295	3
0002	40	8	30	5	280	4	290	3
0003	35	8	345	5	290	4	310	3
0004	45	8	320	4	275	4	315	4
0005	40	7	315	2	270	4	295	4
0006	45	8	345	4	270	4	285	3
0007	45	8	350	4	270	4	285	3
0008	45	8	25	5	275	3	300	3
0009	45	9	35	9	40	7	335	4
0010	40	10	40	12	45	8	30	6
0011	35	8	45	12	40	11	50	8
0012	45	10	40	12	35	11	40	9
0013	45	10	35	11	35	13	40	8
0014	45	11	35	10	30	12	25	6
0015	45	11	30	11	25	12	35	7
0016	40	11	30	9	25	12	40	7
0017	35	8	25	8	25	11	45	5
0018	40	8	15	8	10	9	45	2
0019	350	4	35	7	360	7	45	2

0020	35	5	30	7	340	5	270	2
0021	40	6	25	8	320	4	265	3
0022	45	7	20	7	10	3	265	3
0023	40	8	10	5	300	3	260	2

	0509		0510		0511		0512	
0000	260	2	80	5				
0001	260	2	75	5				
0002	260	2	75	6				
0003	260	2	70	4			360	3
0004	260	2	70	2			30	5
0005	260	2	70	2			40	8
0006	260	2	70	2			40	8
0007	260	2	70	2			35	9
0008	260	2	70	2			45	10
0009	260	2	85	9			40	11
0010	260	2	85	8			40	13
0011	260	2	95	9			40	12
0012	260	2	95	9			35	10
0013	260	2	115	10			40	13
0014	260	2	120	11			35	10
0015	120	12	110	11			40	8
0016	115	11	85	10			35	7
0017	115	11	85	10			35	6
0018	100	11	85	10			30	5
0019	105	9	85	10			25	5
0020	110	9	85	10			20	4
0021	90	8	85	10			20	4
0022	90	7	85	10			25	4
0023	85	4	85	10			45	4

	0513		0514		0515		0516	
0000	45	4	55	4	40	7	50	4
0001	270	3	80	6	35	4	50	3
0002	280	3	75	6	50	5	40	2
0003	270	3	85	2	55	5	45	2
0004	265	3	45	3	65	4	50	2
0005	265	3	70	6	55	6	50	3
0006	270	4	70	6	50	6	270	4
0007	275	3	75	5	60	7	305	4
0008	270	3	70	3	65	9	30	4
0009	310	3	55	6	55	9	40	5
0010	340	3	65	8	45	8	55	7
0011	55	7	40	8	50	9	55	8
0012	45	8	45	8	40	10	90	8
0013	55	10	50	9	45	10	90	9
0014	50	9	45	9	45	11	70	9
0015	50	10	45	10	45	10	65	9
0016	45	9	35	10	40	8	60	8
0017	360	4	30	9	40	7	55	8
0018	315	4	30	7	40	6	65	7
0019	335	5	35	5	40	4	70	6
0020	45	4	35	6	35	4	65	5
0021	45	5	40	7	30	3	65	5
0022	50	5	30	4	40	3	75	5
0023	50	5	35	4	40	2	75	4

	0517		0518		0519		0520	
0000	70	2	80	2	90	2	75	2
0001	70	2	80	2	95	2	75	2
0002	70	2	80	2	95	2	75	2
0003	70	2	80	2	90	2	75	2
0004	70	2	80	2	90	2	75	2
0005	70	2	80	2	90	2	75	2
0006	70	2	80	2	100	2	75	2
0007	70	2	80	2	125	2	75	2
0008	90	6	350	3	110	6	80	3
0009	90	8	30	5	130	5	110	4
0010	85	7	40	6	125	4	130	6
0011	90	8	110	8	125	5	130	7
0012	65	8	110	8	110	6	135	8
0013	75	9	110	8	95	5	125	9
0014	55	9	100	7	115	7	120	9
0015	50	8	120	7	130	6	125	8
0016	70	8	90	7	110	7	120	7
0017	75	8	105	7	110	5	130	6
0018	70	7	105	7	105	3	135	4
0019	80	6	105	6	75	2	155	3
0020	85	2	115	4	75	2	130	3
0021	80	2	100	3	75	2	125	2
0022	80	2	100	3	75	2	135	2
0023	80	2	90	3	75	2	135	2

