PUNA GEOTHERMAL VENTURE
A Hawaii Partnership

July 19, 1993

John C. Lewin, M.D., Director
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJ: KS-9 STEAM ANALYSIS

Dear Dr. Lewin,

Pursuant to Special Condition No. 20 of Permit To Operate (PTO) No. P-833-1399, Puna Geothermal Venture (PGV) hereby submits the attached "PGV Steam Venting Emissions Source Test Summary" for samples taken during the KS-9 cleanout flow on April 20, 1993.

Should you of your staff have any questions, please contact me.

Sincerely,

Thomas G. Kizis

Thomas G. Kizis
Environmental Manager

c: S. Morris
D. Berube
G. Davidson

File: KS-9

14-3860 Kapoho Pahoa Road, Pahoa, Hawaii 96778 • (808) 961-2786 • Facsimile (808) 935-5562
Post Office Box 30, Pahoa, Hawaii 96778

THERMOCHEM

PGV Steam Venting Emissions
Source Test Summary

Emission Source Location: KS-9 Muffler
Field Operations: KS-9 Well clean-out
Test Date: 4/20/93
Test Time: 14:40-15:20

Lab Series Number: 4819(1-3)
Sample Train: Mercury
Nozzle Size: 1/2 inch
Total Sample Weight: 326 g
Average Sample Rate: 7.24 g/min

Stack Diameter: 15 ft.
Average Stack Temperature: 188 Deg. F
Average Mass Flow: 165 KPH Steam
Average Volumetric Flow: 73700 ACFM
Average Stack Velocity: 417 Ft/min

Analyte	Total ug	Concentration ug/Kg	Concentration ug/m3	Emission Rate g/hr	Emission Rate lbs/hr
Mercury	< 0.61	< 1.9	< 1.1	< 0.14	< 0.00031

THERMOCHEM

PGV Steam Venting Emissions
Source Test Summary

Emission Source Location: KS-9 Muffler
Field Operations: KS-9 Well clean-out

Test Date: 4/20/93
Test Time: 13:26-14:31

Lab Series Number: 4820(4-6)
Sample Train: Anions, sodium
Nozzle Size: 1/2 inch
Total Sample Weight: 415 g
Average Sample Rate: 5.85 g/min

Stack Diameter: 15 ft
Average Stack Temperature: 185 Deg. F
Average Mass Flow: 144 KPH Steam
Average Volumetric Flow: 64320 ACFM
Average Stack Velocity: 364 Ft/min

Analyte	Total ug	Concentration ug/Kg	Concentration ug/m3	Emission Rate g/hr	Emission Rate lbs/hr
Sodium	40280	97060	57364	6345	14.0
Boron	< 170	< 410	< 242	< 27	< 0.059
Chloride	410	988	584	64.6	0.142
Fluoride	25.1	60.5	35.7	3.95	0.00871

THERMOCHEM

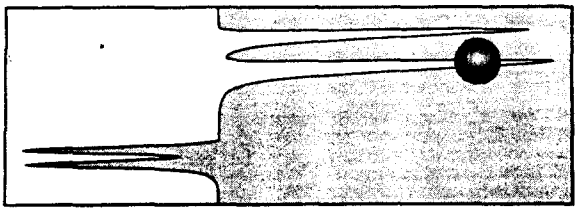
PGV Steam Venting Emissions
Source Test Summary

Emission Source Location:	KS-9 Muffler	**Test Date:**	4/20/93
Field Operations:	KS-9 clean-out	**Test Time:**	13:37-15:20

Lab Series Number:	4821(4-6)
Sample Train:	Metals
Nozzle Size:	5/8 inch
Total Sample Weight:	532.0 g
Average Sample Rate:	4.88 g/min

Stack Diameter:	15 ft.
Average Stack Temperature:	186 Deg. F
Average Mass Flow:	155 KPH Steam
Average Volumetric Flow:	69233 ACFM
Average Stack Velocity:	392 Ft/min

Analyte	Total ug	Concentration ug/Kg	Concentration ug/m3	Emission Rate g/hr	Emission Rate lbs/hr
Arsenic	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Lead	19.4	36.5	21.6	2.57	0.00565
Iron	87.4	164.3	97.1	11.6	0.0255
Manganese	0.98	1.8	1.1	0.13	0.00029
Zinc	51.4	96.6	57.1	6.80	0.0150
Barium	< 255	< 479	< 283	< 33.7	< 0.074
Cadmium	2.85	5.36	3.17	0.377	0.000830
Copper	< 2.0	< 3.8	< 2.3	< 0.27	< 0.00059
Chromium	2.14	< 4.0	< 2.4	< 0.28	< 0.00062
Nickel	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Selenium	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Vanadium	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Beryllium	< 0.2	< 0.4	< 0.2	< 0.03	< 0.0001



THERMOCHEM

PGV Steam Venting Emissions
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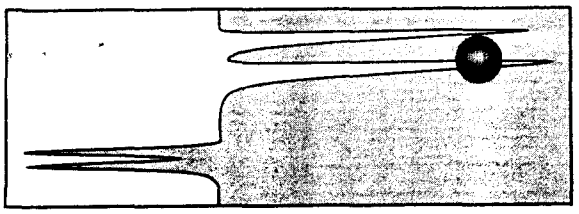

THERMOCHEM

PGV Steam Venting Emissions
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Test Date: 4/20/93
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Lab Series Number: 4820(4-6)
Sample Train: Anions, sodium
Nozzle Size: 1/2 inch
Total Sample Weight: 415 g
Average Sample Rate: 5.85 g/min

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Boron	< 170	< 410	< 242	< 27	< 0.059
Chloride	410	988	584	64.6	0.142
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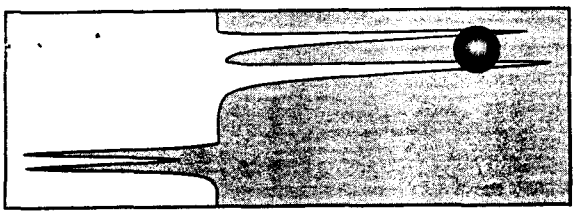

THERMOCHEM

PGV Steam Venting Emissions
Source Test Summary

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Lab Series Number:	4821(4-6)
Sample Train:	Metals
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Average Stack Temperature:	186 Deg. F
Average Mass Flow:	155 KPH Steam
Average Volumetric Flow:	69233 ACFM
Average Stack Velocity:	392 Ft/min

		Concentration		Emission Rate	
Analyte	**Total ug**	**ug/Kg**	**ug/m3**	**g/hr**	**lbs/hr**
Arsenic	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Lead	19.4	36.5	21.6	2.57	0.00565
Iron	87.4	164.3	97.1	11.6	0.0255
Manganese	0.98	1.8	1.1	0.13	0.00029
Zinc	51.4	96.6	57.1	6.80	0.0150
Barium	< 255	< 479	< 283	< 33.7	< 0.074
Cadmium	2.85	5.36	3.17	0.377	0.000830
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Chromium	2.14	< 4.0	< 2.4	< 0.28	< 0.00062
Nickel	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Selenium	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Vanadium	< 5.1	< 9.6	< 5.7	< 0.67	< 0.0015
Beryllium	< 0.2	< 0.4	< 0.2	< 0.03	< 0.0001

PUNA GEOTHERMAL VENTURE
A Hawaii Partnership

July 12, 1993

John C. Lewin, M.D., Director
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJ: KS-9 CLEANOUT PM-10 ANALYSIS

Dear Dr. Lewin,

Attached please find the Ambient Air Monitoring Report for the PM-10 analysis from samples taken during the KS-9 well cleanout.

Should you or your staff have any questions, please contact me.

Sincerely,

Thomas G. Kizis
Environmental Manager

c: S. Morris
D. Berube
N. Hirai (DOH)
G. Davidson
Mesquite

File: KS-9

14-3860 Kapoho Pahoa Road, Pahoa, Hawaii 96778 • (808) 961-2786 • Facsimile (808) 935-5562
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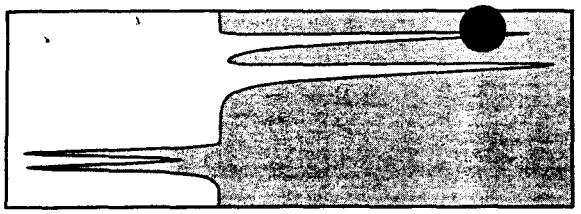


THERMOCHEM

AMBIENT AIR MONITORING REPORT
PGV PM10 ANALYSIS

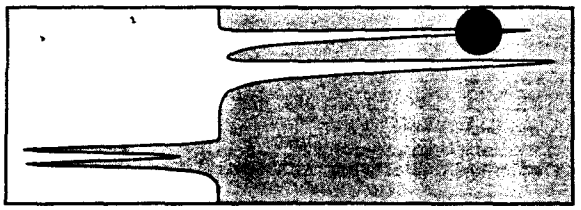
PM10 Monitor Location *Southwest Station #1*

	Start Date	Start Time	Stop Date	Stop Time
Sampling Interval	4/20/93	09:50	4/20/93	15:20
Elapsed Time, Hrs.	5.47		**Lab Number**	4814-1
Total Air Volume, m3 (760 mm Hg, 25 Deg. C)	372		**Filter Number**	039

Analyte	Total ug	ug/m3	ug/g PM10
ARSENIC	< 4.00E+00	< 1.08E-02	< 5.88E+02
LEAD	< 8.00E-01	< 2.15E-03	< 1.18E+02
IRON	1.91E+01	5.14E-02	2.81E+03
MANGANESE	4.40E-01	1.18E-03	6.47E+01
ZINC	< 8.00E+00	< 2.15E-02	< 1.18E+03
BARIUM	< 8.00E+02	< 2.15E+00	< 1.18E+05
CADMIUM	< 2.00E-01	< 5.38E-04	< 2.94E+01
COPPER	7.41E+00	1.99E-02	1.09E+03
CHROMIUM	< 8.00E-01	< 2.15E-03	< 1.18E+02
NICKEL	< 4.00E+00	< 1.08E-02	< 5.88E+02
SELENIUM	< 4.00E+00	< 1.08E-02	< 5.88E+02
VANADIUM	< 4.00E+00	< 1.08E-02	< 5.88E+02
SODIUM	9.00E+02	2.42E+00	1.32E+05
POTASSIUM	5.92E+01	1.59E-01	8.71E+03
CHLORIDE	8.72E+02	2.35E+00	1.28E+05
FLUORIDE	< 2.00E+01	< 5.38E-02	< 2.94E+03
SULFATE	5.53E+02	1.49E+00	8.13E+04
Total PM10	6.80E+03	1.83E+01	

PGV Site Operations: KS-9 Clean out

Power Fail Interruptions: None



THERMOCHEM

AMBIENT AIR MONITORING REPORT
PGV PM10 ANALYSIS

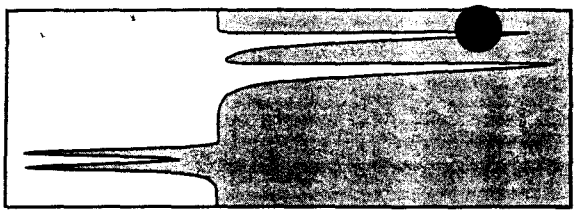
PM10 Monitor Location *Southwest Station #2*

	Start Date	Start Time	Stop Date	Stop Time
Sampling Interval	4/20/93	09:50	4/20/93	15:20
Elapsed Time, Hrs.	5.47		**Lab Number**	4814-2
Total Air Volume, m3 (760 mm Hg, 25 Deg. C)	372		**Filter Number**	043

Analyte	Total ug	ug/m3	ug/g PM10
ARSENIC	< 4.00E+00	< 1.08E-02	< 9.30E+02
LEAD	< 8.00E-01	< 2.15E-03	< 1.86E+02
IRON	1.60E+01	4.30E-02	3.72E+03
MANGANESE	4.30E-01	1.16E-03	1.00E+02
ZINC	< 8.00E+00	< 2.15E-02	< 1.86E+03
BARIUM	< 8.00E+02	< 2.15E+00	< 1.86E+05
CADMIUM	< 2.00E-01	< 5.38E-04	< 4.65E+01
COPPER	5.39E+00	1.45E-02	1.25E+03
CHROMIUM	1.26E+00	3.39E-03	2.93E+02
NICKEL	< 4.00E+00	< 1.08E-02	< 9.30E+02
SELENIUM	< 4.00E+00	< 1.08E-02	< 9.30E+02
VANADIUM	< 4.00E+00	< 1.08E-02	< 9.30E+02
SODIUM	8.68E+02	2.34E+00	2.02E+05
POTASSIUM	6.32E+01	1.70E-01	1.47E+04
CHLORIDE	8.98E+02	2.42E+00	2.09E+05
FLUORIDE	< 2.00E+01	< 5.38E-02	< 4.65E+03
SULFATE	5.61E+02	1.51E+00	1.30E+05
Total PM10	4.30E+03	1.16E+01	

PGV Site Operations: KS-9 clean out

Power Fail Interruptions: None



THERMOCHEM

AMBIENT AIR MONITORING REPORT
PGV PM10 ANALYSIS

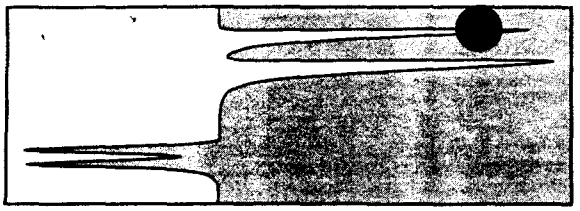
PM10 Monitor Location *Wade Station*

	Start Date	Start Time	Stop Date	Stop Time
Sampling Interval	4/20/93	09:30	4/20/93	15:42
Elapsed Time, Hrs.	6.20		**Lab Number**	4814-3
Total Air Volume, m3 (760 mm Hg, 25 Deg. C)	421		**Filter Number**	065

Analyte	Total ug	ug/m3	ug/g PM10
ARSENIC	< 4.00E+00	< 9.49E-03	< 5.13E+02
LEAD	< 8.00E-01	< 1.90E-03	< 1.03E+02
IRON	1.18E+01	2.80E-02	1.51E+03
MANGANESE	4.20E-01	9.97E-04	5.38E+01
ZINC	< 8.00E+00	< 1.90E-02	< 1.03E+03
BARIUM	< 8.00E+02	< 1.90E+00	< 1.03E+05
CADMIUM	< 2.00E-01	< 4.75E-04	< 2.56E+01
COPPER	5.86E+00	1.39E-02	7.51E+02
CHROMIUM	8.70E-01	2.06E-03	1.12E+02
NICKEL	< 4.00E+00	< 9.49E-03	< 5.13E+02
SELENIUM	< 4.00E+00	< 9.49E-03	< 5.13E+02
VANADIUM	< 4.00E+00	< 9.49E-03	< 5.13E+02
SODIUM	9.32E+02	2.21E+00	1.19E+05
POTASSIUM	7.52E+01	1.78E-01	9.64E+03
CHLORIDE	1.24E+03	2.94E+00	1.59E+05
FLUORIDE	< 2.00E+01	< 4.75E-02	< 2.56E+03
SULFATE	6.05E+02	1.44E+00	7.76E+04
Total PM10	7.80E+03	1.85E+01	

