US EPA ARCHIVE DOCUMENT

APPENDIX F

PLUGGING AND ABANDONMENT PLANS

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Detailed Plan of Procedure for Plugging and Abandoning Injection Wells at the Puna Geothermal Facility

Mlk 16Jun09

Assumptions:

- All four (4) injection wells would be abandoned at the same time. Work would be performed in series, one well at a time.
- Work would be accomplished utilizing a third party Drilling Rig (Water Resources, Inc.)

Procedure for each individual well:

1. Mobilize third party Rig to location, in parallel with site preparation.
2. Nipple up Blow Out Prevention Equipment.
3. If needed, kill well with plant water.
4. Pull and remove hangdown liner.
5. Pick up drill pipe and run in hole to set bottom plug.
6. Set plugs as per EPA Plugging and Abandonment Plan Form 7520-14.
7. Salvage surface equipment, primarily wellhead components.
8. Cut off casing.
9. Reclaim and restore location.
10. Move to next well.
11. Demobe Rig after completion of last well to be plugged and abandoned.

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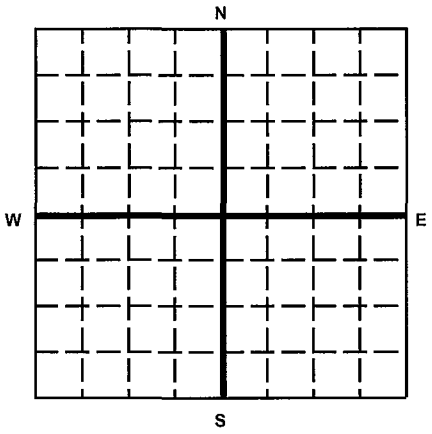
OMB No. 2040-0042 Approval Expires 12/31/2011

United States Environmental Protection Agency
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility	Name and Address of Owner/Operator
Puna Geothermal Venture 14-3860 Kapoho Pahoa Road, Pahoa, HI 96778	Puna Geothermal Venture PO Box 30, Pahoa, HI 96778

Locate Well and Outline Unit on Section Plat - 640 Acres



State	County	Permit Number
HI	Hawaii	

Surface Location Description

n/a 1/4 of n/a 1/4 of n/a 1/4 of n/a 1/4 of Section n/a Township n/a Range n/a

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location 8902.9 ft. N and 9919.0 ft E of Kaliu Benchmark ft. frm (N/S) Line of quarter section and ft. from (E/W) Line of quarter section.

TYPE OF AUTHORIZATION

- [ ] Individual Permit
- [x] Area Permit
- [ ] Rule

Number of Wells

Lease Name: Kapoho State

WELL ACTIVITY

- [ ] CLASS I
- [ ] CLASS II
  - [ ] Brine Disposal
  - [ ] Enhanced Recovery
  - [ ] Hydrocarbon Storage
- [ ] CLASS V

Well Number: 1A

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
20	94		0-1376	26"
13 3/8	61		0-2200	17 1/2
9 5/8	47		0-4061	12/1/4
7	26 & 29	3895-6505	0-3510	8 1/2

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- [x] The Balance Method
- [ ] The Dump Bailer Method
- [ ] The Two-Plug Method
- [ ] Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	8 1/2	8.7-6.2	6.184	6.184	6.184	6184	
Depth to Bottom of Tubing or Drill Pipe (ft	4430	3610	3010	2300	1550	170	
Sacks of Cement To Be Used (each plug)	155	42	52	28	39	24	
Slurry Volume To Be Pumped (cu. ft.)	261	68	85	46	63	39	
Calculated Top of Plug (ft.)	3795	3410	2640	2100	1276	0	
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6	15.6	15.6	
Type Cement or Other Material (Class III)	Type I-II	w/30%	silica flour	10% silica lite			

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
4061	6505		

Estimated Cost to Plug Wells: $303,500

Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibliity of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title *(Please type or print)*	Signature	Date Signed
Michael L. Kaleikini, Plant Manager		

EPA Form 7520-14 (Rev. 12-08)

*Depth of first plug may be revised if wellbore is obstructed
**Range of costs is a function of rig usage

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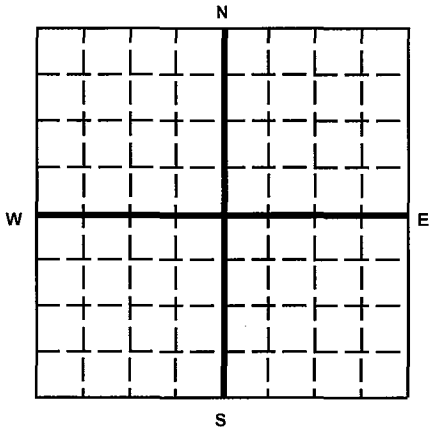
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility
Puna Geothermal Venture
14-3860 Kapoho Pahoa Road, Pahoa, HI 96778

Name and Address of Owner/Operator
Puna Geothermal Venture
PO Box 30, Pahoa, HI 96778

Locate Well and Outline Unit on Section Plat - 640 Acres



State	County	Permit Number
HI	Hawaii	

Surface Location Description
n/a 1/4 of n/a 1/4 of n/a 1/4 of n/a 1/4 of Section n/a Township n/a Range n/a

Locate well in two directions from nearest lines of quarter section and drilling unit
Surface Location 8317.9 ft. N and 9430.2 ft E of Kaliu Benchmark ft. frm (N/S) Line of quarter section
and ft. from (E/W) Line of quarter section.

