PUNA GEOTHERMAL VENTURE

A Hawaii Partnership

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HAND DELIVER

October 24, 1991

DIV. OF WATER & LAND DEVELOPMENT

Mr. William Paty Director State Department of Land and Natural Resources P.O. Box 621 Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Puna Geothermal Venture (PGV) Proposed Amendment to Plan of Operations

Attached please find, for your review and approval, PGV's proposed amendment to the Plan of Operations regarding the following two aspects of the geothermal field development: 1) drilling sequence and schedule; and 2) geologic modeling of the PGV geothermal resource. This amendment is consistent with the recommendations presented in the Geothermal Management Plan, issued on October 4, 1991, by the joint State and County Task Force.

Puna Geothermal Venture is currently completing the noise analysis and will submit this document for your review upon completion. Subsequently, PGV will submit the following documents: 1) revised drilling application for KS-8; and 2) a revised casing and testing program for KS-3 for approval. Future submittals will be made as appropriate to the project.

If you have any questions regarding this submittal or any future applications, please feel free to contact me in the Hilo office at 961-2184.

Sincerely,

Maurice A. Richard Vide President Puna Geothermal Venture

Attachment

91151.011

HDROGEOLOGIC MODEL OF THE PUNA GEOTHERMAL VENTURE GEOTHERMAL RESOURCE UPDATE OCTOBER 22, 1991

EXECUTIVE SUMMARY

- The Puna Geothermal Venture (PGV) geothermal resource lies entirely within the Lower East Rift Zone (LERZ). The LERZ is a 1-2 mile wide, volcanically and tectonically active zone characterized by frequent basaltic eruptions and widespread tensional fracturing.
- 2. Puna Geothermal Venture (PGV) and other operators have drilled nine deep exploration into and adjacent to the PGV geothermal resource.
- 3. Drilling, testing, and long-term commercial production from the deep wells have confirmed the existence of a significant commercial geothermal resource.
- 4. The commercial resource is characterized by two distinct reservoir types: 1) a pervasive, low transmissivity, high temperature reservoir; and 2) high transmissivity zones contained within steeply dipping fractures.
- 5. The low transmissivity reservoir underlies much of the PGV project site at depths below 5000 feet. The reservoir is capable of sustaining commercial production in the range of 60 thousand pounds per hour (kph) steam per well which is equivalent to 3 megawatts of net electrical generation per well.
- 6. Wells drilled into the low transmissivity reservoir also exhibit good injection characteristics. Two to three wells drilled into the reservoir will provide injection capacity for the 25 MW power plant effluent stream.
- The high transmissivity zone, as encountered by production well KS-8, appears to provide very high productivity, possibly in excess of 200 kph steam per well (10 MW electric per well).
- 8. Based on the current reservoir model, PGV production wells will be targeted to intersect the KS-8 fracture at depths below 3500 feet. Injection wells will be targeted to the low transmissivity reservoir as stepouts from the injection zone defined by KS-3.

- 9. Thermal breakthrough from injection zones to production zones is not expected to occur because of the diffuse nature and low transmissivity of the fracture system in the injection zone.
- 10. Non-condensable gas breakthrough is not expected because the gas will be highly undersaturated in the injection zone and will not be concentrated above natural reservoir dissolved gas levels by the power conversion cycle prior to injection.

PUNA GEOTHERMAL VENTURE PROPOSED AMENDMENT TO PLAN OF OPERATIONS

I. DRILLING SEQUENCE AND SCHEDULE:

Upon the reinstatement of the drilling permits (suspended as a result of the June 12, 1991, uncontrolled flow event at KS-8), PGV proposes the following sequence of drilling and field development activities:

- Complete and test production well KS-8 using Parker Rig #231.
- 2. Perform injection test and casing integrity program on KS-1A. Place in service as injection well.
- Move Parker Rig #231 to KS-3 and complete well modification and testing required to covert well into an injection well.
- Move Parker Rig #231 to KS-4 and drill an injection well.
- 5. Move Parker Rig #231 to KS-9 and drill a production well.
- Move Parker Rig #231 to a development well location, to be determined by previous drilling data, and drill an injection or production well, as required by the project.
- 7. Move Parker Rig #231 to KS-7 and perform a well evaluation for possible plug and abandonment.