PGV Site Operations: KS-9 clean out

Power Fail Interruptions: None



THERMOCHEM

AMBIENT AIR MONITORING REPORT
PGV PM10 ANALYSIS

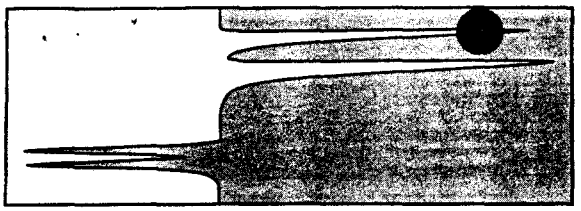
PM10 Monitor Location *Southwest Station #1*

	Start Date	Start Time	Stop Date	Stop Time
Sampling Interval	4/21/93	10:18	4/21/93	17:06
Elapsed Time, Hrs.	6.78		**Lab Number**	4814-4
Total Air Volume, m3 (760 mm Hg, 25 Deg. C)	461		**Filter Number**	053

Analyte	Total ug	ug/m3	ug/g PM10
ARSENIC	< 4.00E+00	< 8.68E-03	< 5.19E+02
LEAD	< 8.00E-01	< 1.74E-03	< 1.04E+02
IRON	1.21E+01	2.63E-02	1.57E+03
MANGANESE	4.10E-01	8.90E-04	5.32E+01
ZINC	< 8.00E+00	< 1.74E-02	< 1.04E+03
BARIUM	< 8.00E+02	< 1.74E+00	< 1.04E+05
CADMIUM	< 2.00E-01	< 4.34E-04	< 2.60E+01
COPPER	4.83E+00	1.05E-02	6.27E+02
CHROMIUM	1.13E+00	2.45E-03	1.47E+02
NICKEL	< 4.00E+00	< 8.68E-03	< 5.19E+02
SELENIUM	< 4.00E+00	< 8.68E-03	< 5.19E+02
VANADIUM	< 4.00E+00	< 8.68E-03	< 5.19E+02
SODIUM	1.20E+03	2.60E+00	1.56E+05
POTASSIUM	6.80E+01	1.48E-01	8.83E+03
CHLORIDE	1.69E+03	3.67E+00	2.19E+05
FLUORIDE	< 2.00E+01	< 4.34E-02	< 2.60E+03
SULFATE	5.96E+02	1.29E+00	7.74E+04
Total PM10	7.70E+03	1.67E+01	

PGV Site Operations: No venting. Background

Power Fail Interruptions: None



THERMOCHEM

AMBIENT AIR MONITORING REPORT
PGV PM10 ANALYSIS

PM10 Monitor Location *Southwest Station #2*

	Start Date	Start Time	Stop Date	Stop Time
Sampling Interval	4/21/93	10:18	4/21/93	17:06
Elapsed Time, Hrs.	6.78		**Lab Number**	4814-5
Total Air Volume, m3 (760 mm Hg, 25 Deg. C)	461		**Filter Number**	074

Analyte	Total ug	ug/m3	ug/g PM10
ARSENIC	< 4.00E+00	< 8.68E-03	< 5.00E+02
LEAD	< 8.00E-01	< 1.74E-03	< 1.00E+02
IRON	1.04E+01	2.26E-02	1.30E+03
MANGANESE	< 4.00E-01	< 8.68E-04	< 5.00E+01
ZINC	< 8.00E+00	< 1.74E-02	< 1.00E+03
BARIUM	< 8.00E+02	< 1.74E+00	< 1.00E+05
CADMIUM	< 2.00E-01	< 4.34E-04	< 2.50E+01
COPPER	1.07E+01	2.33E-02	1.34E+03
CHROMIUM	8.20E-01	1.78E-03	1.03E+02
NICKEL	< 4.00E+00	< 8.68E-03	< 5.00E+02
SELENIUM	< 4.00E+00	< 8.68E-03	< 5.00E+02
VANADIUM	< 4.00E+00	< 8.68E-03	< 5.00E+02
SODIUM	1.10E+03	2.39E+00	1.38E+05
POTASSIUM	7.28E+01	1.58E-01	9.10E+03
CHLORIDE	1.68E+03	3.65E+00	2.10E+05
FLUORIDE	< 2.00E+01	< 4.34E-02	< 2.50E+03
SULFATE	6.01E+02	1.30E+00	7.51E+04
Total PM10	8.00E+03	1.74E+01	

PGV Site Operations: No venting, Background

Power Fail Interruptions: None

PUNA GEOTHERMAL VENTURE
A Hawaii Partnership

May 21, 1993

John C. Lewin,M.D., Director
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJ: KS-9 SAMPLE ANALYSIS

Dear Dr. Lewin,

Pursuant to Special Condition No. 29 of Permit to Operate (PTO) No. P-833-1399, Puna Geothermal Venture (PGV) hereby submits a required sample analysis for the KS-9 well cleanout.

Should you or your staff have any questions, please contact me.

Sincerely,

Thomas G. Kizis

Thomas G. Kizis
Environmental Manager

c: S. Morris
T. Arizumi
N. Hirai
V. Goldstein

File: KS-9

14-3860 Kapoho Pahoa Road, Pahoa, Hawaii 96778 • (808) 961-2786 • Facsimile (808) 935-5562
Post Office Box 30, Pahoa, Hawaii 96778

Tom Kizis
Puna Geothermal Venture
P.O. Box 30
Pahoa, HI 96778

Report of Analysis

Lab Number	Descriptor	Chloride ppmw	Sodium ppmw
4832-1	KS-9 ICS	<0.025	0.012

PUNA GEOTHERMAL VENTURE
A Hawaii Partnership

June 15, 1993

John C. Lewin, M.D., Director
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJ: KS-9 CHEMICAL ANALYSES

Dear Dr. Lewin,

Pursuant to Special Condition No. 20 of Permit To Operate (PTO) No. P-833-1399, Puna Geothermal Venture (PGV) hereby submits the brine and steam condensate chemical analyses for samples taken during the KS-9 cleanout flow on April 20, 1993.

Should you of your staff have any questions, please contact me.

Sincerely,

Thomas G. Kizis

Thomas G. Kizis
Environmental Manager

c: S. Morris
D. Berube
G. Davidson

File: KS-9

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Post Office Box 30, Pahoa, Hawaii 96778

Mesquite Group, Inc.
P.O. Box 1283
221 North Harbor Blvd., Suite K
Fullerton, California 92632
(714) 738-8224 • FAX (714) 525-2852

June 10, 1993

Mr. Tom Kizis
PUNA GEOTHERMAL VENTURE
P. O. Box 30
Pahoa, HI 96778

Subject: KS-9 Chemical Analyses

Dear Tom:

Enclosed are chemical analyses of brine and steam condensate that the Mesquite Group, Inc. collected during the KS-9 cleanout flow on April 20, 1993. Brine samples were collected from the bottom of the flowline and steam condensate samples were collected from the top of the flow line. Both sample types utilized a small separator and were collected from cooling coils submerged in tap water to prevent flashing. The methods used for sampling are listed in Tables 1 and 2. All sample bottles were washed in 10% by volume nitric acid and rinsed in deionized water before sampling. The analytical laboratories and methods are summarized in Tables 3 and 4. Blank samples (Table 5) were also submitted and analyzed. The chemical results are listed on the attached analyses tabulations.

Sincerely,

Skip Matlick

J. S. "Skip" Matlick, III
Senior Geologist

JSM/mjw

Enclosures

PUNA GEOTHERMAL VENTURE
WELL KS-9

Table 1
BRINE SAMPLE METHODS

Sample	Analyte	Sample Size *(ml)*	Container	Filtered *(0.45 micron)*	Preservative
KS-9 1NB	Ammonium	125	amber glass	no	none
KS-9 2NB	Ammonium	125	amber glass	no	none
KS-9 1BEB	Benzene	40	VOA	no	none
KS-9 2BEB	Benzene	40	VOA	no	none
KS-9 1VCB	Vinyl Chloride	40	VOA	no	none
KS-9 2VCB	Vinyl Chloride	40	VOA	no	none
KS-9 1BB	Arsenic, Lead, Boron, Cadmium, Beryllium, Sodium, Calcium, Lithium, Strontium, Silica, Potassium	500	plastic	yes	10 ml HNO_3
KS-9 2BB	Arsenic, Lead, Boron, Cadmium, Beryllium, Sodium, Calcium, Lithium, Strontium, Silica, Potassium	500	plastic	yes	10 ml HNO_3
KS-9 1SB	Sulfide	250	plastic	no	12.5 ml $CdCl_2$
KS-9 2SB	Sulfide	250	plastic	no	12.5 ml $CdCl_2$
KS-9 1ICAB	ICAP*	20	plastic	yes	4 ml HNO_3
KS-9 2ICAB	ICAP*	20	plastic	yes	4 ml HNO_3
KS-9 1QB	Silica	10	plastic	no	2 ml HNO_3 + 90 ml H_2O
KS-9 2QB	Silica	10	plastic	no	2 ml HNO_3 + 90 ml H_2O
KS-9 1HB	Mercury	100	amber glass	no	25 ml $K_2Cr_2O_7$ + HNO_3
KS-9 2HB	Mercury	100	amber glass	no	25 ml $K_2Cr_2O_7$ + HNO_3
KS-9 1AB	Bromide, Bicarbonate, Carbonate, Sulfate, Chloride, Nitrate, Fluoride, Total Dissolved Solids, Total Suspended Solids, pH	500	plastic	no	none

Table 1: BRINE SAMPLE METHODS

Sample	Analyte	Sample Size *(ml)*	Container	Filtered *(0.45 micron)*	Preservative
KS-9 2AB	Bromide, Bicarbonate, Carbonate, Sulfate, Chloride, Nitrate, Fluoride, Total Dissolved Solids, Total Suspended Solids, pH	500	plastic	no	none
KS-9 1IB	Isotopes	125	plastic	no	none
KS-9 2IB	Isotopes	125	plastic	no	none
KS-9 1ASB	Asbestos	1,000	glass	no	none
KS-9 2ASB	Asbestos	1,000	glass	no	none
KS-9 1RB	Radionuclides	1,000	plastic	no	10 ml HNO_3
KS-9 2RB	Radionuclides	1,000	plastic	no	10 ml HNO_3

*ICAP: Sodium, Potassium, Calcium, Magnesium, Iron, Aluminum, Silica, Boron, Lithium, Strontium, Zinc, Silver, Gold, Barium, Bismuth, Beryllium, Cadmium, Cerium, Cobalt, Chromium, Lanthanum, Manganese, Molybdenum, Nickel, Lead, Tin, Antimony, Tellurium, Thorium, Titanium, Uranium, Vanadium, Tungsten, Zirconium

Table 2
STEAM CONDENSATE SAMPLE METHODS

Sample	Analyte	Sample Size *(ml)*	Container	Filtered *(0.45 micron)*	Preservative
KS-9 1AS	Bromide, Bicarbonate, Carbonate, Sulfate, Chloride, Nitrate, Fluoride, Total Dissolved Solids, Total Suspended Solids, pH	500	plastic	no	none
KS-9 1SS	Sulfide	250	plastic	no	12.5 ml $CdCl_2$
KS-9 1CAS	ICAP*	20	plastic	yes	4 ml HNO_3
KS-9 1NS	Ammonium	125	amber glass	no	none
KS-9 1BS	Arsenic, Lead, Boron, Cadmium, Beryllium, Sodium, Calcium, Lithium, Strontium, Silica, Potassium	500	plastic	yes	10 ml HNO_3
KS-9 1CS	Hydrogen Chloride	250	plastic	no	none
KS-9 1HS	Mercury	100	amber glass	no	25 ml $K_2Cr_2O_7$ + HNO_3
KS-9 1RS	Radionuclides	1,000	plastic	no	10 ml HNO_3
KS-9 1VCS	Vinyl Chloride	40	VOA	no	none
KS-9 1BES	Benzene	40	VOA	no	none
KS-9 1ASS	Asbestos	1,000	glass	no	none
KS-9 1IS	Isotopes	125	plastic	no	none

*ICAP: Sodium, Potassium, Calcium, Magnesium, Iron, Aluminum, Silica, Boron, Lithium, Strontium, Zinc, Silver, Gold, Barium, Bismuth, Beryllium, Cadmium, Cerium, Cobalt, Chromium, Lanthanum, Manganese, Molybdenum, Nickel, Lead, Tin, Antimony, Tellurium, Thorium, Titanium, Uranium, Vanadium, Tungsten, Zirconium

Table 3
BRINE ANALYTICAL METHODS

Sample	Analyte	Lab*	EPA Method	Instrumentation
KS-9 1&2NB	Ammonium	UURI	600	Electrode
KS-9 1&2BEB	Benzene	BEI	602	Gas Chromatograph
KS-9 1&2VCB	Vinyl Chloride	BEI	502.2	Gas Chromatograph
KS-9 1&2BB	Arsenic	UURI	600	Colorimetric
	Lead	UURI	200.7	ICAP
	Boron	UURI	200.7	ICAP
	Cadmium	UURI	200.7	ICAP
	Beryllium	UURI	200.7	ICAP
	Sodium	UURI	200.7	ICAP
	Calcium	UURI	200.7	ICAP
	Lithium	UURI	200.7	ICAP
	Strontium	UURI	200.7	ICAP
	Silica	UURI	200.7	ICAP
	Potassium	UURI	200.7	ICAP
KS-9 1&2SB	Sulfide	UURI	600	Titrimetric
KS-9 1&2ICAB	ICAP**	UURI		ICAP
KS-9 1&2QB	Silica	UURI	200.7	ICAP
KS-9 1&2HB	Mercury	UURI		Cold Vapor AA
KS-9 1&2AB	Bromide	UURI	600	Titration
	Bicarbonate/Carbonate	UURI	600	Titration
	Sulfate	UURI	600	Turbidimetric
	Chloride	UURI	600	Titration
	Nitrate	UURI	600	Colorimetric
	Fluoride	UURI	600	Electrode
	Total Dissolved Solids	UURI	600	Gravimetric
	Total Suspended Solids	UURI	600	Gravimetric
	pH	UURI	600	Meter
KS-9 1&2IB	Isotopes	SMU		Mass Spectrographic
KS-9 1&2ASB	Asbestos	Inalab		TEM
KS-9 1&2RB	Radionuclides	TMA		Scintillation

*Lab: UURI - University of Utah Research Institute; BEI - Brewer Environmental Industries; SMU - Southern Methodist University, Institute for the Study of Earth and Man; TMA - TMA-NORCAL; TC - Thermochem

**ICAP: Sodium, Potassium, Calcium, Magnesium, Iron, Aluminum, Silica, Boron, Lithium, Strontium, Zinc, Silver, Gold, Barium, Bismuth, Beryllium, Cadmium, Cerium, Cobalt, Chromium, Lanthanum, Manganese, Molybdenum, Nickel, Lead, Tin, Antimony, Tellurium, Thorium, Titanium, Uranium, Vanadium, Tungsten, Zirconium

