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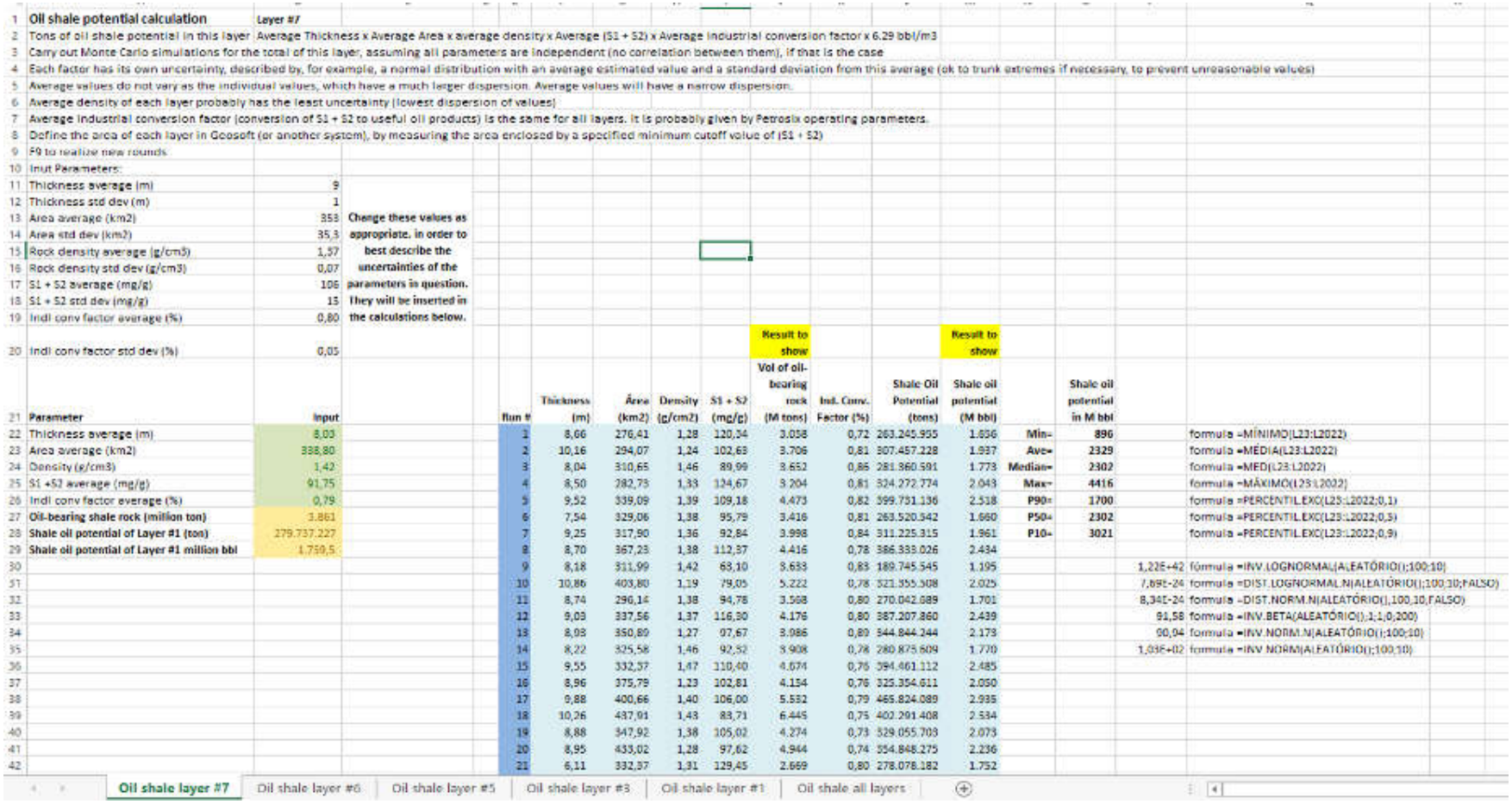
APÊNDICE - MÉTODO PROBABILÍSTICO UTILIZADO.

Com o objetivo de ilustrar o método probabilístico utilizado serão apresentadas a seguir figuras referentes as sete subunidades do cenário de 60 mg HC/ g Rocha, 80 mg HC/ g Rocha e 100 mg HC/ g Rocha.

Cenário de 60 mg HC/g Rocha

Subunidade L7



1	**Oil shale potential calculation**	**Layer #7**													
2	Tons of oil shale potential in this layer	Average Thickness x Average Area x average density x Average (S1 + S2) x Average Industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	9													
12	Thickness std dev (m)	1													
13	Area average (km2)	353	**Change these values as**												
14	Area std dev (km2)	35,3	**appropriate, in order to**												
15	Rock density average (g/cm3)	1,37	**best describe the**												
16	Rock density std dev (g/cm3)	0,07	**uncertainties of the**												
17	S1 + S2 average (mg/g)	106	**parameters in question.**												
18	S1 + S2 std dev (mg/g)	15	**They will be inserted in**												
19	Indl conv factor average (%)	0,80	**the calculations below.**												
20	Indl conv factor std dev (%)	0,05								**Result to show**			**Result to show**		
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm3)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Indl. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	8,03		1	8,66	276,41	1,28	120,34	3.058	0,72	263.245.955	1.656	**Min=**	**896**	formula =MÍNIMO(L23:L2022)
23	Area average (km2)	338,80		2	10,16	294,07	1,24	102,63	3.706	0,81	307.457.228	1.937	**Ave=**	**2329**	formula =MÉDIA(L23:L2022)
24	Density (g/cm3)	1,42		3	8,04	310,65	1,46	89,99	3.652	0,86	281.360.591	1.773	**Median=**	**2302**	formula =MED(L23:L2022)
25	S1 +S2 average (mg/g)	91,75		4	8,50	282,75	1,33	124,67	3.204	0,81	324.272.774	2.043	**Max=**	**4416**	formula =MÁXIMO(L23:L2022)
26	Indl conv factor average (%)	0,79		5	9,52	339,09	1,39	109,18	4.473	0,82	399.731.136	2.518	**P90=**	**1700**	formula =PERCENTIL.EXC(L23:L2022;0,1)
27	**Oil-bearing shale rock (million ton)**	3.861		6	7,54	329,06	1,38	95,79	3.416	0,81	263.520.542	1.660	**P50=**	**2302**	formula =PERCENTIL.EXC(L23:L2022;0,5)
28	**Shale oil potential of Layer #1 (ton)**	279.737.227		7	9,25	317,90	1,36	92,84	3.998	0,84	311.225.315	1.961	**P10=**	**3021**	formula =PERCENTIL.EXC(L23:L2022;0,9)
29	**Shale oil potential of Layer #1 million bbl**	1.759,5		8	8,70	367,23	1,38	112,37	4.416	0,78	386.333.026	2.434			
30				9	8,18	311,99	1,42	63,10	3.633	0,83	189.745.545	1.195		1,22E+42	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	10,86	403,80	1,19	79,05	5.222	0,78	321.355.308	2.025		7,69E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	8,74	296,14	1,38	94,78	3.568	0,80	270.042.089	1.701		8,34E-24	formula =DIST.NORM.N(ALEATÓRIO(),100,10,FALSO)
33				12	9,03	337,56	1,37	116,30	4.176	0,80	387.207.860	2.439		91,58	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	8,03	350,89	1,27	97,67	3.986	0,89	544.844.244	2.173		90,04	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	8,22	325,58	1,46	92,52	3.908	0,78	280.875.609	1.770		1,03E+02	formula =INV.NORM(ALEATÓRIO();100;10)
36				15	9,55	332,57	1,47	110,40	4.674	0,76	394.461.112	2.485			
37				16	8,96	375,79	1,23	102,81	4.154	0,76	325.354.611	2.050			
38				17	9,88	400,66	1,40	106,00	5.532	0,79	465.824.089	2.935			
39				18	10,26	437,91	1,43	83,71	6.445	0,75	402.291.408	2.534			
40				19	8,88	347,92	1,38	105,02	4.274	0,73	329.055.703	2.073			
41				20	8,95	433,02	1,28	97,62	4.944	0,74	354.848.275	2.236			
42				21	6,11	332,37	1,31	129,45	2.669	0,80	278.078.182	1.752			

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Subunidade L6

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**Oil shale potential calculation**	**Layer #6**																	
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3																	
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case																		
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)																		
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.																		
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)																		
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.																		
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)																		
9	F9 to realize new rounds																		
10	Inut Parameters:																		
11	Thickness average (m)	2																	
12	Thickness std dev (m)	0,1	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**																
13	Area average (km2)	12																	
14	Area std dev (km2)	1,2																	
15	Rock density average (g/cm3)	1,68																	
16	Rock density std dev (g/cm3)	0,07																	
17	S1 + S2 average (mg/g)	28																	
18	S1 + S2 std dev (mg/g)	6																	
19	Indl conv factor average (%)	0,80																	
20	Indl conv factor std dev (%)	0,05								**Result to show**			**Result to show**						
21	**Parameter**	**Input**			**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**				
22	Thickness average (m)	2,16			1	1,99	11,87	1,73	21,32	41	0,80	697.138	4	**Min=**	**1**		formula =MÍNIMO(L23:L2022)		
23	Area average (km2)	10,81			2	1,92	10,44	1,76	34,94	35	0,75	922.412	6	**Ave=**	**6**		formula =MÉDIA(L23:L2022)		
24	Density (g/cm3)	1,68			3	2,13	12,38	1,75	19,86	46	0,80	731.404	5	**Median=**	**6**		formula =MED(L23:L2022)		
25	S1 +S2 average (mg/g)	27,74			4	2,04	14,46	1,68	35,61	50	0,80	1.415.182	9	**Max=**	**11**		formula =MÁXIMO(L23:L2022)		
26	Indl conv factor average (%)	0,82			5	2,02	9,80	1,61	28,79	32	0,80	738.437	5	**P90=**	**4**		formula =PERCENTIL.EXC(L23:L2022;0,1)		
27	**Oil-bearing shale rock (million ton)**	39			6	2,04	13,32	1,70	26,11	46	0,76	924.699	6	**P50=**	**6**		formula =PERCENTIL.EXC(L23:L2022;0,5)		
28	**Shale oil potential of Layer #1 (ton)**	888.888			7	1,77	11,68	1,64	35,81	34	0,83	1.012.910	6	**P10=**	**8**		formula =PERCENTIL.EXC(L23:L2022;0,9)		
29	**Shale oil potential of Layer #1 million bbl**	5,6			8	2,07	13,78	1,74	20,33	50	0,80	805.353	5						
30					9	2,02	12,10	1,68	24,82	41	0,81	827.209	5			4,49E+43	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)		
31					10	2,08	9,70	1,62	33,20	33	0,81	879.532	6			7,68E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)		
32					11	2,15	11,94	1,68	41,39	43	0,71	1.261.556	8			1,04E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)		
33					12	1,76	12,67	1,65	31,43	37	0,75	863.919	5			98,70	formula =INV.BETA(ALEATÓRIO();1;1;0;200)		
34					13	1,97	12,46	1,68	17,14	41	0,74	521.122	3			103,77	formula =INV.NORM.N(ALEATÓRIO();100;10)		
35					14	2,03	11,81	1,65	24,29	40	0,79	762.831	5			1,02E+02	formula =INV.NORM(ALEATÓRIO();100;10)		

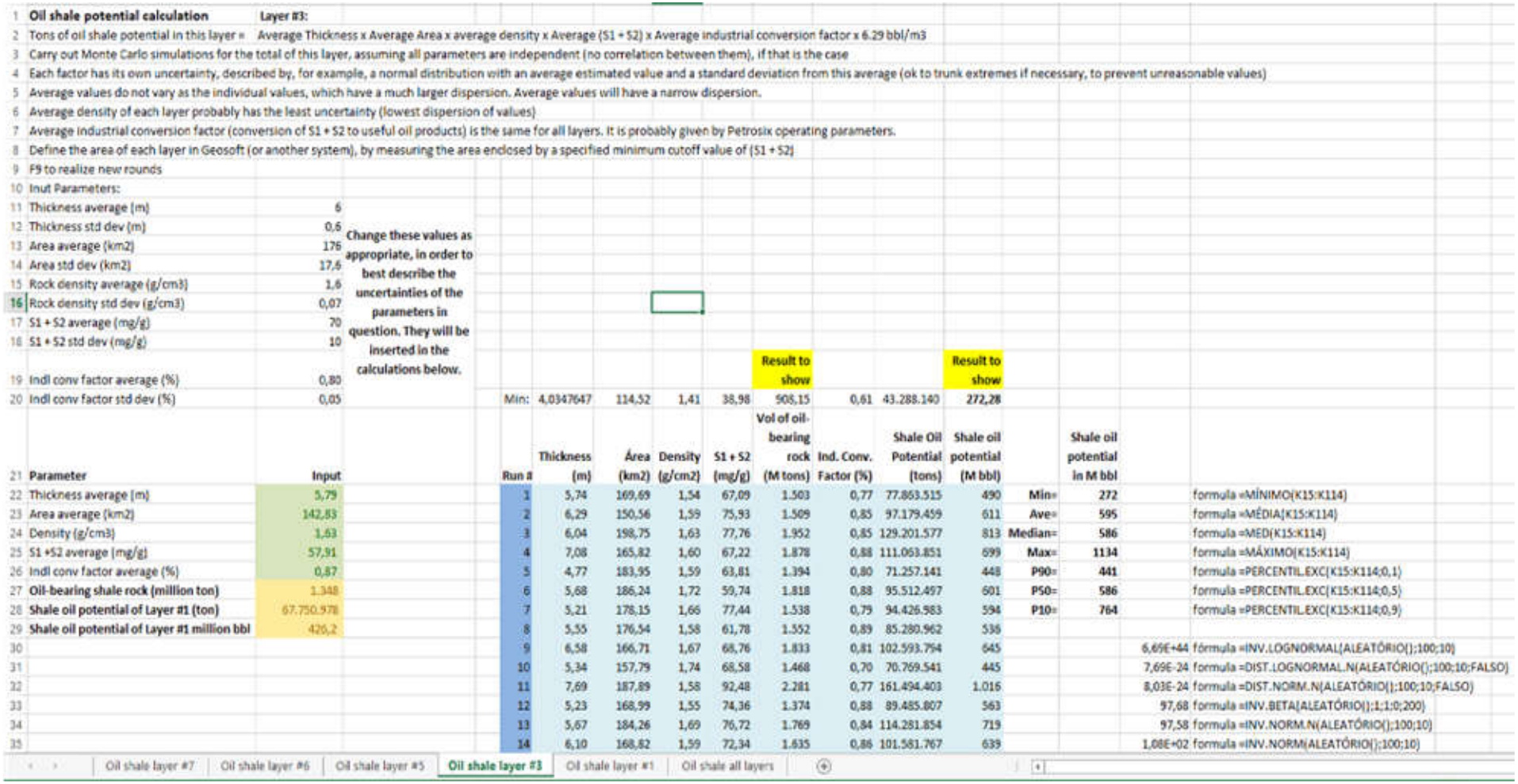
Oil shale layer #7 | **Oil shale layer #6** | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Subunidade L5

