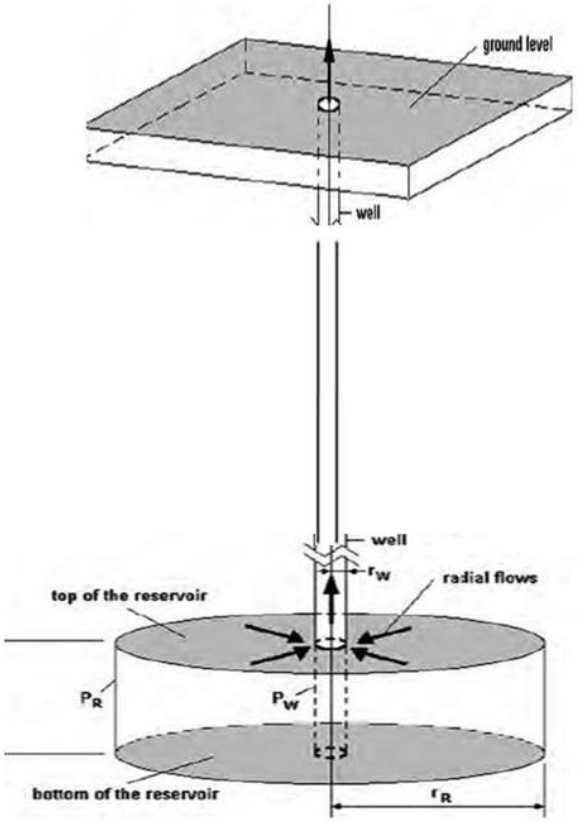
PROBLEM
PRESSURE TRANSIENT ANALYSIS

Class Assignments

- Simple Problems
- Complex Problems



Peoblem 1

The feed zone in a geothermal well is at a temperature of 262^{o}C and the reservoir fluid is boiling there. In a drawdown/buildup test of the well the mass flow rate was 26 kg/s before the well was closed and the discharge enthalpy was 1400 kJ/kg. The well was shut in when downhole pressure = 20 bar. A Horner plot of pressure buildup data gave. A semilog plot of 25 bar/cycle. Calculate kh (the permeability thickness product) for reservoir

Answer:

At P = 20 bar,

- h_l = 909 kJ/kg
- h_g = 2799 kJ/kg
- v_g = 0.09957 m^3/kg → ρ_g = 10.04 kg/m^3
- v_l = 0.1177*10^{-2} m^3/kg → ρ_l = 849.6 kg/m^3
- μ_g = 16.07*10^{-6}
- μ_l = 125.7*10^{-6}

$$v_l = \frac{\mu_l}{\rho_l} = \frac{125 * 10^{-6}}{849.6} = 0.14795 * 10^{-6}$$

$$v_v = \frac{\mu_v}{\rho_v} = \frac{16.7 * 10^{-6}}{10.04} = 1.6633 * 10^{-6}$$

$$\frac{k_{rl}}{k_{rg}} = \frac{0.14795 * 10^{-6}}{1.6633 * 10^{-6}} \frac{(2799 - 1400)}{(1400 - 909)} = 0.2534$$

- $k_{rl} + k_{rg} = 1$
- $0.2534\ k_{rg} + k_{rg} = 1 \rightarrow k_{rg} = 0.7978$, dan $k_{rl} = 1 - 0.7978 = 0.2022$

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$0.2534\ k_{rg} + k_{rg} = 1 \rightarrow k_{rg} = 0.7978$, dan $k_{rl} = 1 - 0.7978 = 0.2022$

$$\frac{1}{v_t} = \frac{k_{rl}}{v_l} + \frac{k_{rg}}{v_g} = \frac{0.2022}{0.14795 * 10^{-6}} + \frac{0.7978}{1.6633 * 10^{-6}} = 1846326.8$$

$$kh = \frac{2.3 * Q_m}{4\pi m\left(\frac{1}{v_t}\right)} = \frac{2.3 * 26}{4\pi * 25 * 10^5 * 1846326.8} = 1.03096 * 10^{-12} = 1.03 \text{ Darcy m}$$

Problem 2:

- In a drawdown/buildup test of geothermal well the mass flow rate was 26 kg/sec before the well was closed. The flowing enthalpy was 1433 kJ/kg and the reservoir temperature 262^{o}C. The well was shut in when the downhole pressure was 22 bar. A Horner plot of pressure buildup data gave. A semilog plot of 24 bar/cycle. Calculate kh (the permeability thickness product) for reservoir.

- **Answer:**

$$kh = \frac{2.3 * Q_m}{4\pi m\left(\frac{1}{v_t}\right)}$$

$$\frac{1}{v_t} = \frac{k_{rl}}{v_l} + \frac{k_{rg}}{v_g} \qquad \frac{k_{rl}}{k_{rg}} = \frac{v_l}{v_v}\frac{(h_v - h_f)}{(h_f - h_l)}$$

At P = 22 bar and T = 217.2^{o}C

h_l = 931 kJ/kg

- h_g = 2801 kJ/kg
- v_g = 0.09069 m^3/kg → ρ_g = 11.03 kg/m^3
- v_l = 0.100228*10^{-2} m^3/kg → ρ_l = 997.7 kg/m^3
- μ_v = 16.2*10^{-6}
- μ_l = 122.7*10^{-6}

$$v_l = \frac{\mu_l}{\rho_l} = \frac{122.7 * 10^{-6}}{997.7} = 0.123 * 10^{-6}$$

$$v_v = \frac{\mu_v}{\rho_v} = \frac{16.2 * 10^{-6}}{11.03} = 1.469 * 10^{-6}$$

$$\frac{k_{rl}}{k_{rv}} = \frac{0.123 * 10^{-6}}{1.469 * 10^{-6}} \frac{(2801 - 1433)}{(1433 - 931)} = 0.2282$$

- $k_{rl} + k_{rv} = 1$
- $0.2282\ k_{rv} + k_{rv} = 1 \rightarrow k_{rv} = 0.8142$, dan $k_{rl} = 1 - 0.8142 = 0.1858$

$$\frac{1}{v_t} = \frac{k_{rl}}{v_l} + \frac{k_{rv}}{v_v} = \frac{0.1858}{0.123 * 10^{-6}} + \frac{0.8142}{1.469 * 10^{-6}} = 2064823.7$$

$$kh = \frac{2.3 * Q_m}{4\pi m\left(\frac{1}{v_t}\right)} = \frac{2.3 * 26}{4\pi * 24 * 10^5 * 2064823.7} = 0.9603 * 10^{-12} m^3 \approx 1\ \text{Darcy m}$$

Problem 3:

A well has discharge enthalpy of 1200 kJ/kg when a constant rate test of 37.5 kg/s was carried out. A semilog plot of pressure drop gave a slope of 1 MPa/cycle. The feedpoint is from a 2-phase zone at 264 deg C. Calculate kh for the reservoir. The total pressure drop during the test was 3.2 MPa with the straight line portion of the curve occurring between pressure drops of 2.2 and 3.2 MPa.

Problem 4:

A geothermal well was discharged for 40 days at an average rate of 50 t/hr. The discharge enthalpy averaged 1350 kJ/kg. When the well was shut in, the build-up test produced a slope of 0.6 MPa/log cycle. The major feed for the well is probably at 800m where a stable downhole temperature of 266^{o}C and a reservoir pressure of 6.5 MPa were recorded before the test. The minimum downhole pressure recorded at shut-in was 2.8 MPa.

- Calculate kh, the permeability-thickness product, for the reservoir.

Problem 5

The following data were obtained from a pressure drawdown test performed on a certain geothermal reservoir. Use a semi-log plot to calculate kh for the reservoir.

Well data:

- Mass flow = 25 kg/s
- Enthalpy = 1310 kJ/kg
- Test type = drawdown
- Instrument depth = 1700 m

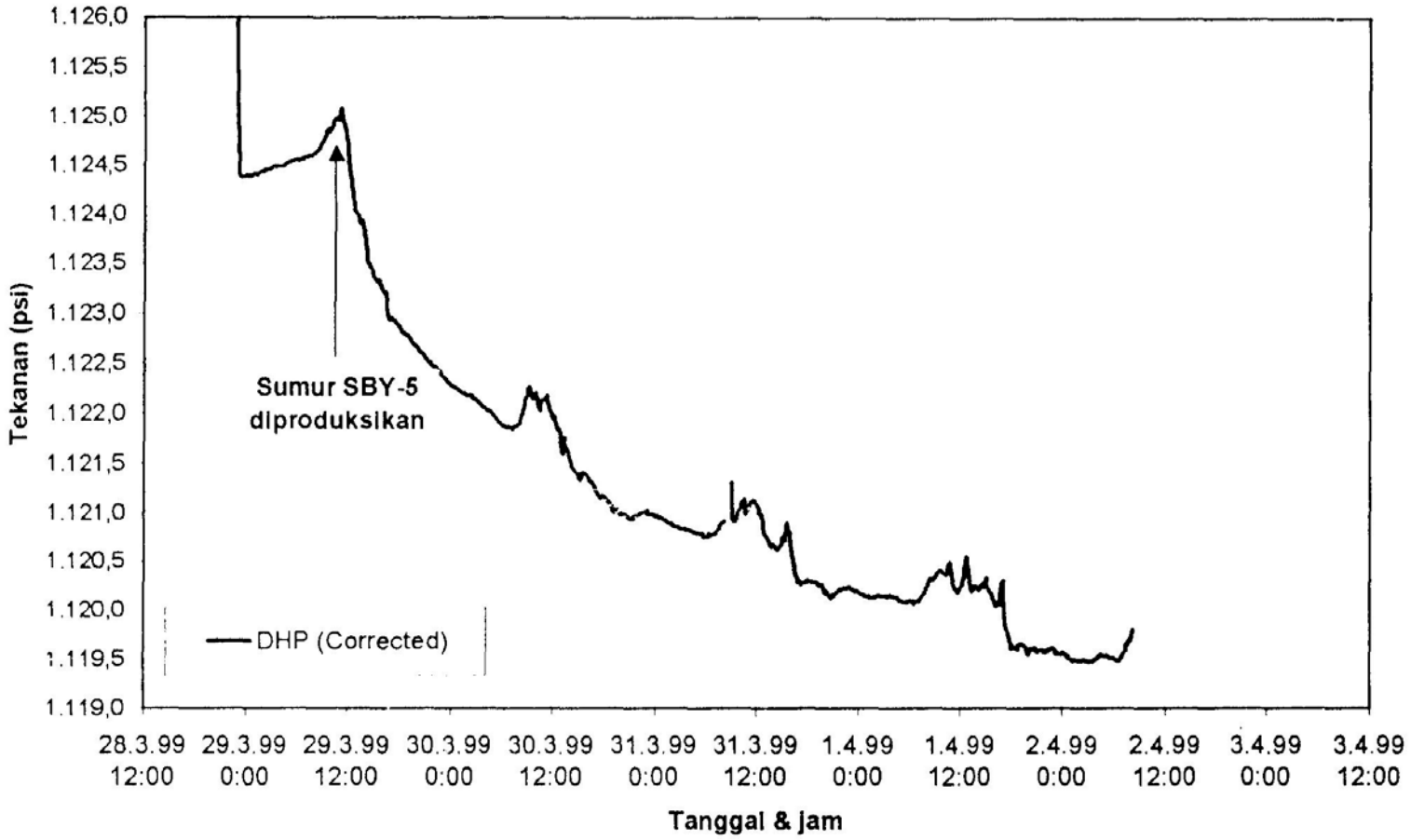
Time (mins)	Pressure (MPag)
0	10.78
1	10.30
2	9.80
3	9.67
4	9.59
5	9.54
6	9.48
7	9.44
8	9.36
9	9.28
10	9.2
12	9.09
14	8399
16	9.91
18	8.85
20	8.79
22	8.75
24	8.7
26	8.66
28	8.62
30	8.58