Table 4
STEAM CONDENSATE ANALYTICAL METHODS

Sample	Analyte	Lab*	EPA Method	Instrumentation
KS-9 1AS	Bromide	UURI	600	Titration
	Bicarbonate/Carbonate	UURI	600	Titration
	Sulfate	UURI	600	Turbidimetric
	Chloride	UURI	600	Titration
	Nitrate	UURI	600	Colorimetric
	Fluoride	UURI	600	Electrode
	Total Dissolved Solids	UURI	600	Gravimetric
	Total Suspended Solids	UURI	600	Gravimetric
	pH	UURI	600	Meter
KS-9 1SS	Sulfide	UURI	600	Titrimetric
KS-9 1CAS	ICAP**	UURI		ICAP
KS-9 1NS	Ammonium	UURI	600	Electrode
KS-9 1BS	Arsenic	UURI	600	Colorimetric
	Lead	UURI	200.7	ICAP
	Boron	UURI	200.7	ICAP
	Cadmium	UURI	200.7	ICAP
	Beryllium	UURI	200.7	ICAP
	Sodium	UURI	200.7	ICAP
	Calcium	UURI	200.7	ICAP
	Lithium	UURI	200.7	ICAP
	Strontium	UURI	200.7	ICAP
	Silica	UURI	200.7	ICAP
	Potassium	UURI	200.7	ICAP
KS-9 1CS	Hydrogen Chloride	TC		Chromatograph
KS-9 1HS	Mercury	UURI		Cold Vapor AA
KS-9 1RS	Radionuclides	TMA		Scintillation
KS-9 1VCS	Vinyl Chloride	BEI	502.2	Gas Chromatograph
KS-9 1BES	Benzene	BEII	600	Gas Chromatograph
KS-9 1ASS	Asbestos	Inalab		TEM
KS-9 1IS	Isotopes	SMU		Mass Spectrographic

*Lab: UURI - University of Utah Research Institute; BEI - Brewer Environmental Industries; SMU - Southern Methodist University, Institute for the Study of Earth and Man; TMA - TMA-NORCAL; TC - Thermochem

**ICAP: Sodium, Potassium, Calcium, Magnesium, Iron, Aluminum, Silica, Boron, Lithium, Strontium, Zinc, Silver, Gold, Barium, Bismuth, Beryllium, Cadmium, Cerium, Cobalt, Chromium, Lanthanum, Manganese, Molybdenum, Nickel, Lead, Tin, Antimony, Tellurium, Thorium, Titanium, Uranium, Vanadium, Tungsten, Zirconium

Table 5
BLANK SAMPLES

Sample	Analyte	Sample Size *(ml)*	Container	Filtered *(0.45 micron)*	Preservative
KS-9 1SBB	Sulfide	125	plastic	no	12.5 ml $CdCl_2$
KS-9 1QBB	Silica	60	plastic	no	60 ml HNO_3
KS-9 1ICAB	ICAP*	100	plastic	no	2 ml HNO_3

*ICAP: Sodium, Potassium, Calcium, Magnesium, Iron, Aluminum, Silica, Boron, Lithium, Strontium, Zinc, Silver, Gold, Barium, Bismuth, Beryllium, Cadmium, Cerium, Cobalt, Chromium, Lanthanum, Manganese, Molybdenum, Nickel, Lead, Tin, Antimony, Tellurium, Thorium, Titanium, Uranium, Vanadium, Tungsten, Zirconium

CHEMICAL ANALYSES

(NOT FLASH CORRECTED)

SAMPLE TYPE: Brine
WELL: KS-9
COLLECTION DATE: April 20, 1993
SAMPLE TIME: 1315 hrs
SAMPLE POINT: Bottom flow line
FLOW RATE: 132,000 lbs/hr
SAMPLE METHOD: Two-phase liquid flow into separator then into cooling coil submerged in water.

WHP: 1920 psig
Separator Pressure: 38 psig

Analyses*

TDS	220.00 mg/l	F	0.34 mg/l
pH	6.79	B	5.1 mg/l
SiO_2	116.04 mg/l	Br	<0.50 mg/l
Fe	0.27 mg/l	S	122 mg/l
Ca	0.57 mg/l	NO_3	<0.01 mg/l
Mg	0.03 mg/l	PO_4	0.89 mg/l
Na	31.25 mg/l	Mo	0.11 mg/l
K	5.60 mg/l	Mn	0.03 mg/l
Li	0.092 mg/l	Ba	0.12 mg/l
Sr	<0.00 mg/l	Zn	0.02 mg/l
Al	0.30 mg/l	Be	<0.005 mg/l
NH_4	0.22 mg/l	Hg	<0.0005 mg/l
Benzene	0.006 mg/l	TTS	9.0 mg/l
Vinyl Chloride	<0.001 mg/l	Asbestos	0.19 ± 0.19 mfl
As	0.122 mg/l	Gross Alpha	3 ± 2 pCi/L
Pb	<0.002 mg/l	Gross Beta	7 ± 2 pCi/L
Cd	<0.005 mg/l	^{226}Ra	0 ± 1 pCi/L
HCO_3	39.00 mg/l	^{228}Ra	0 ± 3 pCi/L
CO_3	<1.00 mg/l	^{18}O (SMOW)	+1.90‰
SO_4	4.8 mg/l	^{2}H (SMOW)	+3.6‰
Cl	24 mg/l		

* Refer to originals for elements determined to be below detection limits.

Mesquite Group, Inc.

CHEMICAL ANALYSES

(NOT FLASH CORRECTED)

SAMPLE TYPE: Brine
WELL: KS-9
COLLECTION DATE: April 20, 1993
SAMPLE TIME: 1510 hrs
SAMPLE POINT: Bottom flow line
FLOW RATE: 166,000 lbs/hr
SAMPLE METHOD: Two-phase liquid flow into separator then into cooling coil submerged in water.

WHP: 1905 psig
Separator Pressure: 48 psig

Analyses*

TDS	174 mg/l
pH	6.26
SiO_2	130.79 mg/l
Fe	0.30 mg/l
Ca	0.51 mg/l
Mg	0.04 mg/l
Na	20.06 mg/l
K	1.89 mg/l
Li	0.03 mg/l
Sr	<0.00 mg/l
Al	0.14 mg/l
NH_4	0.17 mg/l
Benzene	0.007 mg/l
Vinyl Chloride	<0.001 mg/l
As	0.016 mg/l
Pb	<0.002 mg/l
Cd	<0.005 mg/l
HCO_3	8.00 mg/l
CO_3	<1.00 mg/l
SO_4	11.00 mg/l
Cl	8 mg/l

F	0.38 mg/l
B	5.98 mg/l
Br	<0.50 mg/l
S	141 mg/l
NO_3	<0.1 mg/l
PO_4	0.51 mg/l
Ba	0.13 mg/l
Be	<0.005 mg/l
Hg	<0.0005 mg/l
TTS	9.0 mg/l
Asbestos	0.93 ±0.46 mfl
Gross Alpha	3 ± 2 pCi/L
Gross Beta	2 ± 1 pCi/L
^{226}Ra	0 ± 1 pCi/L
^{228}Ra	0 ± 3 pCi/L
^{18}O (SMOW)	+0.44‰
^{2}H (SMOW)	-0.1‰

* Refer to originals for elements determined to be below detection limits.

CHEMICAL ANALYSES

(NOT FLASH CORRECTED)

SAMPLE TYPE: Condensed Steam
WELL: KS-9
COLLECTION DATE: April 20, 1993
SAMPLE TIME: 1430 hrs
SAMPLE POINT: Bottom flow line
FLOW RATE: 161,000 lbs/hr
SAMPLE METHOD: Two-phase liquid flow into separator then into cooling coil submerged in water.

WHP: 1900 psig
Separator Pressure: 48 psig

Analyses*

TDS	14.00 mg/l	F	0.07 mg/l
pH	4.6	B	0.08 mg/l
SiO_2	5.28 mg/l	Br	<0.05 mg/l
Fe	0.15 mg/l	S	403 mg/l
Ca	<0.02 mg/l	NO_3	<0.01 mg/l
Mg	<0.01 mg/l	PO_4	<0.15 mg/l
Na	0.07 mg/l	Be	<0.005 mg/l
K	<0.05 mg/l	Hg	<0.0005 mg/l
Li	<0.04 mg/l	TTS	1.0 mg/l
Sr	<0.00 mg/l	Asbestos	<0.23 mfl
Al	<0.05 mg/l	Gross Alpha	1 ± 2 pCi/L
NH_4	0.35 mg/l	Gross Beta	1 ± 1 pCi/L
Benzene	0.036 mg/l	^{226}Ra	0 ± 1 pCi/L
Vinyl Chloride	<0.001 mg/l	^{228}Ra	0 ± 2 pCi/L
As	<0.04 mg/l	^{18}O (SMOW)	+0.44‰
Pb	0.004 mg/l	^{2}H (SMOW)	-0.1‰
Cd	<0.005 mg/l	HCl	not detected
HCO_3	3.00 mg/l		
CO_3	<1.00 mg/l		
SO_4	1.00 mg/l		
Cl	1.40 mg/l		

* Refer to originals for elements determined to be below detection limits.

Mesquite Group, Inc.

Appendix

CHEMICAL ANALYSES ORIGINALS

BREWER ENVIRONMENTAL INDUSTRIES, INC.
a C BREWER company

LABORATORY ANALYSIS REPORT
Environmental Laboratories Division

CLIENT: PUNA GEOTHERMAL VENTURE
P.O. BOX 30
PAHOA, HAWAII 96778

ATTN: BILL TEPLOW

JOB NUMBER: 0029

DATE: APRIL 29, 1993

MATRIX: WATER

QA/QC DATA

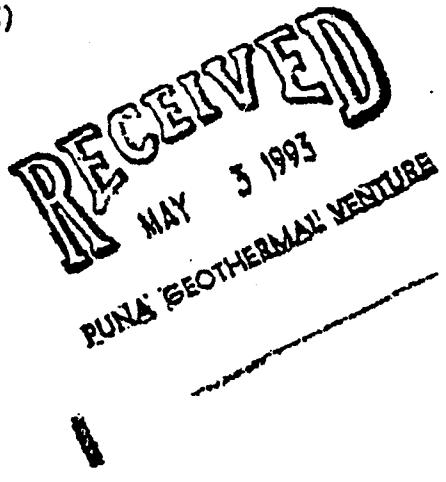
SPIKE COMPOUND	MS % REC	MSDS % REC	RPD %
BENZENE	97.0	98.5	1.5
VINYL CHLORIDE	101.2	99.0	2.2

SURROGATE RECOVERY (BENZENE)

1BES = 99.5%
1BEB = 94.8%
2BEB = 96.6%

SURROGATE RECOVERY (VINYL CHLORIDE)

1VCB = 98.9%
1VCS = 100.0%
2VCB = 91.7%



Approved by: D Takeki

BREWER ENVIRONMENTAL LABORATORIES
PO BOX 552
PAPAIKOU, HI 96781
PHONE (808) 964-5522
FAX (808) 964-5309

BREWER ENVIRONMENTAL INDUSTRIES, INC.
a G. BREWER company

LABORATORY ANALYSIS REPORT
Environmental Laboratories Division

CLIENT: PUNA GEOTHERMAL VENTURE
P.O. BOX 30
PAHOA, HAWAII 96778

ATTN: BILL TEPLOW

JOB NUMBER: 0029

DATE: APRIL 29, 1993

SAMPLE LOCATION: KS-9

Date/Time Sampled: 04/20/93 @ 1200
Date/Time Received: 04/21/93 @ 1345

Matrix: WATER

SAMPLE ID#	BENZENE RESULT mg/L	DETECTION LIMIT mg/L	ANALYSIS DATE	METHOD NUMBER
IBES	0.036	0.005	04/21/93	M 602
IBEB	0.006	0.005	04/21/93	M 602
2BEB	0.007	0.005	04/21/93	M 602

SAMPLE ID#	VINYL CHLORIDE RESULT mg/L	DETECTION LIMIT mg/L	ANALYSIS DATE	METHOD NUMBER
IVCB	ND	0.001	04/26/93	502.2
IVCS	ND	0.001	04/26/93	502.2
2VCB	ND	0.001	04/26/93	502.2

RECEIVED
MAY 3 1993
PUNA GEOTHERMAL VENTURE

ND = NOT DETECTED

Approved by: M. Takaki

BREWER ENVIRONMENTAL LABORATORIES
PO. BOX 552
PAPAIKOU, HI 96781
PHONE (808) 964-5522
FAX (808) 964-5309

THERMOCHEM

4832 (1) May 14, 1993

Tom Kizis
Puna Geothermal Venture
P.O. Box 30
Pahoa, HI 96778

Report of Analysis

Lab Number	Descriptor	Chloride ppmw	Sodium ppmw
4832-1	KS-9 ICS	<0.025	0.012

TMA
Thermo Analytical Inc.

TMA/Norcal
2030 Wright Avenue
P. O. Box 4040
Richmond, CA 94804-0040
(510) 235-2633 Fax No. (510) 235-0438

May 18, 1993

Ref: Customer P.O. 60324
TMA/Norcal N3-04-134-8331

Mr. Tom Kizis
Project Geologist
Puna Geothermal Venture
P.O. Box 1337
Hilo, HI 96721

Dear Mr. Kizis:

The results of the three water samples we received on 27 April 1993 for analysis have been completed and are shown on Attachment 1. The samples were filtered before analysis.

We appreciate this opportunity to be of service.

Very truly yours,

D. P. Kharkar

Dinkar P. Kharkar, Ph.D.
Manager, Nuclear Projects

DPK/ss

Enclosures: Attachment 1

TMA

ATTACHMENT 1 RESULTS

Customer ID No.	TMA/Norcal Group No. 8331	Analysis	Results pCi/L ± 2 σ
KS-9-1RB	1	Gross Alpha	3 ± 2
		Gross Beta	7 ± 2
		^{226}Ra	0 ± 1
		^{228}Ra	0 ± 3
KS-9-2RB	2	Gross Alpha	3 ± 2
		Gross Beta	2 ± 1
		^{226}Ra	0 ± 1
		^{228}Ra	0 ± 3
KS-9-1RS	3	Gross Alpha	1 ± 2
		Gross Beta	1 ± 1
		^{226}Ra	0 ± 1
		^{228}Ra	0 ± 2

INALAB, INC.
3615 HARDING AVE. • SUITE 304 • HONOLULU, HAWAII 96816
(808) 735-0422 • FAX: (808) 735-0047
TECHNICAL EXPERTS CONSULTING IN
ENVIRONMENTAL • FORENSIC • OCCUPATIONAL AND LABORATORY SERVICES

INALAB, INC.

To Skip

Laboratory Report

Puna Geothermal Venture
P.O. Box 30
Hilo, Hawaii 96778
phone (808) 961-2786
fax (808) 935-5562

Date: 7 May 1993
Invoice Number: 93335
Your P.O. Number: 60323

Attention: Skip

Sample Description	Concentration of Asbestos Structures (MFL)	Detection Limit (MFL)	Analysis Date
KS-9 2ASB	0.93	0.46	4/29/93
KS-9 1ASB	0.19	0.19	4/30/93
KS-9 1ASS	none detected	0.23	4/29/93

Note: MFL = Million Fibers per Liter

(1) Sample was not collected by INALAB, Inc. personnel.
(2) Samples will be retained by the laboratory for a **maximum** of 15 days. Unless otherwise requested **in writing**, they will then be discarded.
(3) Disposal of all samples found to be **hazardous** with respect to their physical or chemical properties (as defined by the EPA's 40 CFR part 260 regulations will be the responsibility of the client. A disposal charge of $500.00 will be assessed for all hazardous samples not reclaimed **within 10 calendar days** of the date of the written report of results.

