HVC Aardwarmte Polanen B.V.

energie en hergebruik

End of Job Report

MON-GT-02 perforate, clean-up & injection test

April / May 2024

Conform Mijnbouwregeling article 8.2.2.2 and Bijlage 12

energie en hergebruik

Authorisation

Function	Name	Date	Signature
Drilling Manager	G. Schurink	7-6-2024	[redacted]
Plaatsvervangend drilling manager	B.J. Koers	7-6-2024	

colofon.

kenmerk EOJR MON-GT-02
status Final
versie V1.0
auteur(s) B.J. Koers
datum 7 juni 2024

Contents

1 Project Details

1.1 Organisation

Project Director	Marco van Soerland
Project Manager	Geert van Ek
Drilling Manager	Gerrit Schurink
Plaatsvervangend Drilling Manager	Bert Jan Koers
Sr. Production Engineer	Axel Sanden
Production Engineer	Sander Maat
HSE Manager	Peter v.d. Burg

Well Site Supervisors:

Well Site Supervisor (day)	Axel Sanden	23-04-2024 / 24-04-2024
Well Site Supervisor (day)	Gerjan Hazelaar	26-04-2024 / 08-05-2024
Well Site Supervisor (night)	Regilio Kasirin	26-04-2024 / 06-05-2024

1.2 Operational summary

Field	Monster	
Well Number:	MON-GT-02	
Well Name	MONSTER-GT-02	
Well Type	Geothermal injector	
Dates of operations	23&24-04-2024 (RBT wireline logging) 26-04-2024 till 08-05-2024 (perforating, well testing and MFC logging)	
Days Operational	15 days (including work performed on MON-GT-01)	
Operator	HVC Aardwarmte Polanen B.V.	
Surface coordinates	Rijksdriehoek X: 73.644,39 m Y: 449.975,59 m	ETRS89 52° 1' 59.204" N 4° 12' 6.356" E
Surface elevation (Ground level)	Ground level to NAP: +0,50m (GL is above NAP)	

1.3 Equipment & Contractors

Main Contractor

Well Services Group	:	Coiled tubing and nitrogen services
Equipment	:	2" Coiled Tubing

Other contractors

Expro	:	Perforation (TCP)
Boekestijn	:	Crane
Bakker Oilfield Solutions	:	Well test equipment
InWaTec	:	Wireline unit
ID Oiltools	:	Wireline logging tools

1.4 Objectives

Project objectives:

- Obtain Radial Bond Tool log of 9 5/8" casing.
- Perforate reservoir interval in one run using TCP guns.
- Perform well bore clean-up by N2 lift.
- Perform injection test.
- Take MFC base-line log.

1.5 Summary of operations

Three days before arrival of the Coil tubing unit the wireline work was executed. First a drift run was done using a 4.875" Teflon drift on slickline, HUD was tagged at 2548mBGL. Second run was done with the RBT tool, log was successfully taken from 2548m till 400m. Top of cement is found at 1252mBGL.

Rigged up CT unit and prepared Rotosweep jetting BHA. Washed down with 100-250LPM/70-215 bar at 10m/min. Clean returns at surface, filtered returns with 10micron. Reduced flowrate to 100LPM while performing pull tests to prevent damaged to GRE. Tagged HUD met 1mT at 2548mBGL. Washed out of hole with Rotosweep jetting BHA with 250LPM to surface.

Make up reverse circulating BHA and RIH to 800m. Removed 25m3 brine from well by injecting 2860m3 N2 into coil x casing annulus to create 50 bar underbalance. Lifted and suspended injector head on second tower. Removed top frame for running TCP guns. RIH TCP guns as per appendix 6.1. Reinstalled top frame, connected coil and injector head. RIH to 2540m spaced out with top shot at 2425,36mBGL. Activated guns by pressuring up to 171 bar, clear indication of guns firing. POOH with TCP guns to 475m (bull nose depth) / 400m pressure gauge depth and monitored well for 30 minutes. Gauge readings showed stable pressure of 36 bar at 400m which corresponds with a static fluid level at 60m below ground level based on 1,08 s.g. brine. POOH TCP guns to surface, suspended injector head on second tower and removed top frame for handling guns. Laid down and inspected guns, all guns fired. Moved coil tubing to MON-GT-01, meanwhile BOS rigged up well test equipment.

After perforating MON-GT-01 moved CT unit back to MON-GT-02. RIH 2” coil to 2414 while pumping N2 at 10Nm3/min, increased to 20Nm3/mni at 250m. Observed well fluid returns as from 550m depth. Well fluid cleaning up after 310m3 returns, flowrate approx. 180m3/hr. Stopped N2 injection after 475m3. POOH to surface at 20m/min. Total 606m3 produced. Rigged down and demobilized coil tubing unit while preparing for production and injection test.

