



December 12, 2024

Ms. Marianne Rossio  
Clean Air Branch  
State Department of Health  
2827 Waimano Home Road  
Hale Ola Building, Room 130  
Pearl City, Hawaii 96782

**SUBJECT: PGV MODIFICATION TO NON-COVERED SOURCE PERMIT (NSP)  
NO. 0008-02-N**

Dear Ms. Rossio:

Puna Geothermal Venture (PGV), a subsidiary of Ormat Technologies, Inc. (Ormat), is hereby requesting a modification to the Noncovered Source Permit (NSP) No. 0008-02-N issued under Hawaii Administrative Rule (HAR), Title 11, Chapter 60.1. In January of 2024, PGV Repower Project (Project) was approved under the authority of the County of Hawaii Planning Department, to increase the power-generating capacity of the facility to 46 MW (Nominal), by replacing the 12 existing Ormat Energy Converters (OECs) with just three (3) new and more efficient units. The new OECs would be built at a new location on the PGV site. Most of the existing buildings and infrastructure would remain for the project, including administration buildings, the control room, maintenance areas, well pads, and the gathering system. PGV is requesting to modify the following based for this Project:

- (1) Section A.1 Attachment IIA Equipment Description, a forty-six (46) MW (Nominal) Geothermal Power Plant with three new OECs and one new Vapor Recovery Maintenance Unit (VRMU). The upgraded OECs will utilize existing geothermal wells. The VRMU will be used to evacuate and recover cyclopentane before venting non-condensable gases from the system.
- (2) Section B.3 Attachment IIA. Emission and Operational Limitations and/or Standards Fugitive air emissions for the Project will come from use of motive fluid (cyclopentane) in the process. PGV is proposing an operational limit for emission losses for the new OEC units and VRMU at a total of at 261.69 per day (lbs/day) on a quarterly average for fugitive sources and the vapor recovery/ maintenance units.
- (3) A 39,500-gallon storage tank will be needed for maintenance and storage of motive fluid.



PGV is requesting this unit be considered exempt under HAR11.60.1-62(d)(7).

- (4) Attachment II.B. Special Conditions: Wellfield & Geothermal Exploratory/ Developmental Wells, Sections A.1.a. and B.2 update to increase from fourteen (14) wells to twenty-eight (28) wells in the permit. This request is being made to reflect the 28 wells authorized per the Plan of Operations approved by the Department of Land and Natural Resources - Land Board in 2006.

Once the three OECs are constructed and operational, PGV will disconnect and decommission the existing OECs in the current power plant. The following equipment listed in the current NSP permit, Section A.1 Attachment IIA Equipment Description, would ultimately be decommissioned:

- a. Ten (10) integrated back pressure steam turbine and air-cooled binary cycle turbine/generator modules. Ormat Energy Converter (OEC) or equivalent.
- b. Noncondensable gas (NCG) compressor units.
- c. Vapor Recovery Unit (VRU).
- d. Sulfa-Treat System (two (2) abatement reactor vessels).
- g. Two (2) Integrated Two Level Units (ITLU).
- i. No. 2 Vapor Recovery Maintenance Unit (VRMU).

We appreciate your review of this application for modification. Should you or your staff have any questions, please contact me at (808) 494-8882.

Sincerely,



FOR

Jordan Hara  
Plant Manager

Enclosure: Application Form S-1, S-12, & C-1  
Application Fee Check

cc: PGV File

We certify that this document and all attachments are true, accurate, and complete, pursuant to HAR 11-60 1-4



11. Proposed Equipment/Plant Location (e.g. street address): 14-3860 Kapoho Road  
City: Pahoa State: HI Zip Code: 96778  
UTM Coordinates (meters): East: 301.00-301.66 North: 2154.84-2155.58  
UTM Zone: 4 UTM Horizontal Datum:  Old Hawaiian  NAD-27  NAD-83

12. General Nature of Business: Power Generation

13. Date of Planned Commencement of Construction or Modification: Q1 2025

14. Is **any** of the equipment to be leased to another individual or entity?  Yes  No

15. Type of Organization:  Corporation  Individual Owner  Partnership  
 Government Agency (Government Facility Code: \_\_\_\_\_)  
 Other: \_\_\_\_\_

