	Oil an	ıd gas producti	on wells		TV: 1				111			1, cc	1.1		Prof M	Milan S	Stanko	(NTNU)	
	Oli ali	la gas product	OH Wells		Video 32:	pressure c	rop calcul	lations	in wellbor	e, com	nparison of c	lifferent	models		1 101.10	villari	Jianko	(141140)	<u></u>
ation in satu	urated oil v	vell, Prof. Milan	Stanko (NTNU)																
m3/Sm3] [m]	155.1 0.15																		
[m2]	0.0177																		
[m] [deg]	1.50E-05 90																		
Sm3/d]	100 1.55E+04																		
	8	3O table column	3					3 10			11								emayat and Gh
VD [m]	T [C]	p[bara] 28	Rs [Sm3/Sm3] 22.6					viscg [cp] 3 1.10E-02			sigma_o_g [N/m] 1.15E-02			uso [m/s] 0.077			bdag[-] 0.80	e[-] 0.49	dp/dx [bara/ 0.03
500 1000	57.1 64.3	47.2 71.4	41.1 65.3					1.25E-02 1.49E-02						0.081 0.087			0.64	0.34	0.0
1500	71.4	99.2	93.9	1.69E-05	1.4	7.29E-03	178.7	7 1.91E-02	657.3	0.6	2.64E-03	144.4	4.468E+01	0.095	0.02	29 (0.24	0.12	0.0
2000 2500	78.6 85.7	128.6 158.4	124.4 153.2					2 2.38E-02 5 2.44E-02						0.103 0.111			0.10	0.06	0.0
3000 3500	92.9 100.0	188.2 218.3	155.1 155.1					0.00E+00 0.00E+00						0.111 0.111			0.00	0.00	0.0
3300	100.0	210.3	155.1	0.002100	1.7	0.002+00	0.0	0.002100	607.4	0.4	0.002101	109.5	0.0002400	0.111	0.00		0.00	0.00	0.0
		(usl, usg, der	nl, deng, si	gma_lg, teta	_deg, p, D)		1 1		Fu		odx_mpf(roughness mpf pressure grad					angle,	, voidf:	raction)	'
'p in 'D in	m									'denl,	liquid density, gas density, [kg	[kg/m3]							
'usg i	in m/s in m/s									'usl su	aperficial liquid aperficial gas ve	velocity,							
	kg/m^3 kg/m^3									'angle,	, inclination ang raulic diameter o	le of pipe		to horizo	ontal [de	eg]			
	deg in d a lg in N	_								'roughn	ness pipe roughne , liquid viscosit	ss, [m] y [cP]							
If uso	g = 0 The wolgha =	en								'viscg,	gas viscosity,								
Else	_worgha									Pi = At denm =	tn(1) * 4 voidfraction * d			n) * denl					
te	eta = tet	ta_deg * Pi / ction correlat		egematiat and	Ghadar (200)	5)				ug	ifraction = 0 Or = 0	usg = 0 The	en						
a	= usg *	(1 + ((usl /	usg) ^ ((der	ng / denl) ^	0.1)))		1 4 200 4 5	251		fg	= usl = 0								
C	= (1.22	((9.81 * sign + 1.22 * Sin	(teta)) ^ (1.		a)) ^ (denl -	- deng) / (de	ıı - 2)) ^ 0.	.25)		ElseIf	<pre>= ffactor(den1, voidfraction = 1</pre>		-	L)					
End If	f	= usg / (a +	(B * C))							ul	= usg = 0								
nd Functi	ion									fg	= 0 = ffactor(deng,	viscg, D,	roughness, ug	1)					
										_	= usg / voidfrac								
										fg	<pre>= usl / (l - voi = ffactor(deng,</pre>	viscg / 100							
										fl End If	= ffactor(den1,	viscl / 100	00, D, roughn	ness, ul)					
									<pre>dpdx_f = (fg * deng * (ug * Abs(usg)) * 0.5 / D) + (fl * denl * (ul * Abs(usl)) * 0.5 dpdx h = denm * 9.81 * Sin(angle * Pi / 180)</pre>									5 / D)	
										dpdx_mp	of = dpdx_f + dpd of = dpdx_mpf / 1								
									En	d Functio	on								
tion in satu	urated oil v	well, Prof. Milan	Stanko (NTNU)																
			,,																
m3/Sm3] [m]	155.1 0.15																		
[m2]	0.0177 1.50E-05																		
Limit .	1 S0E-05														_	-			
[m] [deg]	90																		
[deg] Sm3/d]	90 1000																		
[deg] m3/d]	90 1000 1.55E+05	80 table column	1	3 4			9	8 10	7	9	11								Nagoo
[deg] :m3/d] :m3/d] /D [m]	90 1000 1.55E+05 T [C]	p[bara]	Rs [Sm3/Sm3]	rs [Sm3/Sm3]	Bo [m3/Sm3]		deng [kg/m3]	viscg [cp]	deno [kg/m3]		sigma_o_g [N/m]	qo [m3/d]							
