

KAPOHO GROWN
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ctf.

RECEIVED
DRINKING WATER PROGRAM

Mr. Chauncey Hew(Hiu?)
Department of Health
Underground Injection Control
Box 3378
Honolulu 96801-9984

JUN 10

June 7, 1989

Dear Mr. Hew,

Enclosed please find a copy of the testimony I presented to the Hawaii County Planning Commission yesterday at the hearing for the Puna Geothermal Ventures GRF application.

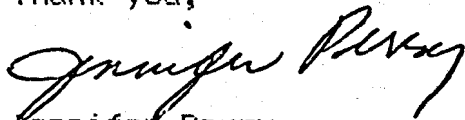
I hope this information will prove valuable in your review of their petition to modify the UIC line in lower Puna and in your review of the amendments of the UIC program.

Our Kapoho Community Association is very concerned with the possible contamination to our groundwater aquifer that may be caused not only by the reinjection of geothermal wastes but also by the production wells in light of their past history of casing failures.

We hope to gather more data regarding the depth of the water table in all the wells in lower Puna. We will also collect statewide data on temperatures, chlorides, and TDS of all water wells to run that comparison with our Puna wells. Any information you can provide to assist us in this study would be greatly appreciated. If we are overlooking significant data, please inform us so that we may become more fully aware on the impact the PGV application will have on our groundwater resource.

I will submit a copy of Dr. Don Thomas's report as soon as I can make xeroxs of it.

Thank you,


Jennifer Perry

cc: Bruce Anderson
William Sewake
Dean Nakano
Lyle Wong

2 enc.

INVENTORY OF WELLS IN THE LOWER FUNA DISTRICT

2883-03 KAPOHO STATE 1, Thermal Power Co.(driller: Water Resources Int'l)
 elevation: 619'
 well depth: 7290'
 casing: 4072' cement; 7216' perforated
 drilling days: 9/1/81 - 11/12/81 (65)
 chloride: 1200 DLNR bailing sample
 temperature: bottom hole 650 F or 343 C
 9/11/81: water table at 540'-630', bailed for sample at 608', 113F
 2/20/82: casing leaks determined at 900-940' and 1040-1080'
 5/12/82: 9-5/8" casing found jammed into the expansion spool
 8/4-6/82: flow test, well substantially "dried up" during testing
 8/11-28/82: separator test, chemical emission control problem ensued
 resulting in a temporary shut down; well produces 100% steam
 at a FWHP of 120 psig with mass flow rate of 72,000 lb/hr
 10/2/82: pipe to flange well failed, flowed uncontrolled for 38 hrs
 11/2/82: after inspection, wellhead considered to be sound, FBI
 investigation; as consequence of interzonal flow, a gas cap was
 forming in the well, bled on 11/29 and 12/14
 2/18/83: casing leak found at 670'
 4/15/83: Dia-Log caliper logs, parted casing from 226-233', split casing
 from 362-363', gaps at numerous collars (buttress coupling recess)
 (found with TV camera recording)
 top of cement plug at 1750'

2883-04 KAPOHO STATE 2, Thermal Power Co.(driller: Water Resources Int'l)
 elevation: 718'
 well depth: 8005'
 casing: 4209' cement, 7891' perforated
 drilling days: 1/19/82-4/2/82 (56)
 chloride:
 temperature: 659.9F or 348.8C
 wellbore deviation: 399.32'
 1/2/82: 706' bailed for water sample to DLNR
 2/3/82: fluid level noted at 550' in wellbore
 3/30/82: flow test
 4/20-5/1/82: flow test
 7/28-8/2/82: flow test with separator system
 5/11/82: wireline, temperature and pressure tools lost in hole due to
 embrittlement of .092" carbon plow steel
 8/24/82: Sanicro-28 stainless steel found embrittled, study indicated that
 type 310 stainless steel with moderate tensile strength would be
 most cost effective
 7/14/82: casing leak found at 1040-1050'
 1/25/83: 4' gap at the 9-5/8" casing tieback between 1093-1097'
 3/29/83: with wireline debris still lost in hole, cement plug placed at
 3175'

2883-06 KAPOHO STATE 1A, Thermal Power Co.(driller:Water Resources Int'l)
 elevation: ~640'
 well depth: 6505'
 casing: 4000' cement, 5505 perforated liner
 drilling days: 7/8/85-9/3/85
 chloride: 1098 DLNR bailing sample
 temperature: 654.7F bottomhole; 369F production test
 well bore deviation: 619.21'
 7/18/85: water table 597"
 7/19/85: bailed for sample @618', 75 gal.
 1/29/86: chloride from chemical analysis of geo reservoir 21,000 ppm