1	**Oil shale potential calculation**	**Layer #5:**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:	If negative values (Min= is negative), consider truncating negative values													
11	Thickness average (m)	6													
12	Thickness std dev (m)	1	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
13	Area average (km2)	200													
14	Area std dev (km2)	20													
15	Rock density average (g/cm3)	1,35													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	75													
18	S1 + S2 std dev (mg/g)	20													
19	Indl conv factor average (%)	0,80								**Result to show**			**Result to show**		
20	Indl conv factor std dev (%)	0,05		Min:	3,0190053	127,80	1,13	4,93	779,38	0,57	4.290.113	**26,98**			
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	5,33		1	7,81	233,51	1,35	36,84	2.459	0,83	74.858.263	471	**Min=**	**27**	formula =MÍNIMO(K15:K114)
23	Area average (km2)	205,75		2	6,65	204,76	1,34	125,59	1.826	0,88	202.139.195	1.271	**Ave=**	**611**	formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,33		3	6,01	185,31	1,54	88,38	1.715	0,77	117.370.886	738	**Median=**	**592**	formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	71,92		4	5,97	229,30	1,41	108,32	1.932	0,82	172.427.936	1.085	**Max=**	**1652**	formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,76		5	4,96	184,35	1,37	62,21	1.253	0,81	63.164.142	397	**P90=**	**353**	formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	1.463		6	6,18	144,21	1,38	4,93	1.228	0,71	4.290.113	27	**P50=**	**592**	formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	79.981.487		7	5,73	208,63	1,35	77,48	1.619	0,84	105.058.409	661	**P10=**	**886**	formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	503,1		8	5,85	218,16	1,23	15,27	1.574	0,87	20.811.301	131			
30				9	6,19	207,57	1,29	86,05	1.657	0,84	120.421.192	757			1,51E+51 fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	6,10	232,84	1,37	49,01	1.946	0,82	78.022.227	491			7,69E-24 formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	5,86	187,53	1,40	105,57	1.542	0,76	123.623.609	778			1,21E-23 formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	7,26	187,94	1,24	114,96	1.695	0,75	146.811.385	923			156,04 formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	6,85	207,34	1,44	64,05	2.050	0,77	101.379.571	638			85,45 formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	6,20	224,52	1,45	67,06	2.020	0,81	109.988.525	692			9,94E+01 formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | **Oil shale layer #5** | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Subunidade L3



Oil shale potential calculation	**Layer #3:**													
Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
F9 to realize new rounds														
Inut Parameters:														
Thickness average (m)	6													
Thickness std dev (m)	0,6	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
Area average (km2)	176													
Area std dev (km2)	17,6													
Rock density average (g/cm3)	1,6													
Rock density std dev (g/cm3)	0,07													
S1 + S2 average (mg/g)	70													
S1 + S2 std dev (mg/g)	10													
									Result to show			**Result to show**		
Indl conv factor average (%)	0,80													
Indl conv factor std dev (%)	0,05		Min:	4,0347647	114,52	1,41	38,98	908,15	0,61	43.288.140	272,28			
								Vol of oil-bearing					**Shale oil**	
Parameter	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
Thickness average (m)	5,79		1	5,74	169,69	1,54	67,09	1.503	0,77	77.863.515	490	**Min=**	**272**	formula =MÍNIMO(K15:K114)
Area average (km2)	142,83		2	6,29	150,56	1,59	75,93	1.509	0,85	97.179.459	611	**Ave=**	**595**	formula =MÉDIA(K15:K114)
Density (g/cm3)	1,63		3	6,04	198,75	1,63	77,76	1.952	0,85	129.201.577	813	**Median=**	**586**	formula =MED(K15:K114)
S1 +S2 average (mg/g)	57,91		4	7,08	165,82	1,60	67,22	1.878	0,88	111.063.851	699	**Max=**	**1134**	formula =MÁXIMO(K15:K114)
Indl conv factor average (%)	0,87		5	4,77	183,95	1,59	63,81	1.394	0,80	71.257.141	448	**P90=**	**441**	formula =PERCENTIL.EXC(K15:K114;0,1)
Oil-bearing shale rock (million ton)	1.348		6	5,68	186,24	1,72	59,74	1.818	0,88	95.512.497	601	**P50=**	**586**	formula =PERCENTIL.EXC(K15:K114;0,5)
Shale oil potential of Layer #1 (ton)	67.750.978		7	5,21	178,15	1,66	77,44	1.538	0,79	94.426.983	594	**P10=**	**764**	formula =PERCENTIL.EXC(K15:K114;0,9)
Shale oil potential of Layer #1 million bbl	426,2		8	5,55	176,54	1,58	61,78	1.552	0,89	85.280.962	536			
			9	6,58	166,71	1,67	68,76	1.833	0,81	102.593.794	645		6,69E+44	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
			10	5,34	157,79	1,74	68,58	1.468	0,70	70.769.541	445		7,69E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
			11	7,69	187,89	1,58	92,48	2.281	0,77	161.494.403	1.016		8,03E-24	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
			12	5,23	168,99	1,55	74,36	1.374	0,88	89.485.807	563		97,68	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
			13	5,67	184,26	1,69	76,72	1.769	0,84	114.281.854	719		97,58	formula =INV.NORM.N(ALEATÓRIO();100;10)
			14	6,10	168,82	1,59	72,34	1.635	0,86	101.581.767	639		1,08E+02	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | **Oil shale layer #3** | Oil shale layer #1 | Oil shale all layers

Subunidade L1

1	**Oil shale potential calculation**	**Layer #1:**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ck to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	8													
12	Thickness std dev (m)	2													
13	Area average (km2)	150	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
14	Area std dev (km2)	15													
15	Rock density average (g/cm3)	1,66													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	70													
18	S1 + S2 std dev (mg/g)	13													
19	Indl conv factor average (%)	0,80							**Result to show**			**Result to show**			
20	Indl conv factor std dev (%)	0,05		Min:	1,621674	96,54	1,37	24,86	405,10	0,64	14.159.567	**89,06**			
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	7,05		1	4,01	121,68	1,63	85,83	795	0,83	56.343.055	354	**Min=**	**89**	formula =MÍNIMO(K15:K114)
23	Area average (km2)	178,30		2	7,42	156,36	1,58	65,15	1.833	0,76	91.124.100	573	**Ave=**	**706**	formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,73		3	6,17	154,19	1,56	68,96	1.487	0,74	75.932.037	478	**Median=**	**687**	formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	68,24		4	7,61	166,17	1,76	90,53	2.229	0,71	143.852.362	905	**Max=**	**1666**	formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,71		5	10,81	145,31	1,69	86,42	2.658	0,81	185.759.590	1.168	**P90=**	**410**	formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	2.174		6	9,33	161,15	1,75	80,03	2.635	0,80	168.126.738	1.058	**P50=**	**687**	formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	105.259.503		7	6,78	132,01	1,65	53,21	1.473	0,77	60.664.669	382	**P10=**	**1022**	formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	662,1		8	8,23	158,87	1,61	84,23	2.098	0,87	152.889.421	962			
30				9	8,08	155,03	1,68	74,08	2.111	0,84	130.826.803	823			1,05E+43 fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	7,77	153,40	1,56	77,61	1.856	0,75	108.120.471	680			7,62E-24 formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	5,43	145,23	1,68	50,41	1.323	0,88	59.001.136	371			1,38E-23 formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	10,45	133,56	1,70	57,86	2.365	0,81	111.119.739	699			105,17 formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	6,33	147,69	1,59	73,09	1.490	0,80	87.574.177	551			102,15 formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	8,08	144,36	1,69	87,56	1.972	0,81	139.258.206	876			1,08E+02 formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | **Oil shale layer #1** | Oil shale all layers

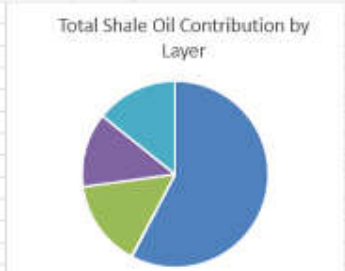
Cálculo total das subunidades

Total oil shale potential resource calculation

Perform a sum of all layers as a Monte Carlo simulation, so that the total is probabilistically calculated as a sum of independent terms (assume that the results for each layer are independent - no correlation between them)

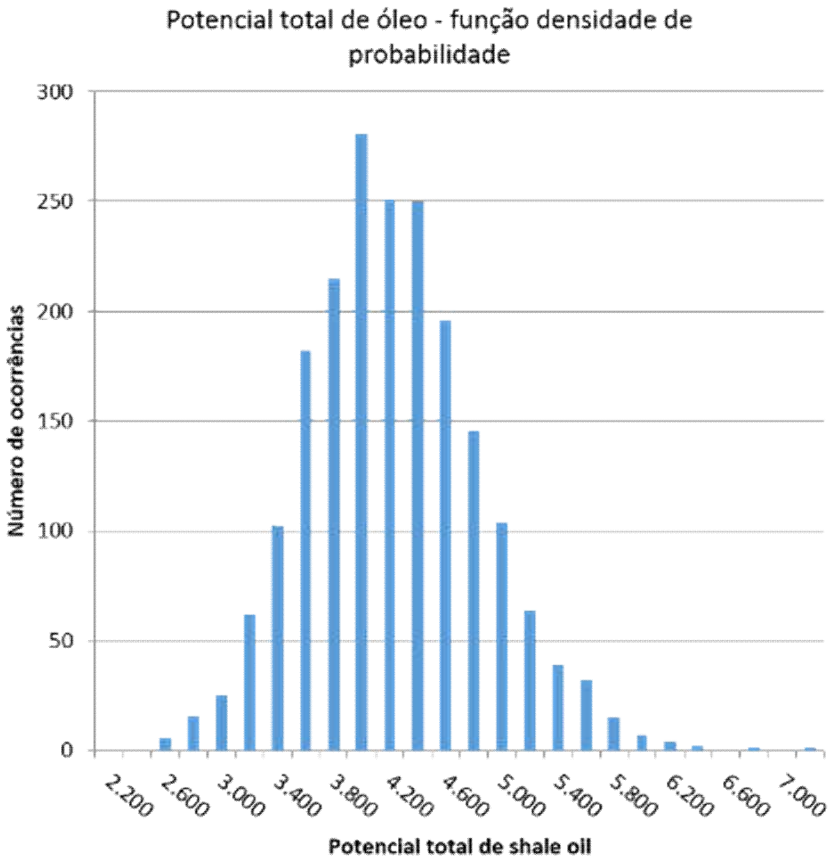
Values for each layer are copied from each layer calculation