[deg] m3/d] m3/d]	90 1000 1.55E+05		Rs [Sm3/Sm3] 22.6	rs [Sm3/Sm3] 5 1.28E-05	Bo [m3/Sm3]	3.44E-02	deng [kg/m3] 37.8	viscg [cp] 8 1.10E-02	deno [kg/m3] 728.8	1.8	sigma_o_g [N/m] 1.15E-02	qo [m3/d]	4.566E+03	0.769	9 2.9	91	o.80 0.67	0.61	dp/dx [bara, 0.0
(deg) m3/d) m3/d) m3/d) /D [m] 0 500	90 1000 1.55E+05 T [C] 50.0 57.1 64.3	p[bara] 28 43.7 63.0	Rs [Sm3/Sm3] 22.6 37.3 56.3	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05	Bo [m3/Sm3] 1.2 1.2 1.3	3.44E-02 2.08E-02 1.34E-02	deng [kg/m3] 37.8 63.4 100.1	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02	deno [kg/m3] 728.8 711.9 691.6	1.8 1.2 0.9	sigma_o_g [N/m] 1.15E-03 8.90E-03 6.20E-03	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4	4.566E+03 2.451E+03 1.320E+03	0.769 0.805 0.852	9 2.99 5 1.60 2 0.80	91 605 665	0.80 0.67 0.50	0.61 0.50 0.38	dp/dx [bara 0.0 0.0 0.0
(deg) m3/d) m3/d) /D [m] 0 500 1000	90 1000 1.55E+05 T [C] 50.0 57.1 64.3 71.4	p[bara] 28 43.7 63.0 86.1	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2	rs [Sm3/Sm3] 5 1.28E-03 3 1.29E-03 3 1.36E-03 2 1.53E-03	Bo [m3/Sm3] 1.2 1.2 1.3 1.4	3.44E-02 2.08E-02 1.34E-02 8.91E-03	deng [kg/m3] 37.8 63.4 100.1 146.3	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02	deno [kg/m3] 728.8 711.9 691.6 668.7	1.8 1.2 0.9 0.6	sigma_o_g [N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4 3 1390.6	4.566E+03 2.451E+03 1.320E+03 6.776E+02	0.769 0.805 0.852 0.911	9 2.99 5 1.60 2 0.80 1 0.44	91 (605 (665 (644 (0.80 0.67 0.50 0.33	0.61 0.50 0.38 0.26	dp/dx [bara; 0.0 0.0 0.0 0.0
(deg) sm3/d] sm3/d] /D [m] 0 500 1000 1500 2000	90 1000 1.55E+05 T [C] 50.0 57.1 64.3 71.4 78.6 85.7	p[bara] 28 43.7 63.0 86.1 112.3 140.7	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2	1.8 1.2 0.9 0.6 0.5 0.4	sigma_o_g [N/m] 1.15E-02 8.90E-02 6.20E-02 3.75E-03 2.05E-03 1.12E-03	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4 3 1390.6 3 1497.1 3 1615.5	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02	0.769 0.805 0.852 0.911 0.981 1.058	9 2.99 5 1.66 2 0.86 1 0.44 1 0.28 8 0.00	91 (605 (65) (644 (617) (676)	0.80 0.67 0.50 0.33 0.18 0.07	0.61 0.50 0.38	dp/dx [bara 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2000 2000	90 1000 1.55E+05 8 T [C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6	1.8 1.2 0.9 0.6 0.5 0.4 0.4	sigma_o_g [N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 2.05E-03 1.12E-03 6.30E-05	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4 3 1390.6 3 1497.1 3 1615.5 5 1701.8	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01	0.769 0.805 0.852 0.911 0.981 1.058	9 2.99 5 1.60 2 0.80 1 0.44 1 0.23 8 0.00 5 0.00	91 (605 (65) (65) (644 (62) (76) (600) (600)	0.80 0.67 0.50 0.33 0.18 0.07	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara, 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] /D [m] 0 500 1000 1500 2000 2500 3000	90 1000 1.55E+05 T [C] 50.0 57.1 64.3 71.4 78.6 85.7	p[bara] 28 43.7 63.0 86.1 112.3 140.7	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0	1.8 1.2 0.9 7 0.6 0.5 0.4 0.4 0.4	sigma_o_g [N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 2.05E-03 1.12E-03 6.30E-03 0.00E+00	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4 3 1390.6 3 1497.1 3 1615.5 5 1701.8 0 1702.0	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00	0.769 0.805 0.852 0.911 0.981 1.058 1.115	9 2.99 5 1.60 2 0.81 1 0.44 1 0.22 8 0.00 5 0.00	991 (605) 665 (665) 667 (76) 776 (76) 776 (76) 776 (76)	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2000 