

Activation Dose Rate in the Pixel Detector

Here are given estimations for activation dose rate resulted from activation of pixel detector and services ($Z_{\min}=0$ cm, $Z_{\max}=350$ cm and $R_{\min}=0$ cm, $R_{\max}=280$ cm).

1. Both hadron and neutron activation was taken into account.
2. Concentration of dangerous materials by blocks of the detector was taken from *pixel.doc* (<http://cern.ch/vhedberg/atlas/act/activation.html>) developed by Ivan Bedajenek. Distributions of mass by detector blocks are given in Table 1.
3. Calculations are based on neutron and charged hadron fluxes supplied by Mike Shupe. Fluxes were calculated on a fine grid along radius ($\Delta R=1$ cm for $4 \text{ cm} < R < 120 \text{ cm}$ and $\Delta R=10$ cm for $120 \text{ cm} < R$), and uniform grid along Z-axis ($\Delta Z=10$ cm).
4. For the purpose of calculations the pixel detector and services were subdivided onto a set of circle radiation sources and the dose rate was calculated as sum all over the sources. At that the dose rate will be conservative as no self-attenuation of gamma radiation was taken into account, though this overestimation is negligible, as median density of material in every block of the detector is rather low.
5. Results of activation dose rate calculations are presented in the Table 2 (high-energy hadrons) and in the Table 3 (low energy neutrons) for various running and cooling times. All values are in $\mu\text{Sv/h}$. Dimensions are given in cm from the interaction point.
6. One can see from the Tables 2 and 3 that the doses from neutron activation are rather low in comparison with hadron activation and can be neglected for cooling time longer than 5 days. For cooling time 1 day, neutron contribution is comparable and even exceeds hadron's in the region $R \geq 50$ cm. At $t=1$ day after shutdown, neutron activation in pixel is dominated by copper due to reaction $^{63}\text{Cu}(n,g)^{64}\text{Cu}$ and later on by silver $^{109}\text{Ag}(n,g)^{110\text{m}}\text{Ag}$.

Table 1

Material composition of the Pixel Detector and services, gram per block

Block	Block ID	R1 [mm]	R2 [mm]	Z1 [mm]	Z2 [mm]
B-layer	1	45.5	74	-400	400
Layer 1	2	83	111	-400	400
Layer 2	3	117	144	-400	400
Disk 1	4	85	148	490	500
Disk 2	5	85	148	575	585
Disk 3	6	85	148	645	655
B-layer end	7	45.5	74	400	442
Layer 1 end	8	83	111	400	442
Layer 2 end	9	117	144	400	442
Disk 1 cooling connections	10	148	170	490	500
Disk 2 cooling connections	11	148	170	575	585
Disk 3 cooling connections	12	148	170	645	655
Barrel radial services	13	45.5	170	442	484
Barrel/disk type 0 services along frame	14	170	215	442	700
Outer frame connections	15	205	215	420	442
PP0	16	170	215	700	1070
Type 1 services	17	170	215	1070	3350
PP1 and end plug	18	170	215	3350	3500
Central PST	19	227	228	-800	800
Pixel to PST to SCT fixations	20	228	285	750	800
Forward PST	21	227	228	800	3420
Type 2 services	22	215	2800	3420	3500

Table 1 (continuation)