2883-02 LANIPUNA 1, Barnwell Indus.(driller:
elevation:
well depth: 8389' DLNR
8400' DPED 7/82 Public Sector Geo Dev Program
casing:
date drilled: 2/9/81-5/26/85
chloride:
temperature:
well bore deviation:

2883-05 LANIPUNA 6, Barnwell/GEDCO (driller:
elevation:
well depth: 4000'
casing:
date drilled: 1984 (completion in May)
chloride:
temperature:
well bore deviation:

2102-01 PULAMA, DOWALD,(driller: Samson Zerbe)
elevation: 230'
well depth: 250' 1979 Preliminary Regional Survey HIG
casing: 250'; 8"
date drilled: 1963
status: unused
location: 192107x1550212
chloride: 110-298 ppm
temperature: 79F or 25.8C

2317-01 VOLCANO NATIONAL PARK, Colorado School of Mines(Water Res. Int'l)
elevation: 3606'
well depth: 4127'
casing: 1025'; 14"
date drilled: 1973
status: observation
location: 192344x1551721 (1 km S. Halemaumau)
chloride: 1150 ppm (HIG Chloride/Magnesium Ratio 1979)
temperature: 279F or 137C

2487-01 KEAUAHANA 1, DWS (Ocean View Drilling)
elevation: 752'
well depth: 802'
casing: 800' ; 8"
date drilled: 1961
status: Municipal
location: 192456x1545719
chloride: 72-92ppm
temperature: 72-75F or 23.9C

2487-02 KEAUAHANA 2, DWS (Layne Driling)
elevation: 752'
well depth: 803'
casing: 803'; 12"
date drilled: 1970
status: Municipal
location: 192457x1545718

chloride: 124-134ppm
temperature: 23.5C

2655-x (2685-01 DLNR) ASHIDA: BARNWELL/GEDCO (driller:Water Resources)
elevation: 244.8m
well depth: 8000'
casing:
date drilled: 1980
status:
location: near Bryson's cinder pit, land owner Harold Ashida
chloride: 460 DLNR bailing sample
temperature:

2686-01 PUNA THERMAL 1,Haw.Thermal Power(driller: Samson Zerbe)
GEOHERMAL 1
elevation: 1009
well depth:178'
casing: 177'; 14"
date drilled: 1961
status: unused
location: 192634x1545646
chloride:
temperature: 54.5C

2686-02 PUNA THERMAL TH2, Haw.Thermal Power (driller:Samson Zerbe)
GEOHERMAL 2
elevation: 1035'
well depth: 556'
casing: 107'; 14"
date drilled: 1961
status: unused
location: 192633x1545648 Opihikao off highway
chloride:
temperature: 83C (Preliminary Regional Survey, HIG 1974)
Abandoned at 350' due to loose formation; lost drill piece

2783-01 MALAMA KI, DOWALD (driller: Ocean View Drilling)
elevation: 274'
well depth: 319'
casing: 319'; 8"
date drilled: 1962
status: unused
location: 192728x1545301
chloride: 2200-6600ppm (Preliminary Regional Survey HIG 1974)
temperature: 129F or 53.9C
Chloride/Magnesium Ratio HIG 1979: 9/62 5850ppm
1/74 11000ppm
1/75 3811ppm

2881-01 POHOIKI PUNA, Oneloa Co.(driller: Cont. Drilling)
ALLISON (Ralph)
elevation: 132'
well depth: 140'
casing: 138'; 4"
date drilled: 1973
status: irrigation
location: 192819x1545110

chloride: 722-2300ppm
temperature: 39C

ALLISON SPRING

location:

Chloride/Magnesium Ratio, HIG, 1979: 1/74 38C 281ppm chloride
1/75 37.8C 1400ppm chloride

2883-01 HGPA, University of Hawaii (driller: UH/GEDCO)

elevation: 184.1m

well depth: 6455'

casing: 2270'; intermediate depth slotted liner rather than cement

date drilled: 11/75-4/76

status: production

location:

chloride: 1040ppm (Chloride/Magnesium Ratio HIG 1979)

1000-2000 DLNR bailing sample

9/22/87 Don Thomas to Jack Huisingh NELH "The presence of only slightly brackish water at 2km depths suggested that some mechanism associated with the rift zone was responsible for exclusion of seawater from the interior of the geothermal reservoir."

temperature: 358F

water table: 5 samplings taken at drill time

4/76: Venting

7/2/76: Unabated 4 hrs, vertical plume 200-300'