Performed injection test as per program. Performed PLT log during injection test and made fall-down test with gauges from PLT toolstring at 2415m. POOH to surface and changed to multi finger caliper toolstring. RIH MFC toolstring to 2530m and logged up with 10m/min to surface. Rigged down wireline and closed 9” master valve.

2 Well data

2.1 Depth reference and total depth

Used depth reference	: Ground Level
Elevation: Ground level – NAP	: +0,50 m (ground level lays above NAP)
Well total depth	: 2583mMD / 2438mTVD

2.2 Deviation plots

See drilling EOWR.

2.3 Casing scheme

Table 1. Casing details

Item OD [in]	Top (m MD)	Bottom (m MD)	Weight	Grade	Connection
24" conductor	0	145	0,5" WT	S355	Welded
13 3/8" Casing	0	1251	68#	L80	VAM TOP
9 ⅝" GRE lined csg	0	2394	47/51,9 #	L80	VAM TOP
9 ⅝" Cr13 casing	2394	2554	47#	L8013Cr	VAM TOP
9 ⅝" L80 casing	2554	2578	47#	L80	VAM TOP

Table 2. Cement details

Item	TOC (m MD)	Lead Slurry Volume (m^3)	Lead Slurry Weight (s.g.)	Tail Slurry Volume (m^3)	Tail Slurry Weight (s.g.)	Type
13 3/8" Casing	Surface	89	1,35	16	1,75	HOZ Lite lead and HOZ tail
9 5/8" Casing	1252 (confirmed by RBT log)	44	1,35	8,8	1,84	HOZlite lead HMR+ tail

2.4 Cement bond log

The full Radial Bond Tool log can be found in appendix 6.4.
The cement job was successful without losses. Top of cement is found 1 meter below the 13 3/8" casing shoe.

Table 3. RBT log interpretation vs. formation and rock type

Formation	Rock type	Bond quality	Remarks
U Holand Marl	aquitard	Good	Top of cement: 1252mBGL.
M Holland Clay	seal rock	Good	
Holland Greensand	reservoir	Good	
L Holland Marl	aquitard	Good	
Lier Sand	reservoir	Good	
Vlieland Clay	seal rock	Good	
Berkel Clastics	reservoir	Good	
Rijswijk Sandstone	reservoir	Partial	
Rodenrijs Claystone	seal rock	Good	
Delft Sandstone	reservoir	Good	Tail slurry 1,84s.g. HMR+
Alblasserdam	reservoir	Good	Tail slurry 1,84s.g. HMR+

2.5 Well schematic – post job

Nr.	Item Description All depths from GROUND LEVEL RT = 9,3 m above GL	MON-GT-02 Injection well	Depth m tvd	Depth m ah	Hole ID in	Pipe OD in	Collar OD in (nom)	Pipe ID in	Pipe ID in (drift)	Geology m tvd	Geology m ah	
1	24" 0,5" WT Conductor	Static fluid level @60m 1,08 s.g. Brine	145	145	-	24,000	welded	23,000	23,000	0	0	North Sea Group
										663	663	Chalk Group
	Swell packers (1155,1 - 1166,4 m)											
2	13 3/8" 68# L80 VAMTOP Casing Top of cement		1233 1234	1251 1252	16,00	13,375	14,175	12,415	12,259	1195	1208	KN (Holland)
										1724	1796	KN (Vlieland)
3c	9 5/8" 47# L80 VAMTOP - GRE-lined (51.9#)		2260	2394	12,250	9,625	10,396	8,250	8,125	2231	2356	Schieland Group
			2294	2425	Top perforations					Top Delft 2294	2425	
			2352	2489	Bottom perforations					Base Delft 2352	2489	
3b	9 5/8" 47# L80 13%Cr VAMTOP		2411	2554	12,250	9,625	10,396	8,681	8,525	Alblasserdam		
3a	9 5/8" 47# L80 VAMTOP (2 jnt shoetrack)		2432	2578	12,250	9,625	10,396	8,681	8,525			
			2438	2583	TD							
	*Not in scale											

3 Drilling fluid summary

Not applicable. Well filed with 1.08s.g. brine.