2500 3000	90 1000 1.55E+05 8 T [C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf (ix_mpf pres	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.4 0.5	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 2.05E-03 1.12E-03 6.30E-04 0.00E+06	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 0 1702.0	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115	9 2.99 5 1.60 2 0.88 1 0.44 1 0.22 8 0.00 5 0.00	991 (605) 665 (665) 6444 (117) 676 (600)	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2000 2500	90 1000 1.55E+05 8 T [C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 Function dpd den	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf (ix_mpf pres	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure gadensity,	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 2.05E-03 1.12E-03 6.30E-03 0.00E+00 ess, viscl, radient, in ry, [kg/m3]	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viseg, debar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115	9 2.99 5 1.60 2 0.88 1 0.44 1 0.22 8 0.00 5 0.00	991 (605) 665 (665) 6444 (117) 676 (600)	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2500 2500 3500	90 1000 1.55E+05 8 T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 8 1.29E-05 8 1.36E-05 9 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 Function 'dpd 'den 'den 'usl	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf(kx_mpf pres ll, liquid gg, gas den superfici superfici	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure gradensity, ial liquial gas	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 2.05E-03 1.12E-03 6.30E-03 0.00E+00 ess, viscl, radient, in : y, [kg/m3] [kg/m3] uid velocity, [i	qo [m3/d] 2 1174.3 3 1229.4 3 1301.4 3 1390.6 3 1497.1 3 1615.5 1701.8 0 1702.0 viscg, d bar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2500 3500 ction e_N.	90 1000 1.55E+05 7 [C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) oid fraction of	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 Function 'dpd 'den 'den 'us1 'usg 'ang 'D h	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 dx_mpf pres l, liquid gg, gas den superfici fsuperfici fle, inclin	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure gransity, ial liquial gas nation diameter	1.15E-02 8.90E-03 8.90E-03 6.20E-03 3.75E-03 6.30E-03 6.30E-04	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, dear/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2500 2500 3500 ction e_Nago 'lambdag If lambd	90 1000 1.55E+05 8 T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 [agoo (lamboo, the vogis non stag = 0 Th	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 ddag) ddag) ddid fraction of slip volume	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'dpd 'den 'den 'usg 'ang 'D h 'rou 'vis	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf(ix_mpf pres il, liquid g, gas den superfici guerfici guerfici guerfici gle, inclin	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure generation sity, ital liquidation site of the condition of the	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 ess, viscl, radient, in ry, [kg/m3] kg/m3] kg/m3] velocity, [tangle of pip r of pipe [m hness, [m] sity [cP]	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, dear/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