*Any applicant for a permit who fails to submit any relevant facts or who has submitted incorrect information in any permit application shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant shall provide additional information as necessary to address any requirements that become applicable to the source after the date it filed a complete application, but prior to the issuance of the noncovered source permit or release of a draft covered source permit. (HAR §11-60.1-64 & 11-60.1-84)*

**RESPONSIBLE OFFICIAL** (as defined in HAR §11-60.1-1)

Name (Last): Hara (First): Jordan (MI): \_\_\_\_\_

Title: Plant Manager Phone: 1-808-965-2838

Mailing Address: P.O. Box 30

City: Pahoa State: HI Zip Code: 96778

**Certification by Responsible Official** (pursuant to HAR §11-60.1-4)

I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by the Department of Health as public record. I further state that I will assume responsibility for the construction, modification, or operation of the source in accordance with the Hawaii Administrative Rules (HAR), Title 11, Chapter 60.1, Air Pollution Control, and any permit issued thereof.

NAME (Print/Type): Jordan Hara

(Signature): 

Date: 12/12/24

<b>FOR AGENCY USE ONLY:</b>
File/Application No.: _____
Island: _____
Date Received: _____

**EMISSIONS UNITS TABLE**

Review of applications and issuance of permits will be expedited by supplying all necessary information on this table.

AIR POLLUTANT DATA: EMISSION POINTS				AIR POLLUTANT Regulated/ Hazardous Air Pollutant Name & CAS#	AIR POLLUTANT EMISSION RATE		UTM Zone: <u>5</u> Horizontal Datum <sup>a</sup> :	STACK SOURCE PARAMETERS							
Stack No.	Unit No.	Equipment Name/ Description & SICC number	Equipment Date		# HR	Tons/ YR		Coordinates (mtrs)	Stack Height (mtrs)	Direction (wd/h) <sup>b</sup>	Inside Diameter (mtrs)	Velocity (m/s)	Flow Rate (m <sup>3</sup> /s)	Temp. (° K)	Capped (Y/N)
S-2	P-4	Vapor Recovery Maintenance Unit	2024	Cyclopentane 287-92-3	68.33	3.96	East	301413.000	2.1	Up		0.028	323	No	
							North	2154823.00							
	F-7	Power Plant- OEC 1 (15MW)	2024	Cyclopentane 287-92-3	Total for all 3 OECS		East	301413.000							
							North	2154823.00							
	F-8	Power Plant- OEC 2 (15MW)	2024	Cyclopentane 287-92-3	193.36	35.29	East	301413.000							
							North	2154823.00							
	F-9	Power Plant- OEC 3 (16MW)	2024	Cyclopentane 287-92-3			East	301413.000							
							North	2154823.00							
							East								
							North								
							East								
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							North								

<sup>a</sup> Specify UTM Horizontal Datum as Old Hawaiian, NAD-83, or NAD-27

<sup>b</sup> Specify the direction of the stack exhaust as u = upward, d = downward, or h = horizontal

ATTACHMENT 1 TO FORM S-1  
NEW FACILITY EMISSION UNITS

FUGITIVE SOURCES

System F-7, F-8, and F-9: New Power Plant – Three Ormat Energy Convertors (OECs):

The proposed OEC units are a two-turbine combined cycle binary unit, operating on a subcritical Rankine cycle, with cyclopentane as the motive fluid instead of pentane. The OEC system consists of a generator, turbines, a vaporizer, air-cooled condensers, preheaters and recuperators, and an evacuation skid/vapor recovery maintenance unit (VRMU) for purging and maintenance events. The design capacity for each unit is 15MW, 15MW, and 16MW (net).

This system has the potential for fugitive cyclopentane emissions through leaking seals, flanges, and other fugitive emission points. Combustible gas detection sensors are strategically located throughout the system. These emissions are addressed and reduced using both control technology and an ongoing Leak Detection and Repair (LDAR) program.

System P-4 Vapor Recovery Maintenance Unit (VRMU):

The VRMU is utilized as a method to remove motive fluid before venting non-condensable gases (NCG's) from the system (turbines, cooler, heat exchanger, etc.) due to NCGs decreasing operating efficiency. The cyclopentane must be evacuated from all/ portions of an OEC for maintenance or repair. The OECs are divided into zones that can be isolated and evacuated for maintenance while the cyclopentane remains in the rest of the system. To evacuate the cyclopentane from a zone for maintenance, the cyclopentane liquid and vapor are removed using the VRMU (with a 98% control efficiency) and held in the storage tanks. Any remaining vapors are purged from the zone using nitrogen and passes through the VRMU. The unit is not opened to the atmosphere until the vapor concentration is less than 20% of the lower explosion limit for cyclopentane.