Time (mins)	**Pressure (MPag)**
35	8.50
40	8.42
45	8.37
50	8.32
55	8.27
60	8.25
62	8.23
72	8.17
82	8.11
92	8.07
102	8.03
112	8.00
121	7.97
132	7.97
152	7.85
181	7.78
182	7.76
212	7.71
241	7.66
242	7.66
272	7.62
289	7.60

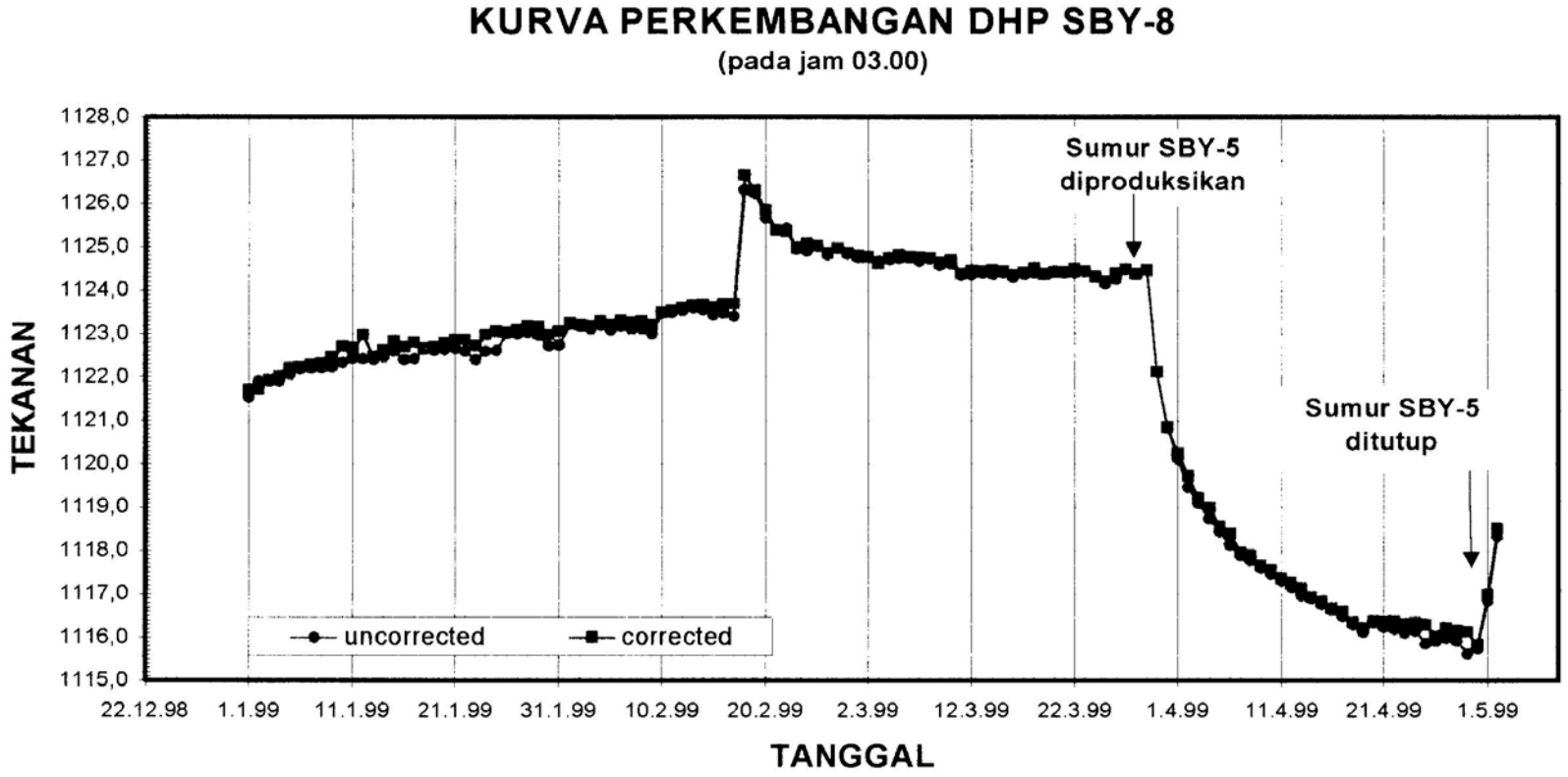
INTERFERENCE TEST

- Respons tekanan disumur pengamatan (SBY-8) diamati pada tiga perioda, yaitu:
  1. Respons tekanan sebelum sumur SBY-5 diproduksikan. Hal ini dilaksanakan selama 3 bulan.
  2. Respons tekanan saat interference test berlangsung (waktu sumur SBY-5 diproduksikan). Test dilaksanakan selama 1 bulan
  3. Respons tekanan setelah sumur SBY-5 ditutup). Setelah sumur ditutup, tekanan diamati selama 1 bulan

Respon tekanan di sumur SBY-8
beberapa hari setelah sumur SBY-5 diproduksikan



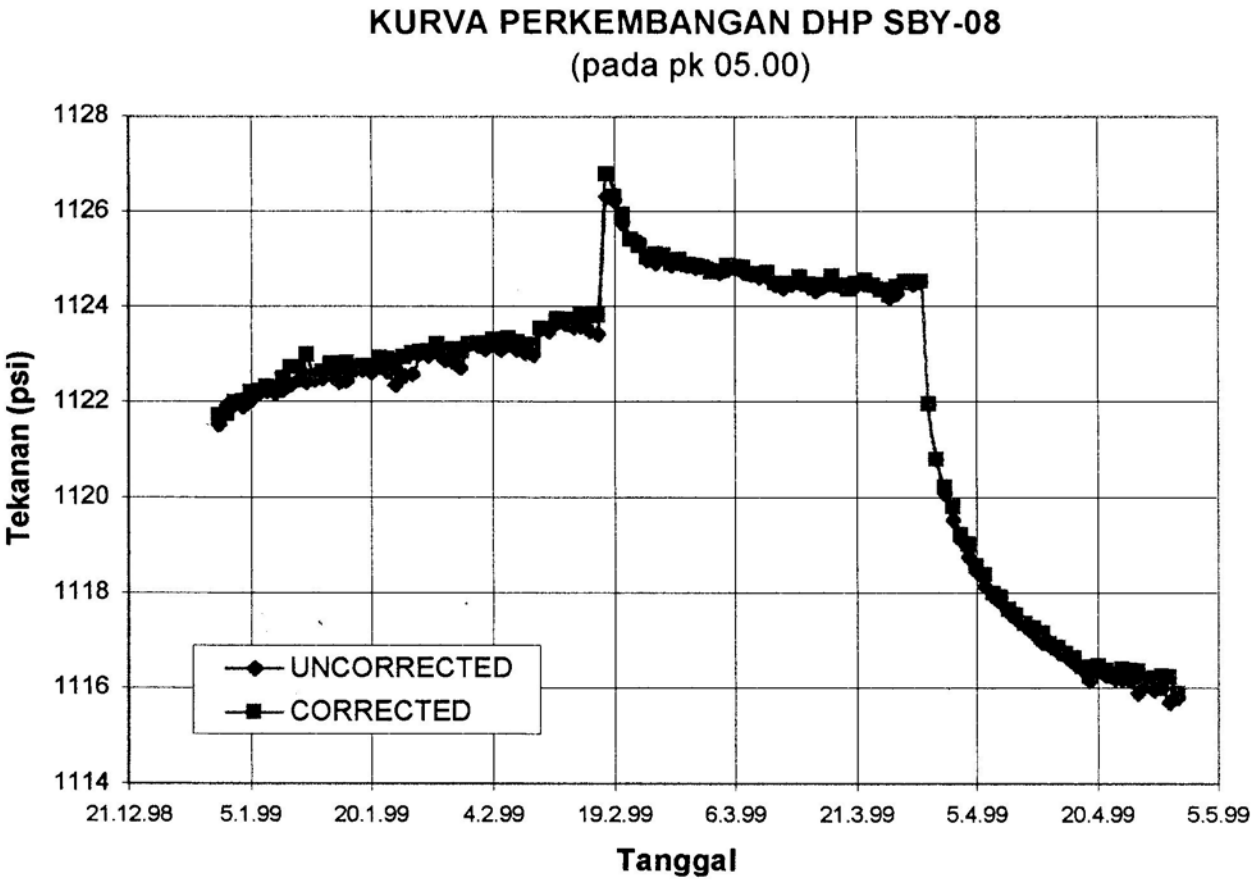
Gambar 3.10



Gambar 3.12

Kurva Perkembangan Tekanan di Sumur SBY-8

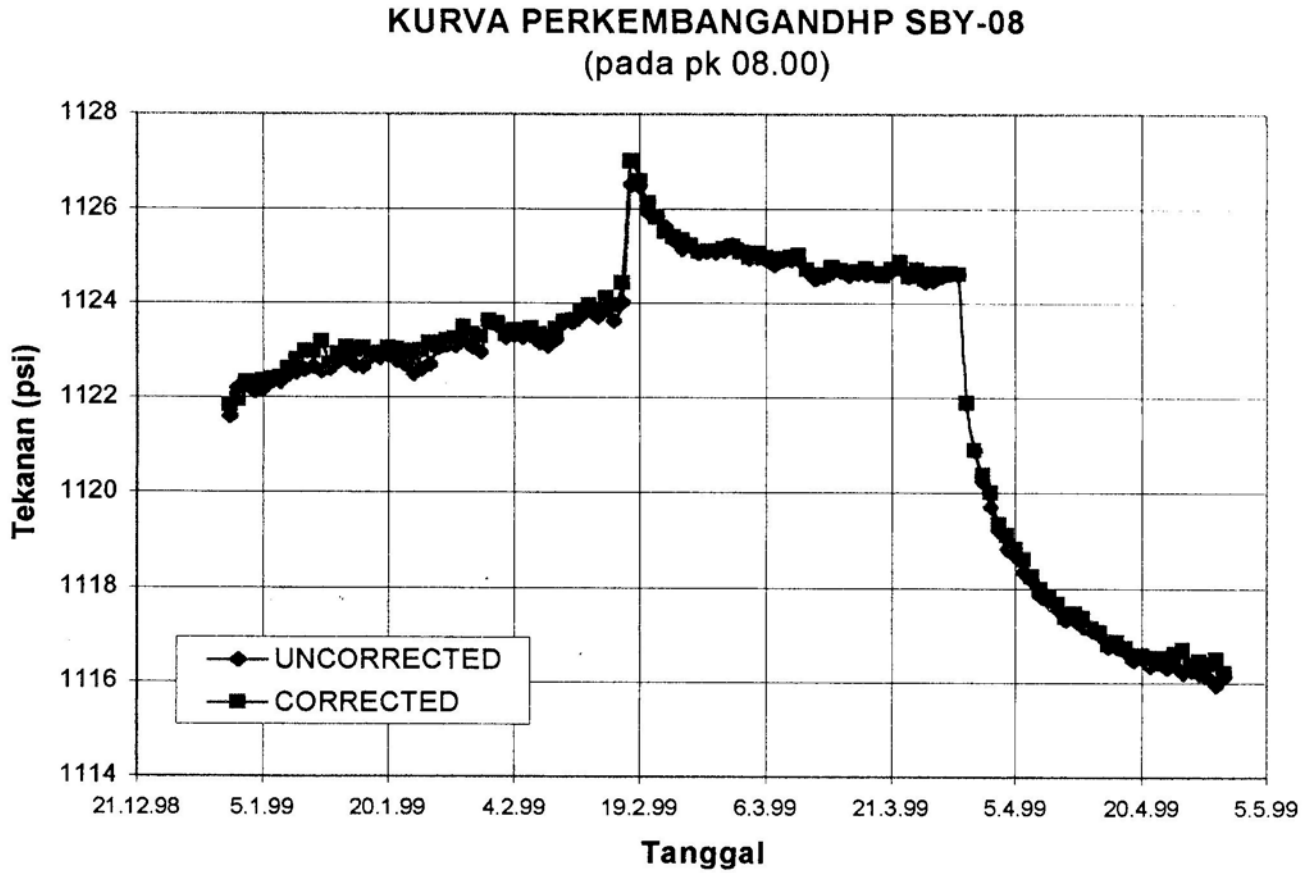
Berdasarkan Hasil Pengukuran Pukul 03.00