UNIVERSITY OF UTAH RESEARCH INSTITUTE
UURI
EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

June 3, 1993

Skip Matlick
Mesquite Group, Inc.
P.O. Box 1283
221 North Harbor Blvd., Suite K
Fullerton, CA 92632

REPORT

Sample	ppb Se
KS-9 1 BS	236
KS-9 2 BB	1.0

Ruth L. Kroneman

Ruth L. Kroneman
Chemist

RLK/cd

UNIVERSITY OF UTAH RESEARCH INSTITUTE
UURI
EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

RECEIVED MAY 2 7 1993

May 25, 1993

Tom Kizis
Puna Geothermal Venture
P.O. Box 1337
Hilo, HI 96721-1337

REPORT

Sample	mg/l Hg	method
KS-9 1 HSB	<0.0005	cold vapor AA
KS-9 1 HS	<0.0005	cold vapor AA
KS-9 1 HB	<0.0005	cold vapor AA
KS-9 2 HB	<0.0005	cold vapor AA

Sample	mg/l As	method
KS-9 1BB	0.120	colorimetric 600
KS-9 2BB	0.016	colorimetric 600

Sample	mg/l Pb	mg/l B	mg/l Cd	mg/l Be	mg/l Na	mg/l Ca	mg/l Li	method
KS-9 1 BS	0.004	0.08	<0.005	<0.005	0.07	<0.02	<0.04	ICP 200.7
KS-9 1 BB	<0.002	5.00	<0.005	<0.005	31.12	0.58	0.09	ICP 200.7
KS-9 2 BB	<0.002	5.86	<0.005	<0.005	20.15	0.52	0.03	ICP 200.7
KS-9 1 BBB	<0.002	<0.05	<0.005	<0.005	0.49	0.02	<0.04	ICP 200.7

Sample	mg/l NH_4	Method	mg/l $S^=$	Method
KS-9 1NS	0.35	gas sensing electrode 600	403	titrimetric 600
KS-9 1NB	0.22	gas sensing electrode 600	122	titrimetric 600
KS-9 2NB	0.17	gas sensing electrode 600	141	titrimetric 600

Samples KS-9, 1SBB, 1SB, 1SS and 2QB contained nitric acid as well as Cadmium chloride. The nitric acid is an interferent for sulfide analysis. Splits labeled 1NS, 1NB and 2NB were analyzed for Sulfide instead.

Ruth L. Kroneman
Chemist

RLK/cd

enclosures

****

PUNA GEOTHERMAL
KS-9 1AB, 1BB

ID #: A:3930391.PG
DATE: 05-25-93

****

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
Na	31.12	1	.04	.135E-02
K	5.49	1	.05	.140E-03
Ca	.58	1	.02	.145E-04
Mg	.03	1	.01	.123E-05
Fe	.26	1	.00	.466E-05
Al	.29	1	.05	.107E-04
SiO2	113.76	1	.04	.189E-02
B	5.00	1	.00	.463E-03
Li	.09	1	.00	.130E-04
Sr	.00	1	.00	.571E-07
Zn	.02	1	.01	.306E-06
Ag	N.D.	1	.00	< .371E-07
As	.12	1	.04	.160E-05
Au	N.D.	1	.01	< .406E-07
Ba	.12	1	.03	.874E-06
Be	N.D.	1	.00	< .111E-07
Bi	N.D.	1	.20	< .957E-06
Cd	N.D.	1	.00	< .356E-07
Ce	N.D.	1	.02	< .143E-06
Co	N.D.	1	.00	< .339E-07
Cr	N.D.	1	.01	< .192E-06
Cu	N.D.	1	.01	< .787E-07
La	N.D.	1	.01	< .720E-07
Mn	.03	1	.02	.546E-06
Mo	.11	1	.05	.115E-05
Ni	N.D.	1	.01	< .170E-06
Pb	N.D.	1	.02	< .965E-07
Sn	N.D.	1	.01	< .843E-07
Sb	N.D.	1	.04	< .329E-06
Te	N.D.	1	.10	< .784E-06
Th	N.D.	1	.20	< .862E-06
Ti	N.D.	1	.01	< .209E-06
U	N.D.	1	.50	< .210E-05
V	N.D.	1	.10	< .196E-05
W	N.D.	1	.01	< .544E-07
Zr	N.D.	1	.01	< .110E-06
NH4	.22	5	.12	.122E-04
Cs	N.A.	10	.50	< .376E-05
Rb	N.A.	10	.30	< .351E-05

PUNA GEOTHERMAL
KS-9 1AB, 1BB

ID #: A:3930391.PG
DATE: 05-25-93

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
TOTAL ALKALINITY AS				
HCO3	39.00	2	1.00	.639E-03
CO3	N.D.	2	1.00	< .167E-04
Cl	24.00	2	1.00	.677E-03
F	.34	5	.05	.179E-04
SO4	4.80	11	1.00	.500E-04
Br	N.D.	2	.50	< .626E-05
I	N.A.	2	.10	< .788E-06
NO3	N.D.	9	.01	< .161E-05
S	122.00	2	.20	.381E-02
PO4	.89	1	.15	.934E-05
TOTAL DISSOLVED SOLIDS				
MEASURED	220.00	4	4.00	
CALCULATED	328.45	6		
100*MEAS/CALC	66.98			
pH	6.79	7		

ADDITIONAL ANALYSIS:

EC	210	u mhos/cm
Hg	<0.5	ppb
As	120	ppb
TSS	9.0	ppm Gravimetric, 600
SIO2	16.4 MG/L	ICP 200.7 (100)

****

ANALYTICAL METHODS:

1. INDUCTIVELY COUPLED PLASMA SPECTROMETER 200.7
2. TITRATION (LABORATORY) 600
3. TITRATION (FIELD)
4. GRAVIMETRIC 600
5. SPECIFIC ION ELECTRODE 600
6. METHOD OF HEM (1970, USGS Water Supply Paper 1473)
7. pH METER (LABORATORY) 600
8. pH METER (FIELD)
9. COLORIMETRIC 600
10. ATOMIC ABSORPTION
11. TURBIDIMETRIC 600

N.D. - NOT DETECTED
N.A. - NOT ANALYZED

****

PUNA GEOTHERMAL
KS-9 1AB, 1BB

ID #: A:3930391.PG
DATE: 05-25-93

	Milliequivalents/Liter
CATIONS	
Na	1.35372
K	.14038
Ca	.02894
Mg	.00247
Fe	.00931
Al	.03225
Li	.01297
Sr	.00011
Zn	.00061
As	.00206
Ba	.00175
Mn	.00109
Mo	.00229
NH4	.01220
SUM OF CATIONS:	1.60016
ANIONS	
HCO3	.63921
Cl	.67704
F	.01790
SO4	.09994
S	7.61036
PO4	.02809
SUM OF ANIONS:	9.07254
CATION-ANION BALANCE	-7.47238
BALANCE DIFF. CATION + ANION	-70.01

****

TRILINEAR DIAGRAM COORDINATES

PUNA GEOTHERMAL
KS-9 1AB, 1BB

ID #: A:3930391.PG
DATE: 05-25-93

****

	Meq / L	Percent (Meq / L)
CATIONS		
Na	1.35372	88.73890
K	.14038	9.20213
Ca	.02894	1.89720
Mg	.00247	.16177
TOTAL	1.52551	99.99999
ANIONS		
HCO3	.63921	45.13602
CO3	.00000	.00000
SO4	.09994	7.05670
Cl	.67704	47.80728
TOTAL	1.41619	100.00000

****

GEOTHERMOMETERS

PUNA GEOTHERMAL
KS-9 1AB, 1BB

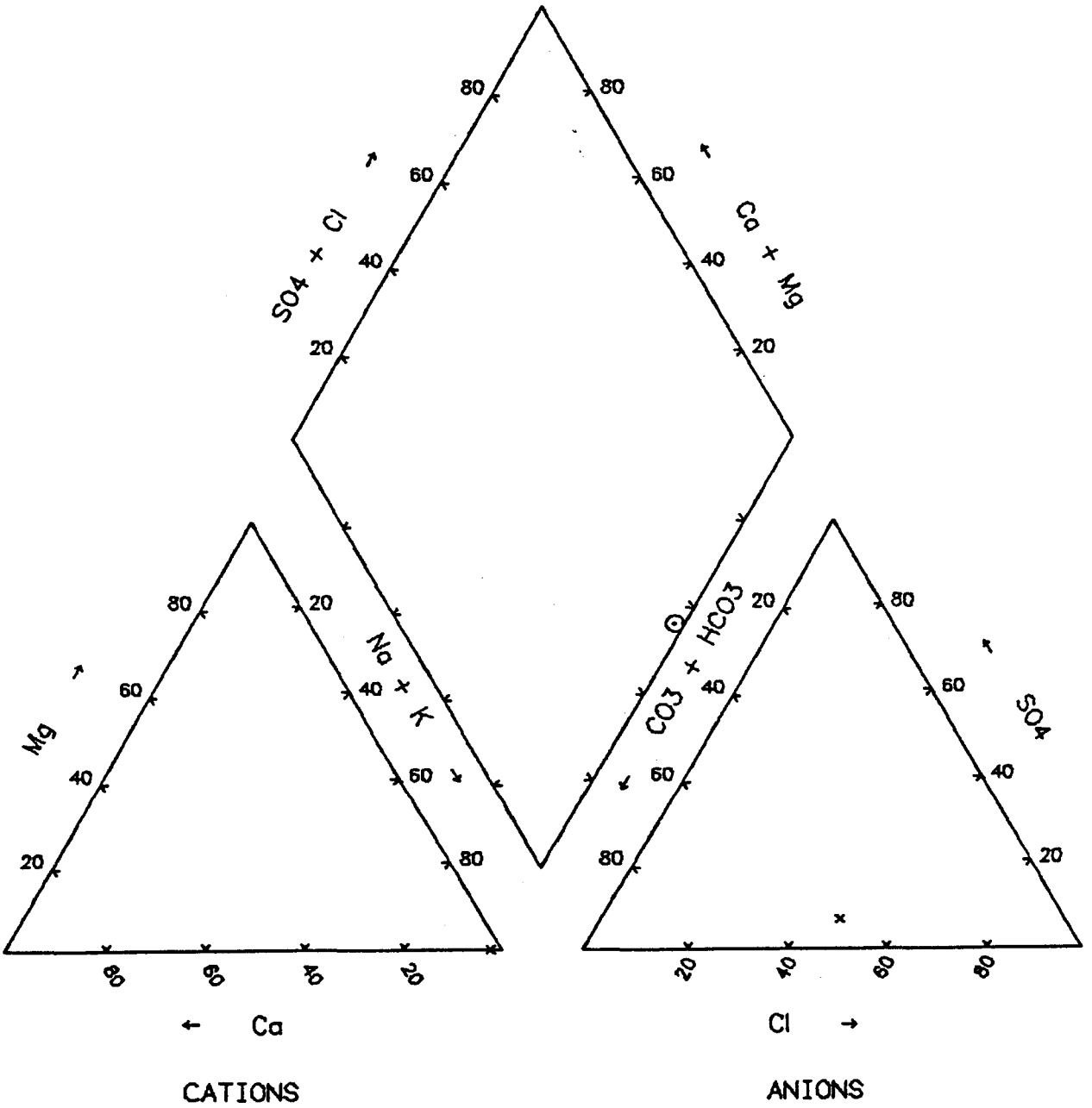
ID #: A:3930391.PG
DATE: 05-25-93

****

Geothermometer	Temp (deg C)		Reference
Quartz (no steam loss)	145.		Fournier (1981)
Quartz (maximum steam loss)	139.		Fournier (1981)
Chalcedony	119.		Fournier (1981)
alpha-Cristobalite	94.		Fournier (1981)
beta-Cristobalite	45.		Fournier (1981)
Amorphous Silica	24.		Fournier (1981)
Na/K (Fournier)	271.		Fournier (1979)
Na/K (Truesdell)	258.		Fournier (1981)
Na-K-Ca	215.	beta= .33	Fournier and Truesdell(1974)
Na/Li	144.		Fouillac and Michard(1981)

PUNA GEOTHERMAL
KS-9 1AB,1BB

UURI ID# A:3930391.PG
DATE: 05-25-93



PERCENT OF TOTAL
MILLIEQUIVALENTS PER LITER

****

PUNA GEOTHERMAL
KS-9 1BBB

ID #: A:3930393.PG
DATE: 05-25-93

****

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
Na	.49	1	.04	.213E-04
K	N.D.	1	.05	< .128E-05
Ca	.05	1	.02	.125E-05
Mg	N.D.	1	.01	< .535E-06
Fe	N.D.	1	.00	< .358E-07
Al	N.D.	1	.05	< .185E-05
SiO2	4.06	1	.04	.676E-04
B	N.D.	1	.00	< .370E-06
Li	N.D.	1	.00	< .432E-06
Sr	N.D.	1	.00	< .114E-07
Zn	N.D.	1	.01	< .765E-07
Ag	N.D.	1	.00	< .371E-07
As	N.D.	1	.04	< .534E-06
Au	N.D.	1	.01	< .406E-07
Ba	N.D.	1	.03	< .182E-06
Be	N.D.	1	.00	< .111E-07
Bi	N.D.	1	.20	< .957E-06
Cd	N.D.	1	.00	< .356E-07
Ce	N.D.	1	.02	< .143E-06
Co	N.D.	1	.00	< .339E-07
Cr	N.D.	1	.01	< .192E-06
Cu	N.D.	1	.01	< .787E-07
La	N.D.	1	.01	< .720E-07
Mn	N.D.	1	.02	< .364E-06
Mo	N.D.	1	.05	< .521E-06
Ni	N.D.	1	.01	< .170E-06
Pb	N.D.	1	.02	< .965E-07
Sn	N.D.	1	.01	< .843E-07
Sb	N.D.	1	.04	< .329E-06
Te	N.D.	1	.10	< .784E-06
Th	N.D.	1	.20	< .862E-06
Ti	N.D.	1	.01	< .209E-06
U	N.D.	1	.50	< .210E-05
V	N.D.	1	.10	< .196E-05
W	N.D.	1	.01	< .544E-07
Zr	N.D.	1	.01	< .110E-06
NH4	N.A.	5	.12	< .665E-05
Cs	N.A.	10	.50	< .376E-05
Rb	N.A.	10	.30	< .351E-05