Block ID	Al	Cu	Ni	Sn	Pb	Ag	Au	Fe
1	425.0	109.7	8.7	6.9	6.4	15.8	0.2	38.6
2	587.4	187.4	10.8	11.9	11.0	27.3	0.4	40.7
3	803.8	256.8	13.6	16.2	15.0	37.4	0.5	48.8
4	107.6	17.3	0.4	1.2	1.1	2.7	0.0	0.0
5	107.6	17.3	0.4	1.2	1.1	2.7	0.0	0.0
6	107.6	17.3	0.4	1.2	1.1	2.7	0.0	0.0
7	3.5	14.7	17.1	0.0	0.0	0.0	0.0	15.3
8	6.0	25.3	29.7	0.0	0.0	0.0	0.0	27.1
9	8.2	34.6	39.0	0.0	0.0	0.0	0.0	27.1
10	12.4	1.6	1.6	0.0	0.0	0.0	0.0	0.0
11	12.4	1.6	1.6	0.0	0.0	0.0	0.0	0.0
12	12.4	1.6	1.6	0.0	0.0	0.0	0.0	0.0
13	931.9	19.6	5.4	0.0	0.0	0.0	0.0	0.0
14	4155.7	75.8	21.9	0.0	0.0	0.0	0.0	0.0
15	14.5	0.0	8.6	0.0	0.0	0.0	0.0	53.3
16	640.0	599.9	0.0	31.8	16.7	0.0	0.0	0.0
17	10149.4	133.4	0.0	0.0	0.0	186.6	0.0	0.0
18	980.9	164.8	620.6	16.3	12.1	0.0	0.5	3847.7
19	580.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	7.3	0.0	4.3	0.0	0.0	0.0	0.0	26.7
21	1103.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	71063.3	8992.3	0.0	0.0	0.0	0.0	6992.6
Total	39116.8	144930.4	19523.1	138.3	96.3	469.7	2.4	22107.7

Table 1 (continuation)

Block ID	Cr	In	Ru	Pd	Mg	Mo	Ti
1	16.3	0.0	0.1	0.0	1.0	1.9	9.1
2	17.7	0.1	0.1	0.0	1.7	2.0	15.8
3	21.4	0.1	0.1	0.1	2.4	2.3	21.6
4	0.0	0.0	0.0	0.0	0.0	0.0	1.5
5	0.0	0.0	0.0	0.0	0.0	0.0	1.5
6	0.0	0.0	0.0	0.0	0.0	0.0	1.5
7	6.2	0.7	0.0	0.0	0.0	0.7	0.0
8	10.9	1.2	0.0	0.0	0.0	1.3	0.0
9	10.9	1.7	0.0	0.0	0.0	1.3	0.0
10	0.0	0.1	0.0	0.0	0.0	0.0	0.0
11	0.0	0.1	0.0	0.0	0.0	0.0	0.0
12	0.0	0.1	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.4	0.0	0.0	0.0	0.0	0.0
15	21.5	0.0	0.0	0.0	0.0	2.6	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1551.5	0.0	0.0	0.0	0.0	186.2	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	10.8	0.0	0.0	0.0	0.0	1.3	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	2819.6	0.0	0.0	0.0	0.0	338.4	0.0
Total	8918.2	8.9	0.4	0.1	5.1	1069.7	55.8

Table 2

Equivalent dose rate resulted from hadron activation in the Pixel Detector for various
running and cooling times, $\mu\text{Sv/h}$

T=30 d, t=1d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	171	107	88	49	21	11	5.7	3.6	2.5	1.7
10	213	110	88	48	21	11	5.7	3.6	2.5	1.7
25	218	91	73	42	19	10	5.6	3.6	2.5	1.7
35	93	62	54	36	18	10	5.5	3.5	2.5	1.7
50	46	36	33	26	15	9.3	5.3	3.5	2.5	1.7
75	23	19	18	15	11	7.8	4.9	3.3	2.4	1.7
100	14	12	11	10	8.3	6.4	4.3	3.1	2.3	1.6
125	9.4	8.2	8.0	7.4	6.3	5.2	3.8	2.8	2.2	1.6
150	6.9	6.2	6.0	5.6	5.0	4.3	3.3	2.6	2.0	1.5
175	5.3	4.8	4.7	4.5	4.0	3.6	2.9	2.3	1.9	1.4
200	4.2	3.9	3.8	3.7	3.4	3.0	2.5	2.1	1.7	1.3
225	3.4	3.2	3.2	3.1	2.8	2.6	2.2	1.9	1.6	1.3

T=30 d, t=5d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	104	65	53	30	12	6	3.2	2.0	1.4	0.9
10	130	67	53	29	12	6	3.2	2.0	1.4	0.9
25	135	56	44	25	11	6	3.1	2.0	1.4	0.9
35	57	37	32	21	11	6	3.1	1.9	1.4	0.9
50	28	21	20	15	9	5.3	3.0	1.9	1.3	0.9
75	13	11	10	9	7	4.4	2.7	1.8	1.3	0.9
100	7.9	6.6	6.4	5.8	4.7	3.6	2.4	1.7	1.2	0.8
125	5.3	4.5	4.4	4.1	3.5	2.8	2.1	1.5	1.2	0.8
150	3.8	3.3	3.3	3.1	2.7	2.3	1.8	1.4	1.1	0.8
175	2.8	2.5	2.5	2.4	2.1	1.9	1.5	1.2	1.0	0.7
200	2.2	2.0	2.0	1.9	1.8	1.6	1.3	1.1	0.9	0.7
225	1.7	1.6	1.6	1.6	1.5	1.3	1.2	1.0	0.8	0.7