deg] m3/d] m3/d] 0 500 1000 1500 2000 2500 3500 ction e_Na ' e_Nago 'lambdag If lambda e_Na	90 1000 1.55E+05 T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 ddag) ddag) ddid fraction of slip volume	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 3 1.29E-05 3 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 9 1.91E-03 0 0.00E+00 'den 'den 'den 'usl 'usg 'ang 'D h 'rous 'vis 'vis 'vis	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf (ix_mpf pres il, liquid ag, gas den superfici superfici superfici graphess pip col, liquid	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure grantsty, ital liquial gas nation diameter or rough it viscosity (-)	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 ess, viscl, radient, in ry, [kg/m3] kg/m3] kg/m3] velocity, [tangle of pip r of pipe [m hness, [m] sity [cP]	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, dear/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 laggoo (lamb	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 ddag) ddag) ddid fraction of slip volume	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'usl 'usg 'ang 'n h 'rou 'vis 'vis 'voi Pi = denm If v	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 1 dpdx_mpf(ix_mpf pres il, liquid ig, gas den superfici fle, inclin iydraulic d ighness pip icl, liquid icg, gas vi dfraction i Atn(1) * i = voidfra coidfraction	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 ess, viscl, radient, in ry, [kg/m3] kg/m3] kg/m3] velocity, [tangle of pip r of pipe [m hness, [m] sity [cP]	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, d bar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'den 'usl 'usg 'ang 'D h 'rou 'vis 'vis 'voi Pi = denm If v	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf(ix_mpf pres il, liquid ag, gas den superfici fic, inclin sydraulic d ghness pip ficl, liquid agg, gas vi dfraction at Atn(1) * a = voidfraction ug = 0 ul = usl	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E+00 ess, viscl, radient, in: y, [kg/m3] [kg/m3] uid velocity velocity, [in angle of pipe [miness, [m] sity [cP] y, [cP] * deng + (1	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, d bar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'den 'usl 'usg 'ang 'D h 'rou 'vis 'vis 'vis 'vis 'vis 'vis 'loi Pi = denm If v	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 day mpf presil, liquid gg, gas den superficiale, inclin dydraulic degeness pip col, liquid egg, gas vei diffraction and fraction and fracti	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, debar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
[deg] im3/d] im3/d] 0 500 1000 1500 2000 2500 3000 3500 ction e_Na ' e_Nago 'lambdag If lambda e_Nae Else e_Nae	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'usl 'usg 'ang 'ang 'D h 'rou 'vis 'vis 'voi Pi = denm If v	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 deno [kg/m3] 691.6 668.7 644.3 620.2 604.6 605.0 deno [kg/m3] 620.2 deno [kg/m3] 6	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	sigma_o_g[N/m] 1.15E-03 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, debar/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 9 1.91E-03 0 0.00E+00 Function 'dpd 'den 'den 'den 'vis 'vis 'vis 'vis 'vis 'vis 'toi Pi = denm If v	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 day a deno superficio super	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure grantsty, ital liquital gas nation diameter or rough it viscosity ital section is considered action in