	0521		0522		0523		0524	
0000	135	2	80	2	95	2	45	2
0001	135	2	80	2	100	2	315	2
0002	135	2	80	2	90	2	265	3
0003	135	2	80	2	80	2	260	3
0004	145	2	80	2	80	2	255	3
0005	175	2	80	2	80	2	255	3
0006	175	2	80	2	80	2	255	3
0007	200	2	80	2	80	2	260	3
0008	190	3	75	3	80	2	260	2
0009	130	4	95	6	85	3	80	6
0010	135	4	115	6	90	4	50	4
0011	135	6	170	5	90	5	45	6
0012	130	8	130	7	95	7	60	7
0013	130	6	130	7	80	7	40	7
0014	130	6	125	7	110	8	40	7
0015	130	5	130	7	90	8	45	8
0016	120	5	125	6	90	9	20	5
0017	85	3	110	5	75	8	25	4
0018	65	3	100	4	65	7	360	3
0019	70	3	90	3	60	6	355	3
0020	70	3	90	2	65	5	300	2
0021	80	2	90	2	45	3	270	3
0022	80	2	90	2	45	2	310	2
0023	80	2	90	2	45	2	270	2

	0525		0526		0527		0528	
0000	280	2	45	4	50	3	45	5
0001	35	2	45	2	40	3	45	6
0002	35	3	45	2	20	2	45	5
0003	265	3	300	2	320	2	45	6
0004	260	3	60	6	265	3	40	4
0005	260	3	45	2	270	3	30	3
0006	250	3	280	4	260	2	55	7
0007	290	3	290	4	265	3	25	2
0008	280	4	300	4	285	3	330	3
0009	275	4	290	4	315	3	270	4
0010	315	4	340	4	340	3	310	4
0011	60	8	25	5	50	10	350	5
0012	75	8	35	5	55	10	355	4
0013	45	8	35	6	55	10	325	4
0014	50	8	45	7	45	10	30	5
0015	75	9	55	6	40	8	50	9
0016	80	4	40	7	60	7	40	7
0017	50	7	45	8	50	7	35	6
0018	55	6	45	7	45	6	25	5
0019	45	7	45	6	40	5	75	7
0020	50	6	50	4	45	5	50	6
0021	45	5	45	4	35	4	60	8
0022	45	5	50	3	45	6	50	6
0023	45	5	50	5	45	5	65	7

	0529		0530		0531	
0000	75	6	85	4	-	-
0001	65	5	80	6	-	-
0002	75	5	55	3	-	-
0003	65	4	50	2	-	-
0004	50	3	50	2	-	-
0005	45	3	50	2	-	-
0006	310	2	50	2	-	-
0007	55	6	55	6	-	-
0008	55	9	65	7	-	-
0009	60	9	70	8	-	-
0010	65	10	60	2	-	-
0011	55	9	75	5	-	-
0012	40	8	65	3	-	-
0013	45	8	60	2	-	-
0014	70	11	80	4	-	-
0015	60	7	90	2	-	-
0016	55	4	260	3	-	-
0017	55	2	-	-	-	-
0018	50	2	-	-	-	-
0019	60	4	-	-	-	-
0020	65	4	-	-	-	-
0021	65	4	-	-	-	-
0022	55	5	-	-	-	-
0023	85	6	-	-	-	-