7/22/76: Unabated flashing 4 hrs

7/27-28/78: flashing

9/18/81: smell reported as bad

12/11/81: venting through silencers, plume over Lanipuna, 110dba

2/8/82: asthma attack reported

3/4/82: bad smell in Leilani, steam blocking Pohoiki road

3/19/82: smell reported worse than ever

3/30/82: smell & ear infections reported

9/18-20/84: venting, H₂S exceeded instrument calibration of 150ppb

9/19/84: odor and noise (brine sparger) complaint filed

8/25/86: odor complaint (plant abatement system out of service for repair)
abated through rock muffler

2982-01 PUNA THERMAL TH3, Hawaii Thermal Power Co (driller: Samson Zerbe)

elevation: 563'

well depth: 690' or 210.3m

casing: 18"

date drilled: 1961

status: unused

location: 192913x1545255, landowner Reginald Ho & Hiroo Sato

temperature: 210m = 48.6C; 175m = 91.6C (USGS)

chloride: 1975 = 3274ppm

2986-01 PAHOA BATTERY 2A, DWS (driller: Maui Drilling)

elevation: 711'

well depth: 755'

casing: 754', 8"

date drilled: 1960

status: municipal

location: 192924x1545647

temperature: 22.2C or 74F

chloride: 2-6ppm

2986-02 FAHOA BATTERY 2B, DWS(driller: Pacific Drilling)
elevation: 705'
well depth:
casing:
date drilled: 1963
status: municipal
location: 192925x1545646
temperature: 23C
chloride: 6-27ppm

ISAAC HALE SPRING at Pohoiki (Chloride/Magnesium Ratio HIG 1979)
temperature: 38.9C; ph:7.28; chloride: 4062ppm

3080-01 KAPOHO CRATER, DWS (driller: Hawaii DWS)
elevation: 38'
well depth: 46'
casing: 46'; 66"
date drilled: 1961
status: municipal
location: 193016x1545021
temperature: 25.3C
chloride: 64-174ppm

3081-01 KAPOHO AIRSTRIP, DWS (driller: Ocean View)
elevation: 287'
well depth: 337'
casing: 8"
date drilled: 1961
status: unused
location: 193024x1545159
temperature: 33.9C (1961= 28C)
chloride: 331-345ppm (1972 220ppm USGS)

3081-02 PUNA THERMAL TH4, Hawaii Thermal Power Co (driller: Samson Zerbe)
elevation: 250'
well depth: 290'
casing: 14"
date drilled: 1961
status: unused, hole plugged with rocks at 98'
location: 193039x1545119
temperature: 43C
chloride:

3185-01 HAWAIIAN SHORES 1, Miller & Lieb (driller: Ocean View Drilling)
elevation: 402'
well depth: 446'
casing: 446', 8"
date drilled: 1964
status: domestic
location: 193113x1545558
temperature: 21.7C
chloride: 11-16ppm

3185-02 HAWAIIAN SHORES 2, Miller & Lieb (driller: Water Resources Int'l)
elevation: 380'
well depth: 430'
casing: 387', 10"
date drilled: 1971
status: domestic

location: 193126x1545544
temperature:
chloride: 23-28ppm

3188-01 KEONEPOKO NUI, DWS (Driller: Roscoe Moss)
elevation: 603'
well depth: 650'
casing: 621', 14"
date drilled: 1977
status: municipal
location: 193105x1545803
temperature: 20C
chloride: 4ppm

Public Hearing before the Planning Commission

Puna Geothermal Ventures GRP

6/6/89

Presented by Jennifer Perry, Box 537 Pahoa, HI 96778

May I request that all the testimony presented to the Commission regarding the SOH wells be incorporated into this hearing for reference.

I would like to reply to Ormats' position stating that the quality of the groundwater resource in the area of the plant is considered already contaminated by geothermal fluids, and that this water should not be used for potable or irrigation supply. PGM has applied to the DOH to amend the boundaries of the underground injection line to include the plant area and areas downgradient of the plant. This would permit them to contaminate the groundwater in that area. The DOH will be struggling with this basic issue when PGM files its permit for underground injection. At present the well at Kapoho Crater is at great risk.

I know the Commission has already taken the position that what happens underground is not within their regulatory review, but if that review alters the workings of the application or the responsibility of the County Board of Water Supply, then it must be considered.

To provide additional data regarding this resource, I would like to submit an update of my previous testimony at the SOH hearings delineating the chloride contents of the wells in Puna, which are noted on the map.

The Dept of Water Supply limits potable drinking water to 250 ppm chlorides. Cooperative Extension Service reports and other irrigation studies claim that 1200 ppm is common and acceptable for most major crops, with some crops showing no adverse effects at 2600 ppm.