action is cor (deniation	1.15E-02 8.90E-02 8.90E-02 8.90E-02 6.20E-02 6.20E-02 6.30E-02	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, dear/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip espect to action) *	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'den 'usl 'vis 'vis 'vis 'vis 'vis 'vis 'vis 'vis	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 ddpdx_mpf(dx_mpf pres l, liquid dg, gas den superfici fle, inclin hydraulic d dghness pip cl, liquid dg, gas vi dfraction Atn(1) * a = voidfra oidfractio ug = 0 ul = usl fg = 0 fl = ffact If voidfra ug = usg ul = 0 fl = 0 fg = ffact	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.5 0.6 0.7 0.7 0.7 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, dear/m, f	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip espect to action) *	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 1.115 hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
(deg m3/d m3/d m3/d 0	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 Function 'dpd 'den 'den 'usl 'usg 'ang 'D h 'rou 'vis 'vis 'vis 'vis 'toi Pi = denm If v Else	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 a dpdx_mpf(ix_mpf pres il, liquid ag, gas den superfici fle, inclin sydraulic d ghness pip fcl, liquid ag, gas vi dfraction at the condition at the	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.4 0.5 0.5 0.5 0.6 0.7 0.7 0.7 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, d bar/m, f , [m/s] m/s] e with r - voidfr hen roughne 0 Then	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip espect to action) * ss, ul) ss, ug)	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 c, usl, hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (605 (665 (665 (665 (665 (665 (665 (665	0.80 0.67 0.50 0.33 0.18 0.07 0.00	0.61 0.50 0.38 0.26 0.16 0.06 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0
[deg	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 8 1.10E-02 4 1.22E-02 1 1.40E-02 3 1.68E-02 8 2.08E-02 6 2.48E-02 9 1.91E-03 0 0.00E+00 'den 'den 'den 'usl 'vis 'vis 'vis 'vis 'vis 'vis 'vis 'toi Pi = denm If v Else Else	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 dadpdx_mpf(dx_mpf pres l, liquid dg, gas den superfici fle, inclin dydraulic d dghness pip cl, liquid dg, gas vi difraction draction and fle fle fle fle fle ffact fle fle ffact fle fle ffact fle	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 0.4 (roughning and in a contion action a	sigma_o_g[N/m] 1.15E-02 8.90E-03 6.20E-03 3.75E-03 1.12E-03 6.30E-03 0.00E+00 0.00E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, d bar/m, f , [m/s] m/s] e with r - voidfr hen roughne 0 Then roughne 0 Then	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip espect to action) * ss, ul) roughness roughness	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 , usl, hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (1005 (1	0.80 0.67 0.50 0.33 0.18 0.07 0.00 0.00 gle, v	0.61 0.50 0.38 0.26 0.16 0.06 0.00 0.00	dp/dx [bara 0.0 0.0 0.0 0.0 0.0 0.0 0.0 action)