H2S CHART REDUCTION -- SOH-2 Station

5-1-91 to 5-31-91

HOUR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Avg	Max	Total
0501	2	2	2	2	1	2	2	2	2	1	1	1	2	2	2	2	2	2	1	2	2	1	1	1	2	2	40
0502	1	0	1	1	1	1	2	1	2	3	3	2	2	2	2	1	2	2	1	1	2	2	2	2	2	3	39
0503	2	2	2	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2	37
0504	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	2	30
0505	1	1	1	1	1	1	1	2	1	2	2	2	2	1	2	1	2	1	1	1	1	1	1	1	1	2	31
0506	1	1	1	1	1	1	0	0	1	2	1	1	1	2	2	1	1	2	2	1	1	1	2	1	1	2	28
0507	1	1	0	1	1	1	1	2	1	2	2	1	1	1	2	2	2	3	2	1	1	0	1	1	1	3	31
0508	1	1	1	1	2	1	1	1	2	1	2	2	2	1	2	1	0	1	0	1	2	3	2	2	1	3	33
0509	2	1	*	*	*	*	*	*	*	*	*	*	*	*	1	1	1	0	1	1	2	2	2	2	1	2	16
0510	2	3	2	1	1	1	1	2	2	2	2	3	2	*	*	*	*	*	*	*	*	*	*	*	2	3	24
0511	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0
0512	*	*	*	2	2	2	1	2	2	2	3	2	2	2	2	1	1	1	1	2	1	1	1	0	2	3	33
0513	0	1	0	0	0	0	0	1	1	2	1	2	2	1	1	1	1	0	1	0	1	0	1	1	1	2	18
0514	1	1	1	0	1	1	1	2	2	3	2	1	1	1	0	1	1	1	1	0	1	1	1	1	1	3	26
0515	1	1	1	0	0	1	1	1	2	1	1	1	1	0	1	1	1	0	0	0	0	0	0	1	1	2	16
0516	1	1	1	1	1	1	1	2	1	1	2	1	2	2	1	1	1	1	1	1	1	1	2	1	1	2	29
0517	2	1	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	0	0	1	0	1	1	1	2	15
0518	0	0	0	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	15
0519	1	0	1	1	1	1	1	2	1	2	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	2	20
0520	0	0	0	0	0	0	1	1	1	2	2	2	2	2	2	1	2	1	1	1	0	0	1	1	1	2	23
0521	1	1	1	1	1	1	0	1	1	1	1	2	2	1	2	1	2	1	1	1	1	1	1	1	1	2	27
0522	1	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	2	2	1	2	1	1	1	2	2	3	36
0523	1	1	1	2	1	1	1	1	2	2	1	2	2	2	2	2	2	1	1	1	1	2	1	0	1	2	33
0524	1	1	1	1	0	0	0	1	1	2	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	2	15
0525	0	0	0	1	1	1	0	1	1	1	1	1	2	1	1	1	0	0	0	0	1	1	0	0	1	2	15
0526	1	2	2	1	1	2	1	2	2	2	2	2	2	2	1	0	1	1	0	1	1	1	1	1	1	2	32
0527	1	1	2	2	1	2	1	1	1	2	2	2	1	2	1	1	1	2	1	2	1	1	1	1	1	2	33
0528	1	1	2	2	2	1	1	1	1	2	2	2	2	2	2	2	1	2	1	1	1	2	1	1	2	2	36
0529	1	1	2	2	1	2	2	2	2	1	1	2	2	2	1	1	1	1	0	0	1	1	2	1	1	2	32
0530	2	2	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1	*	*	*	*	*	*	*	1	2	22
0531	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	0
																											785
AVG.	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
MAX.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		3	

** = power or equipment failure; * = calibration

All measurements in points per billion (ppb)

5-12 Wednesday, 5-1-91

5042 H2S Range @ -2000

Flow Steady @ 3.0, Renewed Chart - Lead Acetate O.K.

Tygon Dry - Pump + Bubbler O.K.

Check 3 7/8, down .710

Optics Steady @ 2420-2420

Range - High 1:1 Low 1:1

Zero Cal 6 30 6 -0 0

50 Hz Mot

Operating Normally - Renewed Chart.