*Attachment 4 of Form S-1 with a description emission rate request.*

ATTACHMENT 2 TO FORMS A-1  
NEW FACILITY EMISSION UNITS

EXEMPT SOURCES

Reference Unit E-14: Motive Fluid Storage Tanks (39,500-gallon nominal capacity tanks):

The motive fluid storage tanks are exempt from noncovered source permit requirements, as specified under HAR 11.60.1-62(d)(7) which exempts storage tanks containing volatile organic compounds (VOCs) with capacity equal to or less than 40,000 gallons.

ATTACHMENT 3 TO FORM S-1  
EMISSION RATE CALCULATIONS



PGV Emission Calculations  
Vapor Recovery Maintenance Unit (VRMU)

Estimated																					
Controlled	lb	=	540	gal	x	6.2	lb	x	1	-1	=	68.33	lb								
Emissions	hr			hr			gal		98				hr								
Estimated									100												
Controlled	68.33	lb			x		116	hrs	=	7925.9	lb	=	3.96	ton							
Emissions		hr					yr				yr										

**NOTES**

**Cyclopentane Recovered**  $\frac{\text{lb}}{\text{time}}$  =  $\frac{\text{Volume ( lb )}}{\text{Time}} \times \text{Density (lb / gal)}$

\*Volume is based on engineering design estimate  
 \*Density of Cyclopentane is 6.2 lb/gal

**Controlled Emissions**  $\frac{\text{lb}}{\text{time}}$  =  $\frac{\text{Cyclopentane Recovered (lb/time)}}{\text{(% Recovery)}}$  x  $\frac{1}{100}$

PGV Emission Calculations  
Ormat Energy Convertors (OECs)

	MF Volume Total gallons	Emission Factor (lb/day)/1,000 gal	Cyclopentane Emissions lbs/day	tons/year
11 OECs	171000	1.74	297.88	54.36
3 OECs	111000	1.74	193.36	35.29