Volume of oil-bearing rock in layer #7 M tons	Shale oil potential in layer #7 M bbl	Volume of oil-bearing rock in layer #6 M tons	Shale oil potential in layer #6 M bbl	Volume of oil-bearing rock in layer #5 M tons	Shale oil potential in layer #5 M bbl	Volume of oil-bearing rock in layer #3 M tons	Shale oil potential in layer #3 M bbl	Volume of oil-bearing rock in layer #1 M tons	Shale oil potential in layer #1 M bbl	**Total vol of oil-bearing rock M tons**	**Total shale oil potential M bbl**		**Total shale oil potential M bbl**		**% in layer #7**	**% in layer #6**	**% in layer #5**	**% in layer #3**	**% in layer #1**		
3.662	1.972	30	4	1.969	794	1.287	387	1.504	471	8.452	3.629				54%	0%	22%	11%	13%	Min #7	801
4.431	2.492	36	5	1.172	408	1.627	577	1.607	606	8.873	4.088	Min=	2.014	formula =MÍNIMO(G5:G2004)	61%	0%	10%	14%	15%	Min #6	1
3.774	2.445	27	4	1.328	557	1.535	650	1.127	417	7.791	4.074	Méd=	4.143	formula =MÉDIA(G5:G2004)	60%	0%	14%	16%	10%	Min #5	-583
3.586	2.116	29	4	2.676	1.182	1.767	782	2.111	559	10.170	4.644	Mediana=	4.099	formula =MED(G5:G2004)	46%	0%	25%	17%	12%	Min #3	196
5.968	3.041	31	4	3.138	1.122	1.400	459	1.993	559	12.530	5.185	Max=	7.461	formula =MÁXIMO(G5:G2004)	59%	0%	22%	9%	11%	Min #1	57
4.075	2.124	36	5	1.969	702	1.475	420	1.181	397	8.735	3.649	**P90=**	**3.228**	formula =PERCENTIL.EXC(G5:G2004;0	58%	0%	19%	12%	11%		
3.555	2.299	32	5	925	455	1.752	642	1.223	311	7.487	3.712	**P50=**	**4.099**	formula =PERCENTIL.EXC(G5:G2004;0	62%	0%	12%	17%	8%		
4.274	2.970	35	6	4.686	1.121	1.827	482	1.512	375	12.335	4.955	**P10=**	**5.151**	formula =PERCENTIL.EXC(G5:G2004;0	60%	0%	23%	10%	8%		
4.443	2.906	26	4	829	308	1.398	476	2.912	911	9.608	4.606				63%	0%	7%	10%	20%		
3.576	2.064	36	4	2.385	849	1.521	442	1.600	474	9.117	3.832		**58%**	**Ave of Layer #7**	54%	0%	22%	12%	12%		
3.058	1.914	38	4	1.946	895	1.928	456	2.056	661	9.026	3.931		**0%**	**Ave of Layer #6**	49%	0%	23%	12%	17%		
4.531	2.318	38	7	402	153	1.296	505	2.025	775	8.290	3.758		**15%**	**Ave of Layer #5**	62%	0%	4%	13%	21%		
5.557	3.278	29	4	907	448	1.837	730	943	277	9.273	4.736		**13%**	**Ave of Layer #3**	69%	0%	9%	15%	6%		
3.542	2.296	28	3	1.926	595	1.702	733	1.710	852	8.907	4.479		**14%**	**Ave of Layer #1**	51%	0%	13%	16%	19%		
5.424	2.936	34	4	2.880	487	1.822	548	1.262	454	11.421	4.430		**100%**	**Total all layers**	66%	0%	11%	12%	10%		
3.458	1.510	32	5	3.253	1.179	1.460	465	1.367	736	9.571	3.894				39%	0%	30%	12%	19%		
5.410	2.953	34	3	2.458	1.017	1.403	516	1.581	576	10.886	5.065				58%	0%	20%	10%	11%		
4.519	2.759	38	6	764	308	1.712	496	1.529	632	8.562	4.201				66%	0%	7%	12%	15%		
5.404	2.865	32	5	903	275	1.911	563	1.577	459	9.828	4.167				69%	0%	7%	14%	11%		
4.724	3.056	38	5	3.040	1.180	1.412	467	1.124	461	10.339	5.168				59%	0%	23%	9%	9%		
5.569	2.967	27	4	1.588	756	1.210	338	1.681	765	10.074	4.831				61%	0%	16%	7%	16%		
4.810	2.522	41	6	2.032	1.101	1.570	633	1.212	437	9.663	4.699				54%	0%	23%	13%	9%		
4.698	2.454	32	5	-967	-335	1.645	587	2.013	675	7.420	3.385				72%	0%	-10%	17%	20%		
5.310	3.098	36	5	2.005	655	1.224	454	2.261	987	10.836	5.209				59%	0%	13%	9%	19%		
3.942	2.353	31	3	-416	-107	1.129	421	1.192	479	5.878	3.148				75%	0%	-3%	13%	15%		
3.472	1.311	34	4	229	96	1.684	603	1.029	310	6.449	2.324				56%	0%	4%	26%	13%		
4.309	2.335	36	5	769	355	1.345	461	1.408	529	7.887	3.685				63%	0%	10%	13%	14%		
5.827	3.078	39	5	4.296	1.282	1.408	449	1.347	508	12.917	5.322				58%	0%	24%	8%	10%		
4.260	2.550	35	3	1.122	261	1.269	417	1.200	445	7.886	3.675				69%	0%	7%	11%	12%		
4.973	2.854	33	4	1.167	343	1.436	429	1.272	422	8.881	4.052				70%	0%	8%	11%	10%		



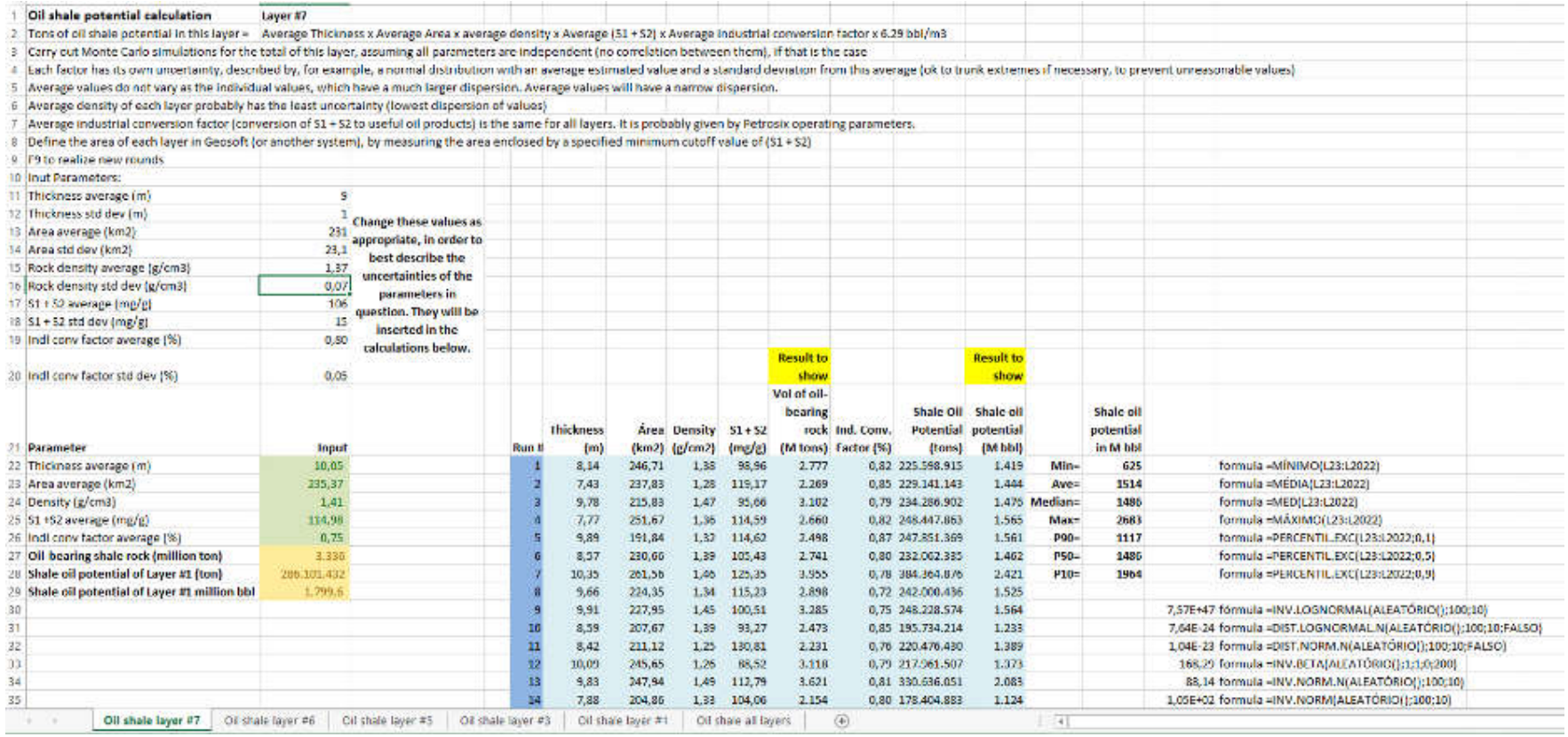
Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | **Oil shale all layers**

Gráfico de Percentile



Cenário de 80 mg HC/g Rocha

Subunidade L7

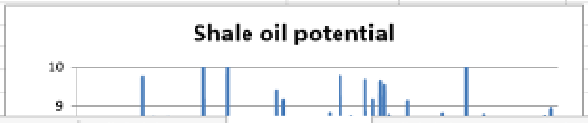


1	**Oil shale potential calculation**	**Layer #7**												
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3												
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them). If that is the case													
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)													
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.													
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)													
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.													
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)													
9	F9 to realize new rounds													
10	Inut Parameters:													
11	Thickness average (m)	9												
12	Thickness std dev (m)	1												
13	Area average (km2)	231	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**											
14	Area std dev (km2)	23,1												
15	Rock density average (g/cm3)	1,37												
16	Rock density std dev (g/cm3)	0,07												
17	S1 + S2 average (mg/g)	106												
18	S1 + S2 std dev (mg/g)	15												
19	Indl conv factor average (%)	0,80												
20	Indl conv factor std dev (%)	0,05							**Result to show**			**Result to show**		
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	10,05		1	8,14	246,71	1,38	98,96	2.777	0,82	225.598.915	1.419	**Min=**	**625**	formula =MÍNIMO(L23:L2022)
23	Area average (km2)	235,37		2	7,43	237,83	1,28	119,17	2.269	0,85	229.141.143	1.444	**Ave=**	**1514**	formula =MÉDIA(L23:L2022)
24	Density (g/cm3)	1,41		3	9,78	215,83	1,47	95,66	3.102	0,79	234.286.902	1.475	**Median=**	**1486**	formula =MED(L23:L2022)
25	S1 +S2 average (mg/g)	114,98		4	7,77	251,67	1,36	114,59	2.660	0,82	248.447.863	1.565	**Max=**	**2683**	formula =MÁXIMO(L23:L2022)
26	Indl conv factor average (%)	0,75		5	9,89	191,84	1,32	114,62	3.498	0,87	247.851.369	1.561	**P00=**	**1117**	formula =PERCENTIL.EXC(L23:L2022;0,1)
27	**Oil bearing shale rock (million ton)**	3.330		6	8,57	230,60	1,39	105,43	2.741	0,80	232.062.385	1.462	**P50=**	**1486**	formula =PERCENTIL.EXC(L23:L2022;0,5)
28	**Shale oil potential of Layer #1 (ton)**	286.101.432		7	10,35	261,56	1,46	125,35	3.955	0,78	384.364.876	2.421	**P10=**	**1964**	formula =PERCENTIL.EXC(L23:L2022;0,9)
29	**Shale oil potential of Layer #1 million bbl**	1.799,6		8	9,66	224,35	1,34	115,23	2.898	0,72	242.000.436	1.525			
30				9	9,91	227,95	1,45	100,51	3.285	0,75	248.228.574	1.564			7,57E+47 fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	8,59	207,67	1,39	93,27	2.473	0,85	195.734.214	1.233			7,64E-24 formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	8,42	211,12	1,25	130,81	2.231	0,76	220.476.430	1.389			1,04E-23 formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	10,09	245,65	1,26	88,52	3.118	0,79	217.061.507	1.373			168,29 formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	9,83	247,94	1,49	112,79	3.621	0,81	330.636.051	2.083			88,14 formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	7,88	204,86	1,33	104,06	2.154	0,80	178.404.883	1.124			1,05E+02 formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