[deg	90 1000 1.55E+05 E T[C] 50.0 57.1 64.3 71.4 78.6 85.7 92.9 100.0 Image: The volume of t	p[bara] 28 43.7 63.0 86.1 112.3 140.7 170.1 200.0 odag) od fraction of slip volume fraction	Rs [Sm3/Sm3] 22.6 37.3 56.3 79.2 105.7 134.2 154.6 155.1	rs [Sm3/Sm3] 5 1.28E-05 6 1.29E-05 8 1.36E-05 2 1.53E-05 7 1.84E-05 2 2.32E-05 6 1.91E-06 1 0.00E+06	Bo [m3/Sm3] 1.2 1.3 1.4 1.5 1.6 1.7 1.7	3.44E-02 2.08E-02 1.34E-02 8.91E-03 6.67E-03 5.56E-03 3.87E-04 0.00E+00	deng [kg/m3] 37.8 63.4 100.1 146.3 195.8 234.6 17.9 0.0	viscg [cp] 1.10E-02 1.10E-02 1.10E-02 1.40E-02 1.40E-0	deno [kg/m3] 728.8 711.9 691.6 668.7 644.3 620.2 604.6 605.0 dadpdx_mpf(dx_mpf pres drawing gas den superfici fle, inclin dydraulic den gas vi diffraction Atn(1) * den voidfra den voidfraction den us usl fg = 0 fl = ffact ff voidfra dug = usg dul = usl fg = ffact ff = ffact	1.8 1.2 0.9 0.6 0.5 0.4 0.4 0.4 (roughnessure gradensity, tal liquidanteressure) talliquidanteressure gradensity, talliquidanteressu	sigma_o_g[N/m] 1.15E-02 8.90E-02 6.20E-02 3.75E-03 2.05E-03 6.30E-03 6.30E	qo [m3/d] 1174.3 1229.4 1301.4 1390.6 1497.1 1615.5 1701.8 1702.0 viscg, debar/m, fe with relation of then roughner roughner 0 Then roughner 0 Then	4.566E+03 2.451E+03 1.320E+03 6.776E+02 3.306E+02 1.167E+02 2.006E-01 0.000E+00 enl, deng or multip espect to action) * ss, ul) roughnes roughness 0.5 / D)	0.769 0.805 0.852 0.911 0.981 1.058 1.115 1.115 , usl, hase fl	9 2.9 5 1.6 2 0.8 1 0.4 1 0.2 8 0.0 5 0.0 5 0.0 usg, D	991 (1005 (1	0.80 0.67 0.50 0.33 0.18 0.07 0.00 0.00 gle, v	0.61 0.50 0.38 0.26 0.16 0.06 0.00 0.00	dp/dx [bara] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 action)

Oil xercise: Pressure drop cal		roduction v		nko (NTNU)											Pro	of. Milan	Stanko	(NTNU)	
ipe ID ipe cross section area ipe roughness ipe inclination from hor o	[m] [m2] [m] [deg] [Sm3/d] [Sm3/d]	0.15 0.0177 1.50E-05 90 6000 9.31E+05	O table column	3	4	5			10	7	9	. 11							istic model
	TVD [m] 0 500 1000 1500 2000 2500 3000	50.0 57.1 64.3 71.4 78.6 85.7 92.9	p[bara] Rs 28 52.6 73.5 103.7 137.5 172.9 207.5	46.8 1 67.6 1 99.2 1 134.8 2 155.1 0	3/5m3] Bo [m3 .28E-05 .34E-05 .45E-05 .76E-05 .33E-05 .00E+00	1.2 1.3 1.3 1.5 1.6 1.7	3.44E-02 1.64E-02 1.05E-02 6.90E-03 5.37E-03 0.00E+00	37.1 82.1 125.0 189.1 243.1	viscg [cp] de 3 1.10E-02 1.29E-02 1.53E-02 2.00E-02 2.55E-02 0.00E+00 0.00E+00	728.8 704.1 682.4 653.3 623.6 609.0 610.1	riso [cp] sigma 1.8 1.1 0.8 0.6 0.4 0.4 0.4	_o_g [N/m] 1.15E-02 7.56E-03 4.88E-03 2.35E-03 1.07E-03 0.00E+00 0.00E+00	7046.0 7564.5 8044.2 8781.2 9650.4	qg[m3/d] 2.740E+04 1.065E+04 5.540E+03 2.322E+03 6.558E+02 0.000E+00 0.000E+00	4.615 4.954 5.269 5.751 6.321 6.644 6.633	17.944 6.976 3.628 1.521 0.430 0.000 0.000	0.80 0.58 0.41 0.21 0.06 0.00	Slug Slug Slug Bubble Bubble Bubble Liquid Liquid	dp/dx [bara/m] 0.0492 - 0.0417 0.0605 - 0.0675 0.0708 - 0.0693 0.0693
File Home File Copy Paste Format P	Insert [Draw Pag	e Layout Formu	or_v1.2-public.xls Lulas Data Rev	riew View	Develop xt		0.0	0.00E+00	610.1	0.4	0.00E+00	10125.7	0.000E+00	6.632	0.000	0.00	Liquid	0.0692
C5 A 1 FLUID PROP		B put:	C C Place of the control of the cont	D E	ignment	F	Se Se												
3 μ _ο 4 μ _g 5 σ _{og} 6 ρ _ο 7 ρ _π 8 9 OPERATING		[Pa s] [Pa s] [N/m] [kg/m^3] [kg/m^3]	3.662E-04 0.000E+00 0.00E+00 610.1 0.0	dp/ [Pa 6924	/m]	ow patter [-] Liquid	'n												
10	RACTERIST	[m/s] [m/s]	6.632 0.000																
17 Diamet	ter	[m] [m]	0.15 1.50E-05																
qo	Volgha pwf [bara] 218.3 200.0 188.5 182.4 186.9 199.2 224.5 245.2 280.5	Nagoo pwf [bara] 197.5 197.6 198.2 200.0 211.5 223.7 238.5 266.9 287.5	Mechanistic pwf [bara] 205.5 187.5 173.2 165.6 166.8 178.4 206.2 224.2	ottom-hole pressure, pwf [Wolgha								
	200.3	207.3	242.1		0.0	1000	2000	3000 oil rate, qo	4000 o, [Sm3/d]		Mechanist	7000							
									, ,										