PUNA GEOTHERMAL
KS-9 18BB

ID #: A:3930393.PG
DATE: 05-25-93

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
TOTAL ALKALINITY AS				
HCO3	N.A.	2	1.00	< .164E-04
CO3	N.A.	2	1.00	< .167E-04
Cl	N.A.	2	1.00	< .282E-04
F	N.A.	5	.05	< .263E-05
SO4	N.A.	11	1.00	< .104E-04
Br	N.A.	2	.50	< .626E-05
I	N.A.	2	.10	< .788E-06
NO3	N.A.	9	.10	< .161E-05
S	N.A.	2	.20	< .624E-05
PO4	N.D.	1	.15	< .159E-05
TOTAL DISSOLVED SOLIDS				
MEASURED	NOT MEAS.	4	4.00	
CALCULATED	4.60	6		
pH	.00	7		

****

ANALYTICAL METHODS:

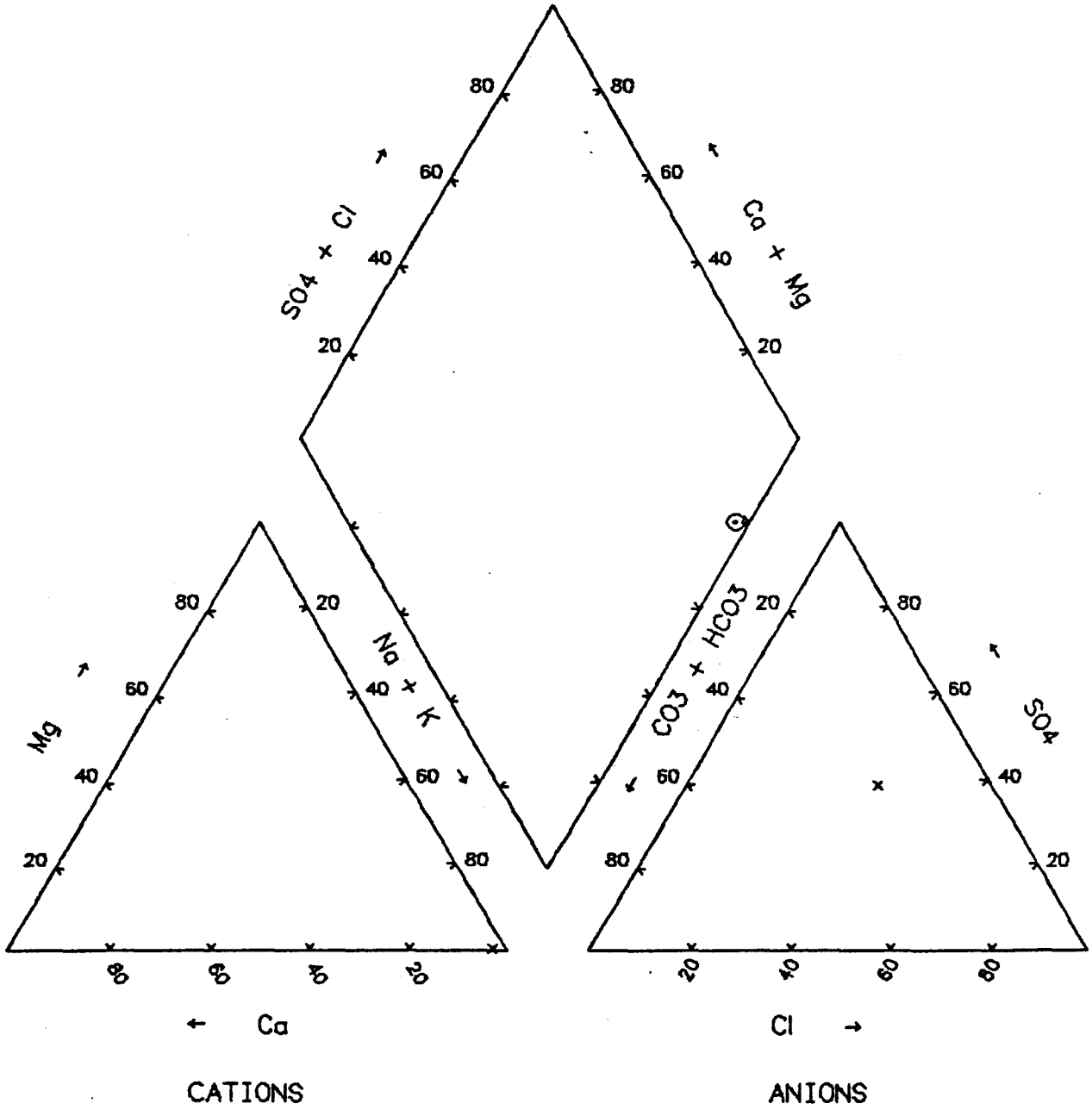
1. INDUCTIVELY COUPLED PLASMA SPECTROMETER 200.7
2. TITRATION (LABORATORY)
3. TITRATION (FIELD)
4. GRAVIMETRIC
5. SPECIFIC ION ELECTRODE
6. METHOD OF HEM (1970, USGS Water Supply Paper 1473)
7. pH METER (LABORATORY)
8. pH METER (FIELD)
9. COLORIMETRIC
10. ATOMIC ABSORPTION
11. TURBIDIMETRIC

N.D. - NOT DETECTED
N.A. - NOT ANALYZED

****

PUNA GEOTHERMAL
KS-9 2AB,2BB

UURI ID# A:3930392.PG
DATE: 05-25-93



PERCENT OF TOTAL
MILLIEQUIVALENTS PER LITER

****

PUNA GEOTHERMAL
KS-9 1AS, 1BS

ID #: A:3930390.PG
DATE: 05-25-93

****

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
Na	.07	1	.04	.304E-05
K	N.D.	1	.05	< .128E-05
Ca	N.D.	1	.02	< .374E-06
Mg	N.D.	1	.01	< .535E-06
Fe	.15	1	.00	.269E-05
Al	N.D.	1	.05	< .185E-05
SiO2	5.18	1	.04	.862E-04
B	N.D.	1	.00	< .370E-06
Li	N.D.	1	.00	< .432E-06
Sr	N.D.	1	.00	< .114E-07
Zn	N.D.	1	.01	< .765E-07
Ag	N.D.	1	.00	< .371E-07
As	N.D.	1	.04	< .534E-06
Au	N.D.	1	.01	< .406E-07
Ba	N.D.	1	.03	< .182E-06
Be	N.D.	1	.00	< .111E-07
Bi	N.D.	1	.20	< .957E-06
Cd	N.D.	1	.00	< .356E-07
Ce	N.D.	1	.02	< .143E-06
Co	N.D.	1	.00	< .339E-07
Cr	N.D.	1	.01	< .192E-06
Cu	N.D.	1	.01	< .787E-07
La	N.D.	1	.01	< .720E-07
Mn	N.D.	1	.02	< .364E-06
Mo	N.D.	1	.05	< .521E-06
Ni	N.D.	1	.01	< .170E-06
Pb	N.D.	1	.02	< .965E-07
Sn	N.D.	1	.01	< .843E-07
Sb	N.D.	1	.04	< .329E-06
Te	N.D.	1	.10	< .784E-06
Th	N.D.	1	.20	< .862E-06
Ti	N.D.	1	.01	< .209E-06
U	N.D.	1	.50	< .210E-05
V	N.D.	1	.10	< .196E-05
W	N.D.	1	.01	< .544E-07
Zr	N.D.	1	.01	< .110E-06
NH4	.35	5	.12	.194E-04
Cs	N.A.	10	.50	< .376E-05
Rb	N.A.	10	.30	< .351E-05

PUNA GEOTHERMAL
KS-9 1AS, 1BS

ID #: A:3930390.PG
DATE: 05-25-93

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
TOTAL ALKALINITY AS				
HCO3	3.00	2	1.00	.492E-04
CO3	N.D.	2	1.00	< .167E-04
Cl	1.40	2	1.00	.395E-04
F	.07	5	.05	.368E-05
SO4	1.00	11	1.00	.104E-04
Br	N.D.	2	.50	< .626E-05
I	N.A.	2	.10	< .788E-06
NO3	N.D.	9	.01	< .161E-05
S	403.00	2	.20	.126E-01
PO4	N.D.	1	.15	< .159E-05
TOTAL DISSOLVED SOLIDS				
MEASURED	14.00	4	4.00	
CALCULATED	412.70	6		
100*MEAS/CALC	3.39			
pH	4.60	7		

ADDITIONAL ANALYSIS:

EC	27	u mhos/cm
Hg	<0.5	ppb
TSS	1.0	ppm Gravimetric, 600

****

ANALYTICAL METHODS:

1. INDUCTIVELY COUPLED PLASMA SPECTROMETER 200.7
2. TITRATION (LABORATORY) 600
3. TITRATION (FIELD)
4. GRAVIMETRIC 600
5. SPECIFIC ION ELECTRODE 600
6. METHOD OF HEM (1970, USGS Water Supply Paper 1473)
7. pH METER (LABORATORY) 600
8. pH METER (FIELD)
9. COLORIMETRIC 600
10. ATOMIC ABSORPTION
11. TURBIDIMETRIC 600

N.D. - NOT DETECTED
N.A. - NOT ANALYZED

****

PUNA GEOTHERMAL
KS-9 1AS, 1BS

ID #: A:3930390.PG
DATE: 05-25-93

	Milliequivalents/Liter
CATIONS	
Na	.00304
Fe	.00537
NH4	.01940
SUM OF CATIONS:	.02782
ANIONS	
HCO3	.04917
Cl	.03949
F	.00368
SO4	.02082
S	25.13914
SUM OF ANIONS:	25.25231
CATION-ANION BALANCE	-25.22449
BALANCE DIFF. CATION + ANION	-99.78

****

PUNA GEOTHERMAL
KS-9 2AB, 2BB

ID #: A:3930392.PG
DATE: 05-25-93

****

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
Na	20.45	1	.04	.890E-03
K	1.85	1	.05	.473E-04
Ca	.52	1	.02	.130E-04
Mg	.04	1	.01	.165E-05
Fe	.29	1	.00	.519E-05
Al	.14	1	.05	.519E-05
SiO2	128.23	1	.04	.213E-02
B	2.79	1	.00	.258E-03
Li	.03	1	.00	.432E-05
Sr	N.D.	1	.00	< .114E-07
Zn	N.D.	1	.01	< .765E-07
Ag	N.D.	1	.00	< .371E-07
As	N.D.	1	.04	< .534E-06
Au	N.D.	1	.01	< .406E-07
Ba	.13	1	.03	.947E-06
Be	N.D.	1	.00	< .111E-07
Bi	N.D.	1	.20	< .957E-06
Cd	N.D.	1	.00	< .356E-07
Ce	N.D.	1	.02	< .143E-06
Co	N.D.	1	.00	< .339E-07
Cr	N.D.	1	.01	< .192E-06
Cu	N.D.	1	.01	< .787E-07
La	N.D.	1	.01	< .720E-07
Mn	N.D.	1	.02	< .364E-06
Mo	N.D.	1	.05	< .521E-06
Ni	N.D.	1	.01	< .170E-06
Pb	N.D.	1	.02	< .965E-07
Sn	N.D.	1	.01	< .843E-07
Sb	N.D.	1	.04	< .329E-06
Te	N.D.	1	.10	< .784E-06
Th	N.D.	1	.20	< .862E-06
Ti	N.D.	1	.01	< .209E-06
U	N.D.	1	.50	< .210E-05
V	N.D.	1	.10	< .196E-05
W	N.D.	1	.01	< .544E-07
Zr	N.D.	1	.01	< .110E-06
NH4	.17	5	.12	.942E-05
Cs	N.A.	10	.50	< .376E-05
Rb	N.A.	10	.30	< .351E-05

PUNA GEOTHERMAL
KS-9 2AB, 2BB

ID #: A:3930392.PG
DATE: 05-25-93

SPECIES	CONCENTRATION (ppm)	ANALYTICAL METHOD	DETECTION LIMITS	CONCENTRATION (MOL/L)
TOTAL ALKALINITY AS				
HCO3	8.00	2	1.00	.131E-03
CO3	N.D.	2	1.00	< .167E-04
Cl	8.00	2	1.00	.226E-03
F	.38	5	.05	.200E-04
SO4	11.00	11	1.00	.115E-03
Br	N.D.	2	.50	< .626E-05
I	N.A.	2	.10	< .788E-06
NO3	N.D.	9	.01	< .161E-05
S	141.00	2	.20	.440E-02
PO4	.51	1	.15	.541E-05
TOTAL DISSOLVED SOLIDS				
MEASURED	174.00	4	4.00	
CALCULATED	319.47	6		
100*MEAS/CALC	54.47			
pH	6.26	7		

ADDITIONAL ANALYSIS:

EC	174	u mhos/cm
Hg	<0.5	ppb
As	16	ppb
TSS	9.0	ppm Gravimetric 600
SIO2	17.3	MG/L ICP 200.7 (1QBB)

****

ANALYTICAL METHODS:

1. INDUCTIVELY COUPLED PLASMA SPECTROMETER 200.7
2. TITRATION (LABORATORY) 606
3. TITRATION (FIELD)
4. GRAVIMETRIC 600
5. SPECIFIC ION ELECTRODE 600
6. METHOD OF HEM (1970, USGS Water Supply Paper 1473)
7. pH METER (LABORATORY) 600
8. pH METER (FIELD)
9. COLORIMETRIC 600
10. ATOMIC ABSORPTION
11. TURBIDIMETRIC 600

N.D. - NOT DETECTED
N.A. - NOT ANALYZED

****

PUNA GEOTHERMAL
KS-9 2AB, 2BB

ID #: A:3930392.PG
DATE: 05-25-93

	Milliequivalents/Liter
CATIONS	
Na	.88958
K	.04730
Ca	.02595
Mg	.00329
Fe	.01038
Al	.01557
Li	.00432
Ba	.00190
NH4	.00942
SUM OF CATIONS:	1.00772
ANIONS	
HCO3	.13112
Cl	.22568
F	.02000
SO4	.22902
S	8.79558
PO4	.01627
SUM OF ANIONS:	9.41768
CATION-ANION BALANCE	-8.40996
BALANCE DIFF. CATION + ANION	-80.67

****

TRILINEAR DIAGRAM COORDINATES

PUNA GEOTHERMAL
KS-9 2AB, 2BB

ID #: A:3930392.PG
DATE: 05-25-93

****

	Meq / L	Percent (Meq / L)
CATIONS		
Na	.88958	92.07727
K	.04730	4.89635
Ca	.02595	2.68580
Mg	.00329	.34058
TOTAL	.96612	99.99999
ANIONS		
HCO3	.13112	22.38230
CO3	.00000	.00000
SO4	.22902	39.09392
Cl	.22568	38.52378
TOTAL	.58582	100.00000

****

GEOTHERMOMETERS

PUNA GEOTHERMAL
KS-9 2AB,2BB

ID #: A:3930392.PG
DATE: 05-25-93

****

Geothermometer	Temp (deg C)		Reference
Quartz (no steam loss)	152.		Fournier (1981)
Quartz (maximum steam loss)	145.		Fournier (1981)
Chalcedony	127.		Fournier (1981)
alpha-Cristobalite	101.		Fournier (1981)
beta-Cristobalite	52.		Fournier (1981)
Amorphous Silica	30.		Fournier (1981)
Na/K (Fournier)	209.		Fournier (1979)
Na/K (Truesdell)	177.		Fournier (1981)
Na-K-Ca	170.	beta= .33	Fournier and Truesdell(1974)
Na-K-Ca with Mg correction	162.	R= 4.30	Fournier and Potter (1979)
Na/Li	98.		Fouillac and Michard(1981)

PUNA GEOTHERMAL VENTURE

A Hawaii Partnership

May 5, 1993

John C. Lewin,M.D., Director
State Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJ: KS-9 STEAM SAMPLE ANALYSES

Dear Dr. Lewin,

Pursuant to Special Condition No. 29 of Permit to Operate (PTO) No. P-833-1399, Puna Geothermal Venture (PGV) hereby submits the required steam sample analyses for the KS-9 well cleanout.