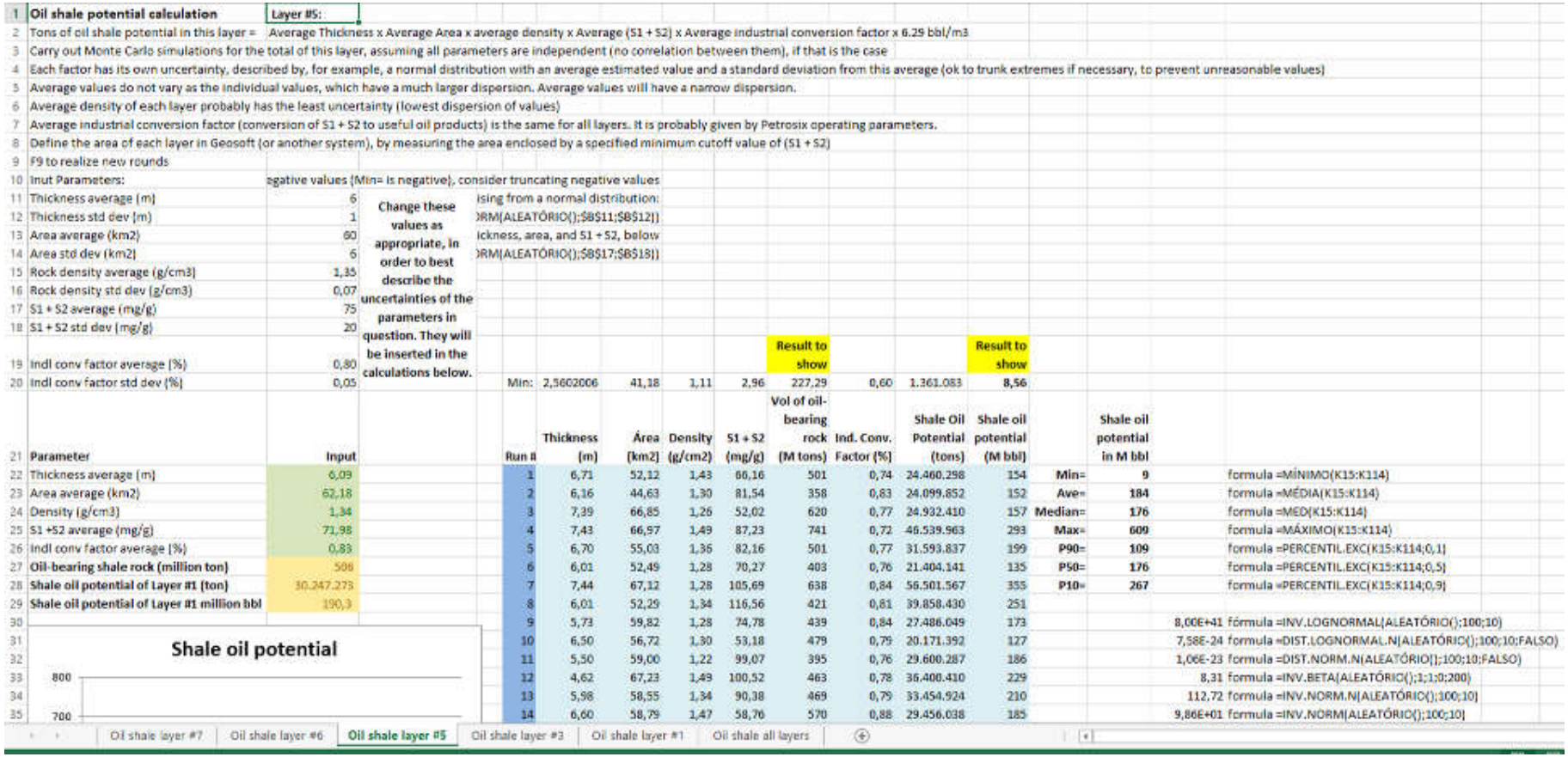
Subunidade L6

1	**Oil shale potential calculation**	**Layer #6**												
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3												
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case													
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)													
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.													
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)													
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.													
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)													
9	F9 to realize new rounds													
10	Inut Parameters:													
11	Thickness average (m)	2												
12	Thickness std dev (m)	0,1												
13	Area average (km2)	10	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**											
14	Area std dev (km2)	2												
15	Rock density average (g/cm3)	1,68												
16	Rock density std dev (g/cm3)	0,07												
17	S1 + S2 average (mg/g)	28												
18	S1 + S2 std dev (mg/g)	6												
19	Indl conv factor average (%)	0,80												
20	Indl conv factor std dev (%)	0,05							**Result to show**			**Result to show**		
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	2,11		1	1,88	12,07	1,78	25,49	41	0,77	800.154	5	**Min=**	1	formula =MÍNIMO(L23:L2022)
23	Area average (km2)	12,34		2	1,87	9,61	1,67	26,71	30	0,74	598.005	4	**Ave=**	5	formula =MÉDIA(L23:L2022)
24	Density (g/cm3)	1,64		3	1,99	11,04	1,80	28,79	40	0,79	905.670	6	**Median=**	5	formula =MED(L23:L2022)
25	S1 +S2 average (mg/g)	26,41		4	2,10	9,65	1,70	21,53	34	0,80	592.905	4	**Max=**	11	formula =MÁXIMO(L23:L2022)
26	Indl conv factor average (%)	0,87		5	2,11	8,72	1,73	25,24	32	0,83	667.749	4	**P90=**	3	formula =PERCENTIL.EXC(L23:L2022;0,1)
27	**Oil-bearing shale rock (million ton)**	43		6	2,07	8,97	1,69	23,12	31	0,85	625.653	4	**P50=**	5	formula =PERCENTIL.EXC(L23:L2022;0,5)
28	**Shale oil potential of Layer #1 (ton)**	989.040		7	2,13	11,20	1,65	14,86	40	0,83	489.085	3	**P10=**	7	formula =PERCENTIL.EXC(L23:L2022;0,9)
29	**Shale oil potential of Layer #1 million bbl**	6,2		8	1,96	9,71	1,80	34,96	34	0,75	643.018	4			
30				9	1,92	11,64	1,71	17,93	38	0,73	534.682	3		1,31E+46	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	2,07	10,50	1,75	36,58	38	0,79	1.101.337	7		7,57E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	2,13	13,63	1,76	17,11	51	0,84	736.599	5		9,68E-24	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	1,97	10,03	1,82	23,09	36	0,79	661.729	4		8,49	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	2,02	6,79	1,67	31,61	23	0,81	590.197	4		100,92	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	1,83	9,46	1,63	25,89	28	0,75	556.735	4		9,59E+01	formula =INV.NORM(ALEATÓRIO();100;10)



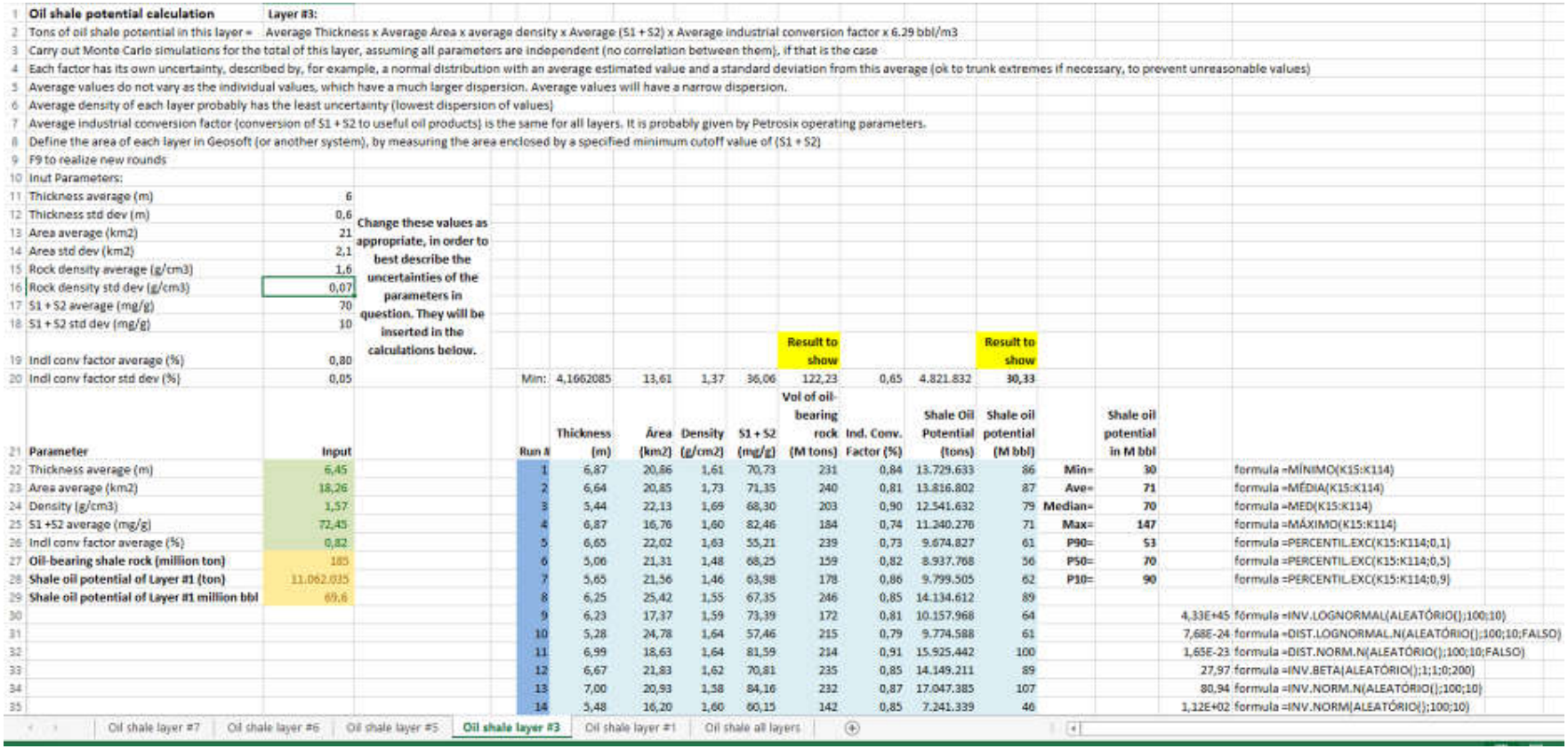
Oil shale layer #7 | **Oil shale layer #6** | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Subunidade L5



1	**Oil shale potential calculation**	**Layer #5:**																	
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3																	
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case																		
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)																		
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.																		
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)																		
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.																		
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)																		
9	F9 to realize new rounds																		
10	Inut Parameters:	egative values (Min= is negative), consider truncating negative values																	
11	Thickness average (m)	6			ising from a normal distribution:														
12	Thickness std dev (m)	1			)RM(ALEATÓRIO();B11;B12))														
13	Area average (km2)	60			ickness, area, and S1 + S2, below														
14	Area std dev (km2)	6			)RM(ALEATÓRIO();B17;B18))														
15	Rock density average (g/cm3)	1,35																	
16	Rock density std dev (g/cm3)	0,07																	
17	S1 + S2 average (mg/g)	75																	
18	S1 + S2 std dev (mg/g)	20																	
19	Indl conv factor average (%)	0,80								Result to show			Result to show						
20	Indl conv factor std dev (%)	0,05			Min:	2,5602006	41,18	1,11	2,96	227,29	0,60	1.361.083	8,56						
21	**Parameter**	**Input**			**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**				
22	Thickness average (m)	6,09			1	6,71	52,12	1,43	66,16	501	0,74	24.460.298	154	**Min=**	**9**	formula =MÍNIMO(K15:K114)			
23	Area average (km2)	62,18			2	6,16	44,63	1,30	81,54	358	0,83	24.099.852	152	**Ave=**	**184**	formula =MÉDIA(K15:K114)			
24	Density (g/cm3)	1,34			3	7,39	66,85	1,26	52,02	620	0,77	24.932.410	157	**Median=**	**176**	formula =MED(K15:K114)			
25	S1 +S2 average (mg/g)	71,98			4	7,43	66,97	1,49	87,23	741	0,72	46.539.963	293	**Max=**	**609**	formula =MÁXIMO(K15:K114)			
26	Indl conv factor average (%)	0,83			5	6,70	55,03	1,36	82,16	501	0,77	31.593.837	199	**P90=**	**109**	formula =PERCENTIL.EXC(K15:K114;0,1)			
27	**Oil-bearing shale rock (million ton)**	506			6	6,01	52,49	1,28	70,27	403	0,76	21.404.141	135	**P50=**	**176**	formula =PERCENTIL.EXC(K15:K114;0,5)			
28	**Shale oil potential of Layer #1 (ton)**	30.247.273			7	7,44	67,12	1,28	105,69	638	0,84	56.501.567	355	**P10=**	**267**	formula =PERCENTIL.EXC(K15:K114;0,9)			
29	**Shale oil potential of Layer #1 million bbl**	190,3			8	6,01	52,29	1,34	116,56	421	0,81	39.858.430	251						
30					9	5,73	59,82	1,28	74,78	439	0,84	27.486.049	173			8,00E+41	formula =INV.LOGNORMAL(ALEATÓRIO();100;10)		
31					10	6,50	56,72	1,30	53,18	479	0,79	20.171.392	127			7,58E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)		
32					11	5,50	59,00	1,22	99,07	395	0,76	29.600.287	186			1,06E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)		
33					12	4,62	67,23	1,49	100,52	463	0,78	36.400.410	229			8,31	formula =INV.BETA(ALEATÓRIO();1;1;0;200)		
34					13	5,98	58,55	1,34	90,38	469	0,79	33.454.924	210			112,72	formula =INV.NORM.N(ALEATÓRIO();100;10)		
35					14	6,60	58,79	1,47	58,76	570	0,88	29.456.038	185			9,86E+01	formula =INV.NORM(ALEATÓRIO();100;10)		