Gambar 3.13

Kurva Perkembangan Tekanan di Sumur SBY-8

Berdasarkan Hasil Pengukuran Pukul 05.00



Gambar 3.14

Kurva Perkembangan Tekanan di Sumur SBY-8

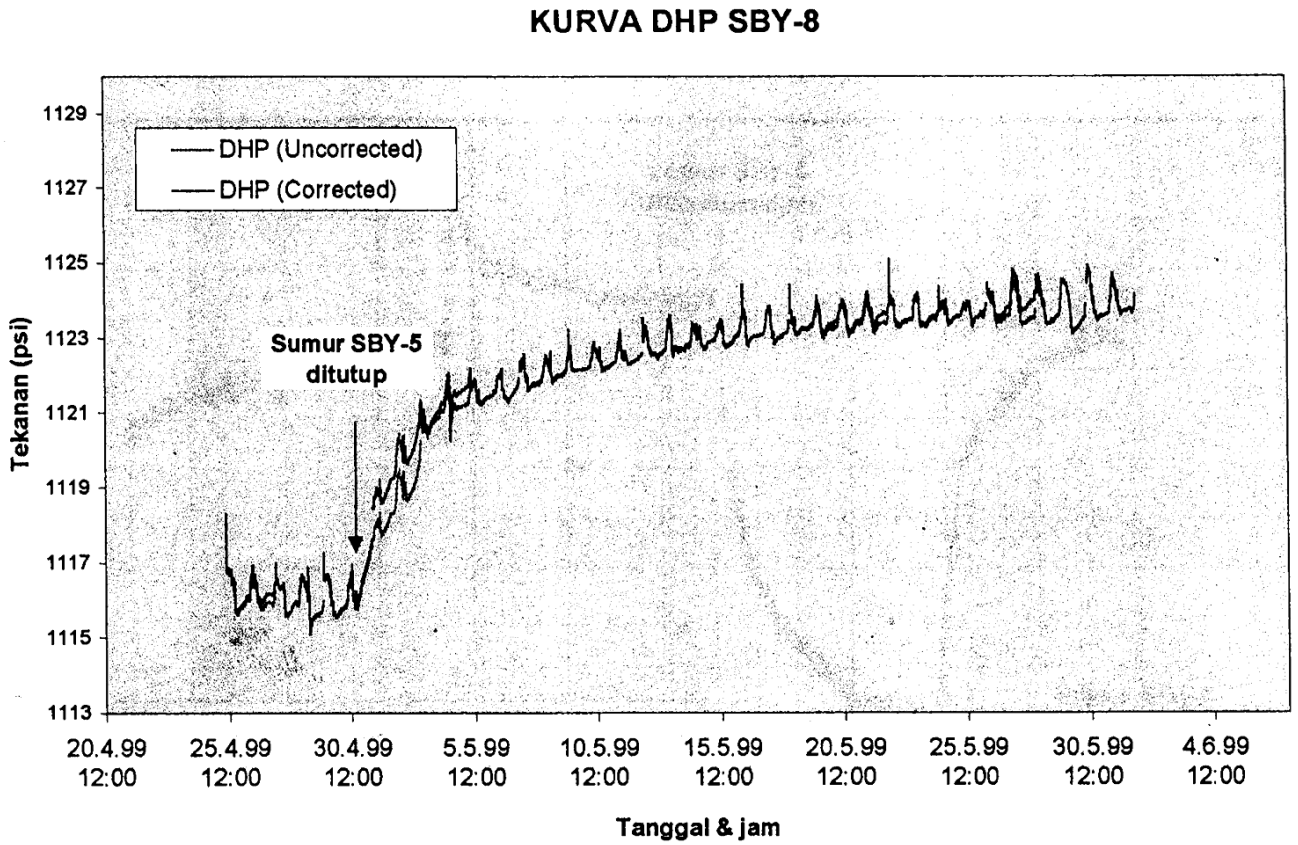
Berdasarkan Hasil Pengukuran Pukul 08.00

Data Produksi Sumur SBY-5

Tgl.	Elapse Time (day)	Koleksi data pada jam 08:00														Produksi rata-rata untuk 24 jam (Ton)					
		Sumur SBY-5											Injeksi (T/jam)							Injeksi	Voidage
		TKS (Kscg)	Psep (Kscg)	dPu (Kscg)	dPa (Kscg)	Pu (Kscg)	Pa (Kscg)	Production (T/jam)					SBY-10			Produksi (Ton/hari)				SBY-10	
								Uap	Air	Total	H	T-out	TKS	T-in	Rate	Uap	Air	Total	Dryness		
29.3.99	0	15,3	10,5	0,34	0,44	8,50	8,80	35	177	212	1087	182	5,8	158	177	728	3388	4115	0,17	2824	1292
30.3.99	1	15,3	11,6	0,36	0,44	8,50	9,10	36	177	213	1099	186	6,0	159	177	866	4255	5121	0,17	4255	866
31.3.99	2	15,8	11,2	0,31	0,38	9,30	10,50	35	164	199	1133	185	6,5	162	164	839	3944	4782	0,18	3780	1003
1.4.99	3	15,8	10,4	0,37	0,38	9,30	9,40	38	165	203	1142	181	5,6	156	165	914	3949	4863	0,19	3949	914
2.4.99	4	15,5	10,5	0,35	0,41	9,40	9,40	37	172	209	1122	182	5,6	156	172	894	4124	5018	0,18	4124	894
3.4.99	5	15,5	10,5	0,34	0,39	9,40	9,40	37	168	204	1125	182	5,9	158	168	882	4025	4906	0,18	4025	882
4.4.99	6	15,5	10,5	0,34	0,39	9,40	9,40	37	168	204	1125	182	5,9	158	168	882	4025	4906	0,18	4025	882
5.4.99	7	15,6	10,6	0,34	0,37	9,50	9,55	37	163	200	1137	182	5,6	156	163	886	3914	4800	0,18	3914	886
6.4.99	8	15,8	10,6	0,34	0,36	9,39	9,92	37	160	197	1147	182	5,8	158	160	881	3844	4725	0,19	3844	881
7.4.99	9	15,8	10,6	0,34	0,36	9,28	10,02	37	160	197	1147	182	5,6	156	160	876	3844	4720	0,19	3844	876
8.4.99	10	15,8	10,6	0,34	0,36	9,28	10,02	37	160	197	1147	182	5,6	156	160	876	3844	4720	0,19	3844	876
9.4.99	11	15,6	10,6	0,34	0,36	9,49	9,92	37	160	197	1148	182	5,8	158	160	885	3844	4729	0,19	3844	885
10.4.99	12	15,6	10,6	0,34	0,36	9,49	10,02	37	160	197	1150	182	5,8	158	160	885	3844	4729	0,19	3844	885
11.4.99	13	15,6	10,6	0,34	0,36	9,49	10,02	37	160	197	1150	182	5,8	158	160	885	3844	4729	0,19	3844	885

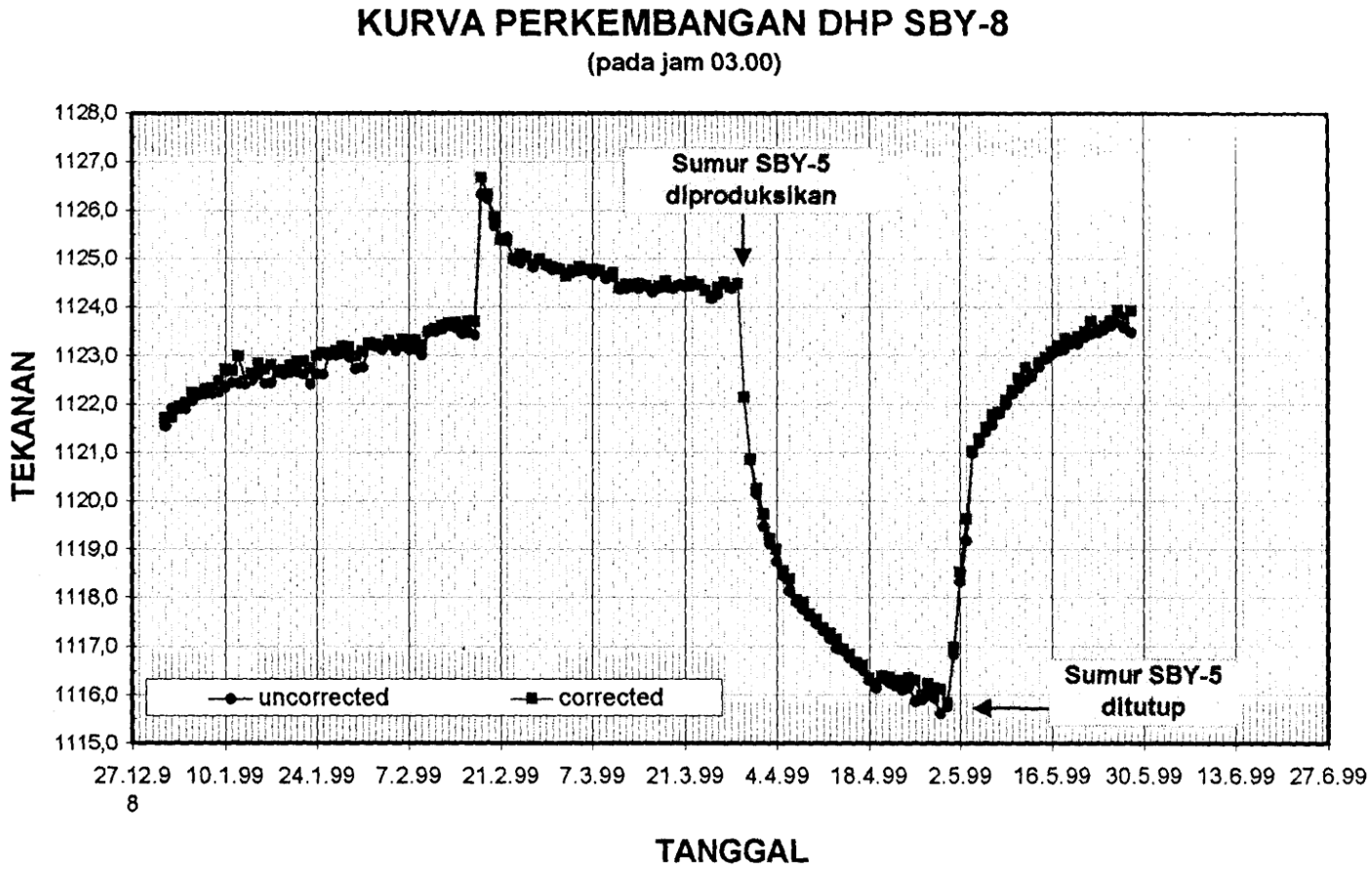
Tabel 3.2
Data Produksi Sumur SBY-5
(lanjutan)