Should you or your staff have any questions, please contact me.

Sincerely,

Thomas G. Kizis

Thomas G. Kizis
Environmental Manager

c: S. Morris
T. Arizumi
N. Hirai
V. Goldstein

File: KS-9

14-3860 Kapoho Pahoa Road, Pahoa, Hawaii 96778 • (808) 961-2786 • Facsimile (808) 935-5562
Post Office Box 30, Pahoa, Hawaii 96778

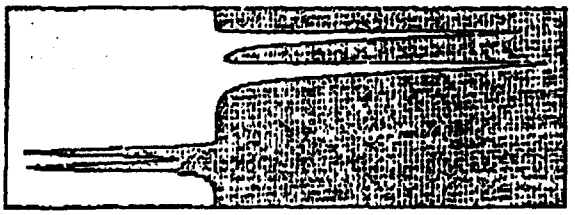
THERMOCHEM

Laboratory and Consulting Services
5347 Skylane Boulevard
Santa Rosa, CA 95403
(707) 575-1310 Fax (707) 575-7932

Fax Transmittal

To:		From:
Tom Kizis Dave Berube		Paul Hirtz
Date: 05/04/93	Time: 12:26 PM	Number of Pages Including Cover: 13

KS-9 gas analyses



THERMOCHEM

4817 (1-9) May 4, 1993

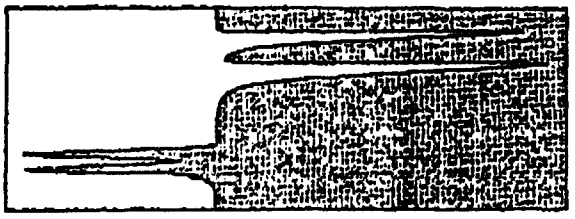
Descriptor: KS-9 4-20-1993 13:45
CLEAN-OUT FLOW LINE, 36 PSIG

Lab Number: 4817-01

Sample Gas/Steam Ratio (ft^3/lb):	0.0161
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	809
Sample Gas/Steam Ratio (ppm by weight):	1460
Percent Air in Sample:	0.719
STP Mls Air in Sample:	4.78
Total Weight of Condensate (grams):	656
Initial Headspace Pressure (psi):	3.03

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.56 E +02	3.81 E +02
Hydrogen Sulfide	6.60 E +01	5.34 E +02	1.01 E +03
Ammonia	1.28 E -01	1.04 E +00	9.78 E -01
Argon	6.05 E -02	4.89 E -01	1.08 E +00
Nitrogen	4.29 E +00	3.47 E +01	5.39 E +01
Methane	1.56 E -01	1.27 E +00	1.13 E +00
Hydrogen	1.00 E +01	8.10 E +01	9.07 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1419
Radon (Pico Curies/Kg Steam):	1426



THERMOCHEM

4817 (1-9) May 4, 1993

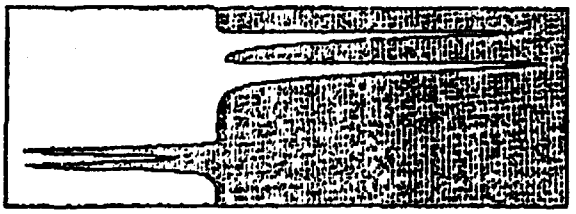
Descriptor: KS-9 4-20-1993 14:30
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-02

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1360
Percent Air in Sample:	1.77
STP Mls Air in Sample:	12.70
Total Weight of Condensate (grams):	757
Initial Headspace Pressure (psi):	3.74

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.97 E +01	1.47 E +02	3.59 E +02
Hydrogen Sulfide	6.68 E +01	4.99 E +02	9.42 E +02
Ammonia	4.19 E -02	3.13 E -01	2.96 E -01
Argon	6.09 E -02	4.55 E -01	1.01 E +00
Nitrogen	3.80 E +00	2.84 E +01	4.40 E +01
Methane	1.26 E -01	9.38 E -01	8.34 E -01
Hydrogen	9.46 E +00	7.07 E +01	7.91 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1343
Radon (Pico Curies/Kg Steam):	1246



THERMOCHEM

4817 (1-9) May 4, 1993

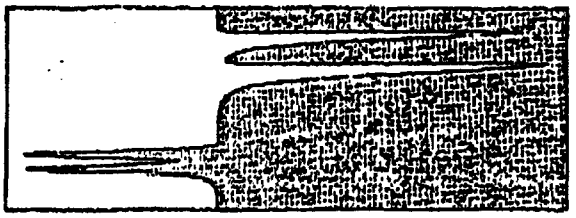
Descriptor: KS-9 4-20-1993 15:00
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-03

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	745
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.516
STP Mls Air in Sample:	3.53
Total Weight of Condensate (grams):	734
Initial Headspace Pressure (psi):	3.73

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.00 E +01	1.49 E +02	3.64 E +02
Hydrogen Sulfide	6.65 E +01	4.96 E +02	9.36 E +02
Ammonia	<3.54 E -02	<2.63 E -01	<2.49 E -01
Argon	5.26 E -02	3.92 E -01	8.68 E -01
Nitrogen	3.38 E +00	2.52 E +01	3.91 E +01
Methane	1.50 E -01	1.12 E +00	9.93 E -01
Hydrogen	9.87 E +00	7.35 E +01	8.23 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1294
Radon (Pico Curies/Kg Steam):	1198



THERMOCHEM

4817 (1-9) May 4, 1993

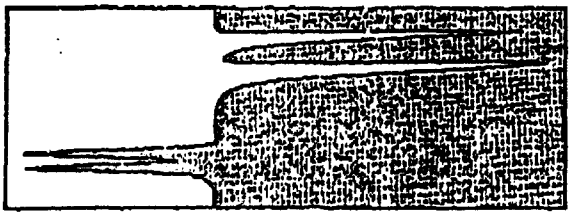
Descriptor: KS-9 4-20-1993 15:15
CLEAN-OUT FLOW LINE, 49 PSIG

Lab Number: 4817-04

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	746
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.702
STP Mls Air in Sample:	3.11
Total Weight of Condensate (grams):	474
Initial Headspace Pressure (psi):	3.44

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.89 E +01	1.41 E +02	3.45 E +02
Hydrogen Sulfide	6.78 E +01	5.06 E +02	9.55 E +02
Ammonia	3.87 E -02	2.89 E -01	2.73 E -01
Argon	5.36 E -02	4.00 E -01	8.85 E -01
Nitrogen	3.03 E +00	2.26 E +01	3.51 E +01
Methane	1.40 E -01	1.04 E +00	9.28 E -01
Hydrogen	1.00 E +01	7.47 E +01	8.36 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1308
Radon (Pico Curies/Kg Steam):	1212



THERMOCHEM

4817 (1-9) May 4, 1993

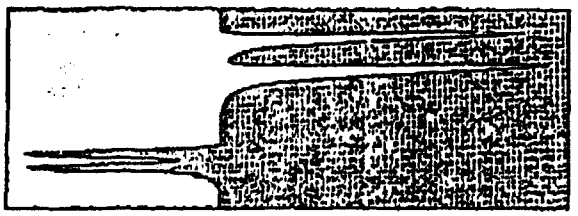
Descriptor: KS-9 4-20-1993 15:17
CLEAN-OUT FLOW LINE, 49-30 PSIG

Lab Number: 4817-05

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.719
STP Mls Air in Sample:	1.77
Total Weight of Condensate (grams):	264
Initial Headspace Pressure (psi):	1.12

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.44 E +02	3.52 E +02
Hydrogen Sulfide	6.60 E +01	4.93 E +02	9.32 E +02
Ammonia	<4.75 E -02	<3.55 E -01	<3.35 E -01
Argon	6.39 E -02	4.78 E -01	1.06 E +00
Nitrogen	5.11 E +00	3.82 E +01	5.93 E +01
Methane	1.01 E -01	7.54 E -01	6.70 E -01
Hydrogen	9.39 E +00	7.01 E +01	7.85 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1079
Radon (Pico Curies/Kg Steam):	1002



THERMOCHEM

4817 (1-9) May 4, 1993

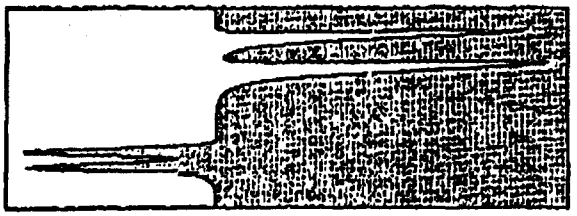
Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:00
95 PSIG
196 KPH

Lab Number: 4817-06

Sample Gas/Steam Ratio (ft^3/lb):	0.0144
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	721
Sample Gas/Steam Ratio (ppm by weight):	1300
Percent Air in Sample:	0.861
STP Mls Air in Sample:	3.66
Total Weight of Condensate (grams):	469
Initial Headspace Pressure (psi):	2.88

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.82 E +01	1.31 E +02	3.20 E +02
Hydrogen Sulfide	6.86 E +01	4.95 E +02	9.34 E +02
Ammonia	4.62 E -02	3.33 E -01	3.15 E -01
Argon	5.36 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.90 E +00	2.09 E +01	3.25 E +01
Methane	1.37 E -01	9.86 E -01	8.76 E -01
Hydrogen	1.01 E +01	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1353
Radon (Pico Curies/Kg Steam):	1213



THERMOCHEM

4817 (1-9) May 4, 1993

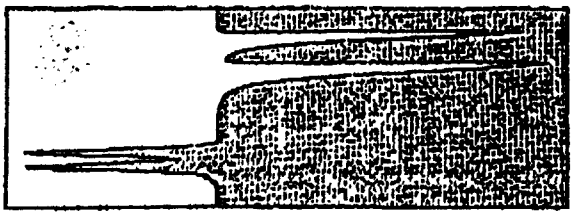
Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:03
98 PSIG
196 KPH

Lab Number: 4817-07

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	742
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	1.01
STP Mls Air in Sample:	4.53
Total Weight of Condensate (grams):	480
Initial Headspace Pressure (psi):	3.31

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.06 E +01	1.53 E +02	3.73 E +02
Hydrogen Sulfide	6.65 E +01	4.94 E +02	9.32 E +02
Ammonia	4.27 E -02	3.17 E -01	2.99 E -01
Argon	5.21 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.82 E +00	2.09 E +01	3.25 E +01
Methane	1.07 E -01	7.90 E -01	7.02 E -01
Hydrogen	9.85 E +00	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1284
Radon (Pico Curies/Kg Steam):	1183



THERMOCHEM

4817 (1-9) May 4, 1993

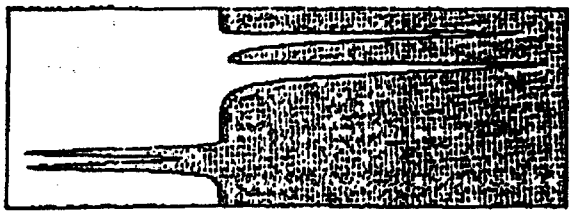
Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-08

Percent Air in Sample:	0.362
STP Mls Air in Sample:	13.80
Total Weight of Condensate (grams):	<4.90
Initial Headspace Pressure (psi):	18.20

Gas	Dry Gas % by Volume
Carbon Dioxide	2.26 E +01
Hydrogen Sulfide	4.24 E +01
Ammonia	<2.68 E -03
Argon	1.80 E -01
Nitrogen	1.23 E +01
Methane	2.64 E -01
Hydrogen	2.23 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2152



THERMOCHEM

4817 (1-9) May 4, 1993

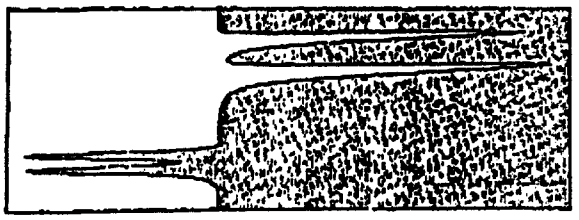
Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-09

Percent Air in Sample:	0.282
STP Mls Air in Sample:	9.49
Total Weight of Condensate (grams):	<4.40
Initial Headspace Pressure (psi):	15.80

Gas	Dry Gas % by Volume
Carbon Dioxide	2.28 E +01
Hydrogen Sulfide	4.31 E +01
Ammonia	<2.99 E -03
Argon	1.88 E -01
Nitrogen	1.20 E +01
Methane	2.20 E -01
Hydrogen	2.16 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2267



THERMOCHEM

4818 (1-3) May 4, 1993

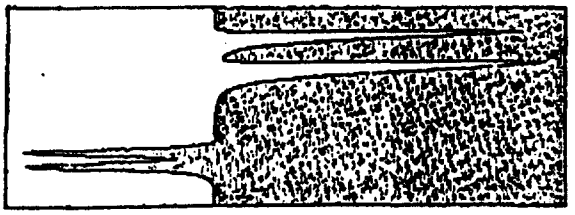
Descriptor: KS-9 04-20-1993 14:50
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4818-01

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.62 E -01	8.56 E -01
Ethylene	5.89 E -03	9.17 E -03
Ethane	1.41 E -01	2.35 E -01
Propylene	6.38 E -03	1.49 E -02
Propane	5.87 E -02	1.44 E -01
Isobutane	2.61 E -02	8.43 E -02
1-Butene	5.40 E -03	1.68 E -02
Butane	3.22 E -02	1.04 E -01
2,2-Dimethylpropane	<2.91 E -04	<1.16 E -03
2-Methylbutane	1.05 E -02	4.19 E -02
1-Pentene	1.63 E -03	6.33 E -03
Pentane	1.89 E -02	7.57 E -02
2,2-Dimethylbutane	<2.24 E -04	<1.07 E -03
(2 and 3)-Methylpentane	5.68 E -04	2.72 E -03
Hexene	<1.66 E -04	<7.77 E -04
Hexane	1.50 E -02	7.17 E -02
Benzene	1.52 E -02	6.58 E -02
Toluene	2.89 E -02	1.48 E -01
Ethyl Benzene	6.96 E -03	4.10 E -02
1,3 & 1,4-Xylene	1.81 E -02	1.07 E -01
1,2-Xylene	5.68 E -03	3.35 E -02
Additional Hydrocarbons*	6.51 E -02	5.79 E -02

*Additional hydrocarbons in the weight range C_2 through C_6 are quantitated as methane.