**Current**  
**Proposed**

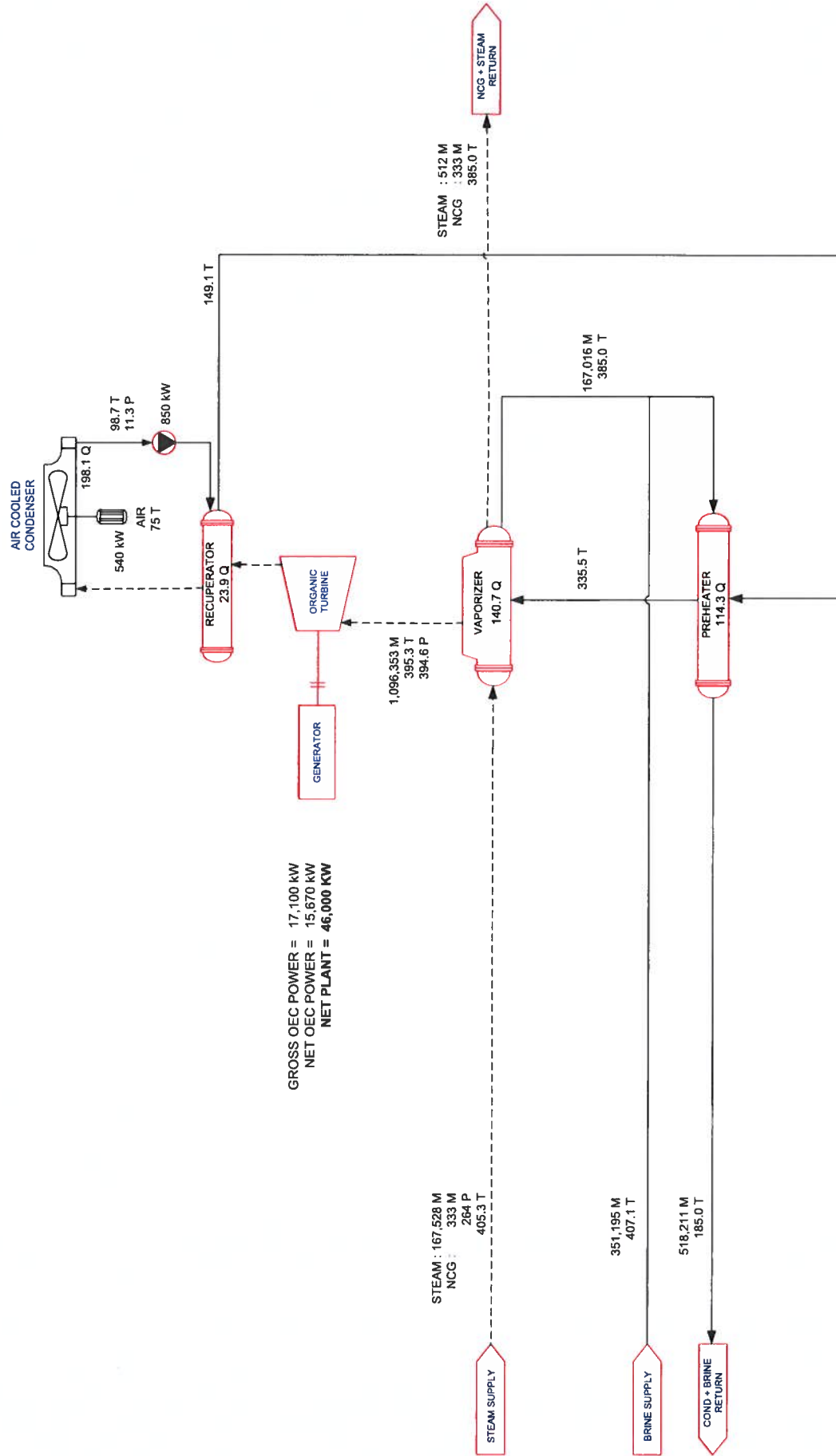
<b>Notes:</b>				
Motive fluid/unit	37000	gallons		
Emission Factor Calculation				
	lbs/day	tons/yr	gallons	
worst-case quarter	297.88	54.36	171000	=
Q3 2023				1.74 (lb/day)/1,000 gal MF

Total VOC Emissions- New Units

	lb/day	ton/yr
OECs	193.36	35.29
VRMU	68.33	3.96
Total	261.69	39.25

Elevation: 640 feet

# ORMAT® ENERGY CONVERTER (OEC 1 OF 3)



GROSS OEC POWER = 17,100 KW  
NET OEC POWER = 15,670 KW  
NET PLANT = 46,000 KW

MOTIVE-FLUID: cyclo-Pentane

**LEGEND**

- - - Vapor
- Liquid

**LEGEND**  
M - lb/hr  
P - psia  
T - °F  
Q - MM-BTU/hr  
H - BTU/lb

**PLANT OPERATING DATA**  
GEO THERMAL FLOW: 502,584 M  
Steam  
NCG 1,000 M  
Brine 1,053,585 M  
STEAM INLET PRESSURE: 264 P  
BRINE INLET TEMP.: 407.1 T  
DRY BULB TEMP.: 75.0 T

REV	DESCRIPTION	DATE	BY	CHECK	APPR	DATE	TR	EB	AF
R1	18.5 bara Separation Pressure	07/05/2023	TR	EB	AF	07/05/2023	TR	EB	AF
R0	Design	14/02/2023	TR	EB	AF				
REV	DESCRIPTION	DATE	BY	CHECK	APPR				

DATE: 07/05/2023  
CHECK: TR, EB, AF  
APPR: TR, EB, AF

DATE: 07/05/2023  
CHECK: TR, EB, AF  
APPR: TR, EB, AF

DATE: 07/05/2023  
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APPR: TR, EB, AF