	Elapse	Koleksi data pada jam 08:00														Produksi rata-rata untuk 24 jam (Ton)					
		Sumur SBY-5											Injeksi (T/jam)								
	Time	TKS	Psep	dPu	dPa	Pu	Pa	Production (T/jam)					SBY-10			Produksi (Ton/hari)				Injeksi	Voidage
Tgl.	(day)	(Kscg)	(Kscg)	(Kscg)	(Kscg)	(Kscg)	(Kscg)	Uap	Air	Total	H	T-out	TKS	T-In	Rate	Uap	Air	Total	Dryness	SBY-10	
12.4.99	14	15,6	10,6	0,34	0,36	9,49	10,02	37	160	197	1150	182	5,8	158	160	885	3844	4729	0,19	3844	885
13.4.99	15	15,6	10,6	0,34	0,36	9,49	10,02	37	160	197	1150	182	5,8	158	160	885	3844	4729	0,19	3844	885
14.4.99	16	15,6	10,6	0,34	0,36	9,49	10,02	37	160	197	1150	182	5,8	158	160	885	3844	4729	0,19	3844	885
15.4.99	17	15,3	10,8	0,34	0,36	9,49	10,13	37	159	196	1151	183	5,9	158	159	879	3817	4696	0,19	3817	879
16.4.99	18	15,3	10,8	0,34	0,36	9,49	10,13	37	159	196	1151	183	5,9	158	159	879	3817	4696	0,19	3817	879
17.4.99	19	15,3	10,8	0,35	0,35	7,60	10,13	34	158	192	1129	183	5,8	157	158	813	3789	4602	0,18	3789	813
18.4.99	20	15,3	10,8	0,35	0,35	7,60	10,13	34	158	192	1129	183	5,8	157	158	813	3789	4602	0,18	3789	813
19.4.99	21	15,3	10,8	0,35	0,35	7,60	10,13	34	158	192	1129	183	5,8	157	158	813	3789	4602	0,18	3789	813
20.4.99	22	15,3	10,8	0,35	0,35	9,60	10,23	38	158	196	1163	183	5,9	158	158	902	3790	4692	0,19	3790	902
21.4.99	23	16,4	10,8	0,34	0,35	9,60	10,34	37	158	195	1160	183	5,9	158	158	890	3789	4679	0,19	3789	890
22.4.99	24	15,3	10,7	0,33	0,36	9,71	10,23	37	159	196	1154	183	5,9	158	159	881	3816	4698	0,19	3816	881
23.4.99	25	15,3	10,7	0,33	0,36	9,71	10,23	37	159	196	1154	183	5,9	158	159	881	3816	4698	0,19	3816	881
24.4.99	26	15,3	10,7	0,33	0,36	9,71	10,23	37	159	196	1154	183	5,9	158	159	881	3816	4698	0,19	3816	881
25.4.99	27	15,3	10,7	0,33	0,36	9,71	10,23	37	159	196	1154	183	5,9	158	159	881	3816	4698	0,19	3816	881
26.4.99	28	15,3	10,7	0,33	0,36	9,71	10,23	37	159	196	1154	183	5,9	158	159	881	3816	4698	0,19	3816	881

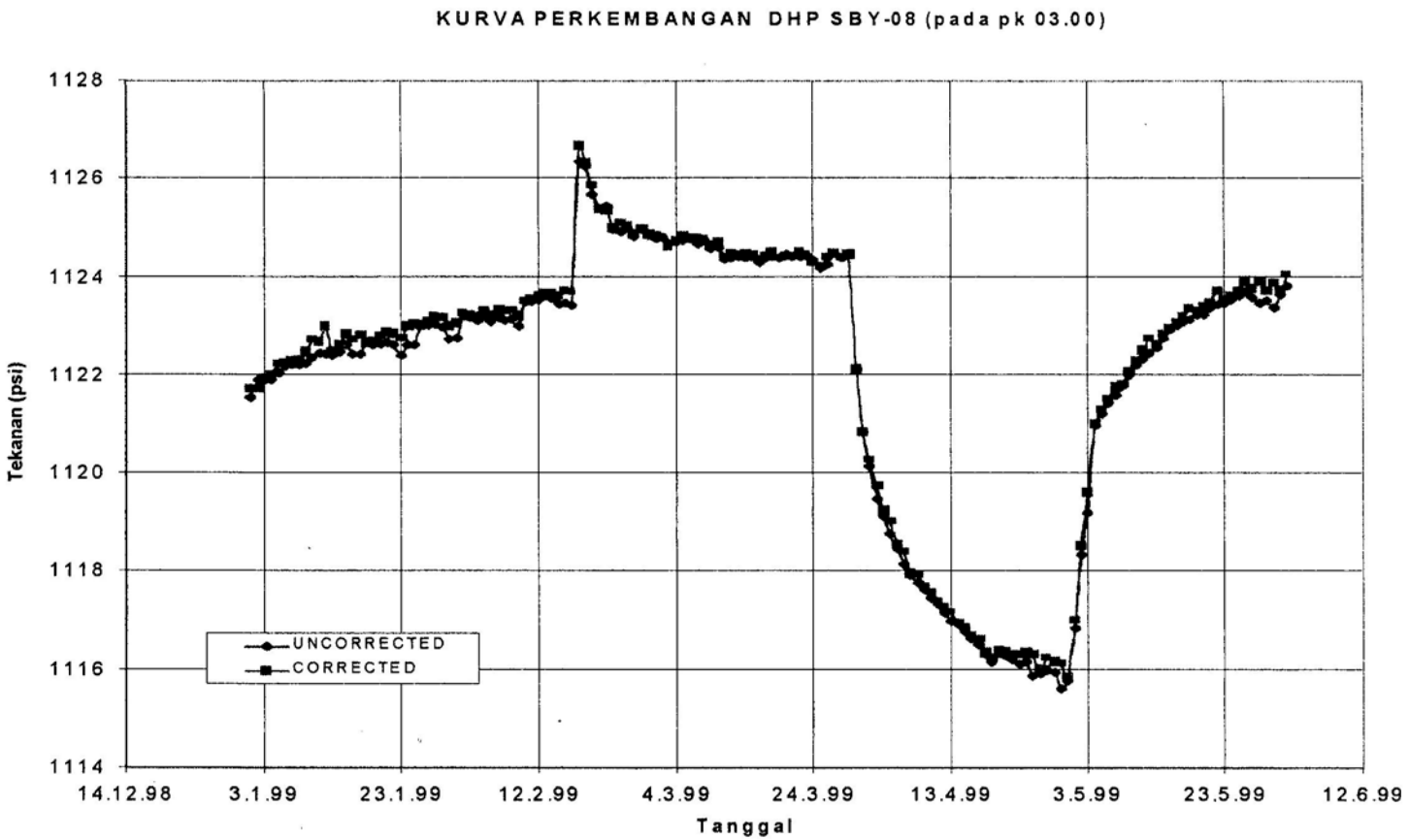


Gambar 3.15

Respons Tekanan di Sumur SBY-8 Setelah Sumur SBY-5 Ditutup



Gambar 3.16 Respons Tekanan di Sumur SBY-8 dari Tanggal 29 Desember 1998 s/d 30 Mei 1999
(Data Pukul 03.00)



Gambar 3.17 Respons Tekanan di Sumur SBY-8 dari Tanggal 29 Desember 1998 s/d 30 Mei 1999
(Data Pukul 08.00)

Tabel 4.1

Data Tekanan dan Waktu Dari Interference Test

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
1.1.99	3:00	1121,547	1121,71	0	0,000	0
2.1.99	3:00	1121,915	1121,73	24	0,011	0,08
3.1.99	3:00	1121,903	1121,95	48	0,231	1,59
4.1.99	3:00	1121,918	1122,02	72	0,304	2,10
5.1.99	3:00	1122,065	1122,22	96	0,508	3,50
6.1.99	3:00	1122,195	1122,23	120	0,519	3,58
7.1.99	3:00	1122,210	1122,30	144	0,585	4,03
8.1.99	3:00	1122,221	1122,32	168	0,607	4,19
9.1.99	3:00	1122,244	1122,48	192	0,762	5,26
10.1.99	3:00	1122,352	1122,72	216	1,002	6,91
11.1.99	3:00	1122,449	1122,69	240	0,977	6,74
12.1.99	3:00	1122,438	1122,99	264	1,279	8,82
13.1.99	3:00	1122,420	1122,48	288	0,765	5,28
14.1.99	3:00	1122,492	1122,63	312	0,914	6,30
15.1.99	3:00	1122,621	1122,84	336	1,121	7,73

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
15.1.99	3:00	1122,621	1122,84	336	1,121	7,73
16.1.99	3:00	1122,422	1122,71	360	0,999	6,89
17.1.99	3:00	1122,444	1122,81	384	1,099	7,58
18.1.99	3:00	1122,660	1122,68	408	0,961	6,63
19.1.99	3:00	1122,627	1122,70	432	0,988	6,81
20.1.99	3:00	1122,654	1122,79	456	1,075	7,41
21.1.99	3:00	1122,680	1122,88	480	1,162	8,01
22.1.99	3:00	1122,614	1122,87	504	1,156	7,97
23.1.99	3:00	1122,420	1122,74	528	1,022	7,05
24.1.99	3:00	1122,618	1122,99	552	1,280	8,83
25.1.99	3:00	1122,623	1123,06	576	1,345	9,28
26.1.99	3:00	1123,020	1123,04	600	1,321	9,11
27.1.99	3:00	1123,014	1123,09	624	1,375	9,48
28.1.99	3:00	1123,048	1123,18	648	1,470	10,14
29.1.99	3:00	1122,976	1123,17	672	1,458	10,06
30.1.99	3:00	1122,734	1122,99	696	1,276	8,80
31.1.99	3:00	1122,757	1123,07	720	1,359	9,37