T=100d, t=1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	216	136	111	63	27	14	7.4	4.7	3.3	2.2
10	269	140	111	62	27	14	7.3	4.7	3.3	2.2
25	279	116	93	54	25	13	7.2	4.6	3.3	2.2
35	121	79	69	46	23	13	7.1	4.6	3.2	2.2
50	61	46	43	33	20	12	6.9	4.5	3.2	2.2
75	30	24	23	20	15	10	6.3	4.3	3.1	2.1
100	19	15	15	13	11	8.3	5.6	4.0	3.0	2.1
125	13	11	11	9.7	8.3	6.7	4.9	3.7	2.8	2.0
150	9.3	8.1	7.9	7.4	6.5	5.5	4.3	3.3	2.6	1.9
175	7.0	6.3	6.2	5.9	5.3	4.6	3.8	3.0	2.4	1.8
200	5.5	5.1	5.0	4.8	4.4	3.9	3.3	2.7	2.3	1.7
225	4.4	4.2	4.1	4.0	3.7	3.4	2.9	2.5	2.1	1.6

Table 2 (continuation)

T=100d, t=5d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	145	92	75	42	18	9	4.8	3.0	2.1	1.4
10	182	94	75	42	18	9	4.7	3.0	2.1	1.4
25	190	79	63	36	17	9	4.7	2.9	2.1	1.4
35	82	53	46	31	15	9	4.6	2.9	2.0	1.4
50	41	31	29	22	13	7.9	4.4	2.9	2.0	1.4
75	20	16	15	13	10	6.6	4.0	2.7	1.9	1.3
100	12	10	9.8	8.8	7.0	5.3	3.6	2.5	1.9	1.3
125	8.3	7.0	6.8	6.2	5.3	4.3	3.1	2.3	1.7	1.2
150	6.0	5.2	5.0	4.7	4.1	3.5	2.7	2.1	1.6	1.2
175	4.4	4.0	3.9	3.7	3.3	2.9	2.3	1.9	1.5	1.1
200	3.4	3.1	3.1	3.0	2.7	2.4	2.0	1.7	1.4	1.1
225	2.7	2.6	2.5	2.4	2.3	2.1	1.8	1.5	1.3	1.0

T= 5 y, t= 1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	240	151	124	70	30	16	8.4	5.4	3.8	2.6
10	298	155	124	69	30	16	8.4	5.4	3.8	2.6
25	309	130	104	61	28	15	8.3	5.3	3.8	2.6
35	135	89	77	51	26	15	8.2	5.3	3.8	2.6
50	69	52	48	38	23	14	7.9	5.2	3.7	2.5
75	34	28	27	23	17	12	7.2	4.9	3.6	2.5
100	21	18	17	15	12	9.5	6.5	4.6	3.4	2.4
125	15	13	12	11	9.5	7.8	5.7	4.3	3.3	2.3
150	11	9.4	9.2	8.6	7.6	6.4	5.0	3.9	3.1	2.3
175	8.1	7.4	7.2	6.8	6.2	5.4	4.4	3.5	2.8	2.2
200	6.4	6.0	5.9	5.6	5.1	4.6	3.8	3.2	2.6	2.0
225	5.2	5.0	4.9	4.7	4.4	4.0	3.4	2.9	2.4	1.9