THERMOCHEM

4818 (1-3) May 4, 1993

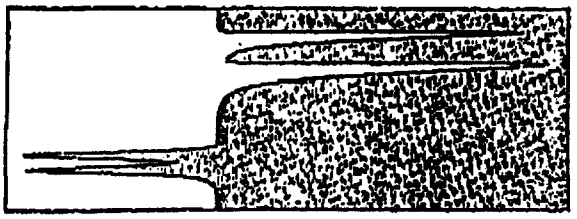
Descriptor: KS-9 SEPARATOR STEAM HEADER 04-21-1993 18:05
97 PSIG

Lab Number: 4818-02

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.22 E -01	8.21 E -01
Ethylene	5.76 E -03	8.97 E -03
Ethane	1.36 E -01	2.26 E -01
Propylene	5.99 E -03	1.40 E -02
Propane	5.58 E -02	1.37 E -01
Isobutane	2.48 E -02	8.01 E -02
1-Butene	7.57 E -03	2.36 E -02
Butane	3.12 E -02	1.01 E -01
2,2-Dimethylpropane	<3.44 E -04	<1.38 E -03
2-Methylbutane	9.96 E -03	3.99 E -02
1-Pentene	2.25 E -03	8.75 E -03
Pentane	1.83 E -02	7.34 E -02
2,2-Dimethylbutane	<2.66 E -04	<1.27 E -03
(2 and 3)-Methylpentane	5.13 E -04	2.45 E -03
Hexene	<2.08 E -04	<9.72 E -04
Hexane	1.44 E -02	6.89 E -02
Benzene	1.22 E -02	5.30 E -02
Toluene	2.18 E -02	1.12 E -01
Ethyl Benzene	4.11 E -03	2.42 E -02
1,3 & 1,4-Xylene	1.22 E -02	7.21 E -02
1,2-Xylene	3.65 E -03	2.15 E -02
Additional Hydrocarbons*	7.50 E -02	6.68 E -02

*Additional hydrocarbons in the weight range C_2 through C_6 are quantitated as methane.



THERMOCHEM

4818 (1-3) May 4, 1993

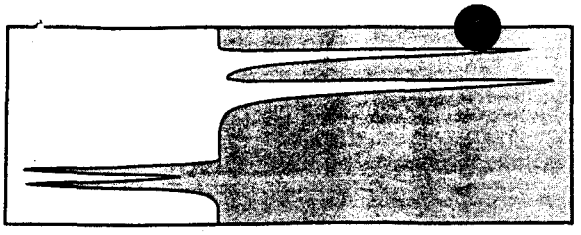
Descriptor: KS-9 04-20-1993 14:40
CLEAN-OUT FLOW LINE, 47 PSIG

Lab Number: 4818-03

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.47 E -01	8.43 E -01
Ethylene	6.41 E -03	9.98 E -03
Ethane	1.41 E -01	2.36 E -01
Propylene	7.27 E -03	1.70 E -02
Propane	5.91 E -02	1.45 E -01
Isobutane	2.60 E -02	8.40 E -02
1-Butene	5.87 E -03	1.83 E -02
Butane	3.20 E -02	1.03 E -01
2,2-Dimethylpropane	<3.33 E -04	<1.33 E -03
2-Methylbutane	1.08 E -02	4.32 E -02
1-Pentene	1.76 E -03	6.87 E -03
Pentane	1.85 E -02	7.41 E -02
2,2-Dimethylbutane	<2.57 E -04	<1.23 E -03
(2 and 3)-Methylpentane	5.32 E -04	2.54 E -03
Hexene	<1.94 E -04	<9.05 E -04
Hexane	1.46 E -02	7.00 E -02
Benzene	1.38 E -02	5.99 E -02
Toluene	2.69 E -02	1.38 E -01
Ethyl Benzene	5.84 E -03	3.44 E -02
1,3 & 1,4-Xylene	1.53 E -02	9.00 E -02
1,2-Xylene	4.73 E -03	2.79 E -02
Additional Hydrocarbons*	6.22 E -02	5.54 E -02

*Additional hydrocarbons in the weight range C_2 through C_8 are quantitated as methane.



THERMOCHEM

4818 (1-3) May 4, 1993

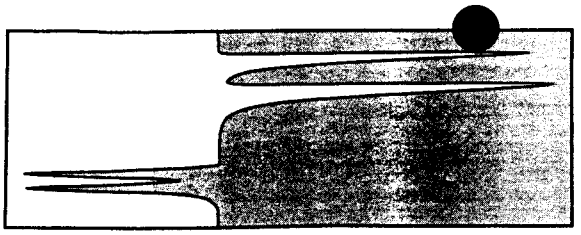
Descriptor: KS-9 04-20-1993 14:50
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4818-01

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.62 E -01	8.56 E -01
Ethylene	5.89 E -03	9.17 E -03
Ethane	1.41 E -01	2.35 E -01
Propylene	6.38 E -03	1.49 E -02
Propane	5.87 E -02	1.44 E -01
Isobutane	2.61 E -02	8.43 E -02
1-Butene	5.40 E -03	1.68 E -02
Butane	3.22 E -02	1.04 E -01
2,2-Dimethylpropane	<2.91 E -04	<1.16 E -03
2-Methylbutane	1.05 E -02	4.19 E -02
1-Pentene	1.63 E -03	6.33 E -03
Pentane	1.89 E -02	7.57 E -02
2,2-Dimethylbutane	<2.24 E -04	<1.07 E -03
(2 and 3)-Methylpentane	5.68 E -04	2.72 E -03
Hexene	<1.66 E -04	<7.77 E -04
Hexane	1.50 E -02	7.17 E -02
Benzene	1.52 E -02	6.58 E -02
Toluene	2.89 E -02	1.48 E -01
Ethyl Benzene	6.96 E -03	4.10 E -02
1,3 & 1,4-Xylene	1.81 E -02	1.07 E -01
1,2-Xylene	5.68 E -03	3.35 E -02
Additional Hydrocarbons*	6.51 E -02	5.79 E -02

*Additional hydrocarbons in the weight range C_2 through C_6 are quantitated as methane.



THERMOCHEM

4818 (1-3) May 4, 1993

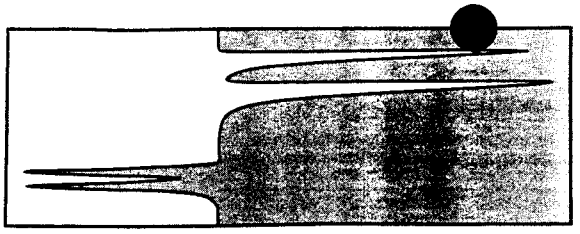
Descriptor: KS-9 SEPARATOR STEAM HEADER 04-21-1993 18:05
97 PSIG

Lab Number: 4818-02

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.22 E -01	8.21 E -01
Ethylene	5.76 E -03	8.97 E -03
Ethane	1.36 E -01	2.26 E -01
Propylene	5.99 E -03	1.40 E -02
Propane	5.58 E -02	1.37 E -01
Isobutane	2.48 E -02	8.01 E -02
1-Butene	7.57 E -03	2.36 E -02
Butane	3.12 E -02	1.01 E -01
2,2-Dimethylpropane	<3.44 E -04	<1.38 E -03
2-Methylbutane	9.96 E -03	3.99 E -02
1-Pentene	2.25 E -03	8.75 E -03
Pentane	1.83 E -02	7.34 E -02
2,2-Dimethylbutane	<2.66 E -04	<1.27 E -03
(2 and 3)-Methylpentane	5.13 E -04	2.45 E -03
Hexene	<2.08 E -04	<9.72 E -04
Hexane	1.44 E -02	6.89 E -02
Benzene	1.22 E -02	5.30 E -02
Toluene	2.18 E -02	1.12 E -01
Ethyl Benzene	4.11 E -03	2.42 E -02
1,3 & 1,4-Xylene	1.22 E -02	7.21 E -02
1,2-Xylene	3.65 E -03	2.15 E -02
Additional Hydrocarbons*	7.50 E -02	6.68 E -02

*Additional hydrocarbons in the weight range C_2 through C_6 are quantitated as methane.



THERMOCHEM

4818 (1-3) May 4, 1993

Descriptor: KS-9 04-20-1993 14:40
CLEAN-OUT FLOW LINE, 47 PSIG

Lab Number: 4818-03

Comprehensive Hydrocarbon Scan

Gas	Moles per 10^6 Moles H_2O	PPM By Weight
Methane	9.47 E -01	8.43 E -01
Ethylene	6.41 E -03	9.98 E -03
Ethane	1.41 E -01	2.36 E -01
Propylene	7.27 E -03	1.70 E -02
Propane	5.91 E -02	1.45 E -01
Isobutane	2.60 E -02	8.40 E -02
1-Butene	5.87 E -03	1.83 E -02
Butane	3.20 E -02	1.03 E -01
2,2-Dimethylpropane	<3.33 E -04	<1.33 E -03
2-Methylbutane	1.08 E -02	4.32 E -02
1-Pentene	1.76 E -03	6.87 E -03
Pentane	1.85 E -02	7.41 E -02
2,2-Dimethylbutane	<2.57 E -04	<1.23 E -03
(2 and 3)-Methylpentane	5.32 E -04	2.54 E -03
Hexene	<1.94 E -04	<9.05 E -04
Hexane	1.46 E -02	7.00 E -02
Benzene	1.38 E -02	5.99 E -02
Toluene	2.69 E -02	1.38 E -01
Ethyl Benzene	5.84 E -03	3.44 E -02
1,3 & 1,4-Xylene	1.53 E -02	9.00 E -02
1,2-Xylene	4.73 E -03	2.79 E -02
Additional Hydrocarbons*	6.22 E -02	5.54 E -02

*Additional hydrocarbons in the weight range C_2 through C_6 are quantitated as methane.

THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 4-20-1993 13:45
CLEAN-OUT FLOW LINE, 36 PSIG

Lab Number: 4817-01

Sample Gas/Steam Ratio (ft^3/lb):	0.0161
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	809
Sample Gas/Steam Ratio (ppm by weight):	1460
Percent Air in Sample:	0.719
STP Mls Air in Sample:	4.78
Total Weight of Condensate (grams):	656
Initial Headspace Pressure (psi):	3.03

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.56 E +02	3.81 E +02
Hydrogen Sulfide	6.60 E +01	5.34 E +02	1.01 E +03
Ammonia	1.28 E -01	1.04 E +00	9.78 E -01
Argon	6.05 E -02	4.89 E -01	1.08 E +00
Nitrogen	4.29 E +00	3.47 E +01	5.39 E +01
Methane	1.56 E -01	1.27 E +00	1.13 E +00
Hydrogen	1.00 E +01	8.10 E +01	9.07 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1419
Radon (Pico Curies/Kg Steam):	1426

THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 4-20-1993 14:30
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-02

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1360
Percent Air in Sample:	1.77
STP Mls Air in Sample:	12.70
Total Weight of Condensate (grams):	757
Initial Headspace Pressure (psi):	3.74

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.97 E +01	1.47 E +02	3.59 E +02
Hydrogen Sulfide	6.68 E +01	4.99 E +02	9.42 E +02
Ammonia	4.19 E -02	3.13 E -01	2.96 E -01
Argon	6.09 E -02	4.55 E -01	1.01 E +00
Nitrogen	3.80 E +00	2.84 E +01	4.40 E +01
Methane	1.26 E -01	9.38 E -01	8.34 E -01
Hydrogen	9.46 E +00	7.07 E +01	7.91 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1343
Radon (Pico Curies/Kg Steam):	1246

THERMOCHEM

4817 (1-9) May 4, 1993

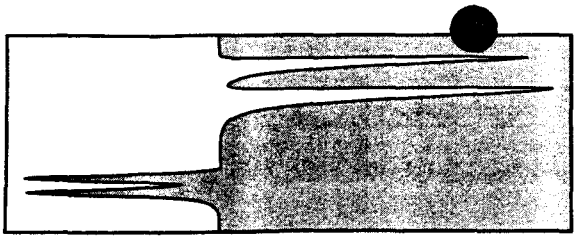
Descriptor: KS-9 4-20-1993 15:00
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-03

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	745
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.516
STP Mls Air in Sample:	3.53
Total Weight of Condensate (grams):	734
Initial Headspace Pressure (psi):	3.73

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.00 E +01	1.49 E +02	3.64 E +02
Hydrogen Sulfide	6.65 E +01	4.96 E +02	9.36 E +02
Ammonia	<3.54 E -02	<2.63 E -01	<2.49 E -01
Argon	5.26 E -02	3.92 E -01	8.68 E -01
Nitrogen	3.38 E +00	2.52 E +01	3.91 E +01
Methane	1.50 E -01	1.12 E +00	9.93 E -01
Hydrogen	9.87 E +00	7.35 E +01	8.23 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1294
Radon (Pico Curies/Kg Steam):	1198



THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 4-20-1993 15:15
CLEAN-OUT FLOW LINE, 49 PSIG

Lab Number: 4817-04

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	746
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.702
STP Mls Air in Sample:	3.11
Total Weight of Condensate (grams):	474
Initial Headspace Pressure (psi):	3.44

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.89 E +01	1.41 E +02	3.45 E +02
Hydrogen Sulfide	6.78 E +01	5.06 E +02	9.55 E +02
Ammonia	3.87 E -02	2.89 E -01	2.73 E -01
Argon	5.36 E -02	4.00 E -01	8.85 E -01
Nitrogen	3.03 E +00	2.26 E +01	3.51 E +01
Methane	1.40 E -01	1.04 E +00	9.28 E -01
Hydrogen	1.00 E +01	7.47 E +01	8.36 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1308
Radon (Pico Curies/Kg Steam):	1212

THERMOCHEM

4817 (1-9) May 4, 1993

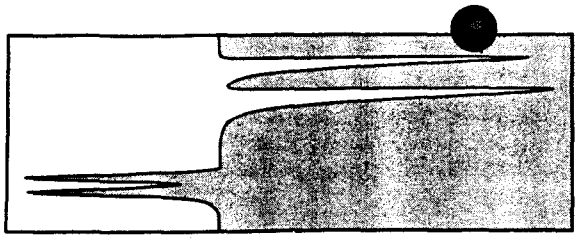
Descriptor: KS-9 4-20-1993 15:17
CLEAN-OUT FLOW LINE, 49-30 PSIG

Lab Number: 4817-05

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.719
STP Mls Air in Sample:	1.77
Total Weight of Condensate (grams):	264
Initial Headspace Pressure (psi):	1.12

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.44 E +02	3.52 E +02
Hydrogen Sulfide	6.60 E +01	4.93 E +02	9.32 E +02
Ammonia	<4.75 E -02	<3.55 E -01	<3.35 E -01
Argon	6.39 E -02	4.78 E -01	1.06 E +00
Nitrogen	5.11 E +00	3.82 E +01	5.93 E +01
Methane	1.01 E -01	7.54 E -01	6.70 E -01
Hydrogen	9.39 E +00	7.01 E +01	7.85 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1079
Radon (Pico Curies/Kg Steam):	1002



THERMOCHEM

4817 (1-9) May 4, 1993

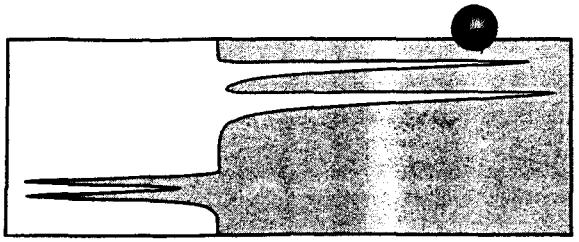
Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:00
95 PSIG
196 KPH