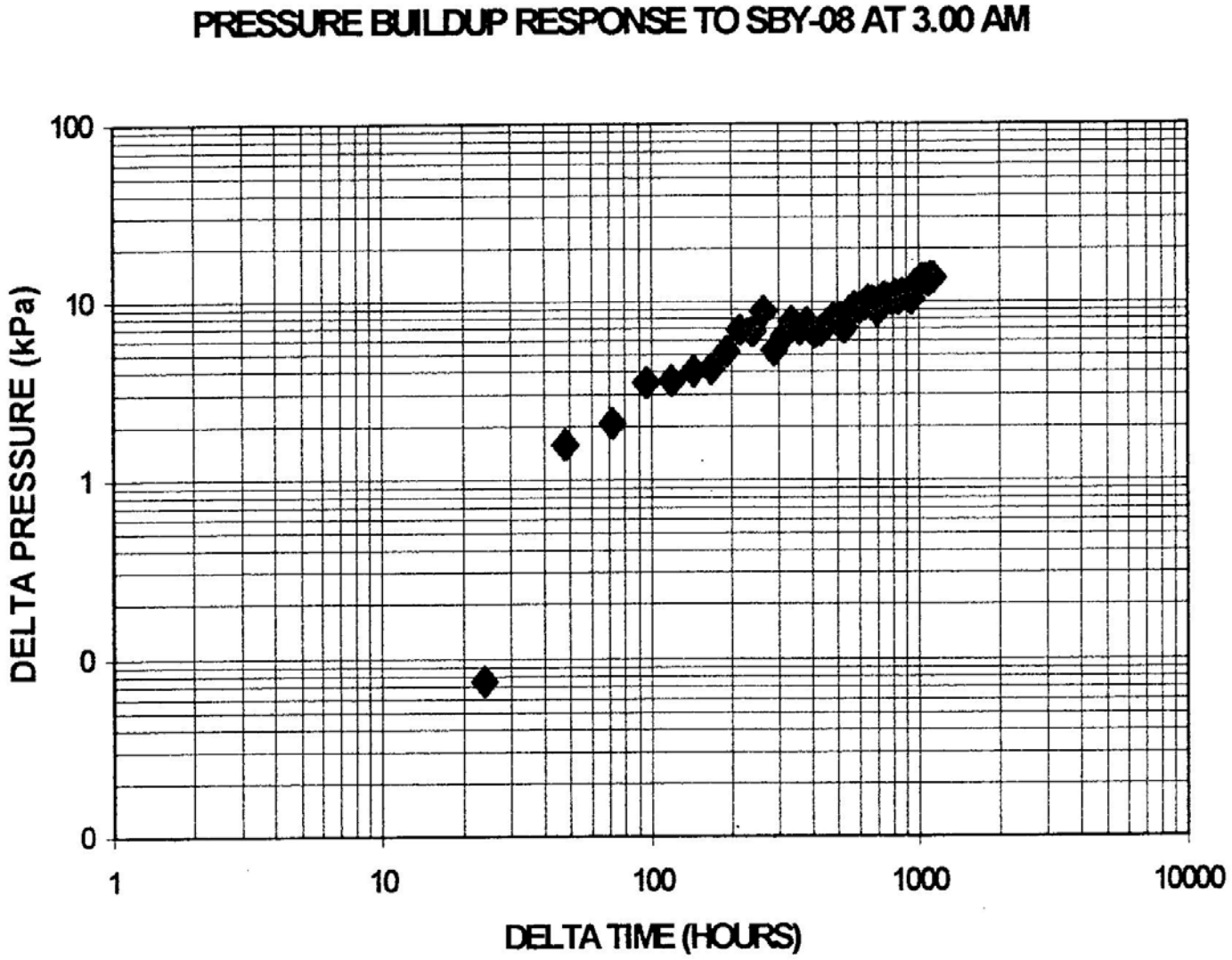
Tabel 4.1

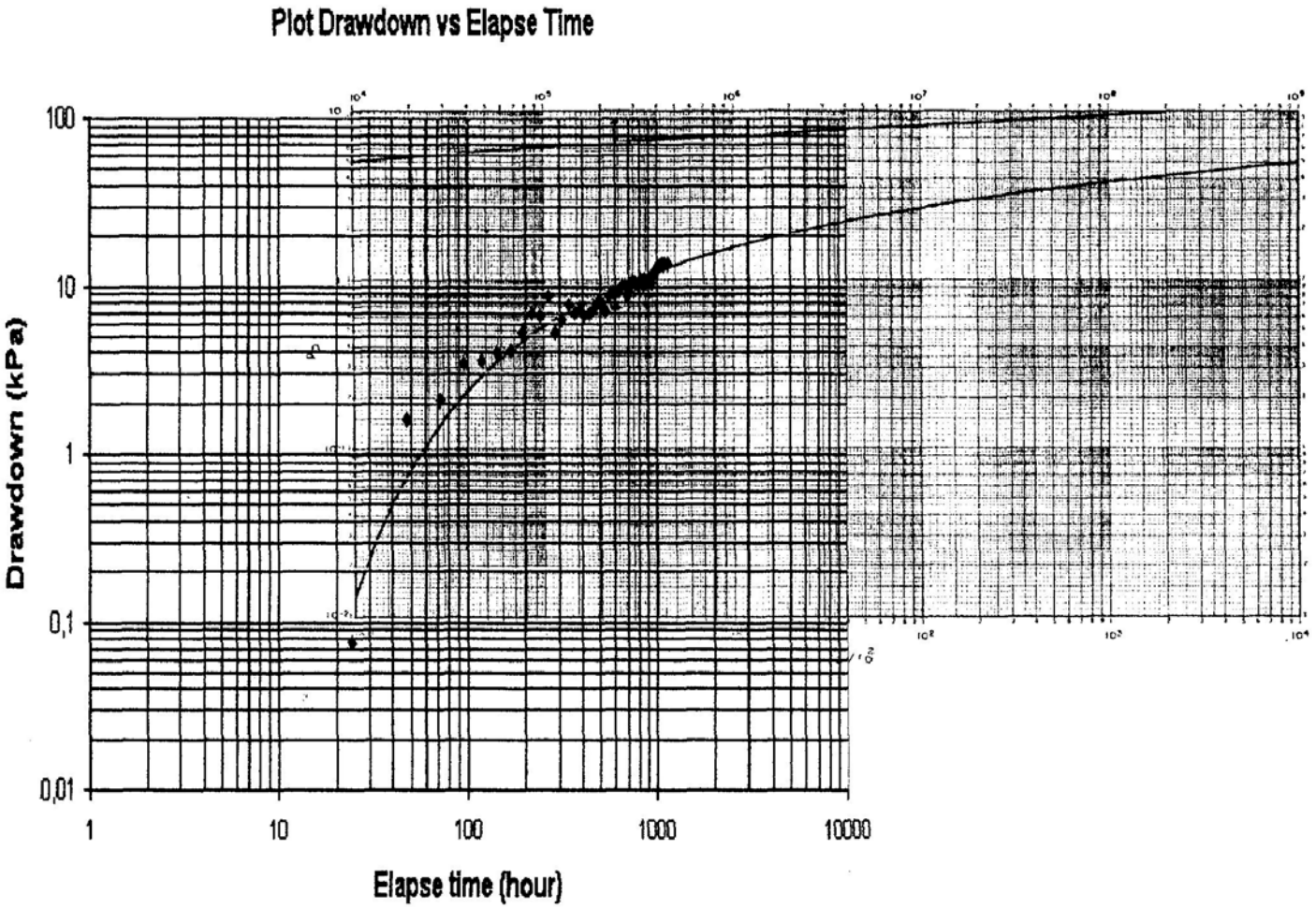
Data Tekanan dan Waktu Dari Interference Test

(lanjutan)

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
1.2.99	3:00	1123,247	1123,25	744	1,539	10,61
2.2.99	3:00	1123,187	1123,22	768	1,503	10,37
3.2.99	3:00	1123,127	1123,18	792	1,467	10,12
4.2.99	3:00	1123,226	1123,30	816	1,590	10,97
5.2.99	3:00	1123,103	1123,21	840	1,491	10,28
6.2.99	3:00	1123,197	1123,32	864	1,608	11,09
7.2.99	3:00	1123,130	1123,28	888	1,565	10,79
8.2.99	3:00	1123,133	1123,31	912	1,592	10,98
9.2.99	3:00	1123,011	1123,21	936	1,494	10,30
10.2.99	3:00	1123,490	1123,50	960	1,783	12,30
11.2.99	3:00	1123,505	1123,54	984	1,827	12,60
12.2.99	3:00	1123,541	1123,61	1008	1,893	13,06

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
13.2.99	3:00	1123,613	1123,66	1032	1,945	13,41
14.2.99	3:00	1123,571	1123,68	1056	1,961	13,52
15.2.99	3:00	1123,457	1123,62	1080	1,904	13,13
16.2.99	3:00	1123,483	1123,70	1104	1,987	13,70
17.2.99	3:00	1123,422	1123,70	1128	1,984	13,68
18.2.99	3:00	1126,334	1126,67	1176	4,953	34,16
19.2.99	3:00	1126,247	1126,32	1200	4,605	31,76
20.2.99	3:00	1125,676	1125,85	1224	4,131	28,49
21.2.99	3:00	1125,403	1125,39	1248	3,673	25,33
22.2.99	3:00	1125,446	1125,37	1272	3,651	25,18
23.2.99	3:00	1124,961	1124,99	1296	3,280	22,62
24.2.99	3:00	1124,916	1125,09	1320	3,373	23,26
25.2.99	3:00	1125,025	1125,03	1344	3,317	22,88
26.2.99	3:00	1124,831	1124,86	1368	3,149	21,72
27.2.99	3:00	1124,972	1124,98	1392	3,263	22,50
28.2.99	3:00	1124,846	1124,87	1416	3,156	21,77


PRESSURE BUILDUP RESPONSE TO SBY-08 AT 3.00 AM
DELTA PRESSURE (kPa)
100
10
1
0
0
1
10
100
1000
10000
DELTA TIME (HOURS)



Gambar 4.2 Type Curve Matching

Tabel 4.1

Data Tekanan dan Waktu Dari Interference Test

(lanjutan)

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
1.3.99	3:00	1124,774	1124,82	1440	3,104	21,41
2.3.99	3:00	1124,792	1124,78	1464	3,064	21,13
3.3.99	3:00	1124,686	1124,62	1488	2,904	20,03
4.3.99	3:00	1124,726	1124,74	1512	3,028	20,88
5.3.99	3:00	1124,751	1124,83	1536	3,114	21,48
6.3.99	3:00	1124,768	1124,78	1560	3,066	21,14
7.3.99	3:00	1124,687	1124,77	1584	3,059	21,10
8.3.99	3:00	1124,747	1124,76	1608	3,042	20,98
9.3.99	3:00	1124,595	1124,64	1632	2,924	20,17
10.3.99	3:00	1124,620	1124,70	1656	2,983	20,57
11.3.99	3:00	1124,373	1124,40	1680	2,687	18,53
12.3.99	3:00	1124,389	1124,47	1704	2,756	19,01
13.3.99	3:00	1124,422	1124,44	1728	2,726	18,80
14.3.99	3:00	1124,392	1124,48	1752	2,765	19,07
15.3.99	3:00	1124,430	1124,44	1776	2,727	18,81
16.3.99	3:00	1124,310	1124,36	1800	2,643	18,23
17.3.99	3:00	1124,398	1124,42	1824	2,707	18,67
18.3.99	3:00	1124,421	1124,53	1848	2,813	19,40
19.3.99	3:00	1124,393	1124,39	1872	2,672	18,43
20.3.99	3:00	1124,465	1124,43	1896	2,716	18,73
21.3.99	3:00	1124,415	1124,43	1920	2,717	18,74
22.3.99	3:00	1124,428	1124,51	1944	2,793	19,26
23.3.99	3:00	1124,457	1124,45	1968	2,738	18,88
24.3.99	3:00	1124,354	1124,33	1992	2,616	18,04
25.3.99	3:00	1124,175	1124,21	2016	2,491	17,18
26.3.99	3:00	1124,265	1124,40	2040	2,690	18,55
27.3.99	3:00	1124,494	1124,50	2064	2,782	19,19
28.3.99	3:00	1124,392	1124,40	2088	2,686	18,52