T= 5y, t= 5 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	104	65	53	30	12	6	3.2	2.0	1.4	0.9
10	130	67	53	29	12	6	3.2	2.0	1.4	0.9
25	135	56	44	25	11	6	3.1	2.0	1.4	0.9
35	57	37	32	21	11	6	3.1	1.9	1.4	0.9
50	28	21	20	15	9	5.3	3.0	1.9	1.3	0.9
75	13	11	10	9	7	4.4	2.7	1.8	1.3	0.9
100	7.9	6.6	6.4	5.8	4.7	3.6	2.4	1.7	1.2	0.8
125	5.3	4.5	4.4	4.1	3.5	2.8	2.1	1.5	1.2	0.8
150	3.8	3.3	3.3	3.1	2.7	2.3	1.8	1.4	1.1	0.8
175	2.8	2.5	2.5	2.4	2.1	1.9	1.5	1.2	1.0	0.7
200	2.2	2.0	2.0	1.9	1.8	1.6	1.3	1.1	0.9	0.7
225	1.7	1.6	1.6	1.6	1.5	1.3	1.2	1.0	0.8	0.7

Table 2 (continuation)

T= 10 y, t= 1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	242	153	125	71	31	16	8.6	5.5	3.9	2.7
10	301	157	126	70	31	16	8.6	5.5	3.9	2.7
25	313	131	105	62	29	16	8.5	5.5	3.9	2.7
35	137	90	78	52	27	15	8.4	5.4	3.9	2.6
50	70	53	49	38	23	14	8.1	5.3	3.8	2.6
75	35	28	27	23	17	12	7.4	5.1	3.7	2.6
100	22	18	18	16	13	9.7	6.7	4.7	3.5	2.5
125	15	13	13	12	9.8	8.0	5.9	4.4	3.4	2.4
150	11	9.7	9.5	8.8	7.8	6.6	5.1	4.0	3.1	2.3
175	8.4	7.6	7.5	7.1	6.3	5.6	4.5	3.6	2.9	2.2
200	6.6	6.2	6.1	5.8	5.3	4.7	4.0	3.3	2.7	2.1
225	5.4	5.1	5.1	4.9	4.5	4.1	3.5	3.0	2.5	2.0

T= 10 y, t= 5 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	172	109	89	51	22	11	6.0	3.8	2.7	1.8
10	214	112	89	50	22	11	6.0	3.8	2.7	1.8
25	224	93	75	44	20	11	5.9	3.8	2.7	1.8
35	98	64	55	37	19	11	5.8	3.8	2.7	1.8
50	50	38	35	27	16	9.8	5.6	3.7	2.6	1.8
75	25	20	19	17	12	8.3	5.2	3.5	2.5	1.8
100	15	13	12	11	8.9	6.8	4.6	3.3	2.4	1.7
125	11	9.0	8.7	8.0	6.8	5.5	4.1	3.0	2.3	1.7
150	7.7	6.7	6.6	6.1	5.4	4.6	3.5	2.7	2.2	1.6
175	5.8	5.2	5.1	4.9	4.4	3.8	3.1	2.5	2.0	1.5
200	4.6	4.2	4.1	4.0	3.6	3.2	2.7	2.2	1.9	1.4
225	3.7	3.5	3.4	3.3	3.1	2.8	2.4	2.0	1.7	1.4

T= 100 d, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	27	17	14	8.2	3.7	2.0	1.1	0.7	0.5	0.3
10	33	18	14	8.1	3.6	2.0	1.1	0.7	0.5	0.3
25	36	15	12	7.2	3.5	1.9	1.1	0.7	0.5	0.3
35	17	11	9.2	6.2	3.2	1.9	1.0	0.7	0.5	0.3
50	9.3	6.6	6.1	4.7	2.8	1.7	1.0	0.7	0.5	0.3
75	4.9	3.7	3.5	3.0	2.1	1.5	0.9	0.6	0.5	0.3
100	3.1	2.4	2.3	2.1	1.6	1.2	0.8	0.6	0.5	0.3
125	2.1	1.7	1.7	1.5	1.3	1.0	0.7	0.6	0.4	0.3
150	1.5	1.3	1.3	1.2	1.0	0.8	0.7	0.5	0.4	0.3
175	1.2	1.0	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3
200	0.9	0.8	0.8	0.8	0.7	0.6	0.5	0.4	0.3	0.3
225	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3

Table 2 (continuation)