50 Hz Sound 0850 Clouds 70% - Calm

Operating Normally - Renewed chart - Replaced Batt

Pegasus Sound 0835 Clouds 75% - Calm

Operating Normally - Renewed chart - Main Batt 12.5

Alt Pegasus Batt 1193-1177 - Spares 1227-1225

Neither Sound 0815 Clouds 75% - Calm

Peg Ram Dry - Lost 19 Hours - Replaced Ram - Renewed Chart

Main Batt 1195 - Alt Batt 1193-1177 - Replaced with

Spares 1259-1242

NAME EXPERIMENT NO.

J-123 Friday 5-3-91

SOH-2 H_2S Range = 0-2 ppb

Flow adj. To 3.0, chart + Lead Acetate O.K

Tygon Dry - Pump + Bubbler O.K

Check 31.5 To down .2%

optics Steady @ 2420-2420

Range - High 1:1 Low 1:1

Zero Calib 30 8 2 0 0 } No adj.

Span Calib - 21 39 48 49 50 }

SOH-2 Met

Operating Normally - Chart O.K - Calib Check O.K

SOH-2 Sound 0847 Clouds 75% WS + Dir. 40° @ 8-10

Operating Normally - Calib Meter To 110.0 Scrn 109.0 - Adjust.

Recorder down 4 dB. - Chart + Pen O.K

Penny Sound 0825 Clouds 80% WS + Dir 25° @ 5-6

Operating Normally - No Calib Adjustments Needed For Meter or Recorder

Main Batt 12.63 - Meter Batt 1185-1163 - Replaced W/spares 1229-1226

Hedtke Sound 0810 Clouds 80% WS + Dir 15° @ 3-4

Operating Normally - Adjust Recorder up 1 dB. - No Meter Adj.

Main Batt 12.01 - Meter Batt 1242-1227 - Spares 1250-1267

Colentech

Replaced Colentech Cards - No Colour Change visible

J-126 Monday 5-6-91 Range = 0-2 ppb

SOH-2-H_2S

Flow steady @ 3.0, chart + Lead Acetate OK

Tygon Dry - Pump + Bubbler O.K.

Check 31.4% down .1%

Optics 2410-2420, up 10 adj. to 2420-2420

Range - High 1:1 Low 2:1

Zero Calib 28 7 2 0

SOH-2 Met

Operating Normally - Chart OK

SOH-2 Sound 0840 Clouds 75% WS + Dir 30° @ 6-8

Lost Recorder @ 30 cm/HR instead of 5 cm/HR - 50 Tape Ran

out and some data was lost - Replaced Chart + Pen

Penny Sound 0822 Clouds 75% WS + Dir 360 @ 4-5

Operating Normally - Replaced Chart + Pen - Main Batt 12.63

Meter Batt 1194-1192 - Spans 1262-1258.

~~S~~ Hedtke Sound 0800 Clouds 70% WS + Dir 360 @ 4-5

Operating Normally - Replaced Chart + Pen - Main Batt 11.60

Meter Batt 1219-1203 - Spares 1253-1244

NAME EXPERIMENT NO.

J-128 Wednesday 5-8-91

SOH-2 H_2S Range 0-2 ppb

Flow steady @ 3.0, Chart & Lead Acetate O.K.

Tygon Dry - Filled Bubbler - Pump O.K.

Check 31.7%, up .3%

Optics 2430-2420, down 10 ea, No Adj.

Range - High 1:1 Low 1:1

Zero Calib 29 5 1 0

SOH-2 Met

Operating Normally - Chart O.K.

SOH-2 sound 0900 Clouds 100%-Rain WS & Dir 300 @ 2-3

Operating Normally - Replaced Battery

Penn sound 0840 Clouds 100%-Rain WS & Dir Calm

2 chart jams in 48 hours caused Loss of some Data.