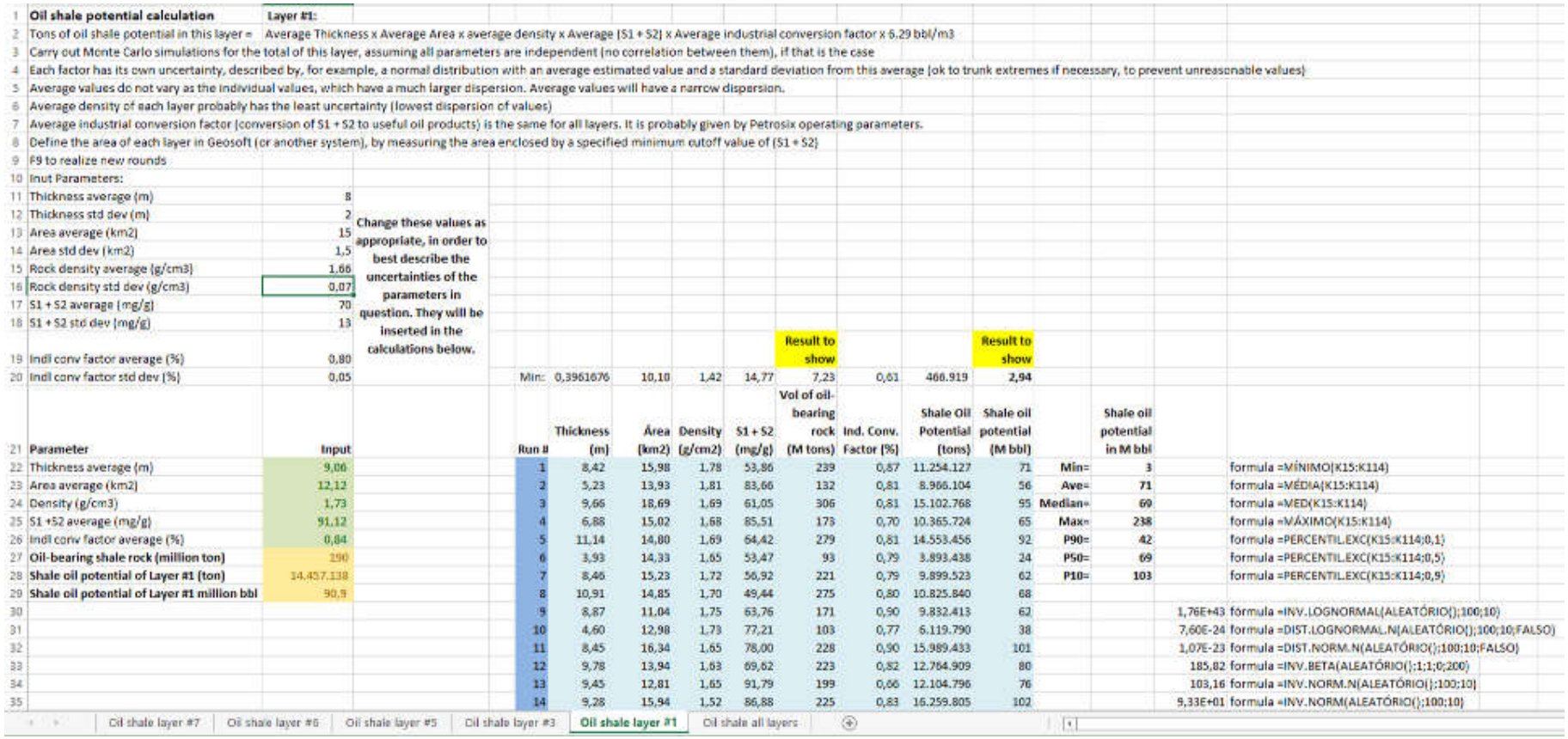
Subunidade L3



1	**Oil shale potential calculation**	**Layer #3:**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	6													
12	Thickness std dev (m)	0,6													
13	Area average (km2)	21	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
14	Area std dev (km2)	2,1													
15	Rock density average (g/cm3)	1,6													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	70													
18	S1 + S2 std dev (mg/g)	10													
19	Indl conv factor average (%)	0,80							**Result to show**			**Result to show**			
20	Indl conv factor std dev (%)	0,05		Min:	4,1662085	13,61	1,37	36,06	122,23	0,65	4.821.832	30,33			
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	6,45		1	6,87	20,86	1,61	70,73	231	0,84	13.729.633	86	**Min=**	**30**	formula =MÍNIMO(K15:K114)
23	Area average (km2)	18,26		2	6,64	20,85	1,73	71,35	240	0,81	13.816.802	87	**Ave=**	**71**	formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,57		3	5,44	22,13	1,69	68,30	203	0,90	12.541.632	79	**Median=**	**70**	formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	72,45		4	6,87	16,76	1,60	82,46	184	0,74	11.240.276	71	**Max=**	**147**	formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,82		5	6,65	22,02	1,63	55,21	239	0,73	9.674.827	61	**P90=**	**53**	formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	185		6	5,06	21,31	1,48	68,25	159	0,82	8.937.768	56	**P50=**	**70**	formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	11.062.035		7	5,65	21,56	1,46	63,98	178	0,86	9.799.505	62	**P10=**	**90**	formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	69,6		8	6,25	25,42	1,55	67,35	246	0,85	14.134.612	89			
30				9	6,23	17,37	1,59	73,39	172	0,81	10.157.968	64			4,33E+45 fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	5,28	24,78	1,64	57,46	215	0,79	9.774.588	61			7,68E-24 formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	6,99	18,63	1,64	81,59	214	0,91	15.925.442	100			1,65E-23 formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	6,67	21,83	1,62	70,81	235	0,85	14.149.211	89			27,97 formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	7,00	20,93	1,58	84,16	232	0,87	17.047.385	107			80,94 formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	5,48	16,20	1,60	60,15	142	0,85	7.241.339	46			1,12E+02 formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | **Oil shale layer #3** | Oil shale layer #1 | Oil shale all layers

Subunidade L1



1	**Oil shale potential calculation**	**Layer #1:**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	8													
12	Thickness std dev (m)	2													
13	Area average (km2)	15	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
14	Area std dev (km2)	1,5													
15	Rock density average (g/cm3)	1,66													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	70													
18	S1 + S2 std dev (mg/g)	13													
19	Indl conv factor average (%)	0,80								**Result to show**			**Result to show**		
20	Indl conv factor std dev (%)	0,05		Min:	0,3961676	10,10	1,42	14,77	7,23	0,61	466.919	2,94			
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	9,06		1	8,42	15,98	1,78	53,86	239	0,87	11.254.127	71	**Min=**	**3**	formula =MÍNIMO(K15:K114)
23	Area average (km2)	12,12		2	5,23	13,93	1,81	83,66	132	0,81	8.966.104	56	**Ave=**	**71**	formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,73		3	9,66	18,69	1,69	61,05	306	0,81	15.102.768	95	**Median=**	**69**	formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	91,12		4	6,88	15,02	1,68	85,51	173	0,70	10.365.724	65	**Max=**	**238**	formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,84		5	11,14	14,80	1,69	64,42	279	0,81	14.553.456	92	**P90=**	**42**	formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	290		6	3,93	14,33	1,65	53,47	93	0,79	3.893.438	24	**P50=**	**69**	formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	14.457.138		7	8,46	15,23	1,72	56,92	221	0,79	9.899.523	62	**P10=**	**103**	formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	90,9		8	10,91	14,85	1,70	49,44	275	0,80	10.825.840	68			
30				9	8,87	11,04	1,75	63,76	171	0,90	9.832.413	62			1,76E+43 formula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	4,60	12,98	1,73	77,21	103	0,77	6.119.790	38			7,60E-24 formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	8,45	16,34	1,65	78,00	228	0,90	15.989.433	101			1,07E-23 formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	9,78	13,94	1,63	69,62	223	0,82	12.764.909	80			185,82 formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	9,45	12,81	1,65	91,79	199	0,66	12.104.796	76			103,16 formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	9,28	15,94	1,52	86,88	225	0,83	16.259.805	102			9,33E+01 formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | **Oil shale layer #1** | Oil shale all layers

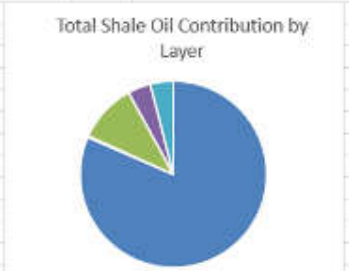
Cálculo Total das Subunidades

Total oil shale potential resource calculation

Perform a sum of all layers as a Monte Carlo simulation, so that the total is probabilistically calculated as a sum of independent terms (assume that the results for each layer are independent - no correlation between them)

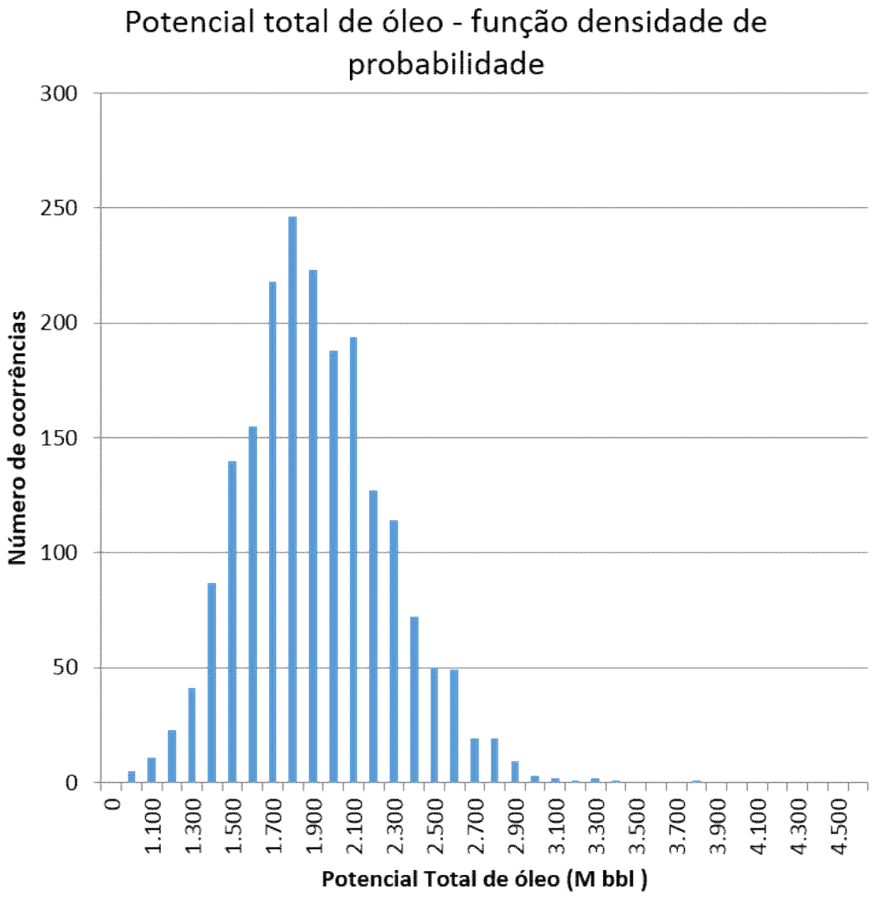
Values for each layer are copied from each layer calculation

Volume of oil-bearing rock in layer #7 M tons	Shale oil potential in layer #7 M bbl	Volume of oil-bearing rock in layer #6 M tons	Shale oil potential in layer #6 M bbl	Volume of oil-bearing rock in layer #5 M tons	Shale oil potential in layer #5 M bbl	Volume of oil-bearing rock in layer #3 M tons	Shale oil potential in layer #3 M bbl	Volume of oil-bearing rock in layer #1 M tons	Shale oil potential in layer #1 M bbl	**Total vol of oil-bearing rock M tons**	**Total shale oil potential M bbl**		**Total shale oil potential M bbl**		**% in layer #7**	**% in layer #6**	**% in layer #5**	**% in layer #3**	**% in layer #1**		
2.777	1.419	33	4	621	206	185	51	164	69	3.780	1.749				81%	0%	12%	3%	4%	Min #7	625
2.269	1.444	38	4	464	131	174	59	284	87	3.229	1.726	Min=	963	formula =MÍNIMO(G5:G2004)	84%	0%	8%	3%	5%	Min #6	1
3.102	1.476	41	6	574	300	291	82	221	72	4.230	1.936	Méd=	1.845	formula =MÉDIA(G5:G2004)	76%	0%	15%	4%	4%	Min #5	32
2.660	1.565	32	4	500	184	181	74	218	88	3.590	1.915	Mediana=	1.817	formula =MED(G5:G2004)	82%	0%	10%	4%	5%	Min #3	35
2.498	1.561	22	4	332	74	203	62	146	39	3.200	1.741	Max=	3.025	formula =MÁXIMO(G5:G2004)	90%	0%	4%	4%	2%	Min #1	2
2.741	1.462	26	5	367	193	224	82	163	68	3.522	1.809	**P90=**	**1.438**	formula =PERCENTIL.EXC(G5:G2004;0	81%	0%	11%	5%	4%		
3.955	2.421	42	8	422	181	223	77	290	100	4.931	2.787	**P50=**	**1.817**	formula =PERCENTIL.EXC(G5:G2004;0	87%	0%	7%	3%	4%		
2.898	1.525	20	3	412	93	235	99	181	63	3.751	1.782	**P10=**	**2.305**	formula =PERCENTIL.EXC(G5:G2004;0	80%	0%	5%	6%	4%		
3.285	1.564	54	8	343	182	255	88	257	79	4.194	1.921				81%	0%	9%	5%	4%		
2.473	1.233	36	5	497	279	243	88	179	40	3.428	1.646		**82%**	**Ave of Layer #7**	75%	0%	17%	5%	2%		
2.231	1.389	29	5	546	280	256	87	291	96	3.352	1.857		**0%**	**Ave of Layer #6**	75%	0%	15%	5%	5%		
3.118	1.373	21	2	332	129	217	83	169	37	3.858	1.624		**10%**	**Ave of Layer #5**	85%	0%	8%	5%	2%		
3.621	2.083	32	4	503	125	256	76	309	111	4.721	2.398		**4%**	**Ave of Layer #3**	87%	0%	5%	3%	5%		
2.154	1.124	45	5	401	196	197	66	132	44	2.928	1.435		**4%**	**Ave of Layer #1**	78%	0%	14%	5%	3%		
2.570	1.642	30	3	551	264	223	80	184	69	3.558	2.059		**100%**	**Total all layers**	80%	0%	13%	4%	3%		
2.886	1.271	23	3	451	220	232	79	170	69	3.761	1.641				77%	0%	13%	5%	4%		
2.102	1.383	16	2	612	192	150	48	281	96	3.161	1.721				80%	0%	11%	3%	6%		
3.551	1.787	39	4	724	294	200	80	232	88	4.746	2.254				79%	0%	13%	4%	4%		
3.210	1.863	30	4	545	198	261	72	174	53	4.221	2.191				85%	0%	9%	3%	2%		
2.929	1.204	27	4	686	426	253	85	268	117	4.164	1.836				66%	0%	23%	5%	6%		
3.002	1.370	31	4	422	83	222	69	87	35	3.765	1.561				88%	0%	5%	4%	2%		
3.408	1.656	33	3	347	98	183	48	260	86	4.231	1.891				88%	0%	5%	3%	5%		
3.124	2.071	39	5	386	169	188	67	100	36	3.837	2.347				88%	0%	7%	3%	2%		
2.476	1.213	25	4	520	217	182	72	149	46	3.351	1.551				78%	0%	14%	5%	3%		
3.659	2.527	19	2	409	143	192	66	162	59	4.441	2.798				90%	0%	5%	2%	2%		
3.245	1.555	31	5	607	306	249	69	124	46	4.257	1.981				78%	0%	15%	4%	2%		
2.278	1.005	47	6	355	234	271	100	276	107	3.268	1.452				69%	0%	16%	7%	7%		
1.984	1.145	41	6	478	172	231	72	150	71	2.885	1.465				78%	0%	12%	5%	5%		
3.047	1.909	33	4	677	228	211	57	152	61	4.120	2.259				85%	0%	10%	3%	3%		
3.103	2.086	30	4	590	224	166	57	139	46	4.029	2.415				86%	0%	9%	2%	2%		