4 Geology

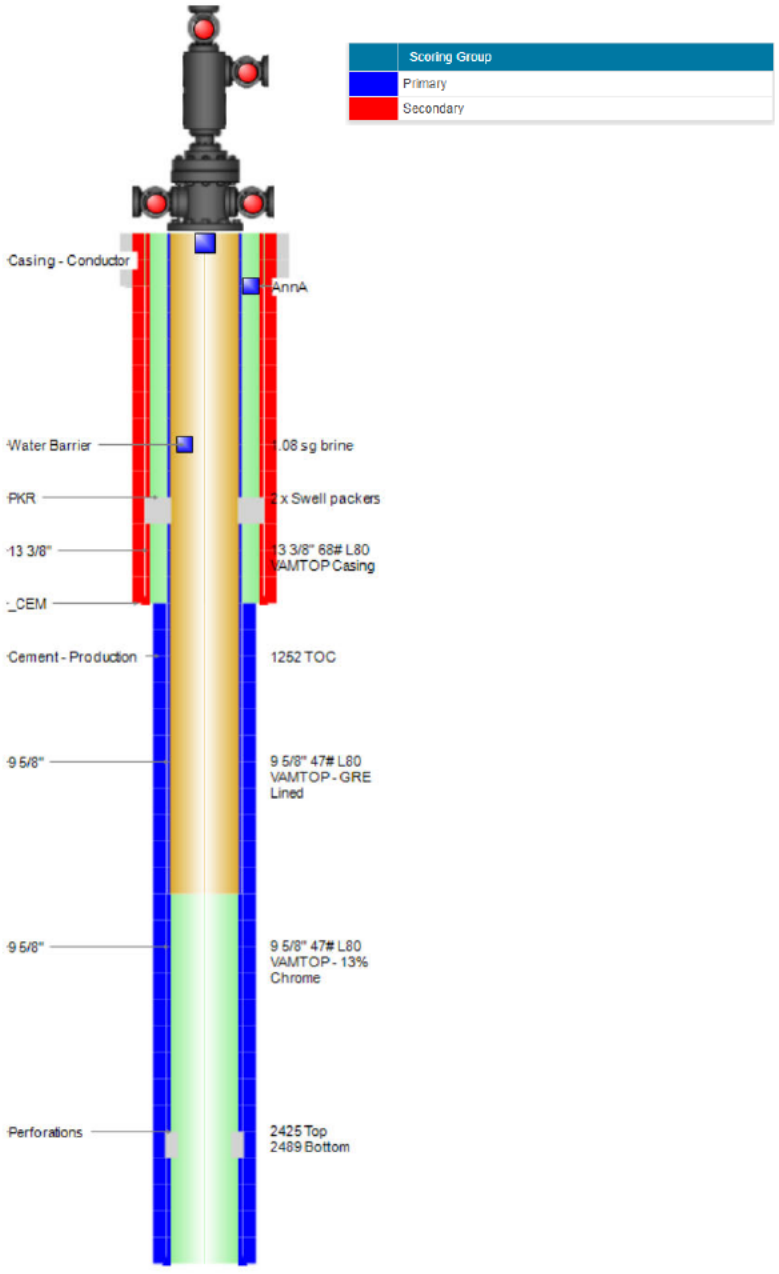
Not applicable – refer to drilling end of well report.