Main Batt 12.5 V - Meter Batts 11.6-11.7 - Replaced w/spares 12.5-12.5

Heathe sound 0825 Clouds 100%-Rain WS & Dir - Calm

Operating Normally - Main Batt 10.1 V Replaced with 12.6

Meter Batt 12.00-11.99 - Spares 12.7-12.8.

J-128 Friday 5-10-91

SOH-2 H_2S Range 0-2 ppb

Flow adj. to 3.0, Replaced Chart - Replaced Lead Acetate

Tygon Dry - Pump & Bubbler O.K.

Check 31.8%, up .1%

Optics 2430-2420 down 10 ea, adj to 2420-2420

Range - High 1:1 Low 1:1

Zero Calib 32 4 0 -0 0

Span Calib 30 39 47 49 (Span Pot Fwd & Right) 50

SOH-2 Met

Operating Normally - Replaced Chart - Calib Check O.K.

SOH-2 sound 0900 Clouds 95% WS & Dir 90° @ 2-3

Operating Normally - Chart - Pen - Batt O.K. - Calibration

Adj Meter to 110.0 from 110.4 - Adj Recorder to 110.0 from 105.0

Penn sound 0827 Clouds 90% WS & Dir 60° @ 2-3

Previous Chart Jam caused some Data Loss - Chart - Pen - Batt O.K. - Calib Check - No Adjustments to Meters or Recorders.

Heathe sound 0810 Clouds 95% WS & Dir 60° @ 3-4

Operating Normally - Chart - Pen O.K. - Replaced Meter Batt. Calibration Check - No Adj to Meters or Recorders

Colortech

Replaced Colortech Cards - No visible Color changes.

NAME

EXPERIMENT NO.

J-133 Monday 5-13-91

SOH-2 H_2S Range 0-2 ppb

Flow steady @ 3.0, Chart + Lead Acetate OK

Tygon Dry - Pump + Bubbler O.K.

Check 3K.5%, down .3%

Optics 2390 - 2380 - down 10 ea, No adj.

Range- High 1:1 Low 1:1

Zero Calib 28 4 -0 -0 (2-20 ppb 1/2 Left) 0

SOH-2 Met

Operating Normally - Chart OK

SOH-2 Sound 0835 Clouds 90% WS + DIR 765 @ 2

Operating Normally - Chart - Pen - Batt OK

Penny Sound 0820 Clouds 95% Calm

Operating Normally - Chart + Pen O.K - Main Batt 1238

Meter Batt 1218 - 1203 - Spares 1242 - 1240.

Hedtke Sound 0805 Clouds 95% - Rain WS + DIR - Calm

Operating Normally - Chart + Pen OK - Main Batt 12.09

Meter Batt 1204 - 1203 - Spares 1264 - 1246.

J-135 Wednesday 5-15-91

SOH-2 H_2S Range 0-3 ppb

Flow adj down To 3.0 - Chart + Lead Acetate O.K

Tygon Dry - Pump + Bubbler OK

Check 3K.1%, down .4%

Optics Steady @ 2410 - 2410

Range - High 1:1 Low 1:1

Zero Calib 28 2 3 2 (3-20 ppb 1/2 Left) (Span 1/2 Left) 0

SOH-2 Met

Operating Normally - Chart OK

SOH-2 Sound 0838 Clouds 90% WS + Dir 70° @ 6-7

Operating Normally - Chart - Pen + Batt OK

Penny Sound 0817 Clouds 80% WS + DIR 80° @ 4-5

Operating Normally - Chart + Pen OK - Main Batt 12.65

Meter Batt. 1206 - 1189 - Spares 1238 - 1234

Hedtke Sound 0803 - Clouds 80% WS + Dir 80° @ 4-5

Chart Jammed - Lost several hours data - Main Batt 1226

Meter Batt 1192 - 1188 . Spares 1259 - 1242

NAME EXPERIMENT NO.

J-137 Friday 5-17-91

SOH-2 H_2S Range = 0-3 ppb

Flow adj. up to 3.0, Renewed Chart - Lead Acetate O.K.

Tygon Dry - Pump + Bubbler O.K.