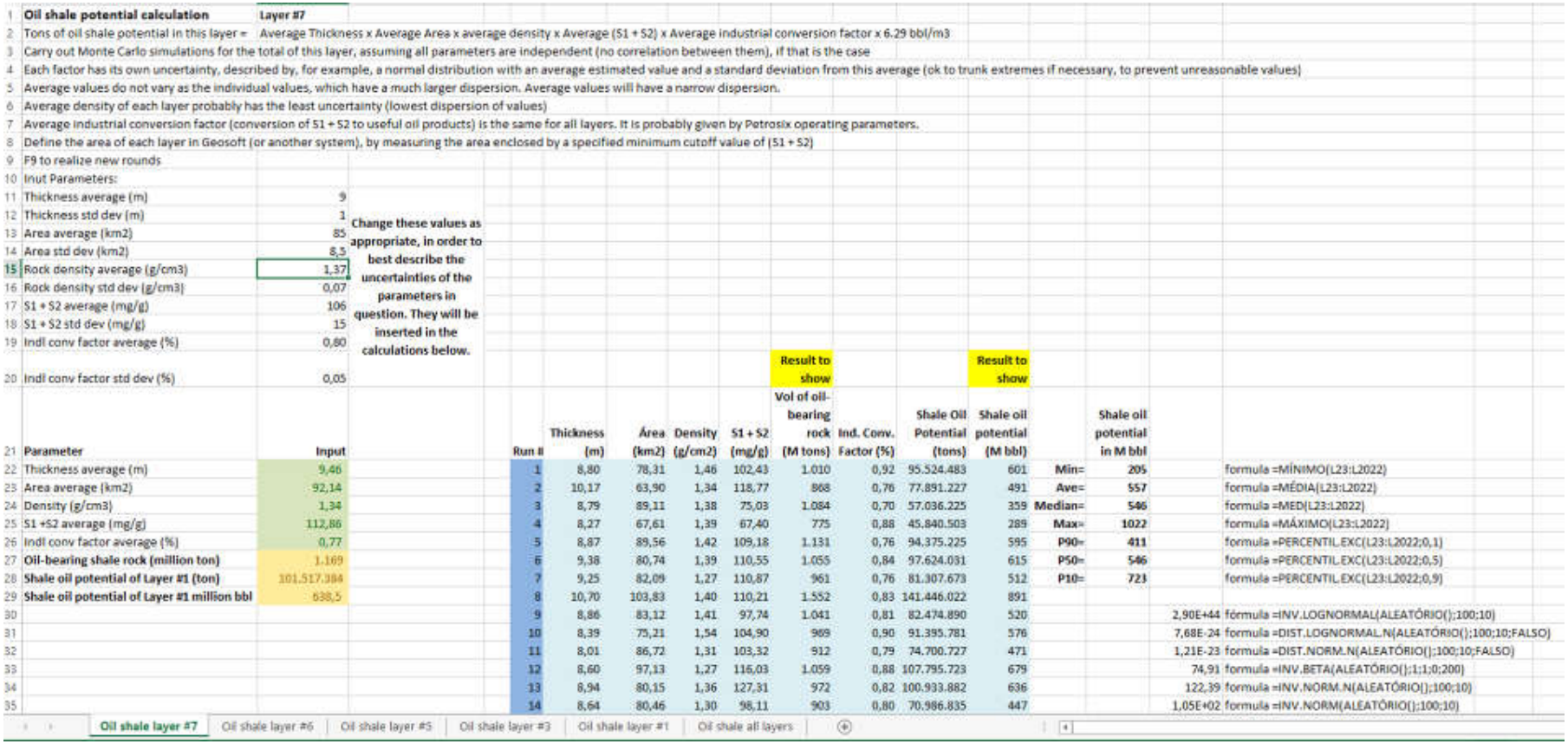
Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | **Oil shale all layers**

Gráfico de Percentile



Cenário de 100 mg HC/g Rocha

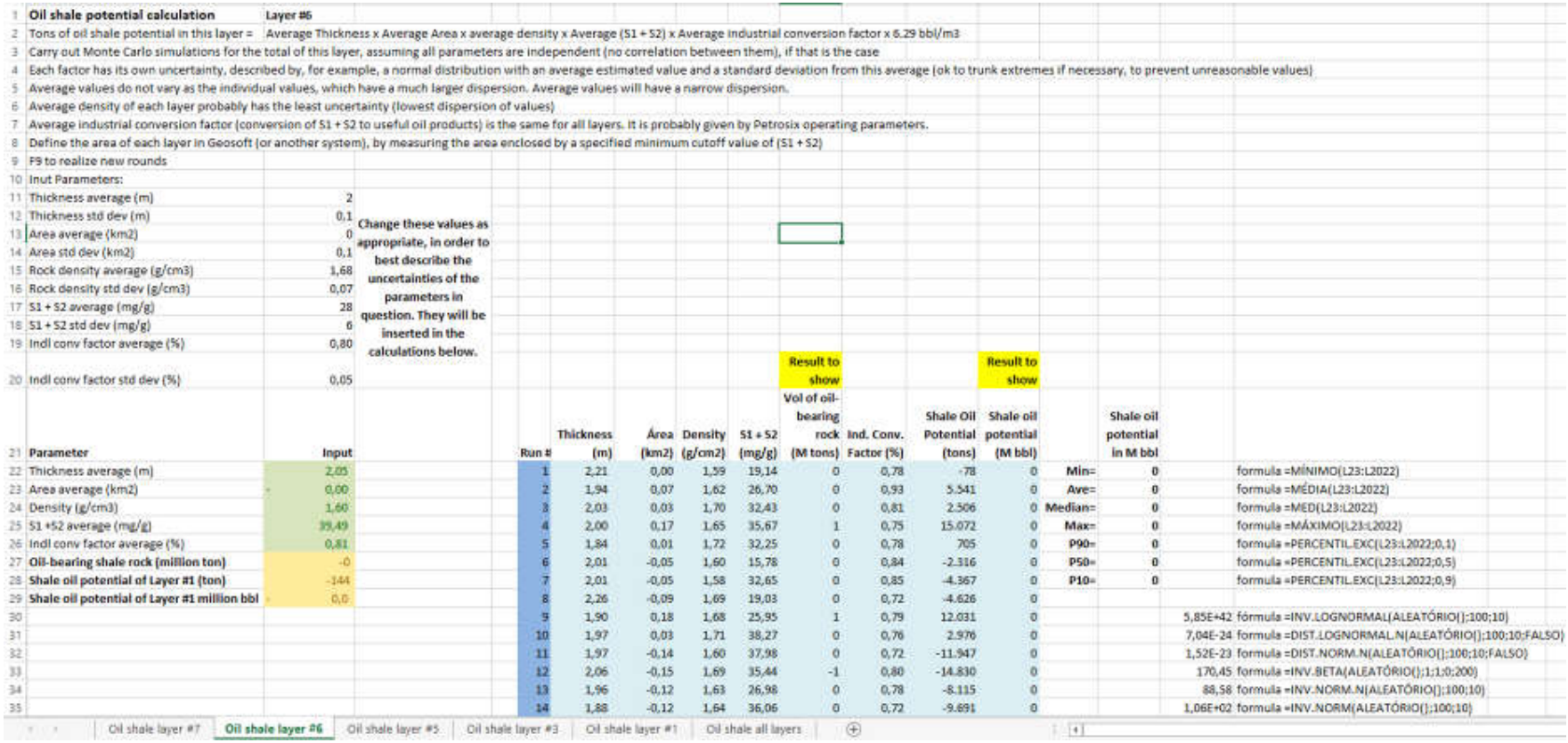
Subunidade L7



1	**Oil shale potential calculation**	**Layer #7**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	9													
12	Thickness std dev (m)	1	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
13	Area average (km2)	85													
14	Area std dev (km2)	8,5													
15	Rock density average (g/cm3)	1,37													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	106													
18	S1 + S2 std dev (mg/g)	15													
19	Indl conv factor average (%)	0,80													
20	Indl conv factor std dev (%)	0,05							**Result to show**			**Result to show**			
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**		
22	Thickness average (m)	9,46		1	8,80	78,31	1,46	102,43	1.010	0,92	95.524.483	601	**Min=**	**205**		formula =MÍNIMO(L23:L2022)
23	Area average (km2)	92,14		2	10,17	63,90	1,34	118,77	868	0,76	77.891.227	491	**Ave=**	**557**		formula =MÉDIA(L23:L2022)
24	Density (g/cm3)	1,34		3	8,79	89,11	1,38	75,03	1.084	0,70	57.036.225	359	**Median=**	**546**		formula =MED(L23:L2022)
25	S1 +S2 average (mg/g)	112,86		4	8,27	67,61	1,39	67,40	775	0,88	45.840.503	289	**Max=**	**1022**		formula =MÁXIMO(L23:L2022)
26	Indl conv factor average (%)	0,77		5	8,87	89,56	1,42	109,18	1.131	0,76	94.375.225	595	**P90=**	**411**		formula =PERCENTIL.EXC(L23:L2022;0,1)
27	**Oil-bearing shale rock (million ton)**	1.169		6	9,38	80,74	1,39	110,55	1.055	0,84	97.624.031	615	**P50=**	**546**		formula =PERCENTIL.EXC(L23:L2022;0,5)
28	**Shale oil potential of Layer #1 (ton)**	101.517.384		7	9,25	82,09	1,27	110,87	961	0,76	81.307.673	512	**P10=**	**723**		formula =PERCENTIL.EXC(L23:L2022;0,9)
29	**Shale oil potential of Layer #1 million bbl**	638,5		8	10,70	103,83	1,40	110,21	1.552	0,83	141.446.022	891				
30				9	8,86	83,12	1,41	97,74	1.041	0,81	82.474.890	520			2,90E+44	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	8,39	75,21	1,54	104,90	969	0,90	91.395.781	576			7,68E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	8,01	86,72	1,31	103,32	912	0,79	74.700.727	471			1,21E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	8,60	97,13	1,27	116,03	1.059	0,88	107.795.723	679			74,91	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	8,94	80,15	1,36	127,31	972	0,82	100.933.882	636			122,39	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	8,64	80,46	1,30	98,11	903	0,80	70.986.835	447			1,05E+02	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