T= 5 y, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	44	28	23	14	6.2	3.4	1.9	1.3	0.9	0.6
10	55	29	23	13	6.2	3.4	1.9	1.3	0.9	0.6
25	58	25	20	12	5.8	3.3	1.9	1.2	0.9	0.6
35	27	18	15	10	5.5	3.2	1.8	1.2	0.9	0.6
50	15	11	10	8	4.8	3.0	1.8	1.2	0.9	0.6
75	7.9	6.2	5.9	5.1	3.7	2.6	1.7	1.2	0.9	0.6
100	5.1	4.2	4.0	3.6	2.8	2.2	1.5	1.1	0.8	0.6
125	3.6	3.0	2.9	2.7	2.2	1.8	1.4	1.0	0.8	0.6
150	2.7	2.3	2.3	2.1	1.8	1.5	1.2	0.9	0.7	0.6
175	2.1	1.9	1.8	1.7	1.5	1.3	1.1	0.9	0.7	0.5
200	1.6	1.5	1.5	1.4	1.3	1.1	1.0	0.8	0.7	0.5
225	1.4	1.3	1.3	1.2	1.1	1.0	0.9	0.7	0.6	0.5

T= 10 y, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	47	30	25	15	6.7	3.7	2.1	1.4	1.0	0.7
10	58	31	25	14	6.6	3.7	2.1	1.4	1.0	0.7
25	61	26	21	13	6.3	3.6	2.1	1.4	1.0	0.7
35	29	19	16	11	5.9	3.5	2.0	1.4	1.0	0.7
50	16	12	11	8.4	5.2	3.3	2.0	1.3	1.0	0.7
75	8.6	6.8	6.4	5.5	4.0	2.8	1.8	1.3	1.0	0.7
100	5.5	4.5	4.4	3.9	3.1	2.4	1.7	1.2	0.9	0.7
125	3.9	3.3	3.2	2.9	2.5	2.0	1.5	1.1	0.9	0.7
150	3.0	2.6	2.5	2.3	2.0	1.7	1.3	1.0	0.8	0.6
175	2.3	2.1	2.0	1.9	1.7	1.5	1.2	1.0	0.8	0.6
200	1.8	1.7	1.7	1.6	1.4	1.3	1.1	0.9	0.7	0.6
225	1.5	1.4	1.4	1.4	1.2	1.1	1.0	0.8	0.7	0.5

Table 3

Equivalent dose rate resulted from low energy neutron activation in the Pixel Detector
for various running and cooling times, $\mu\text{Sv/h}$

T=30 d, t=1d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	12.34	9.83	8.94	6.80	4.36	2.93	1.86	1.29	0.94	0.65
10	13.88	10.1	9.08	6.82	4.36	2.92	1.86	1.29	0.94	0.65
25	20.36	10.6	9.29	6.82	4.33	2.90	1.85	1.28	0.94	0.65
35	18.44	10.2	9.04	6.71	4.29	2.88	1.84	1.28	0.94	0.65
50	16.47	9.39	8.41	6.38	4.17	2.83	1.82	1.26	0.93	0.65
75	13.44	7.97	7.21	5.64	3.85	2.68	1.75	1.23	0.91	0.64
100	10.69	6.64	6.07	4.86	3.45	2.48	1.66	1.18	0.88	0.62
125	8.94	5.60	5.13	4.16	3.03	2.24	1.55	1.12	0.85	0.60
150	7.47	4.69	4.31	3.52	2.62	1.99	1.42	1.05	0.81	0.58
175	5.77	3.77	3.49	2.90	2.22	1.73	1.28	0.97	0.76	0.56
200	4.22	2.91	2.73	2.33	1.85	1.49	1.14	0.89	0.71	0.53
225	3.00	2.22	2.10	1.85	1.53	1.27	1.01	0.81	0.66	0.50