5 Well completion

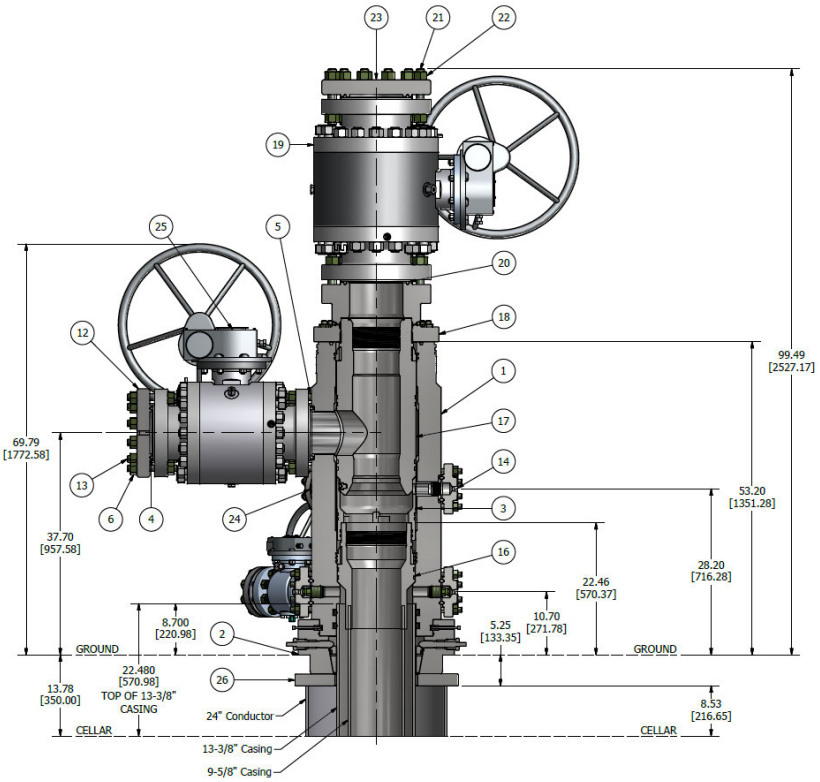
5.1 Well status

Well is suspended with 1.08 s.g. formation brine. Horizontal mastervalve (7 1/16" 3k ball valves with blind flange) and 2 1/16" 3k side outlet valves are installed. A 9" 3k ball valve is installed on top of the wellhead.

5.2 Well barrier schematic



5.3 Wellhead drawing



PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	05-101333-AS	13-3/8" Wellhead Housing
2	1	05-101322-AS	13-3/8" Slip Housing
3	1	05-101290-AS	Landing Sub
4	2	SK20352-45	R45 Type R Ring Gasket (PP)
5	12	SK20306-17	Tap End Stud 1-1/8"-8 UN x 5-7/8" Long
6	36	SK20004-11	Heavy Hex Nut 1-1/8"-8 UN
7	2	09-101311-PP	2-1/16", 3 KSI Ball Valve.
8	2	SK20352-24	R24 Type R Ring Gasket (PP)
9	2	05-100709-01-FM	2-1/16", 5K Blind Flange.
10	16	SK20304-03	All Threaded Stud Bolt 7/8"-9 UNC x 6-1/2" Long
11	51	SK20004-09	7/8 - 9 UNC HEAVY HEX NUT
12	1	05-101323-FM	7-1/16" 3K Blind Flange
13	12	SK20304-17	All Threaded Stud Bolt 1-1/8"-8 UN x 8-1/2" Long
14	5	SK20222-05	1/2" NPT LEVL Plug (PP)
15	2	SK20104	Autoclave Blow Down Plug
16	1	05-101289-AS	9-5/8" Casing Hanger
17	1	05-101291-AS	Injection Well Flow Spool
18	1	05-101174-AS	9" X-Over
19	1	09-101313-PP	9", 3 KSI Ball Valve.
20	2	SK20352-49	R49 Type R Ring Gasket (PP)
21	12	SK20304-20	All Threaded Stud Bolt 1-3/8"-8 UN x 9-1/2" Long
22	24	SK20004-15	1-3/8"-8 UN Heavy Hex Nut
23	1	05-101324-FM	9", 3K Blind Flange
24	2	SK20349	2.06", 3K Blind Flange for HXTS (FM)
25	1	09-101312-PP	7-1/16", 3 KSI Ball Valve.
26	1	05-101531-MA	24" x 13-5/8" Eccentric Base Plate

5.4 Completion schematic

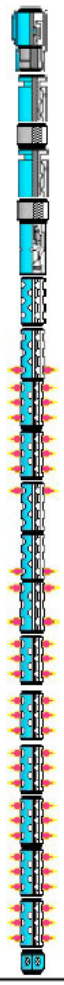
Not applicable.