Lab Number: 4817-06

Sample Gas/Steam Ratio (ft^3/lb):	0.0144
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	721
Sample Gas/Steam Ratio (ppm by weight):	1300
Percent Air in Sample:	0.861
STP Mls Air in Sample:	3.66
Total Weight of Condensate (grams):	469
Initial Headspace Pressure (psi):	2.88

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.82 E +01	1.31 E +02	3.20 E +02
Hydrogen Sulfide	6.86 E +01	4.95 E +02	9.34 E +02
Ammonia	4.62 E -02	3.33 E -01	3.15 E -01
Argon	5.36 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.90 E +00	2.09 E +01	3.25 E +01
Methane	1.37 E -01	9.86 E -01	8.76 E -01
Hydrogen	1.01 E +01	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1353
Radon (Pico Curies/Kg Steam):	1213



THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:03
98 PSIG
196 KPH

Lab Number: 4817-07

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	742
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	1.01
STP Mls Air in Sample:	4.53
Total Weight of Condensate (grams):	480
Initial Headspace Pressure (psi):	3.31

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.06 E +01	1.53 E +02	3.73 E +02
Hydrogen Sulfide	6.65 E +01	4.94 E +02	9.32 E +02
Ammonia	4.27 E -02	3.17 E -01	2.99 E -01
Argon	5.21 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.82 E +00	2.09 E +01	3.25 E +01
Methane	1.07 E -01	7.90 E -01	7.02 E -01
Hydrogen	9.85 E +00	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1284
Radon (Pico Curies/Kg Steam):	1183

THERMOCHEM

4817 (1-9) May 4, 1993

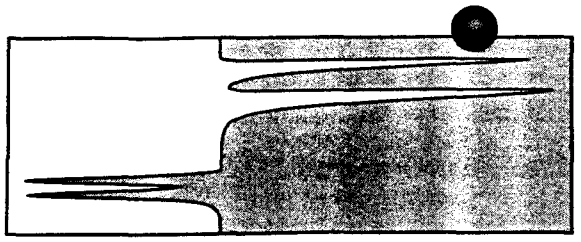
Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-08

Percent Air in Sample:	0.362
STP Mls Air in Sample:	13.80
Total Weight of Condensate (grams):	<4.90
Initial Headspace Pressure (psi):	18.20

Gas	Dry Gas % by Volume
Carbon Dioxide	2.26 E +01
Hydrogen Sulfide	4.24 E +01
Ammonia	<2.68 E -03
Argon	1.80 E -01
Nitrogen	1.23 E +01
Methane	2.64 E -01
Hydrogen	2.23 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2152



THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-09

Percent Air in Sample:	0.282
STP Mls Air in Sample:	9.49
Total Weight of Condensate (grams):	<4.40
Initial Headspace Pressure (psi):	15.80

Gas	Dry Gas % by Volume
Carbon Dioxide	2.28 E +01
Hydrogen Sulfide	4.31 E +01
Ammonia	<2.99 E -03
Argon	1.88 E -01
Nitrogen	1.20 E +01
Methane	2.20 E -01
Hydrogen	2.16 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2267

THERMOCHEM

4817 (1-9) May 4, 1993

Quality Control Data

Samples Received: April 26, 1993

Requested by: Tom Kizis
Puna Geothermal Venture
P.O. Box 30
Pahoa, HI 96778

Analyte	Precision (% RSD)	External Standard (% Recovery)	Sample Spike (% Recovery)
Carbon Dioxide	2.6	99, 100	103
Hydrogen Sulfide	1.7	100	98
Ammonia	13.3	111, 99	N/A
Nitrogen	4.5, 0.2, 4.3	98	N/A
Methane	25.0, 17.4	104	N/A
Hydrogen	1.3, 0.5, 5.0	93	N/A

Precision: Percent Relative Standard Deviation of replicate sample analyses.

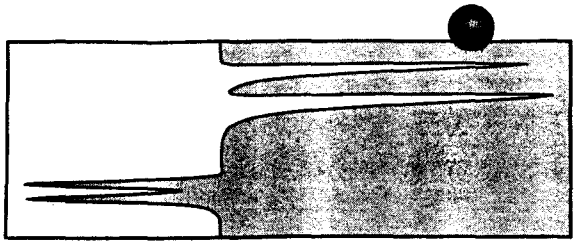
External Standard: Percent Recovery of an independent audit standard analyzed against calibration standards (measured/known x 100).

Sample Spike: Percent Recovery of a known quantity of standard added to sample (measured/theoretical x 100).

N/A: Not applicable.

Paul N. Hirtz
Director of Operations

Distribution: Tom Kizis



THERMOCHEM

4817 (1-9) May 4, 1993

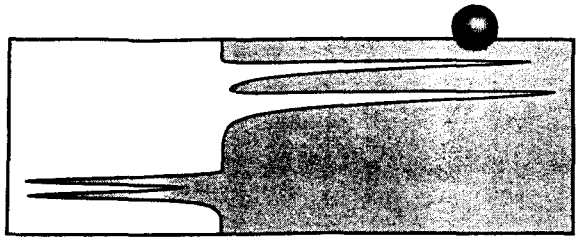
Descriptor: KS-9 4-20-1993 13:45
CLEAN-OUT FLOW LINE, 36 PSIG

Lab Number: 4817-01

Sample Gas/Steam Ratio (ft^3/lb):	0.0161
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	809
Sample Gas/Steam Ratio (ppm by weight):	1460
Percent Air in Sample:	0.719
STP Mls Air in Sample:	4.78
Total Weight of Condensate (grams):	656
Initial Headspace Pressure (psi):	3.03

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.56 E +02	3.81 E +02
Hydrogen Sulfide	6.60 E +01	5.34 E +02	1.01 E +03
Ammonia	1.28 E -01	1.04 E +00	9.78 E -01
Argon	6.05 E -02	4.89 E -01	1.08 E +00
Nitrogen	4.29 E +00	3.47 E +01	5.39 E +01
Methane	1.56 E -01	1.27 E +00	1.13 E +00
Hydrogen	1.00 E +01	8.10 E +01	9.07 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1419
Radon (Pico Curies/Kg Steam):	1426



THERMOCHEM

4817 (1-9) May 4, 1993

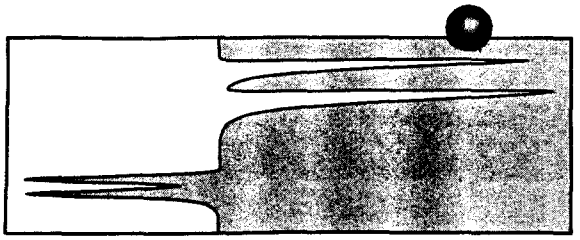
Descriptor: KS-9 4-20-1993 14:30
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-02

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1360
Percent Air in Sample:	1.77
STP Mls Air in Sample:	12.70
Total Weight of Condensate (grams):	757
Initial Headspace Pressure (psi):	3.74

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.97 E +01	1.47 E +02	3.59 E +02
Hydrogen Sulfide	6.68 E +01	4.99 E +02	9.42 E +02
Ammonia	4.19 E -02	3.13 E -01	2.96 E -01
Argon	6.09 E -02	4.55 E -01	1.01 E +00
Nitrogen	3.80 E +00	2.84 E +01	4.40 E +01
Methane	1.26 E -01	9.38 E -01	8.34 E -01
Hydrogen	9.46 E +00	7.07 E +01	7.91 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1343
Radon (Pico Curies/Kg Steam):	1246



THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 4-20-1993 15:00
CLEAN-OUT FLOW LINE, 48 PSIG

Lab Number: 4817-03

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	745
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.516
STP Mls Air in Sample:	3.53
Total Weight of Condensate (grams):	734
Initial Headspace Pressure (psi):	3.73

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.00 E +01	1.49 E +02	3.64 E +02
Hydrogen Sulfide	6.65 E +01	4.96 E +02	9.36 E +02
Ammonia	<3.54 E -02	<2.63 E -01	<2.49 E -01
Argon	5.26 E -02	3.92 E -01	8.68 E -01
Nitrogen	3.38 E +00	2.52 E +01	3.91 E +01
Methane	1.50 E -01	1.12 E +00	9.93 E -01
Hydrogen	9.87 E +00	7.35 E +01	8.23 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1294
Radon (Pico Curies/Kg Steam):	1198

THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: KS-9 4-20-1993 15:15
CLEAN-OUT FLOW LINE, 49 PSIG

Lab Number: 4817-04

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	746
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.702
STP Mls Air in Sample:	3.11
Total Weight of Condensate (grams):	474
Initial Headspace Pressure (psi):	3.44

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.89 E +01	1.41 E +02	3.45 E +02
Hydrogen Sulfide	6.78 E +01	5.06 E +02	9.55 E +02
Ammonia	3.87 E -02	2.89 E -01	2.73 E -01
Argon	5.36 E -02	4.00 E -01	8.85 E -01
Nitrogen	3.03 E +00	2.26 E +01	3.51 E +01
Methane	1.40 E -01	1.04 E +00	9.28 E -01
Hydrogen	1.00 E +01	7.47 E +01	8.36 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1308
Radon (Pico Curies/Kg Steam):	1212

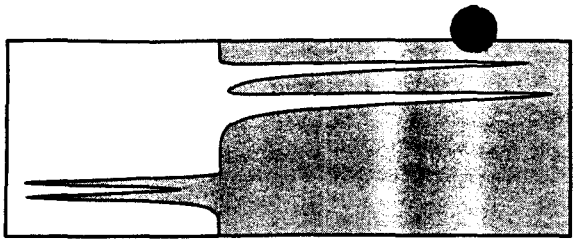
Descriptor: KS-9 4-20-1993 15:17
CLEAN-OUT FLOW LINE, 49-30 PSIG

Lab Number: 4817-05

Sample Gas/Steam Ratio (ft^3/lb):	0.0149
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	747
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	0.719
STP Mls Air in Sample:	1.77
Total Weight of Condensate (grams):	264
Initial Headspace Pressure (psi):	1.12

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.93 E +01	1.44 E +02	3.52 E +02
Hydrogen Sulfide	6.60 E +01	4.93 E +02	9.32 E +02
Ammonia	<4.75 E -02	<3.55 E -01	<3.35 E -01
Argon	6.39 E -02	4.78 E -01	1.06 E +00
Nitrogen	5.11 E +00	3.82 E +01	5.93 E +01
Methane	1.01 E -01	7.54 E -01	6.70 E -01
Hydrogen	9.39 E +00	7.01 E +01	7.85 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1079
Radon (Pico Curies/Kg Steam):	1002



THERMOCHEM

4817 (1-9) May 4, 1993

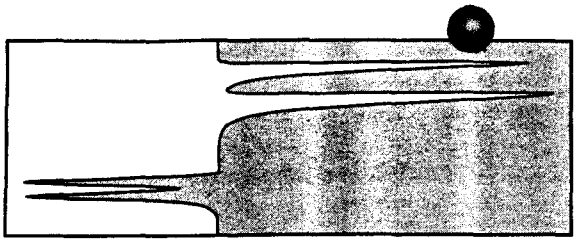
Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:00
95 PSIG
196 KPH

Lab Number: 4817-06

Sample Gas/Steam Ratio (ft^3/lb):	0.0144
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	721
Sample Gas/Steam Ratio (ppm by weight):	1300
Percent Air in Sample:	0.861
STP Mls Air in Sample:	3.66
Total Weight of Condensate (grams):	469
Initial Headspace Pressure (psi):	2.88

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	1.82 E +01	1.31 E +02	3.20 E +02
Hydrogen Sulfide	6.86 E +01	4.95 E +02	9.34 E +02
Ammonia	4.62 E -02	3.33 E -01	3.15 E -01
Argon	5.36 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.90 E +00	2.09 E +01	3.25 E +01
Methane	1.37 E -01	9.86 E -01	8.76 E -01
Hydrogen	1.01 E +01	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1353
Radon (Pico Curies/Kg Steam):	1213



THERMOCHEM

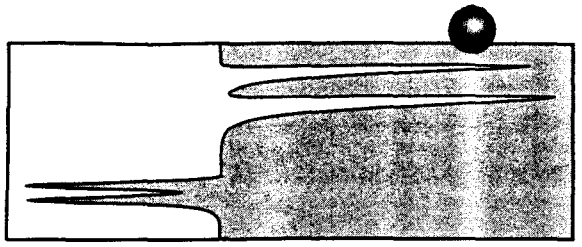
Descriptor: KS-9 SEPARATOR STEAM HEADER 4-21-1993 18:03
98 PSIG
196 KPH

Lab Number: 4817-07

Sample Gas/Steam Ratio (ft^3/lb):	0.0148
Sample Gas/Steam Ratio (moles per 10^6 moles H_2O):	742
Sample Gas/Steam Ratio (ppm by weight):	1350
Percent Air in Sample:	1.01
STP Mls Air in Sample:	4.53
Total Weight of Condensate (grams):	480
Initial Headspace Pressure (psi):	3.31

Gas	Dry Gas % by Volume	Moles per 10^6 Moles H_2O	PPM By Weight
Water Vapor	N/A	N/A	9.99 E +05
Carbon Dioxide	2.06 E +01	1.53 E +02	3.73 E +02
Hydrogen Sulfide	6.65 E +01	4.94 E +02	9.32 E +02
Ammonia	4.27 E -02	3.17 E -01	2.99 E -01
Argon	5.21 E -02	3.87 E -01	8.56 E -01
Nitrogen	2.82 E +00	2.09 E +01	3.25 E +01
Methane	1.07 E -01	7.90 E -01	7.02 E -01
Hydrogen	9.85 E +00	7.31 E +01	8.18 E +00

Radon (Pico Curies/Liter Dry Gas, STP):	1284
Radon (Pico Curies/Kg Steam):	1183



THERMOCHEM

Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-08

Percent Air in Sample:	0.362
STP Mls Air in Sample:	13.80
Total Weight of Condensate (grams):	<4.90
Initial Headspace Pressure (psi):	18.20

Gas	Dry Gas % by Volume
Carbon Dioxide	2.26 E +01
Hydrogen Sulfide	4.24 E +01
Ammonia	<2.68 E -03
Argon	1.80 E -01
Nitrogen	1.23 E +01
Methane	2.64 E -01
Hydrogen	2.23 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2152

THERMOCHEM

4817 (1-9) May 4, 1993

Descriptor: PGV NCG 4-22-1993 20:05
GAS COMPRESSOR OUTLET

Lab Number: 4817-09

Percent Air in Sample:	0.282
STP Mls Air in Sample:	9.49
Total Weight of Condensate (grams):	<4.40
Initial Headspace Pressure (psi):	15.80

Gas	Dry Gas % by Volume
Carbon Dioxide	2.28 E +01
Hydrogen Sulfide	4.31 E +01
Ammonia	<2.99 E -03
Argon	1.88 E -01
Nitrogen	1.20 E +01
Methane	2.20 E -01
Hydrogen	2.16 E +01

Radon (Pico Curies/Liter Dry Gas, STP): 2267