T=30 d, t=5d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	3.00	1.93	1.61	0.97	0.47	0.27	0.15	0.10	0.07	0.05
10	3.61	1.97	1.61	0.96	0.47	0.27	0.15	0.10	0.07	0.05
25	3.79	1.70	1.40	0.87	0.45	0.26	0.15	0.10	0.07	0.05
35	1.94	1.26	1.10	0.76	0.42	0.25	0.15	0.10	0.07	0.05
50	1.18	0.84	0.77	0.60	0.38	0.24	0.15	0.10	0.07	0.05
75	0.71	0.53	0.50	0.42	0.30	0.21	0.14	0.10	0.07	0.05
100	0.51	0.38	0.36	0.32	0.24	0.18	0.13	0.09	0.07	0.05
125	0.41	0.30	0.29	0.25	0.20	0.16	0.11	0.08	0.06	0.05
150	0.33	0.24	0.23	0.20	0.17	0.13	0.10	0.08	0.06	0.05
175	0.25	0.19	0.18	0.16	0.14	0.12	0.09	0.07	0.06	0.04
200	0.19	0.15	0.15	0.13	0.12	0.10	0.08	0.07	0.05	0.04
225	0.14	0.12	0.12	0.11	0.10	0.09	0.07	0.06	0.05	0.04

T=100d, t=1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	16.18	12.3	11.0	8.08	5.00	3.30	2.08	1.44	1.05	0.73
10	18.41	12.6	11.1	8.08	4.99	3.29	2.08	1.44	1.05	0.73
25	25.06	12.8	11.1	7.96	4.94	3.27	2.07	1.43	1.05	0.73
35	20.98	11.8	10.5	7.73	4.87	3.24	2.05	1.42	1.04	0.72
50	18.05	10.5	9.45	7.20	4.69	3.17	2.02	1.41	1.03	0.72
75	14.39	8.70	7.90	6.22	4.28	2.98	1.95	1.37	1.01	0.71
100	11.37	7.17	6.57	5.30	3.79	2.74	1.84	1.31	0.98	0.69
125	9.49	6.01	5.53	4.51	3.31	2.46	1.71	1.25	0.94	0.67
150	7.91	5.02	4.63	3.81	2.85	2.18	1.56	1.17	0.90	0.65
175	6.11	4.04	3.74	3.14	2.42	1.90	1.41	1.08	0.84	0.62
200	4.47	3.13	2.93	2.52	2.02	1.63	1.26	0.99	0.79	0.59
225	3.20	2.39	2.27	2.01	1.67	1.40	1.11	0.90	0.73	0.56

Table 3 (continuation)

T=100d, t=5d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	6.68	4.29	3.59	2.20	1.09	0.63	0.37	0.25	0.18	0.12
10	7.95	4.38	3.59	2.17	1.08	0.63	0.37	0.25	0.18	0.12
25	8.29	3.80	3.14	1.97	1.03	0.61	0.36	0.24	0.18	0.12
35	4.39	2.85	2.50	1.74	0.98	0.60	0.36	0.24	0.18	0.12
50	2.70	1.94	1.79	1.39	0.88	0.57	0.35	0.24	0.17	0.12
75	1.63	1.24	1.16	0.98	0.72	0.50	0.33	0.23	0.17	0.12
100	1.16	0.90	0.85	0.74	0.58	0.44	0.30	0.22	0.16	0.12
125	0.95	0.71	0.67	0.59	0.48	0.38	0.27	0.20	0.16	0.11
150	0.75	0.57	0.54	0.48	0.40	0.32	0.24	0.19	0.15	0.11
175	0.58	0.45	0.43	0.39	0.33	0.28	0.22	0.17	0.14	0.11
200	0.44	0.36	0.35	0.32	0.28	0.24	0.19	0.16	0.13	0.10
225	0.33	0.29	0.28	0.26	0.23	0.21	0.17	0.14	0.12	0.10

T= 5 y, t= 1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	18.23	13.6	12.1	8.81	5.40	3.55	2.23	1.54	1.13	0.79
10	20.67	13.9	12.3	8.80	5.39	3.54	2.23	1.54	1.13	0.79
25	27.24	13.9	12.1	8.63	5.32	3.51	2.22	1.54	1.13	0.79
35	22.34	12.8	11.3	8.33	5.23	3.48	2.20	1.53	1.12	0.78
50	18.94	11.2	10.1	7.71	5.03	3.40	2.17	1.51	1.11	0.78
75	14.95	9.17	8.34	6.60	4.56	3.19	2.09	1.47	1.09	0.77
100	11.77	7.52	6.90	5.60	4.03	2.92	1.97	1.41	1.06	0.75
125	9.81	6.29	5.79	4.75	3.51	2.63	1.83	1.34	1.02	0.73
150	8.16	5.24	4.84	4.00	3.02	2.32	1.67	1.25	0.97	0.70
175	6.31	4.22	3.92	3.30	2.56	2.02	1.51	1.16	0.91	0.67
200	4.64	3.28	3.08	2.66	2.14	1.74	1.35	1.06	0.85	0.64
225	3.34	2.52	2.40	2.13	1.78	1.49	1.19	0.97	0.79	0.61