TYPE OF AUTHORIZATION
- ☐ Individual Permit
- ☑ Area Permit
- ☐ Rule

Number of Wells

WELL ACTIVITY
- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS V

Lease Name: Kapoho State
Well Number: 3

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
20	94		0-1030	26"
13 3/8	61		0-2209	17 1/2
9 5/8	47		0-3897	12/1/4
7	29	3767-6835	0-3724	8 1/2

METHOD OF EMPLACEMENT OF CEMENT PLUGS
- ☑ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	8 1/2	6.184	6.184	6.184	6.184		
Depth to Bottom of Tubing or Drill Pipe (ft	5198*	2660	2309	1130	170		
Sacks of Cement To Be Used (each plug)	460	40	65	28	24		
Slurry Volume To Be Pumped (cu. ft.)	744	64	105	46	39		
Calculated Top of Plug (ft.)	3624	2380	1850	930	0		
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6	15.6		
Type Cement or Other Material (Class III)	Type I-II	w/30%	silica flour	10% silica lite			

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
3897	7406		

Estimated Cost to Plug Wells
$334,000

Certification

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Name and Official Title *(Please type or print)*	Signature	Date Signed
Michael L. Kaleikini, Plant Manager		

EPA Form 7520-14 (Rev. 12-08)

*Depth of first plug may be revised if wellbore is obstructed
**Range of costs is a function of rig usage

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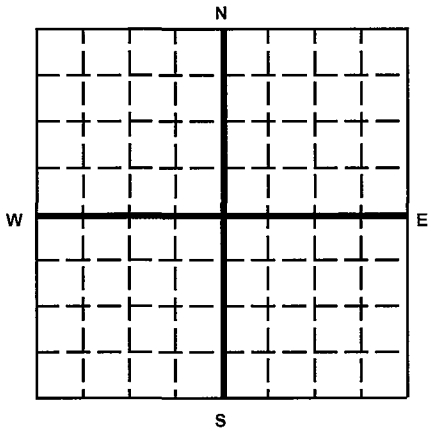
OMB No. 2040-0042 Approval Expires 12/31/2011

United States Environmental Protection Agency
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility	Name and Address of Owner/Operator
Puna Geothermal Venture 14-3860 Kapoho Pahoa Road, Pahoa, HI 96778	Puna Geothermal Venture PO Box 30, Pahoa, HI 96778

Locate Well and Outline Unit on Section Plat - 640 Acres



State	County	Permit Number
HI	Hawaii	

Surface Location Description

n/a 1/4 of n/a 1/4 of n/a 1/4 of n/a 1/4 of Section n/a Township n/a Range n/a

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location 8879.72 ft. N and 9601.32 ft E of Kaliu Benchmark ft. frm (N/S) Line of quarter section and ft. from (E/W) Line of quarter section.

TYPE OF AUTHORIZATION

- ☐ Individual Permit
- ☑ Area Permit
- ☐ Rule

Number of Wells

Lease Name: Kapoho State

WELL ACTIVITY

- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS V

Well Number: 11

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
22	106.5		0-1002	26"
16	97		0-2112	20"
11 3/4	65		0-4367	14 3/4"
9 5/8	47		0-3290	14.85"

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☑ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	10.625	10.625	10.685	8.68	8.68	8.68	
Depth to Bottom of Tubing or Drill Pipe (ft	6205	4467	3390	2202	1102	170	
Sacks of Cement To Be Used (each plug)	608	80	65	51	51	43	
Slurry Volume To Be Pumped (cu. ft.)	985	130	105	83	83	70	
Calculated Top of Plug (ft.)	4605	4267	3190	2002	092	0	
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6	15.6	15.6	
Type Cement or Other Material (Class III)	Type I-II	w/30%	silica flour	10% silica lite			

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
4367'	7952'		

Estimated Cost to Plug Wells

$366,000

Certification

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Name and Official Title *(Please type or print)*	Signature	Date Signed
Michael L. Kaleikini, Plant Manager		

EPA Form 7520-14 (Rev. 12-08)

*Depth of first plug may be revised if wellbore is obstructed
**Range of costs is a function of rig usage

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OMB No. 2040-0042 Approval Expires 12/31/2011

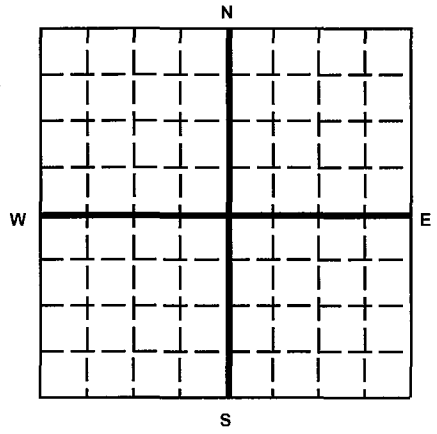
United States Environmental Protection Agency
Washington, DC 20460