6 Appendixes

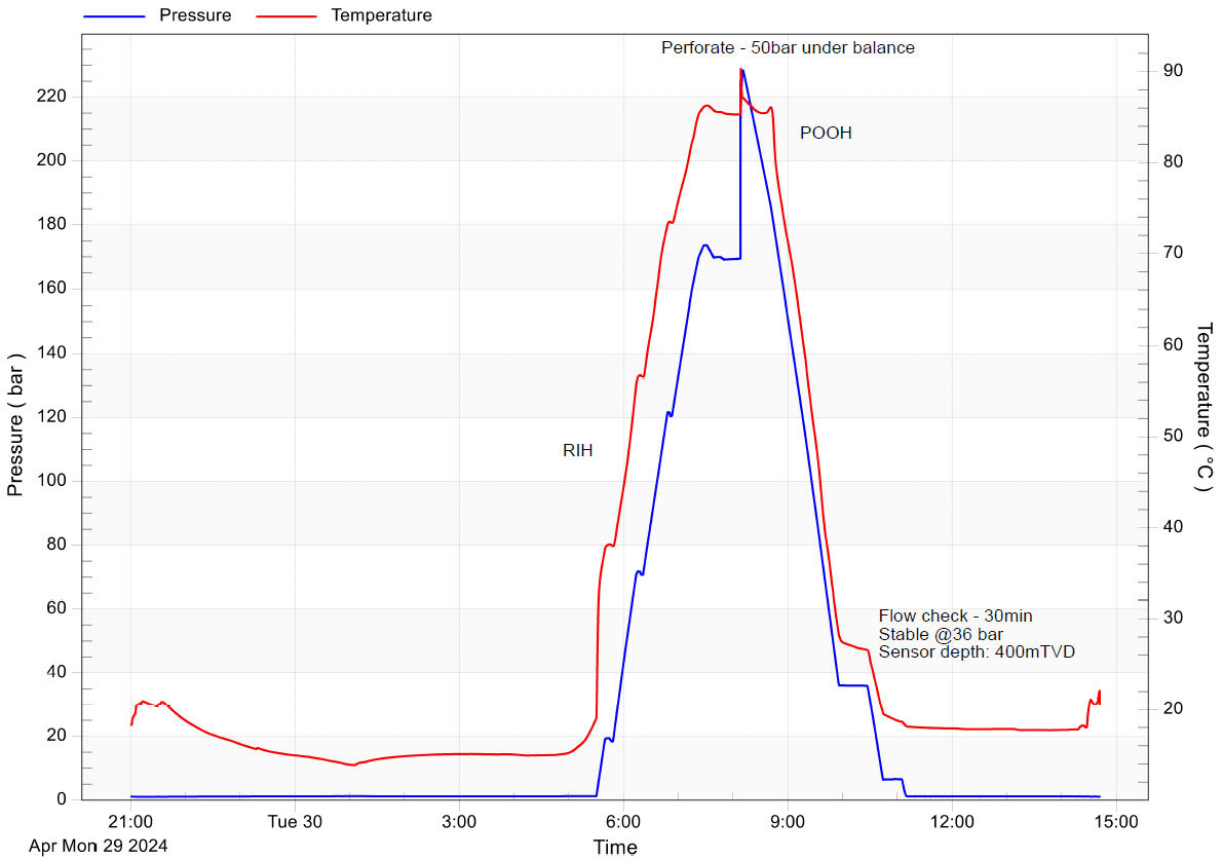
6.1 TCP toolstring

WELL SERVICES GROUP
AN EXCELLENCE LOGGING COMPANY

MON-GT-02

Layout	Item	Equipment Description	Supplier	OD (in.)	Length m
		GR to BTM of Gauge Carrier	WSG	2,650	0,90
		Bypass Gauge Carrier Press/Temp	WSG	2,650	0,91
		Cossover 1.5" AMT to 2 3/8 PAC	WSG	2,875	0,12
		CarSac	WSG	2,875	0,67
		Crossover 2 3/8PAC to 2 3/8 EUE	WSG	2,875	0,18
		Auto Vent Pressure Activated Firing Head	Expro	3,500	0,45
	13	4.5" Fully Blank TCP Gun P-B	Expro	4,500	5,63
	12	4.5" Partial Blank	Expro	4,500	3,48
		4.5" Partial Loaded 39SPM DP TCP Gun P-P			2,09
	11	4.5" Fully Loaded 39SPM DP TCP Gun P-P	Expro	4,500	5,57
	10	4.5" Fully Loaded 39SPM DP TCP Gun P-P	Expro	4,500	5,57
	9	4.5" Fully Loaded 39SPM DP TCP Gun P-P	Expro	4,500	2,57
		4.5" Partial Blank			3,00
	8	4.5" Partial Blank	Expro	4,500	0,40
		4.5" Fully Loaded 39SPM DP TCP Gun P-P			5,17
	7	4.5" Fully Loaded 39SPM DP TCP Gun P-P	Expro	4,500	1,43
		4.5" Partial Blank			2,50
		4.5" Fully Loaded 39SPM DP TCP Gun P-P			1,64
	6	4.5" Fully Loaded 39SPM DPEX TCP Gun P-B	Expro	4,500	5,63
	5	4.5" Fully Loaded 39SPM DPEX TCP Gun P-B	Expro	4,500	5,63
	4	4.5" Fully Loaded 39SPM DPEX TCP Gun P-B	Expro	4,500	5,63
	3	4.5" Fully Loaded 39SPM DPEX TCP Gun P-B	Expro	4,500	5,63
	2	4.5" Fully Loaded 39SPM DPEX TCP Gun P-B	Expro	4,500	5,63
	1	4.5" Fully Loaded 39SPM DP TCP Gun P-P	Expro	4,500	5,41
		TCP roller sub + Bull Nose		4,500	0,51

6.2 Pressure log perforating run



Fluid column above pressure gauge: 36bar / (1.08s.g. *0.0981) = 340m
Static water level: 400m – 340m = 60m

6.3 MFC log

See separate file

6.4 RBT log

See separate file