T= 5y, t= 5 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	8.70	5.57	4.68	2.92	1.48	0.87	0.52	0.35	0.26	0.18
10	10.17	5.66	4.68	2.88	1.47	0.87	0.52	0.35	0.26	0.18
25	10.43	4.93	4.10	2.63	1.41	0.85	0.51	0.35	0.26	0.18
35	5.72	3.77	3.32	2.34	1.34	0.83	0.51	0.35	0.26	0.18
50	3.58	2.62	2.41	1.90	1.22	0.79	0.49	0.34	0.25	0.18
75	2.18	1.70	1.60	1.36	1.00	0.71	0.47	0.33	0.25	0.18
100	1.55	1.24	1.18	1.04	0.81	0.62	0.43	0.31	0.24	0.17
125	1.26	0.98	0.93	0.83	0.67	0.53	0.39	0.29	0.23	0.17
150	1.00	0.79	0.75	0.67	0.56	0.46	0.35	0.27	0.22	0.16
175	0.78	0.63	0.61	0.55	0.47	0.40	0.32	0.25	0.20	0.16
200	0.60	0.51	0.49	0.46	0.40	0.35	0.28	0.23	0.19	0.15
225	0.46	0.41	0.40	0.38	0.34	0.30	0.25	0.21	0.18	0.14

Table 3 (continuation)

T= 10 y, t= 1 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	18.27	13.6	12.1	8.82	5.41	3.55	2.24	1.55	1.13	0.79
10	20.72	13.9	12.3	8.81	5.40	3.55	2.24	1.55	1.13	0.79
25	27.29	13.9	12.1	8.64	5.33	3.52	2.22	1.54	1.13	0.79
35	22.36	12.8	11.3	8.34	5.24	3.48	2.21	1.53	1.13	0.78
50	18.96	11.2	10.1	7.72	5.04	3.40	2.17	1.51	1.12	0.78
75	14.96	9.17	8.35	6.61	4.57	3.20	2.09	1.47	1.09	0.77
100	11.77	7.52	6.91	5.60	4.04	2.93	1.98	1.41	1.06	0.75
125	9.81	6.29	5.80	4.76	3.52	2.63	1.83	1.34	1.02	0.73
150	8.17	5.25	4.84	4.01	3.02	2.32	1.67	1.25	0.97	0.70
175	6.32	4.22	3.92	3.30	2.56	2.02	1.51	1.16	0.91	0.67
200	4.64	3.28	3.08	2.66	2.14	1.75	1.35	1.06	0.85	0.64
225	3.34	2.52	2.40	2.13	1.78	1.49	1.19	0.97	0.79	0.61

T= 10 y, t= 5 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	8.74	5.59	4.71	2.93	1.49	0.88	0.52	0.35	0.26	0.18
10	10.22	5.69	4.70	2.89	1.48	0.88	0.52	0.35	0.26	0.18
25	10.48	4.96	4.12	2.64	1.41	0.86	0.51	0.35	0.26	0.18
35	5.75	3.78	3.33	2.35	1.35	0.84	0.51	0.35	0.26	0.18
50	3.59	2.63	2.43	1.91	1.22	0.80	0.50	0.34	0.25	0.18
75	2.19	1.70	1.61	1.37	1.00	0.71	0.47	0.33	0.25	0.18
100	1.56	1.24	1.19	1.04	0.82	0.62	0.43	0.32	0.24	0.17
125	1.26	0.98	0.94	0.83	0.67	0.54	0.39	0.30	0.23	0.17
150	1.00	0.79	0.76	0.68	0.56	0.46	0.35	0.28	0.22	0.16
175	0.78	0.63	0.61	0.56	0.48	0.40	0.32	0.25	0.21	0.16
200	0.60	0.51	0.50	0.46	0.40	0.35	0.29	0.23	0.19	0.15
225	0.47	0.42	0.41	0.38	0.34	0.30	0.26	0.21	0.18	0.14