ATTACHMENT FORM S-12  
APPLICATION FOR A MODIFICATION TO A NONCOVERED SOURCE

- I. In accordance with Hawaii Administrative Rules (HAR) § 11-60.1-76, the following information is provided:
- A. Equipment Specifications:
1. **Maximum Design Capacity:** The PGV Project is requesting to add three (3) Ormat Energy Converters (OECs) rated at 15 MW, 15 MW, and 16 MW in capacity.
  2. **Fuel Type:** The OECs will use the motive fluid cyclopentane.
  3. **Fuel Use:** The OECs will use approximately 540 gallons per hour (gal/hr) of cyclopentane to convert energy into power as described in more detail below.
  4. **Production Capacity:** The OECs are rated at 15 MW, 15 MW, and 16 MW in capacity.
  5. **Production Rate:** Same as above
  6. **Raw Material:** N/A
  7. The unit is designed by Ormat Technologies, LLC. to generate electrical power by means of a geothermal heat source (See Flow Sheet "Heat and Mass Balance Diagram") and consists of the following main components:
    - **Vaporizers / Preheaters**
      - The vaporizer and preheaters are tube and shell heat exchangers. The geothermal brine flowing through the vaporizer and preheater tubes heats and vaporizes the motive fluid, which flows through the vaporizer and preheater shell sides.
    - **Power Skid**
      - The power skid consists of organic Rankine cycle turbine coupled to a synchronous generator.
    - **Recuperator**
      - The recuperator is a tube and shell heat exchanger, in which the exhaust vapors from the turbine flow through the shell side, heating the motive fluid which is pumped through the tube side.
    - **Condensers**

- The exhaust vapors flow from the recuperator after the organic turbine to the air-cooled condensers, where they are cooled and condensed back into liquid.
- Feed Pumps
  - The three feed pumps, which are multistage centrifugal pumps, transfer organic motive fluid from the condenser to the recuperator and then to the preheater.
- Power and Control Boards
  - The power and control boards house the PLC, the 24VDC distribution box with its fuses and circuit breakers, the GMR (Generator Management protection Relay), the GPR (backup Generator Protection Relay), as well as transducers and control relays.

The OECs use cyclopentane vapor that powers the Rankine cycle turbine that converts the energy into mechanical work and rotates the generator to create electricity. Geothermal fluid enters the heat exchanger where it vaporizes cyclopentane, a low boiling point hydrocarbon. The vaporized cyclopentane turns a turbine before being exhausted into an air cooler to be condensed. The liquid cyclopentane then flows back (using pumps) into the heat exchanger to start the “closed-loop” system again.

The steam entering the heat exchanger contains non-condensable gases (NCGs) including hydrogen sulfide (H<sub>2</sub>S), carbon dioxide (CO<sub>2</sub>), nitrogen gas (N<sub>2</sub>), and hydrogen gas (H<sub>2</sub>). These gases are removed using a steam ejector vacuum system, cooled, compressed, and piped into the reinjection system. The hot geothermal condensate is pumped to a heat exchanger located in an OEC. In the heat exchanger, the condensate pre-heats the cyclopentane. The lower-temperature condensate exiting the heat exchanger is collected and pumped into the reinjection system. The vaporized cyclopentane turns a turbine and is then treated in a similar manner as described above.

Each new OEC would utilize both steam at approximately 678 kilo-pounds per hour (kph) and brine at 226 kph, to get to a total of 46 MW nominal power.

#### B. Description of the Modification

PGV requests a modification to the NSP which allows an addition of three (3) OEC units that are 15 MW, 15MW, and 16 MW, and a new VRMU. This modification would include a change in the equipment listed in NSP #0008-02-N, Section A and in the attachment IIA, Section A. 1. The OECs in the new plant will utilize cyclopentane as a motive fluid.

PGV also requests to modify Attachment II.B. to update the number of authorized wells from fourteen (14) to twenty-eight (28) wells. There will be no change in potential air emissions as a result of this increase in wells.

Lastly, PGV requests to repurpose the Sulfa-Treat System, an abatement system, to be used intermittently for process clearance of residual steam, containing H<sub>2</sub>S, in piping should it need to be shut in as part of maintenance. PGV is not requesting a change to emission limitations for H<sub>2</sub>S as a result of this request.

#### C. Air Pollution Control and Compliance Monitoring Activities:

To ensure compliance regarding the requested modifications, the OECs and VRMU will be maintained in good operating condition and monitored daily. Fugitive cyclopentane emission monitoring will be performed to ensure we do not exceed 10,000 ppm when measured at the component source.

#### D. Operational limitations or Work Practices:

PGV will log daily readings twice per shift and take immediate corrective actions upon identifying any cyclopentane emissions so as not to exceed a 261.69 pound per day (lbs/day) calculated average and be in accordance with the conditions of the NSP.