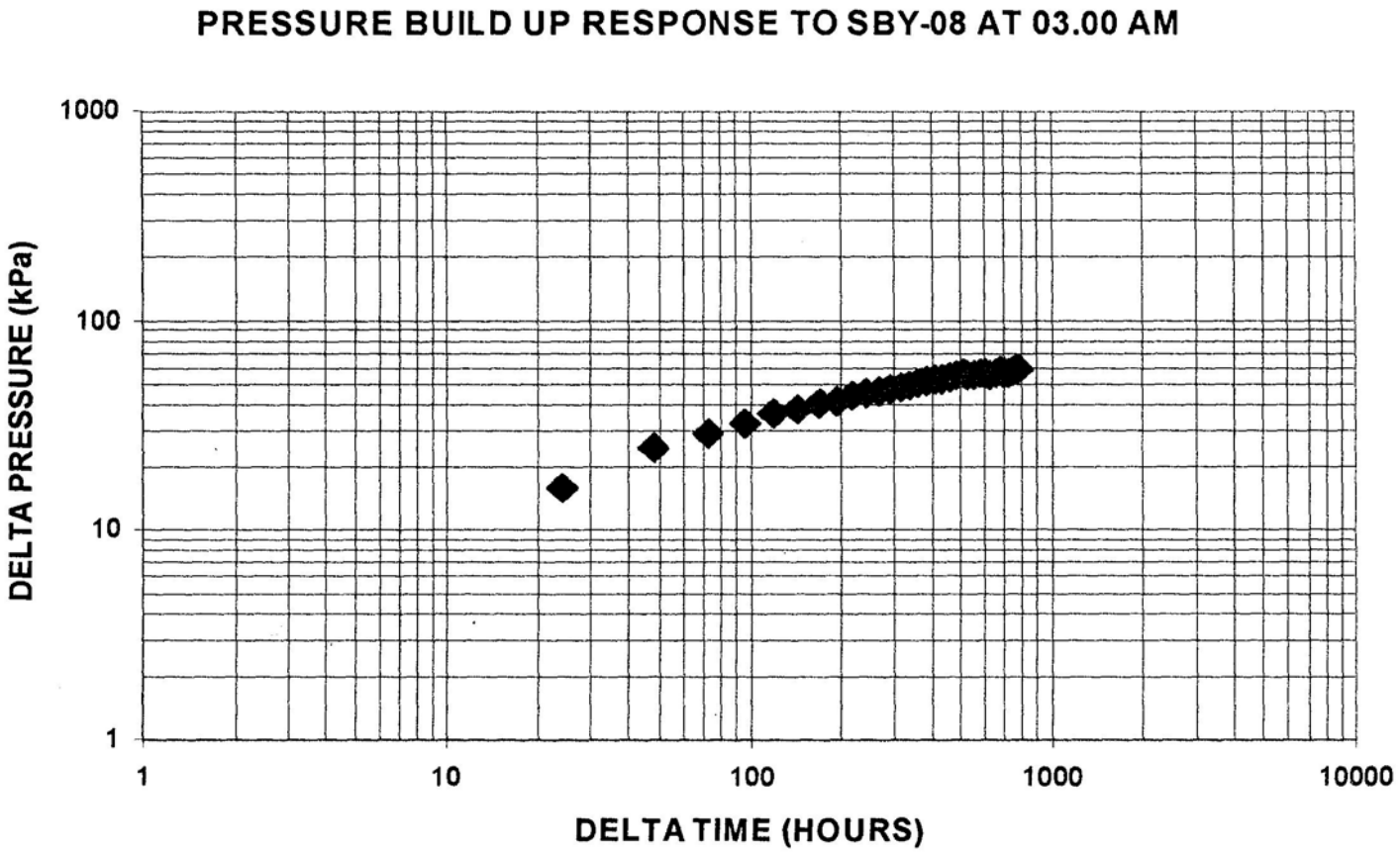
Tabel 4.2

Data Tekanan Pada Pukul 03.00 Dari Interference Test

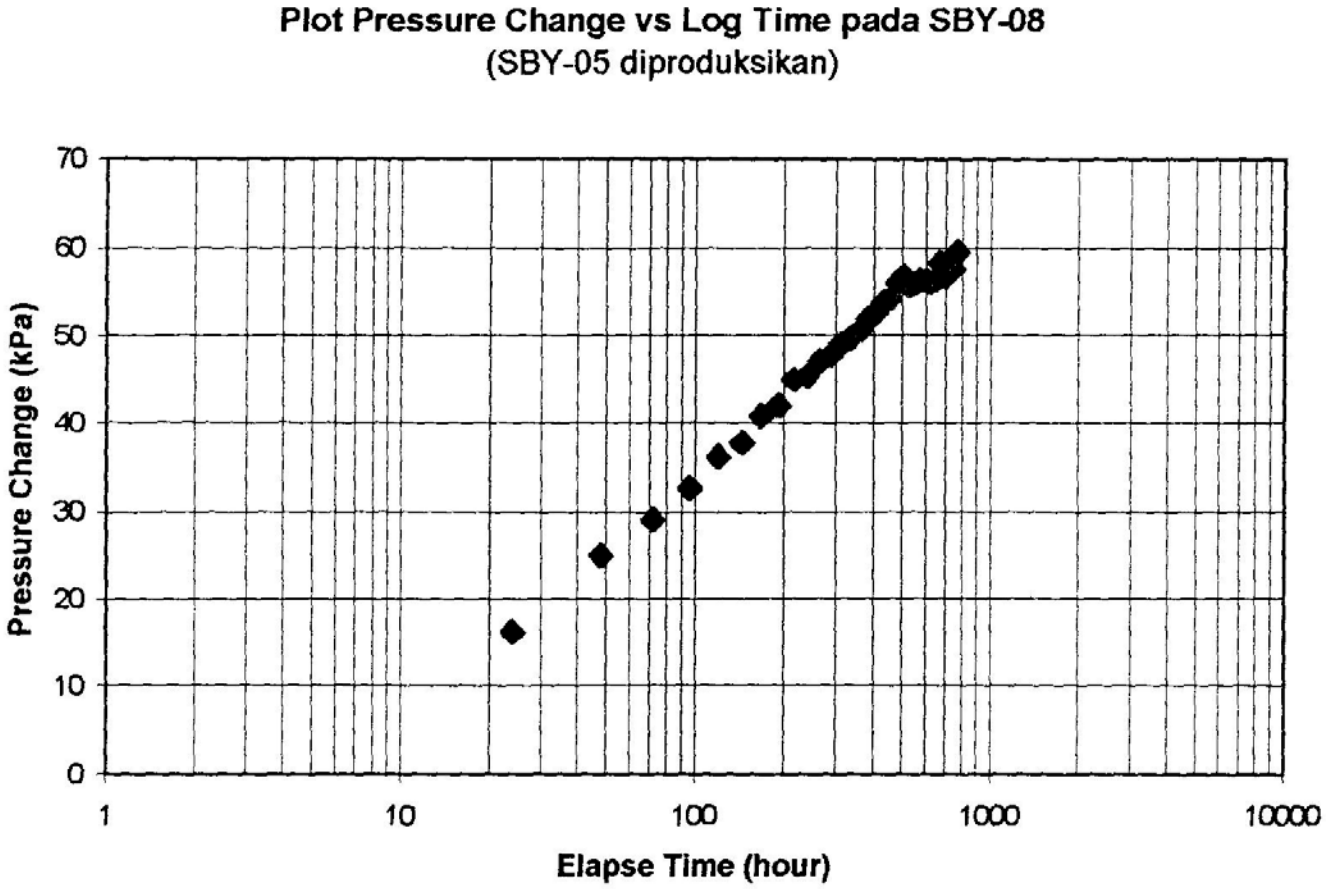
(Sumur SBY-5 diproduksikan)

Date	Time	Read Pressure SBY-8		Press. Response		
		uncorrected	corrected	El. Time (hour)	ΔP(psi)	ΔP(kPa)
29.3.99	3:00	1124,480	1124,480	0	0,000	0,0
30.3.99	3:00	1122,132	1122,130	24	2,350	16,2
31.3.99	3:00	1120,848	1120,844	48	3,636	25,1
1.4.99	3:00	1120,144	1120,255	72	4,225	29,1
2.4.99	3:00	1119,477	1119,733	96	4,747	32,7
3.4.99	3:00	1119,118	1119,224	120	5,256	36,2
4.4.99	3:00	1118,758	1119,002	144	5,478	37,8
5.4.99	3:00	1118,454	1118,555	168	5,925	40,9
6.4.99	3:00	1118,155	1118,390	192	6,090	42,0
7.4.99	3:00	1117,912	1117,965	216	6,515	44,9
8.4.99	3:00	1117,775	1117,898	240	6,582	45,4
9.4.99	3:00	1117,621	1117,660	264	6,820	47,0
10.4.99	3:00	1117,468	1117,552	288	6,928	47,8
11.4.99	3:00	1117,325	1117,371	312	7,109	49,0
12.4.99	3:00	1117,162	1117,268	336	7,212	49,7
13.4.99	3:00	1116,976	1117,142	360	7,338	50,6
14.4.99	3:00	1116,918	1116,945	384	7,535	52,0
15.4.99	3:00	1116,774	1116,835	408	7,645	52,7
16.4.99	3:00	1116,637	1116,673	432	7,807	53,8
17.4.99	3:00	1116,516	1116,605	456	7,875	54,3
18.4.99	3:00	1116,311	1116,347	480	8,133	56,1
19.4.99	3:00	1116,150	1116,233	504	8,247	56,9
20.4.99	3:00	1116,353	1116,394	528	8,086	55,8
21.4.99	3:00	1116,265	1116,359	552	8,121	56,0
22.4.99	3:00	1116,204	1116,290	576	8,190	56,5
23.4.99	3:00	1116,110	1116,307	600	8,173	56,4
24.4.99	3:00	1116,160	1116,349	624	8,131	56,1
25.4.99	3:00	1115,870	1116,302	648	8,178	56,4
26.4.99	3:00	1115,908	1116,009	672	8,471	58,4
27.4.99	3:00	1115,999	1116,235	696	8,245	56,9
28.4.99	3:00	1115,936	1116,150	720	8,330	57,4
29.4.99	3:00	1115,621	1116,118	744	8,362	57,7
30.4.99	3:00	1115,778	1115,839	768	8,641	59,6

FT



Gambar 4.3 Plot Drawdown Tekanan vs Elapse Time
(Data Jam 03.00 Pada Waktu Sumur SBY-5 Diproduksikan)