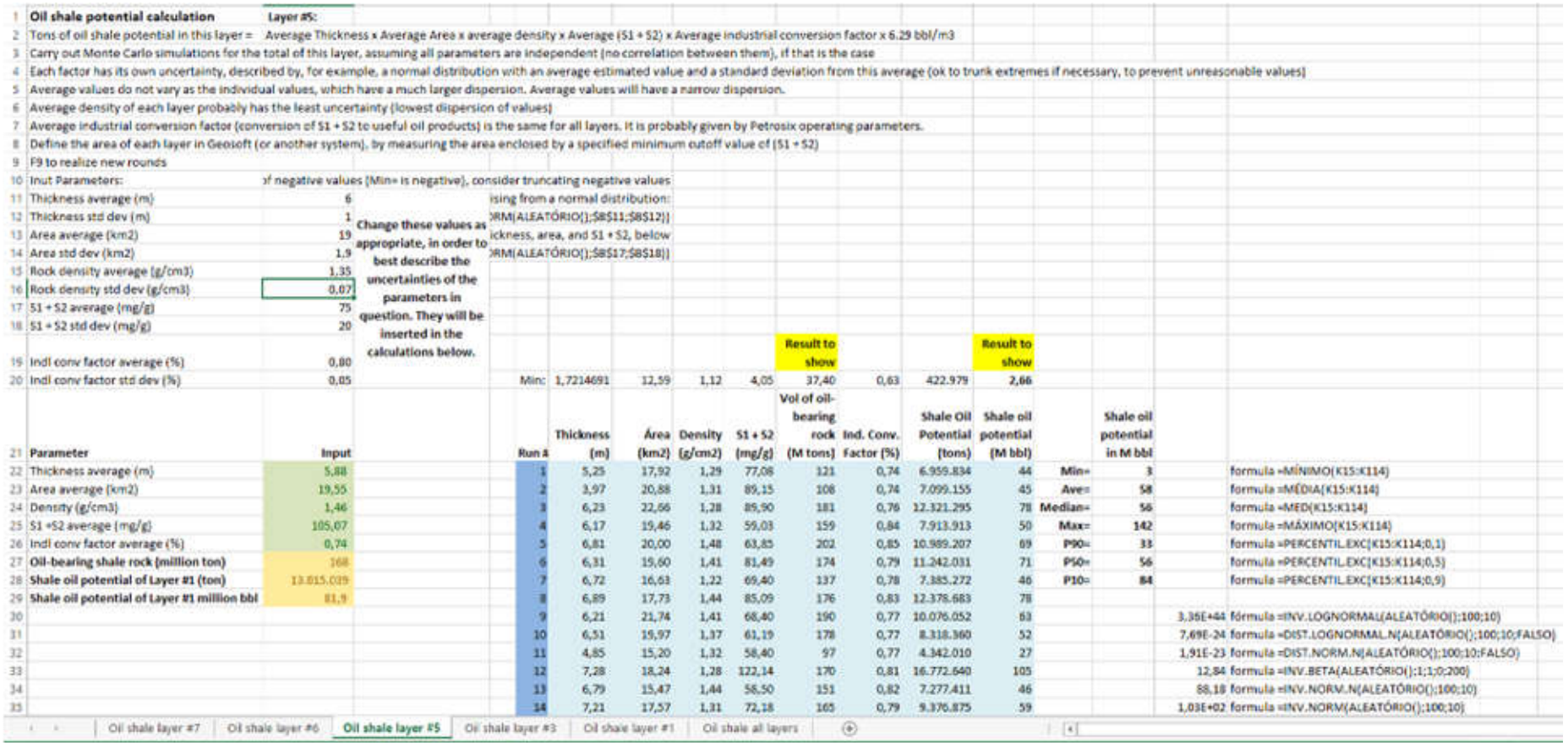
Subunidade L6



1	**Oil shale potential calculation**	**Layer #6**													
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3													
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case														
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)														
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.														
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)														
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.														
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)														
9	F9 to realize new rounds														
10	Inut Parameters:														
11	Thickness average (m)	2													
12	Thickness std dev (m)	0,1	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**												
13	Area average (km2)	0													
14	Area std dev (km2)	0,1													
15	Rock density average (g/cm3)	1,68													
16	Rock density std dev (g/cm3)	0,07													
17	S1 + S2 average (mg/g)	28													
18	S1 + S2 std dev (mg/g)	6													
19	Indl conv factor average (%)	0,80													
20	Indl conv factor std dev (%)	0,05								**Result to show**			**Result to show**		
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**	
22	Thickness average (m)	2,05		1	2,21	0,00	1,59	19,14	0	0,78	-78	0	**Min=**	0	formula =MÍNIMO(L23:L2022)
23	Area average (km2)	0,00		2	1,94	0,07	1,62	26,70	0	0,93	5.541	0	**Ave=**	0	formula =MÉDIA(L23:L2022)
24	Density (g/cm3)	1,60		3	2,03	0,03	1,70	32,43	0	0,81	2.506	0	**Median=**	0	formula =MED(L23:L2022)
25	S1 +S2 average (mg/g)	39,49		4	2,00	0,17	1,65	35,67	1	0,75	15.072	0	**Max=**	0	formula =MÁXIMO(L23:L2022)
26	Indl conv factor average (%)	0,81		5	1,84	0,01	1,72	32,25	0	0,78	705	0	**P90=**	0	formula =PERCENTIL.EXC(L23:L2022;0,1)
27	**Oil-bearing shale rock (million ton)**	-0		6	2,01	-0,05	1,60	15,78	0	0,84	-2.316	0	**P50=**	0	formula =PERCENTIL.EXC(L23:L2022;0,5)
28	**Shale oil potential of Layer #1 (ton)**	-144		7	2,01	-0,05	1,58	32,65	0	0,85	-4.367	0	**P10=**	0	formula =PERCENTIL.EXC(L23:L2022;0,9)
29	**Shale oil potential of Layer #1 million bbl**	0,0		8	2,26	-0,09	1,69	19,03	0	0,72	-4.626	0			
30				9	1,90	0,18	1,68	25,95	1	0,79	12.031	0		5,85E+42	formula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	1,97	0,03	1,71	38,27	0	0,76	2.976	0		7,04E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	1,97	-0,14	1,60	37,98	0	0,72	-11.947	0		1,52E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	2,06	-0,15	1,69	35,44	-1	0,80	-14.830	0		170,45	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	1,96	-0,12	1,63	26,98	0	0,78	-8.115	0		88,58	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	1,88	-0,12	1,64	36,06	0	0,72	-9.691	0		1,06E+02	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | **Oil shale layer #6** | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

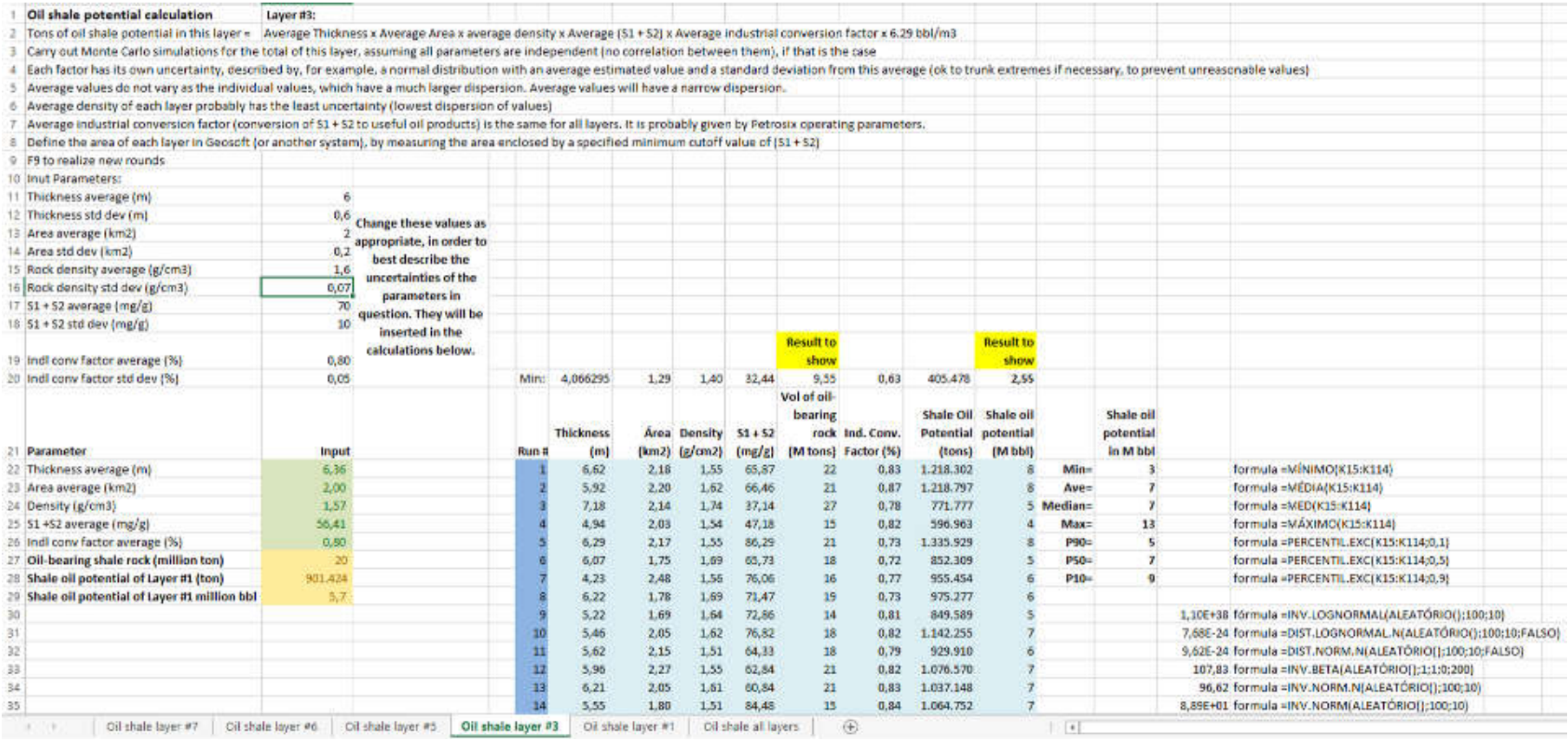
Subunidade L5



1	**Oil shale potential calculation**	**Layer #5:**															
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3															
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case																
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)																
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.																
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)																
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.																
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)																
9	F9 to realize new rounds																
10	Inut Parameters:	of negative values (Min= is negative), consider truncating negative values															
11	Thickness average (m)	6			ising from a normal distribution:												
12	Thickness std dev (m)	1			ORM(ALEATÓRIO();B11;B12))												
13	Area average (km2)	19	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**		ickness, area, and S1 + S2, below												
14	Area std dev (km2)	1,9			ORM(ALEATÓRIO();B17;B18))												
15	Rock density average (g/cm3)	1,35															
16	Rock density std dev (g/cm3)	0,07															
17	S1 + S2 average (mg/g)	75															
18	S1 + S2 std dev (mg/g)	20															
19	Indl conv factor average (%)	0,80								**Result to show**			**Result to show**				
20	Indl conv factor std dev (%)	0,05			Minc	1,7214691	12,59	1,12	4,05	37,40	0,63	422.979	2,66				
21	**Parameter**	**Input**			**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**		
22	Thickness average (m)	5,88			1	5,25	17,92	1,29	77,08	121	0,74	6.959.834	44	**Min=**	3		formula =MÍNIMO(K15:K114)
23	Area average (km2)	19,55			2	3,97	20,88	1,31	89,15	108	0,74	7.099.155	45	**Ave=**	58		formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,46			3	6,23	22,66	1,28	89,90	181	0,76	12.321.295	78	**Median=**	56		formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	105,07			4	6,17	19,46	1,32	59,03	159	0,84	7.913.913	50	**Max=**	142		formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,74			5	6,81	20,00	1,48	63,85	202	0,85	10.989.207	69	**P90=**	33		formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	168			6	6,31	15,60	1,41	81,49	174	0,79	11.242.031	71	**P50=**	56		formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	13.015.039			7	6,72	16,63	1,22	69,40	137	0,78	7.385.272	46	**P10=**	84		formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	81,9			8	6,89	17,73	1,44	85,09	176	0,83	12.378.683	78				
30					9	6,21	21,74	1,41	68,40	190	0,77	10.076.052	63			3,35E+44	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31					10	6,51	19,97	1,37	61,19	178	0,77	8.318.360	52			7,69E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32					11	4,85	15,20	1,32	58,40	97	0,77	4.342.010	27			1,91E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33					12	7,28	18,24	1,28	122,14	170	0,81	16.772.640	105			12,84	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34					13	6,79	15,47	1,44	58,50	151	0,82	7.277.411	46			88,18	formula =INV.NORM.N(ALEATÓRIO();100;10)
35					14	7,21	17,57	1,31	72,18	165	0,79	9.376.875	59			1,03E+02	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | **Oil shale layer #5** | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Subunidade L3



1	**Oil shale potential calculation**	**Layer #3:**														
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3														
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case															
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)															
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.															
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)															
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.															
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)															
9	F9 to realize new rounds															
10	Inut Parameters:															
11	Thickness average (m)	6														
12	Thickness std dev (m)	0,6	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**													
13	Area average (km2)	2														
14	Area std dev (km2)	0,2														
15	Rock density average (g/cm3)	1,6														
16	Rock density std dev (g/cm3)	0,07														
17	S1 + S2 average (mg/g)	70														
18	S1 + S2 std dev (mg/g)	10														
19	Indl conv factor average (%)	0,80								**Result to show**			**Result to show**			
20	Indl conv factor std dev (%)	0,05		Min:	4,066295	1,29	1,40	32,44	9,55	0,63	405.478	2,55				
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**		
22	Thickness average (m)	6,36		1	6,62	2,18	1,55	65,87	22	0,83	1.218.302	8	**Min=**	3		formula =MÍNIMO(K15:K114)
23	Area average (km2)	2,00		2	5,92	2,20	1,62	66,46	21	0,87	1.218.797	8	**Ave=**	7		formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,57		3	7,18	2,14	1,74	37,14	27	0,78	771.777	5	**Median=**	7		formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	56,41		4	4,94	2,03	1,54	47,18	15	0,82	596.963	4	**Max=**	13		formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,80		5	6,29	2,17	1,55	86,29	21	0,73	1.335.929	8	**P90=**	5		formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	20		6	6,07	1,75	1,69	65,73	18	0,72	852.309	5	**P50=**	7		formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	901.424		7	4,23	2,48	1,56	76,06	16	0,77	955.454	6	**P10=**	9		formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	5,7		8	6,22	1,78	1,69	71,47	19	0,73	975.277	6				
30				9	5,22	1,69	1,64	72,86	14	0,81	849.589	5			1,10E+38	fórmula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	5,46	2,05	1,62	76,82	18	0,82	1.142.255	7			7,68E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	5,62	2,15	1,51	64,33	18	0,79	929.910	6			9,62E-24	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	5,96	2,27	1,55	62,84	21	0,82	1.076.570	7			107,83	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	6,21	2,05	1,61	60,84	21	0,83	1.037.148	7			96,62	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	5,55	1,80	1,51	84,48	15	0,84	1.064.752	7			8,89E+01	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | **Oil shale layer #3** | Oil shale layer #1 | Oil shale all layers