Our farming operation is still considering the drilling of a well for irrigation of the crops on our farm.

The chlorides in the HGPA and Kapoho State Wells area range from 1000 to 1400ppm, as recorded by bailing samples provided by Thermal Power and HGPA to the DLNR. This water could be used for irrigation.

In a report by Dr. Donald Thomas of the HIG, 9/22/87, titled "The Geochemistry of the HGPA Geothermal Well: A Review and Update, he states:

"The presence of only slightly brackish water at 2 km depths suggested that some mechanism associated with the rift zone was responsible for exclusion of seawater from the interior of the geothermal reservoir".

This indicates that there is water usable for irrigation at depths of 2km. In my discussions with the USGS, they indicated that the only well that appeared to have conflicting and excessive chlorides is the Malama Ki well located at the Malama Ki Ag Experiment Station. We really need to do more research and monitoring before we allow the contamination of a massive aquifer that appears to be protected by impermeable dikes from salt water intrusion. That this water might be heated by location in lower depths does not make it contaminated.

I would like to recommend that it is necessary to make an in depth

evaluation of our aquifer before the permit for a plant that requires the need to reinject into the lower depths of that 2 km aquifer is considered. If Ormat would be willing to defer their application until this evaluation is completed, we have a better chance of living side by side. More test wells to measure the groundwater aquifer might be needed, and certainly a special monitoring of the effects the HGPA well has had on this aquifer is needed.

FROM A LETTER SENT TO HON. JIM HOGAN, GOVERNOR, IN THE LATE SUPPLEMENTS TO US.

3. GEOTHERMAL FLUIDS CONTAIN MANY CHEMICALS THAT COULD CONTAMINATE THE GROUNDWATER SUPPLY.

The Kapoho Community Association represents residents and landowners of the area, users of the municipal system, and prospective water well drillers. We urge the DOH to prevent the contamination of their groundwater supply from the chemicals contained in geothermal fluids.

Pimental et al 1978 conducted a two year baseline water quality study in Imperial Valley to establish a monitoring program to ensure that geothermal development does not adversely affect water quality. The

report recommends a minimum list of parameters that should be monitored including Sodium(Na), Potassium(K), Magnesium(Mg), Chloride(Cl), Sulfates (SO4), Carbonates(CO3), (HCO3), Total Dissolved Solids (TDS), (SC), pH, Temperature, Boron (B), Lithium(Li), Manganese(Mn), Zinc(Zn).

Lab technologies for measuring trace elements have improved since 1978 and additional parameters may now be included into that list, for the PGV project, Arsenic (As), Lead(Pb), and Mercury (Hg).

Boron: The Kapoho area contains some of the best agricultural lands in the state and is the fruit and flower basket of the Big Island. Boron abatement in air emissions and in irrigation water have been of concern to area agriculturists. Boron data related to humans are limited. Several forms of boron are irritants to skin and mucous membranes. Boron particulate fallout damages plants (Malloch et al 1976, Sharp 1976). Irrigation water with 10-100 ppm boron content is toxic to plants (Nolte 1987, WFFPPP)

Arsenic: All forms of arsenic are toxic at various levels; some are potentially carcinogenic (Lee and Fraumeni, 1969; Tseng et al 1968; Sander 1975, NIOSH 1975). Arsenic compounds are known to be corrosive to skin and are identified as a carcinogen. Prolonged contact can cause skin irritation, with mucous membranes the more sensitive to irritation. Fluids containing arsenic levels of 5 mg/l are considered toxic. Odor threshold is 0.5 ppm. The fatal dose is 70-180 mg/m3.

Chlorides: Salinities are reported to be as high as 21,000 ppm cl in the KS-1A brines. Seawater contains 19,500 ppm chloride. Only two percent contamination of the aquifer by seawater will increase the chloride concentration of the water in the aquifer to exceed the secondary drinking water standard of 250 mg/l (USGS National Water Summary 1986 #2325). Casing leaks in both the production wells and injection wells could easily cause a mixing of the heated geothermal fluids into the colder groundwater, and increase the chloride contents to contamination levels, where it would be unusable for potability and irrigation. The extent and rate of that contamination would have to be monitored.

QUESTIONS YET UNANSWERED:

1. Where is the location of the holding pond. What size/gal? Why unlined? Under what conditions will effluents be routed to the holding pond? Will there be any abatement of chemicals other than H2S prior to disposal to the holding pond? How many hours worth of off line time is the pond expected to accomodate. Is a UIC permit required for use of this sump pond? What will the groundwater impacts be?

They're done their homework