Gambar 4.5 Plot Perubahan Tekanan Vs Log Waktu

Dari Data Pukul 03.00 Pada Waktu Sumur SBY-5 Diproduksikan

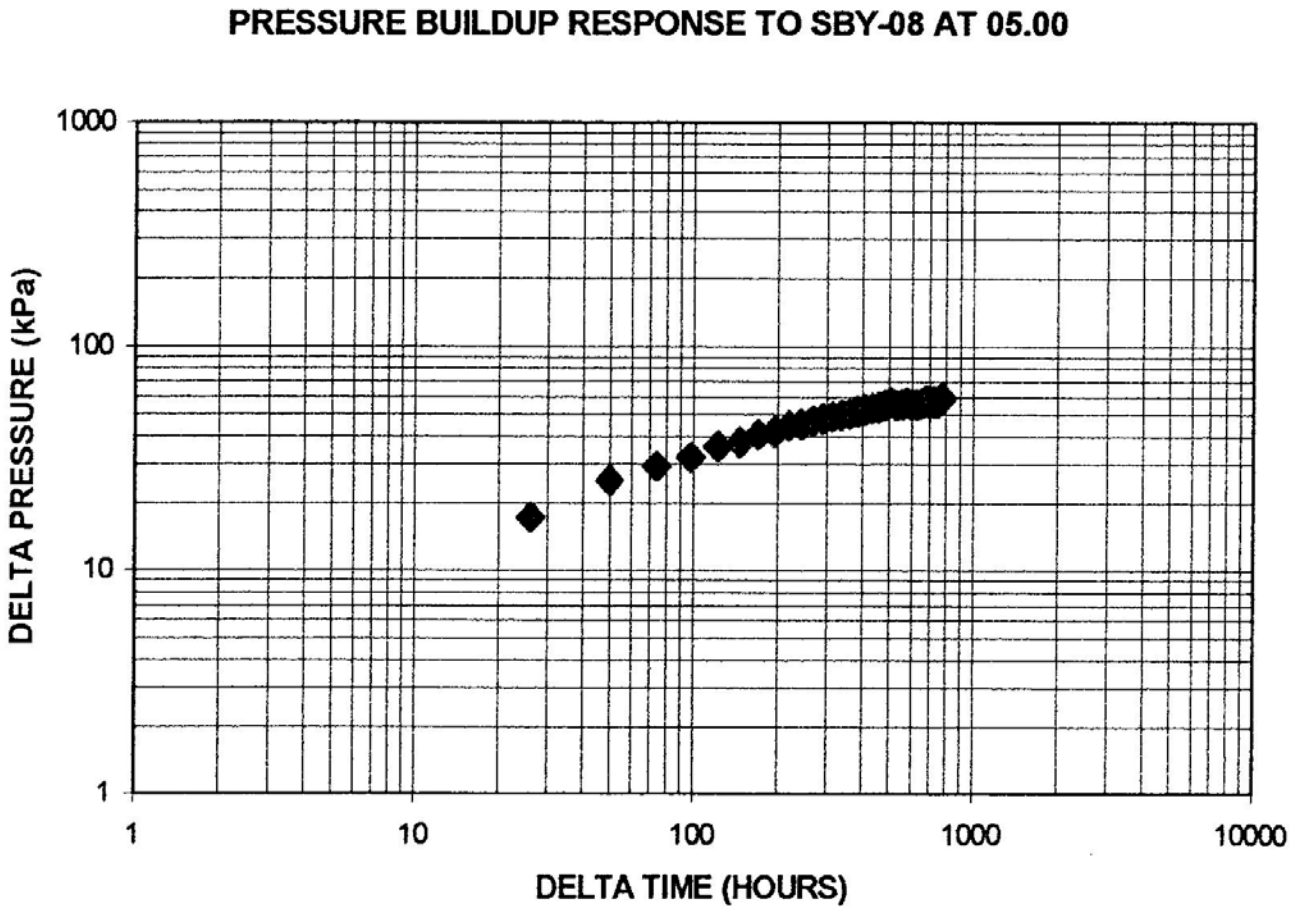
Tabel 4.3

Data Tekanan Pada Pukul 05.00 Dari Interference Test

(Sumur SBY-5 diproduksikan)

		Read Pressure		Press. Response		
Date	Time	SBY-8		El. Time	ΔP(psi)	ΔP(kPa)
		uncorrected	corrected	(hour)		
29.3.99	3:00	1124,480	1124,480	0	0,000	0,0
29.3.99	5:00	1124,536	1124,536	2	-0,056	-0,4
30.3.99	5:00	1121,971	1121,969	26	2,511	17,3
31.3.99	5:00	1120,804	1120,800	50	3,680	25,4
1.4.99	5:00	1120,098	1120,221	74	4,259	29,4
2.4.99	5:00	1119,536	1119,799	98	4,681	32,3
3.4.99	5:00	1119,104	1119,221	122	5,259	36,3
4.4.99	5:00	1118,753	1119,008	146	5,472	37,7
5.4.99	5:00	1118,448	1118,560	170	5,920	40,8
6.4.99	5:00	1118,145	1118,391	194	6,089	42,0
7.4.99	5:00	1117,937	1117,996	218	6,484	44,7
8.4.99	5:00	1117,787	1117,915	242	6,565	45,3
9.4.99	5:00	1117,609	1117,653	266	6,827	47,1
10.4.99	5:00	1117,438	1117,534	290	6,946	47,9
11.4.99	5:00	1117,313	1117,364	314	7,116	49,1
12.4.99	5:00	1117,152	1117,263	338	7,217	49,8
13.4.99	5:00	1116,975	1117,146	362	7,334	50,6

		Read Pressure		Press. Response		
Date	Time	SBY-8		El. Time	ΔP(psi)	ΔP(kPa)
		uncorrected	corrected	(hour)		
13.4.99	5:00	1116,975	1117,146	362	7,334	50,6
14.4.99	5:00	1116,894	1116,924	386	7,556	52,1
15.4.99	5:00	1116,786	1116,850	410	7,630	52,6
16.4.99	5:00	1116,680	1116,720	434	7,760	53,5
17.4.99	5:00	1116,532	1116,621	458	7,859	54,2
18.4.99	5:00	1116,397	1116,437	482	8,043	55,5
19.4.99	5:00	1116,170	1116,257	506	8,223	56,7
20.4.99	5:00	1116,420	1116,465	530	8,015	55,3
21.4.99	5:00	1116,280	1116,379	554	8,101	55,9
22.4.99	5:00	1116,210	1116,305	578	8,175	56,4
23.4.99	5:00	1116,189	1116,395	602	8,085	55,8
24.4.99	5:00	1116,159	1116,368	626	8,112	55,9
25.4.99	5:00	1115,901	1116,353	650	8,127	56,0
26.4.99	5:00	1116,066	1116,179	674	8,301	57,2
27.4.99	5:00	1115,956	1116,203	698	8,277	57,1
28.4.99	5:00	1116,007	1116,245	722	8,235	56,8
29.4.99	5:00	1115,706	1116,227	746	8,253	56,9
30.4.99	5:00	1115,816	1115,884	770	8,596	59,3



Gambar 4.6 Drawdown Tekanan vs Elapse Time

(Data Jam 05.00 Pada Waktu Sumur SBY-5 Diproduksikan)

Perhitungan permeability thickness (kh) adalah sebagai berikut:

$$kh = \frac{(0.37)(56)(1.03 \times 10^{-4})}{2\pi\,(783.699)(10 \times 10^{3})}$$

dan hasilnya adalah:

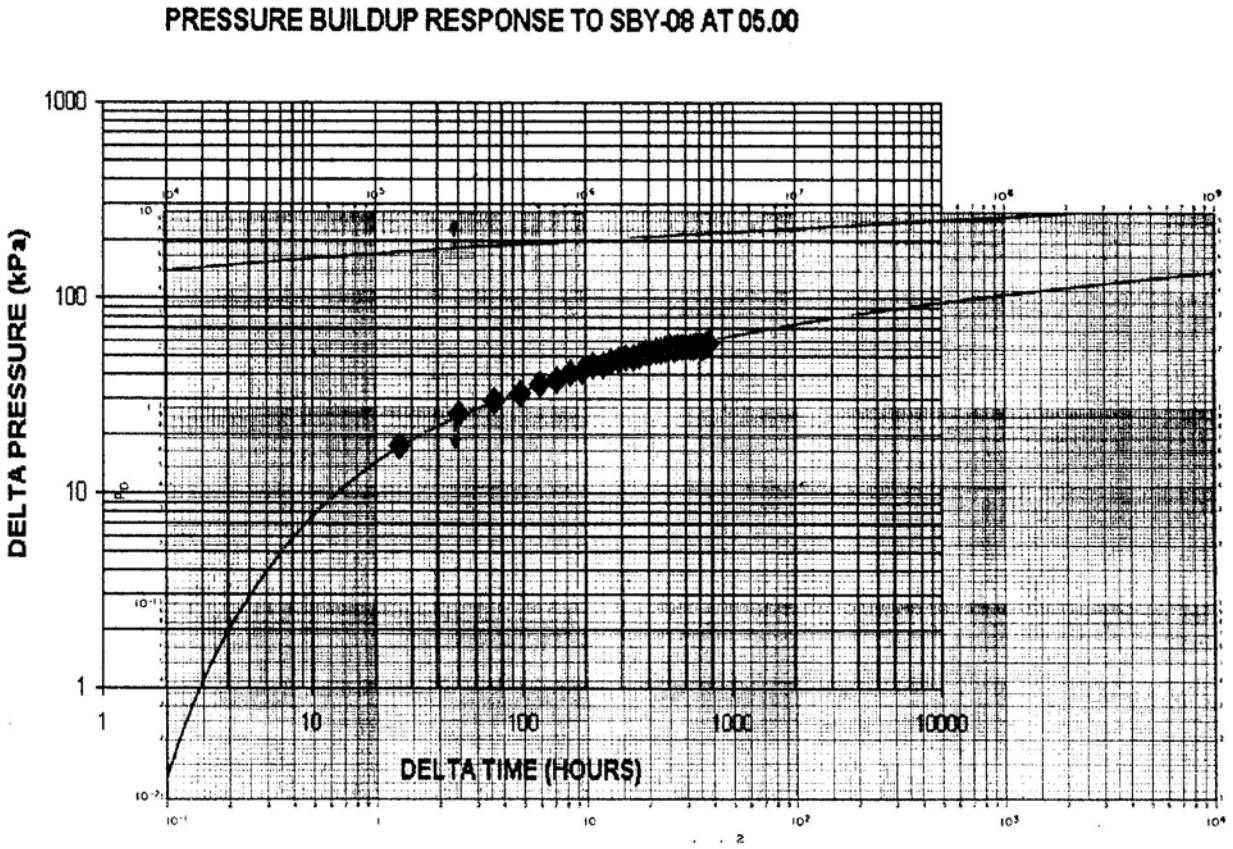
$$kh = 43.34 \times 10^{-12}\ m^3 = 43.34 \quad \text{Darcym}$$

Perhitungan storativity (ϕch) adalah sebagai berikut:

$$\phi ch = \frac{(41 \times 10^{-12})(100 \times 3600)}{(5)(1.03 \times 10^{-4})(855^{2})}$$

dan hasilnya adalah:

$$\phi ch = 4.144 \times 10^{-8}\ m/Pa$$



Gambar 4.7 Type Curve Matching

(Data Pukul 05.00 Pada Waktu Sumur SBY-5 Diproduksikan)