T= 100 d, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	2.73	1.75	1.48	0.95	0.50	0.30	0.18	0.13	0.09	0.07
10	3.12	1.77	1.48	0.93	0.49	0.30	0.18	0.13	0.09	0.07
25	3.16	1.56	1.31	0.86	0.47	0.29	0.18	0.12	0.09	0.07
35	1.85	1.22	1.08	0.77	0.45	0.29	0.18	0.12	0.09	0.07
50	1.19	0.88	0.81	0.64	0.41	0.27	0.17	0.12	0.09	0.06
75	0.74	0.58	0.55	0.47	0.34	0.25	0.16	0.12	0.09	0.06
100	0.53	0.43	0.41	0.36	0.28	0.22	0.15	0.11	0.09	0.06
125	0.43	0.34	0.32	0.29	0.24	0.19	0.14	0.11	0.08	0.06
150	0.34	0.27	0.26	0.24	0.20	0.16	0.13	0.10	0.08	0.06
175	0.27	0.22	0.21	0.20	0.17	0.14	0.11	0.09	0.07	0.06
200	0.21	0.18	0.17	0.16	0.14	0.12	0.10	0.08	0.07	0.05
225	0.16	0.15	0.14	0.14	0.12	0.11	0.09	0.08	0.07	0.05

Table 3 (continuation)

T= 5 y, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	4.10	2.61	2.22	1.44	0.77	0.47	0.29	0.20	0.15	0.11
10	4.60	2.63	2.21	1.42	0.77	0.47	0.29	0.20	0.15	0.11
25	4.55	2.32	1.96	1.31	0.74	0.46	0.29	0.20	0.15	0.11
35	2.75	1.85	1.64	1.19	0.71	0.45	0.28	0.20	0.15	0.11
50	1.79	1.35	1.25	0.99	0.65	0.43	0.28	0.20	0.15	0.11
75	1.11	0.90	0.85	0.73	0.54	0.39	0.26	0.19	0.14	0.10
100	0.80	0.67	0.64	0.57	0.45	0.35	0.24	0.18	0.14	0.10
125	0.64	0.53	0.51	0.46	0.38	0.30	0.22	0.17	0.13	0.10
150	0.51	0.43	0.41	0.37	0.32	0.26	0.20	0.16	0.13	0.10
175	0.40	0.35	0.34	0.31	0.27	0.23	0.18	0.15	0.12	0.09
200	0.32	0.29	0.28	0.26	0.23	0.20	0.17	0.14	0.11	0.09
225	0.26	0.24	0.23	0.22	0.20	0.18	0.15	0.13	0.11	0.09

T= 10 y, t= 100 d

R \ Z, cm	350	365	370	385	415	450	500	550	600	670
0	4.13	2.63	2.24	1.45	0.78	0.48	0.29	0.20	0.15	0.11
10	4.64	2.66	2.23	1.43	0.77	0.48	0.29	0.20	0.15	0.11
25	4.59	2.34	1.98	1.32	0.74	0.47	0.29	0.20	0.15	0.11
35	2.77	1.86	1.66	1.20	0.71	0.46	0.29	0.20	0.15	0.11
50	1.80	1.36	1.26	1.00	0.65	0.44	0.28	0.20	0.15	0.11
75	1.12	0.91	0.86	0.74	0.55	0.39	0.27	0.19	0.15	0.11
100	0.80	0.67	0.64	0.57	0.45	0.35	0.25	0.18	0.14	0.10
125	0.64	0.53	0.51	0.46	0.38	0.30	0.23	0.17	0.14	0.10
150	0.51	0.43	0.41	0.38	0.32	0.27	0.21	0.16	0.13	0.10
175	0.41	0.35	0.34	0.31	0.27	0.23	0.19	0.15	0.12	0.09
200	0.32	0.29	0.28	0.26	0.23	0.20	0.17	0.14	0.11	0.09
225	0.26	0.24	0.23	0.22	0.20	0.18	0.15	0.13	0.11	0.09