Check 31.2%, up .1%

Optics 2440 - 2410, down 30 ea, adj. to 2410 - 2410

Range High 1:1 Low 1:1

Zero Calib 29 16 3 1 (Zero Pot) 0

Span Calib 37 45 49 49 50

SOH-2 Met

Operating Normally - Renewed Chart - Calib Check - O.K.

SOH-2 Sound 0912 Clouds 60% WS + DIR 100° @ 6-8

Operating Normally - Renewed Chart - Replaced Batt - Calibration - No Adj. to Meter - Chart Recorder adjust. Very unstable - Needs overhaul.

Penny Sound 0835 Clouds 50% WS + DIR 90° @ 4-5

Operating Normally - Renewed Chart - Main Batt 12.73 - Meter Batt 1203 - 1180 - Replaced w/spares 1243 - 1238 - Calibrate - No adj. necessary to Meter or Recorder.

Hedtle Sound 0800 Clouds 40% WS + DIR 90° @ 4-5

Chart Jammed - some data lost - Renewed Chart - Main Batt 12.12 Meter Batt 1180 - 1170, Replaced w/spares 1258 - 1244 - Calibrate - No Meter Adj. Necessary - Recorder adj. down 1 div.

Colonel K

Replaced Cells - No Solon change Visible.

J-140 Monday 5-17-91

Flow Steady @ 3.0 Chart + Lead Acetate O.K.

Tygon Dry - Pump + Bubbler O.K.

Check 30.8%, down .4%

Optics 2400 - 2390, down 10 ea, No adj.

Range - High 1:1 Low 1:1

Zero Calib 28 38 4 - 0 0

SOH-2 Met

Operating Normally - Replaced Chart

SOH-2 Sound 0845 Clouds 70% WS + DIR 90° @ 4-5

Operating Normally - Replaced Pen - Chart + Batt O.K.

Penn Sound 0825 Clouds 60% Calm

Lost 18 hours because Pen Ran Dry - Replaced Pen.

Main Batt 12.70, Meter Batt 12.11 - 1198 - Spares 1254 - 1252

Hedtle Sound 0810 Clouds 50% Calm

Lost 67 Hours because of Chart Jam. Replaced Pen - Main Batt 12.02 - Meter Batt 1234 - 1226 - Spares 1251 - 1271

NAME EXPERIMENT NO.

J-142 Wednesday 5-22-91

SOH-2 H_2S Range 0-2 ppb

Flow steady @ 3.0, Chart + lead Acetate O.K.

Tygon Dry - Pump + Bubbler O.K

Check Steady @ 30.8%

Optics Steady @ 2410-2410

Range. High 1:1 Low 1:1

Zero Calib 28 1 2 0

SOH-2 Met

Operating Normally - chart O.K.

SOH-2 Sound 0833 Clouds 35% WS + DIR 85° @ 4-5

Operating Normally - Replaced Chart - Pen + Batt O.K

Penny Sound 0820 Clouds 30% WS + DIR 80° @ 4-5

Operating Normally - chart + Pen O.K - Main Batt 12.85.

Meter Batt 1195-1187 - Spans 1252-1255

Hedtke Sound 0803 Clouds 30% WS + DIR 40° @ 3-4

Only 4 Hours data due to 2 chart Jams - Cleaned + Adj: Chart

Drive - Chart + Pen O.K - Main Batt 1189 - Replaced Batt 1248

Meter Batt 1217-1219 - Spans 1241-1261

J-144 Friday 5-24-91

SOH-2 H_2S Range 0-2 ppb

Flow Steady @ 3.0, Removed chart - Replaced Lead Acetate

Tygon Dry - Pump + Bubbler O.K.

Check Steady @ 30.8%

Optics @ 390-2379, down 20 - Adj. To 2370-2370

Range - High 1:1 Low 1:1

Zero Calib 28 4 1 1 0 } No Adj required

Span Calib 33 39 47 42 50 }

SOH-2 Met

Operating Normally - Removed Chart

SOH-2 Sound 0849 Clouds 90% WS + DIR 40° @ 3-4

Operating Normally - Replaced Batt - Full Calib - No Meter Adj.