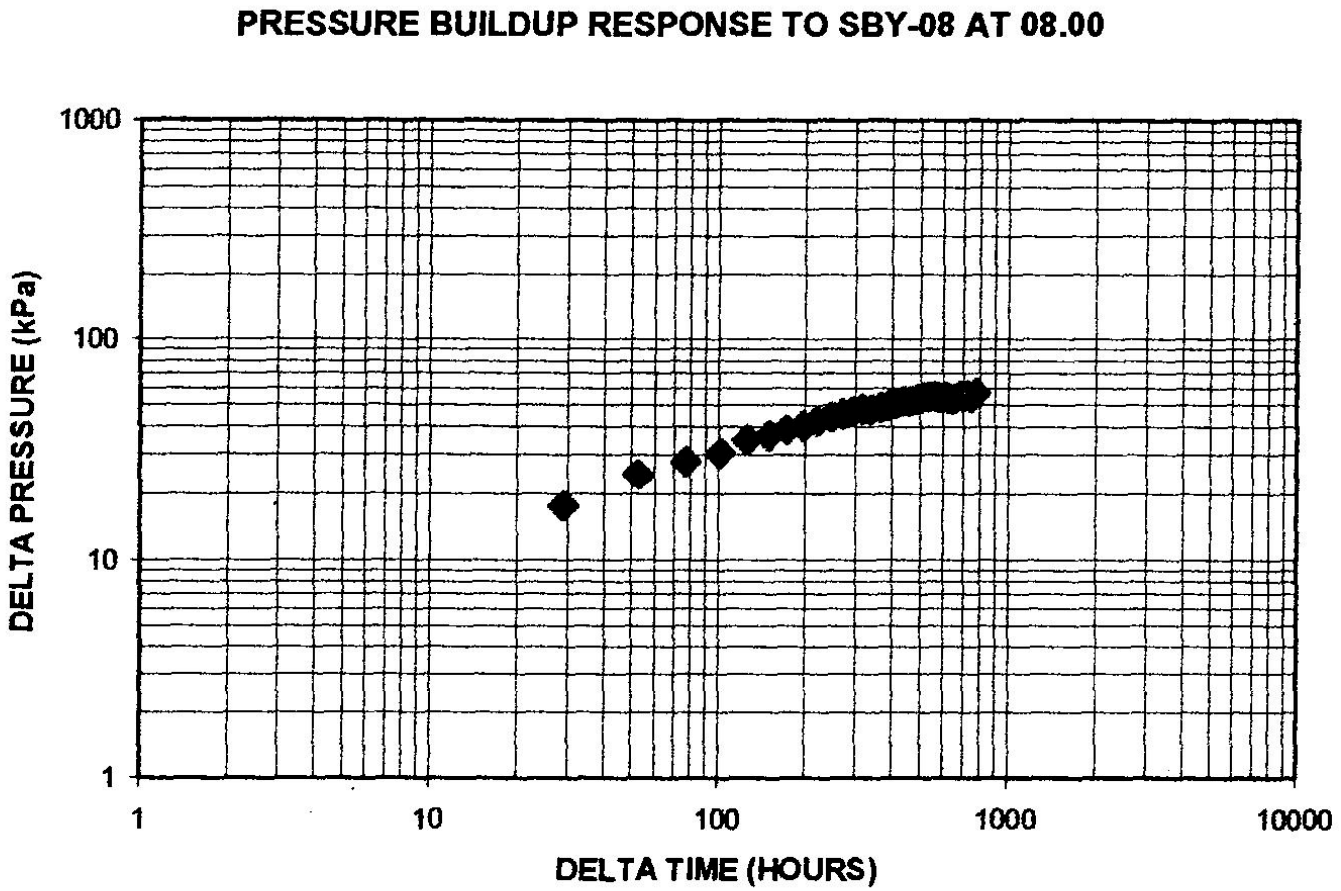
Tabel 4.4

Data Tekanan Pada Pukul 08.00 Dari Interference Test

(Sumur SBY-5 diproduksikan)

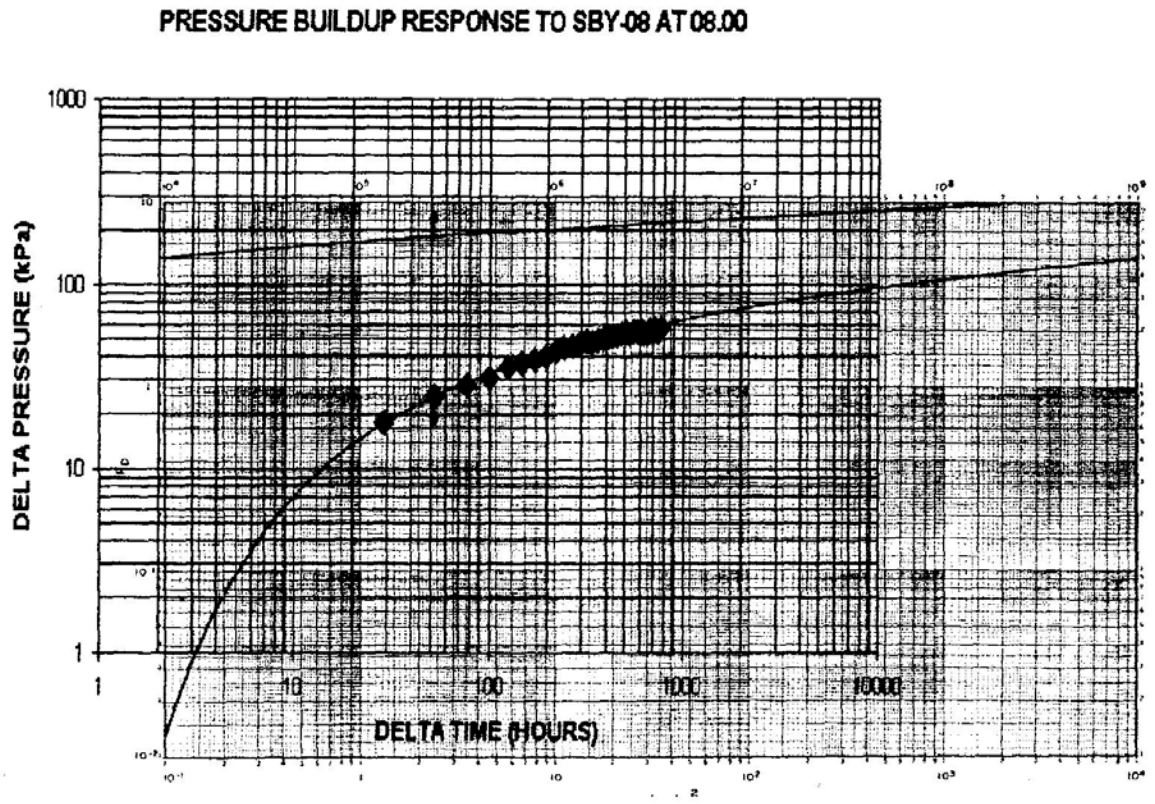
		Read Pressure		Press. Response		
Date	Time	SBY-8		El. Time	ΔP(psi)	ΔP(kPa)
		uncorrected	corrected	(hour)		
29.3.99	##	1124,480	1124,480	0	0,000	0,0
29.3.99	8:00	1124,622	1124,621	5	-0,14	-1,0
30.3.99	8:00	1121,903	1121,901	29	2,58	17,8
31.3.99	8:00	1120,909	1120,905	53	3,58	24,7
1.4.99	8:00	1120,239	1120,380	77	4,10	28,3
2.4.99	8:00	1119,732	1120,018	101	4,46	30,8
3.4.99	8:00	1119,215	1119,350	125	5,13	35,4
4.4.99	8:00	1118,841	1119,113	149	5,37	37,0
5.4.99	8:00	1118,698	1118,827	173	5,65	39,0
6.4.99	8:00	1118,362	1118,625	197	5,86	40,4
7.4.99	8:00	1118,190	1118,258	221	6,22	42,9
8.4.99	8:00	1117,862	1117,999	245	6,48	44,7
9.4.99	8:00	1117,755	1117,805	269	6,67	46,0
10.4.99	8:00	1117,577	1117,680	293	6,80	46,9
11.4.99	8:00	1117,345	1117,404	317	7,08	48,8
12.4.99	8:00	1117,357	1117,476	341	7,00	48,3

		Read Pressure		Press. Response		
Date	Time	SBY-8		El. Time	ΔP(psi)	ΔP(kPa)
		uncorrected	corrected	(hour)		
13.4.99	8:00	1117,206	1117,385	365	7,10	48,9
14.4.99	8:00	1117,137	1117,171	389	7,31	50,4
15.4.99	8:00	1117,016	1117,085	413	7,39	51,0
16.4.99	8:00	1116,778	1116,824	437	7,66	52,8
17.4.99	8:00	1116,785	1116,880	461	7,60	52,4
18.4.99	8:00	1116,691	1116,737	485	7,74	53,4
19.4.99	8:00	1116,491	1116,584	509	7,90	54,5
20.4.99	8:00	1116,548	1116,600	533	7,86	54,3
21.4.99	8:00	1116,359	1116,465	557	8,02	55,3
22.4.99	8:00	1116,430	1116,539	581	7,94	54,8
23.4.99	8:00	1116,331	1116,551	605	7,93	54,7
24.4.99	8:00	1116,395	1116,635	629	7,85	54,1
25.4.99	8:00	1116,225	1116,708	653	7,77	53,6
26.4.99	8:00	1116,264	1116,393	677	8,09	55,8
27.4.99	8:00	1116,212	1116,476	701	8,00	55,2
28.4.99	8:00	1116,133	1116,406	725	8,07	55,7
29.4.99	8:00	1115,961	1116,517	749	7,96	54,9
30.4.99	8:00	1116,154	1116,232	773	8,25	56,9



Gambar 4.8 Drawdown Tekanan vs Elapse Time

(Data Jam 08.00 Pada Waktu Sumur SBY-5 Diproduksikan)



Gambar 4.9 Type Curve Matching

(Data Pukul 08.00 Pada Waktu Sumur SBY-5 Diproduksikan)

d) Perbandingan Hasil Analisis

Dari hasil perhitungan permeability thickness dan storativity dengan menggunakan parameter-parameter yang sama diperoleh harga yang hampir sama (Tabel 4.5), yaitu permeability-thickness sebesar 41 - 43.3 Darcy meter dan storativity sebesar 4.1×10^{-8} -4.7×10^{-8} m/Pa.

Tabel 4.5

Hasil Perhitungan Permeability-Thickness dan Storativity

SUMBER DATA TEKANAN	Permeability-thickness (Darcy.m)	Storativity (m/Pa)
Pengukuran pada pukul 03.00	41	4.667×10^{-8}
Pengukuran pada pukul 05.00	43.34	4.144×10^{-8}
Pengukuran pada pukul 08.00	42.17	4.383×10^{-8}

Dibandingkan dengan hasil perhitungan dengan menggunakan data build up pada waktu sumur SBY-5 belum diproduksikan (kh = 114 Darcy.m), harga kh yang diperoleh dari data uji interference (yaitu saat SBY-5 diproduksikan) relatif lebih kecil (Tabel 4.5), namun demikian perkiraan dari hasil analisis ini lebih merepresentasikan karakteristik reservoir diantara sumur SBY-5 dan SBY-8.