Subunidade L1

1	**Oil shale potential calculation**	**Layer #1:**														
2	Tons of oil shale potential in this layer =	Average Thickness x Average Area x average density x Average (S1 + S2) x Average industrial conversion factor x 6.29 bbl/m3														
3	Carry out Monte Carlo simulations for the total of this layer, assuming all parameters are independent (no correlation between them), if that is the case															
4	Each factor has its own uncertainty, described by, for example, a normal distribution with an average estimated value and a standard deviation from this average (ok to trunk extremes if necessary, to prevent unreasonable values)															
5	Average values do not vary as the individual values, which have a much larger dispersion. Average values will have a narrow dispersion.															
6	Average density of each layer probably has the least uncertainty (lowest dispersion of values)															
7	Average industrial conversion factor (conversion of S1 + S2 to useful oil products) is the same for all layers. It is probably given by Petrosix operating parameters.															
8	Define the area of each layer in Geosoft (or another system), by measuring the area enclosed by a specified minimum cutoff value of (S1 + S2)															
9	F9 to realize new rounds															
10	Inut Parameters:															
11	Thickness average (m)	8														
12	Thickness std dev (m)	2	**Change these values as appropriate, in order to best describe the uncertainties of the parameters in question. They will be inserted in the calculations below.**													
13	Area average (km2)	0														
14	Area std dev (km2)	0,1														
15	Rock density average (g/cm3)	1,66														
16	Rock density std dev (g/cm3)	0,07														
17	S1 + S2 average (mg/g)	70														
18	S1 + S2 std dev (mg/g)	13														
19	Indl conv factor average (%)	0,80								**Result to show**			**Result to show**			
20	Indl conv factor std dev (%)	0,05		Min:	1,38134	-0,32	1,39	21,60	-4,57	0,60	-339.348	-2,13				
21	**Parameter**	**Input**		**Run #**	**Thickness (m)**	**Área (km2)**	**Density (g/cm2)**	**S1 + S2 (mg/g)**	**Vol of oil-bearing rock (M tons)**	**Ind. Conv. Factor (%)**	**Shale Oil Potential (tons)**	**Shale oil potential (M bbl)**		**Shale oil potential in M bbl**		
22	Thickness average (m)	7,06		1	5,05	0,04	1,74	101,40	0	0,82	32.770	0	**Min=**	-2		formula =MÍNIMO(K15:K114)
23	Area average (km2)	0,20		2	7,28	-0,04	1,66	87,15	-1	0,80	-35.296	0	**Ave=**	0		formula =MÉDIA(K15:K114)
24	Density (g/cm3)	1,54		3	2,96	-0,18	1,82	81,84	-1	0,79	-60.932	0	**Median=**	0		formula =MED(K15:K114)
25	S1 +S2 average (mg/g)	66,91		4	7,99	-0,03	1,68	67,76	0	0,73	-22.383	0	**Max=**	2		formula =MÁXIMO(K15:K114)
26	Indl conv factor average (%)	0,83		5	8,29	0,08	1,69	83,96	1	0,78	78.443	0	**P90=**	-1		formula =PERCENTIL.EXC(K15:K114;0,1)
27	**Oil-bearing shale rock (million ton)**	-2		6	9,23	0,05	1,69	78,43	1	0,76	43.832	0	**P50=**	0		formula =PERCENTIL.EXC(K15:K114;0,5)
28	**Shale oil potential of Layer #1 (ton)**	-122.209		7	11,94	-0,01	1,63	82,58	0	0,86	-20.318	0	**P10=**	1		formula =PERCENTIL.EXC(K15:K114;0,9)
29	**Shale oil potential of Layer #1 million bbl**	-0,8		8	6,35	-0,09	1,60	63,68	-1	0,78	-44.810	0				
30				9	6,50	0,05	1,69	62,38	1	0,78	25.718	0			2,00E+42	formula =INV.LOGNORMAL(ALEATÓRIO();100;10)
31				10	6,13	-0,06	1,66	66,58	-1	0,76	-28.822	0			7,68E-24	formula =DIST.LOGNORMAL.N(ALEATÓRIO();100;10;FALSO)
32				11	5,92	0,03	1,56	75,54	0	0,78	17.323	0			1,61E-23	formula =DIST.NORM.N(ALEATÓRIO();100;10;FALSO)
33				12	7,88	-0,17	1,63	49,03	-2	0,85	-89.691	-1			41,82	formula =INV.BETA(ALEATÓRIO();1;1;0;200)
34				13	7,28	-0,13	1,47	73,45	-1	0,72	-73.921	0			101,04	formula =INV.NORM.N(ALEATÓRIO();100;10)
35				14	8,39	-0,03	1,60	56,63	0	0,79	-20.136	0			1,10E+02	formula =INV.NORM(ALEATÓRIO();100;10)

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | **Oil shale layer #1** | Oil shale all layers

Cálculo Total das Subunidades

Total oil shale potential resource calculation

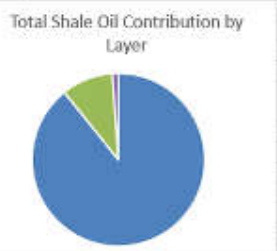
Perform a sum of all layers as a Monte Carlo simulation, so that the total is probabilistically calculated as a sum of independent terms (assume that the results for each layer are independent - no correlation between them)

Values for each layer are copied from each layer calculation

Volume of oil-bearing rock in layer #7 M tons	Shale oil potential in layer #7 M bbl	Volume of oil-bearing rock in layer #6 M tons	Shale oil potential in layer #6 M bbl	Volume of oil-bearing rock in layer #5 M tons	Shale oil potential in layer #5 M bbl	Volume of oil-bearing rock in layer #3 M tons	Shale oil potential in layer #3 M bbl	Volume of oil-bearing rock in layer #1 M tons	Shale oil potential in layer #1 M bbl	Total vol of oil-bearing rock M tons	Total shale oil potential M bbl
1.010	601	0	0	125	44	16	5	0	0	1.150	650
868	491	-1	0	175	61	20	8	-1	-1	1.061	559
1.084	359	0	0	165	62	22	8	-1	0	1.270	429
775	289	0	0	170	28	19	7	-2	-1	962	323
1.131	595	0	0	77	28	16	6	1	0	1.226	629
1.055	615	0	0	140	52	19	5	1	0	1.214	673
961	512	0	0	145	66	16	6	-1	0	1.121	583
1.552	891	1	0	126	61	14	4	1	0	1.693	956
1.041	520	0	0	139	51	21	8	0	0	1.201	579
969	576	0	0	184	66	26	9	0	0	1.179	651
912	471	0	0	135	60	23	9	-2	-1	1.068	539
1.059	679	0	0	161	54	18	7	1	0	1.238	741
972	636	0	0	163	47	19	6	0	0	1.155	689
903	447	0	0	128	64	20	7	2	1	1.053	519
1.301	696	0	0	173	46	20	7	0	0	1.494	749
1.032	485	0	0	119	39	14	5	0	0	1.166	529
774	438	0	0	179	101	18	7	2	1	970	545
1.247	743	1	0	199	75	20	5	3	1	1.469	824
876	429	0	0	161	82	21	8	1	0	1.059	519
893	529	0	0	124	31	20	8	0	0	1.036	568
1.612	787	0	0	170	63	16	4	0	0	1.798	854
1.064	676	0	0	101	52	19	8	1	0	1.185	736
917	452	0	0	208	93	18	8	1	0	1.144	554
1.007	604	0	0	168	63	17	7	2	1	1.194	675
1.079	528	-1	0	95	46	15	6	1	0	1.189	580
1.110	544	0	0	183	68	13	4	0	0	1.307	616
949	560	1	0	186	65	17	6	0	0	1.152	631
1.144	727	0	0	152	90	20	5	2	1	1.318	822
1.184	716	0	0	135	39	18	7	2	1	1.340	704
868	396	0	0	149	49	20	7	4	2	1.041	454

Min=	270	formula =MÍNIMO(G5:G2004)
Méd=	622	formula =MÉDIA(G5:G2004)
Mediana=	610	formula =MED(G5:G2004)
Max=	1.085	formula =MÁXIMO(G5:G2004)
P90=	475	formula =PERCENTIL.EXC(G5:G2004;0
P50=	610	formula =PERCENTIL.EXC(G5:G2004;0
P10=	785	formula =PERCENTIL.EXC(G5:G2004;0

89%	Ave of Layer #7
0%	Ave of Layer #6
10%	Ave of Layer #5
1%	Ave of Layer #3
0%	Ave of Layer #1
100%	Total all layers

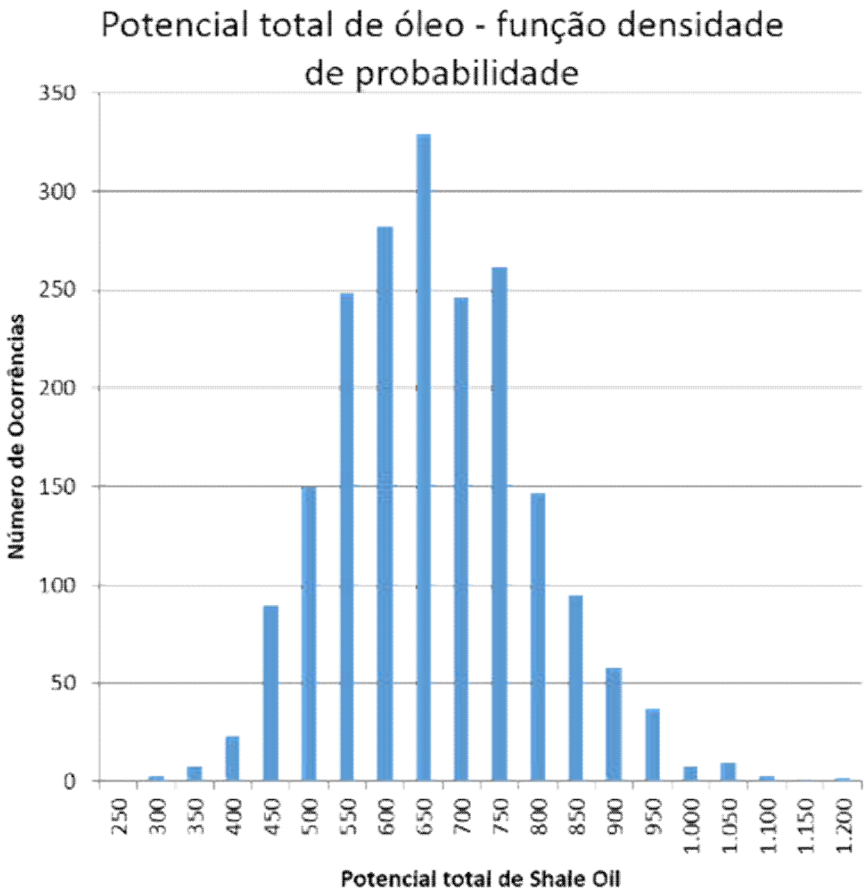


Total shale oil potential M bbl	% in layer #7	% in layer #6	% in layer #5	% in layer #3	% in layer #1
650	92%	0%	7%	1%	0%
559	88%	0%	11%	1%	0%
429	84%	0%	14%	2%	0%
323	89%	0%	9%	2%	0%
629	94%	0%	5%	1%	0%
673	91%	0%	8%	1%	0%
583	88%	0%	11%	1%	0%
956	93%	0%	6%	0%	0%
579	90%	0%	9%	1%	0%
651	89%	0%	10%	1%	0%
539	87%	0%	11%	2%	0%
741	92%	0%	7%	1%	0%
689	92%	0%	7%	1%	0%
519	86%	0%	12%	1%	0%
749	93%	0%	6%	1%	0%
529	92%	0%	7%	1%	0%
545	80%	0%	19%	1%	0%
824	90%	0%	9%	1%	0%
519	81%	0%	16%	1%	0%
568	93%	0%	5%	1%	0%
854	92%	0%	7%	0%	0%
736	92%	0%	7%	1%	0%
554	82%	0%	17%	1%	0%
675	90%	0%	9%	1%	0%
580	91%	0%	8%	1%	0%
616	88%	0%	11%	1%	0%
631	89%	0%	10%	1%	0%
822	88%	0%	11%	1%	0%
704	94%	0%	5%	1%	0%
454	87%	0%	11%	2%	0%

Min #7	205
Min #6	0
Min #5	12
Min #3	2
Min #1	-2

Oil shale layer #7 | Oil shale layer #6 | Oil shale layer #5 | Oil shale layer #3 | Oil shale layer #1 | Oil shale all layers

Gráfico de Percentile


Potencial total de óleo - função densidade de probabilidade
Número de Ocorrências
350
300
250
200
150
100
50
0
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1.000
1.050
1.100
1.150
1.200
Potencial total de Shale Oil