#### E. Schedule:

PGV has tentatively scheduled construction of the upgrade to start in January 2025 or shortly thereafter and start-up the first quarter 2026.

#### F. Proposed Exemptions

A 39,500-gallon storage tank will be needed for maintenance and storage of motive fluid. PGV is requesting this unit be considered exempt under HAR11.60.1-62(d)(7).

#### G. Compliance Plan

Please see attached Form C-1

**C-1: Compliance Plan**

The Responsible Official shall submit a Compliance Plan as indicated in the Instructions for Applying for an Air Pollution Control Permit and at such other times as requested by the Director of Health (hereafter, Director).

Use separate sheets of paper if necessary.

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1. Compliance status with respect to all Applicable Requirements:

Will your facility be in compliance, or is your facility in compliance, with all applicable requirements in effect at the time of your permit application submittal?

YES {If YES, complete items a and c below}

NO {If NO, complete items a, b, and c below}

a. Identify all applicable requirement(s) for which compliance is achieved.

We certify that the PGV facility has achieved compliance with all applicable requirements of HAR Section 11-59-1 (ambient air standards); HAR Section 11-60-1 (air pollution controls), and NSP No.0008-02-N.

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Provide a statement that the source is in compliance and will continue to comply with all such requirements. The non-covered source is in compliance and will continue to comply with all such requirements under applicable HAR regulations and permit conditions.

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b. Identify all applicable requirement(s) for which compliance is NOT achieved.

N/A

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Provide a detailed Schedule of Compliance Schedule and a description of how the source will achieve compliance with all such applicable requirements.

<u>Description of Remedial Action</u>	<u>Expected Date of Completion</u>
<u>N/A</u>	_____
_____	_____
_____	_____
_____	_____



- c. Identify any other applicable requirement(s) with a future compliance date that your source is subject to. These applicable requirements may take effect AFTER permit issuance:

<u>Applicable Requirement</u>	<u>Effective Date</u>	<u>Currently in Compliance?</u>
N/A		

If the source is not currently in compliance, provide a Schedule of Compliance and a description of how the source will achieve compliance with all such applicable requirements:

<u>Description of Proposed Action/Steps to Achieve Compliance</u>	<u>Expected Date of Achieving Compliance</u>
N/A	

Provide a statement that the source on a timely basis will meet all these applicable requirements:

N/A

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If the expected date of achieving compliance will NOT meet the applicable requirement's effective date, provide a more detailed description of each remedial action and the expected date of completion:

<u>Description of Remedial Action and Explanation</u>	<u>Expected Date of Completion</u>
N/A	

2. Compliance Progress Reports:

- a. If a compliance plan is being submitted to remedy a violation, complete the following information:

Frequency of Submittal: \_\_\_\_\_  
(less than or equal to 6 months)

Beginning Date: \_\_\_\_\_

b. Date(s) that the Action described in (1)(b) was achieved:

<u>Remedial Action</u>	<u>Date Achieved</u>
N/A	

c. Narrative description of why any date(s) in (1)(b) was not met, and any preventive or corrective measures taken in the interim:

N/A

**RESPONSIBLE OFFICIAL**

(as defined in HAR §11-60.1-1)

Name (Last): Hara (First): Jordan (MI):

Title: Plant Manager Phone: 808-965-2838

Mailing Address: P.O. Box 30

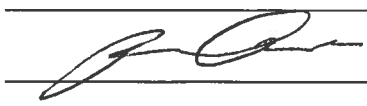
City: Pahoa State: HI Zip Code: 87769

**Certification by Responsible Official**

(pursuant to HAR §11-60.1-4)

I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by the Department of Health as public record. I further state that I will assume responsibility for the construction, modification, or operation of the source in accordance with the Hawaii Administrative Rules, Title 11, Chapter 60.1, Air Pollution Control, and any permit issued thereof.

Name (Print/Type): Jordan Hara

(Signature):  FOR Date: 12/12/24

Facility Name: Puna Geothermal Venture

Location: 14-3860 Kapoho Pahoa Rd, Pahoa, HI

Permit Number: NSP #008-02-N

<b>FOR AGENCY USE ONLY</b>
File/Application No.: _____
Island: _____
Date Received: _____