Adjust Recorder down 2 dB.

Penny Sound 0820 Clouds 90% Calm

Operating Normally - Replaced Chart - Pen O.K Main Batt 1254

Meter Batt 1172-1150 Replaced with Spans 1246-1241

Full Calib - No adjustments Necessary to Meter or Recorder.

Hedtke sound 0800 Clouds 95% - Rain - Calm

Operating O.K. - 1 minor Jam. - Chart + Pen O.K. - Main Batt 12.22

Meter Batt 1199-1199 - Spans 1233-1255 - Full Calib.

No Meter Adj - Adj Recorder up 1 dB.

NAME EXPERIMENT NO.

J-147 Monday 5-27-91

SOH-2 H2S Range 0-2 ppb

Flow Steady @ 3.0, chart + Lead Acetate O.K

Tygon Dry - Pump + Bubbler O.K

Check Steady @ 30.8%

Optics 2390-2420, up 30 =, Adj. to 2420-2420

Range - High 1:1 Low 1:1

Zero Calib 28 18 2 1 0

SOH-2 Met

Operating Normally - Chart O.K

SOH-2 Sound 0840 Clouds 100% - Rain WS + Dir 330° @ 2-3

Operating Normally - Chart - Pen + Batt O.K

Pappy Sound 0840 Clouds 100% - Rain Calm

Chart Jammed - Lost some Data - Main Batt 12.27

Met Batt 1222-1199 - Spares 1265-1265

Hedtke Sound 0800 Clouds 100% WS + Dir 360° @ 2-3

Operating Normally - Chart + Pen OK - Main Batt 1194, Replaced with 12.58 - Met Batt 1168-1179 - Replaced W/ 1222-1250

J-149 Wednesday 5-29-91

SOH-2 H2S Range 0-2 ppb

Flow Steady @ 3.0, Chart + Lead Acetate O.K

Tygon Dry - Pump + Bubbler O.K

Check 30.6%, Low 2%

Optics 2420-2400, down 20, Adj. to 2400-2400

Range - High 1:1 Low 1:1

Zero Calib 28 2 1 0

SOH-2 Met

Operating Normally - Chart O.K

SOH-2 Sound 0843 Clouds 75% WS + Dir 40° @ 8-10

Operating Normally - Chart - Pen + Batt O.K

Pappy Sound 0825 Clouds 75% WS + Dir 10° @ 4-6

Many Chart Jams - Collected only 6 Hours data - Main Batt 12.58 - Met Batt 1209-1177 - Spares 1235-1250

Hedtke Sound 0805 Clouds 75% WS + Dir 360 @ 4-5

Operating Normally - Chart + Pen O.K. Main Batt 12.30

Met Batt 1188 - 1233 Batt Wait hold change - Spares 1271-1256

NAME EXPERIMENT NO.

J-151 Friday 5-31-91

SCH-2 H_2S + Met + Sound

Inoperative - No Power. - Drilling Finished - Power will Now be Intermittent until Drill Rig is Moved to H&P-A. Will prepare stations for More on Monday - Removed Chart From Met - Sound + H_2S.

Penny Sound 0800 clouds 100% Rain Calm

Jammed Again - several Hours Data Lost - Problem this Time was the Paper - Not The Recorder

Full Calib - No Adjustment to Meter or Recorder

Main Batt 12.5 - Meter Batt 1156-1152, Replaced w/ Spares 1225-1242

Hood Ferry Sound 0820 clouds 100% Rain Calm

Operating Normally - Replaced Chart + Pen - Main Batt 1192

Replaced w/ 1245 - Meter Batt 1151-1220, Replaced w/ 1259 - 1244,

Full Calib - No Adjustments Required for Meter or Recorder

ColorTec.

No Visible Color Change - Will Remove Stations Monday