Well locations are shown on Figure 1. The sequence and schedule described above is shown in Figure 2 as they relate to the power plant startup. The power plant startup will commence upon the completion of the KS-3 conversion to an injection well. This is expected to take place approximately 35 days after reinstatement of the drilling permits.

The schedule and drilling sequence described above may be further modified in the event that two drill rigs are used simultaneously. The use of a second drill rig is dependent upon meeting environmental standards and operational safety requirements put forth by the Hawaii Department of Health (HDOH) and the Hawaii Department of Land and Natural Resources (DLNR). In the event that a second rig is allowed, an additional development well will be drilled at the KS-11 site immediately upon receipt of agency authorization. The well can be targeted either as an injection or production well, depending upon the previous drilling and testing data and the need to provide redundant injection capacity in a timely manner.

II. GEOLOGIC MODEL

The PGV geologic staff updates the geologic model of the PGV geothermal resource from time to time as significant new data is gathered from drilling and testing operations and ongoing geotechnical studies. This updated model is provided to DLNR as part of the revision to the Plan of Operations. This is done so that the DLNR staff has an current geologic basis for making regulatory decisions related to drilling and wellfield operations. Attachment A contains the updated geologic model for the PGV geothermal resource. The model incorporates all drilling data and geotechnical studies available to date to the PGV staff. This attachment contains data and analyses which PGV considers to be proprietary and strictly confidential. Puna Geothermal Venture is making this information available to DLNR with the understanding that the document will be maintained in strictest confidence for the internal use of the DLNR and HDOH staff only.



Figure 2

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			PGV	FIELD	DE	VELOPMEN	NT SCHEI	DULE, ON	E RIG		
		Months									
Task Re 4 Days Per Column	esource Schd Dur		1	2		. 3	4	5	6	7	
FIELD2.PJ	232dy	++++-	+++++	++++++	++	++++++++	F++++++	+++++++++	+++++++	+++++++++	+++
Field Development	232dy	++++-	++++	++++++	++	+++++++	+++++++++++++++++++++++++++++++++++++++	+++++++++++++++++++++++++++++++++++++++	+++++++	+++++++++	+++
Agency review	31dy	++++-	++++				1				
Reinstate permits	Ødy		М				i -				
Complete KS-8, test	21dy		++-	++++			İ.		,		
Injection Test KS-1A	3dy		XX	*			1				
Test, complete KS-3	14dy			+++	++		i				
Drill KS-4, Injection	52dy				++	++++++	+++++				
Drill KS-9, Prod.	52dy		1				+++-	++++++++	+++		
Drill devel. well	52dy		1				1.00		+++++	+++++++	+
P&A KS-7	10dy		1								+++
Power Plant	232dy	++++-	+++++	++++++	++	+++++++	+++++++	+++++++++++++++++++++++++++++++++++++++	+++++++	+++++++	+++
Reinstate const. perm	Ødy	M	· 1								
Complete construction	45dy	XXXXX	XXXXX	XXX	*						
Startup and online	166dy		1	_	++	+++++++	*******	******	*****	++++++++	+++



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November 18, 1991

DIV. OF WATER & LAND DEVELOPMENT DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

MEMORANDUM

FROM: Maurice Richard Vice President Puna Geothermal

SUBJECT: Activity Update # 6

Since our last communication, much progress has been made.

- * The Partners of Puna Geothermal Venture have committed to invest additional capital to keep the project from falling behind in its obligations. This commitment was made in anticipation of the reinstatement of drilling permits in the very near future.
- * All major contractors have returned to the job site to to complete construction of the power plant and gathering systems.
- * PGV is working closely with State and County regulators to implement the recommendations outlined in the Geothermal Management Plan. PGV has submitted all relevant data and information and is now awaiting final regulatory approval to proceed.
- * PGV still retains the goal of delivering power to Big Island residents before the new year. Prospects of meeting this year-end goal are, however, diminishing with each day's delay. We do remain optimistic.

We will continue to keep you posted on our activities as they occur.