EPA

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility	Name and Address of Owner/Operator
Puna Geothermal Venture 14-3860 Kapoho Pahoa Road, Pahoa, HI 96778	Puna Geothermal Venture PO Box 30, Pahoa, HI 96778

Locate Well and Outline Unit on Section Plat - 640 Acres



State	County	Permit Number
HI	Hawaii	

Surface Location Description

n/a 1/4 of n/a 1/4 of n/a 1/4 of n/a 1/4 of Section n/a Township n/a Range n/a

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location 9029.2 E and 9854.6 N of Kaliu Benchmark ft. frm (N/S) Line of quarter section and ft. from (E/W) Line of quarter section.

TYPE OF AUTHORIZATION

- ☐ Individual Permit
- ☑ Area Permit
- ☐ Rule

Number of Wells

WELL ACTIVITY

- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS V

Lease Name: Kapoho State

Well Number: 13

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
22	106.5		0-954	26"
16	97		0-2076	20"
11 3/4	65		0-4885	14 3/4"
8 5/8	44		4647-6970	10 9/16"

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☑ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	10 9/16	10.6	10.6	10.6	10.6		
Depth to Bottom of Tubing or Drill Pipe (ft	6955	4985	2175	1054	170		
Sacks of Cement To Be Used (each plug)	1744	140	80	80	65		
Slurry Volume To Be Pumped (cu. ft.)	1205	227	130	130	105		
Calculated Top of Plug (ft.)	5000	4600	1975	854	0		
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6	15.6		
Type Cement or Other Material (Class III)	Type I-II	w/30%	silica flour	10% silica lite			

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
4885	8263		

Estimated Cost to Plug Wells

$399,000

Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibliity of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title *(Please type or print)*	Signature	Date Signed
Michael L. Kaleikini, Plant Manager		

EPA Form 7520-14 (Rev. 12-08)

*Depth of first plug may be revised if wellbore is obstructed
**Range of costs is a function of rig usage

OMB No. 2040-0042 Approval Expires 11/30/2014

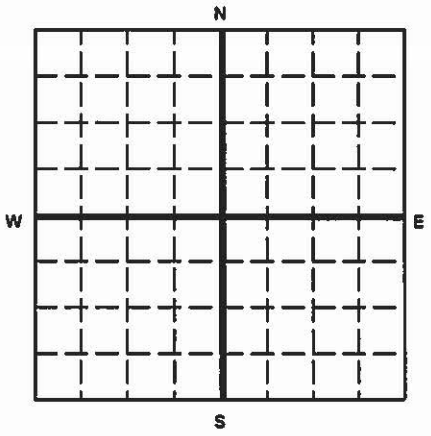
United States Environmental Protection Agency
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility
Puna Geothermal Venture
14-3860 Kapoho Pahoa Road, Pahoa, HI 96778

Name and Address of Owner/Operator
Puna Geothermal Venture
PO Box 30, Pahoa, HI 96778

Locate Well and Outline Unit on Section Plat - 640 Acres N/A



State	County	Permit Number
HI	Hawaii	

Surface Location Description
n/a 1/4 of n/a 1/4 of n/a 1/4 of n/a 1/4 of Section n/a Township n/a Range n/a

Locate well in two directions from nearest lines of quarter section and drilling unit
Surface Location 9638N 11061E of Kaliu Benchmark ft. frm (N/S) ___ Line of quarter section
and ___ ft. from (E/W) ___ Line of quarter section.

TYPE OF AUTHORIZATION
- ☐ Individual Permit
- ☑ Area Permit
- ☐ Rule

Number of Wells ___

WELL ACTIVITY
- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS III X Class V

Lease Name Kapoho State Well Number 15RD

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
22"	114.8		0-1042	26"
16"	84		0-2292	20"
11-3/4	65		0-4705 (milled window)	14-3/4"
8-5/8"	36		2789-3901	10-5/8"

METHOD OF EMPLACEMENT OF CEMENT PLUGS
- ☑ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	7.625	7.6/7.88	10.682	10.682	10.682	10.682	
Depth to Bottom of Tubing or Drill Pipe (ft	5182	3801	2889	2392	1142	232	
Sacks of Cement To Be Used (each plug)	280	30	60	80	80	90	
Slurry Volume To Be Pumped (cu. ft.)	450	48	98	125	125	145	
Calculated Top of Plug (ft.)	3801	3656	2689	2192	942	0	
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6	15.6	15.6	
Type Cement or Other Material (Class III)	Type I-II	with	40%	Silica	Flour		

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (If any)

From	To	From	To
3901'	5182'		

Estimated Cost to Plug Wells
$408,825

Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title *(Please type or print)*	Signature	Date Signed
Keoki Wells EHS coordinator		07/14/2015

EPA Form 7520-14 (Rev. 12-11)