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Doses from the VT beam pipe

Here are given results of simulations of dose rate that results from activation of the beam pipe section placed inside the Thoroid (Zmin=870 cm, Zmax=1300 cm).

1. Both high-energy hadrons and low-energy neutrons activation was taken into account.
2. Design of the beam pipe section was taken from the LHCVC1T_0001 drawing. Geometry for activation calculations is given in the table 1. Material of the beam pipe section is 316 L (stainless steel). Total mass of stainless steel (316 L) is approximately 12.3 kg. Geometry for activation calculations is given in the table 1. A sketch of the beam pipe is given on fig. 1.
3. For the purpose of the study the beam pipe was subdivided onto a set of circular radiation sources centered along Z-axis and the dose was calculated as sum over all the sources. At that the doses will be conservative as no self-attenuation of gamma radiation was taken into account. Consequently doses may be slightly overestimated by some 10%.
4. In this study we use hadron flux on a fine grid ($\Delta R=0.1$ cm for $0<R<4$ cm and $\Delta R=1$ cm for $4<R$), which was produced by Mike Shupe. As usually, all the results are calculated for high luminosity 10^{34} cm^{-1} s^{-1}.
5. Results for VT beam-pipe are given in tables 2 (hadron activation) and 3 (neutron activation). All doses are in μSv/h. Dimensions are given in cm from the interaction point.

Table 1

Material zones of the VT beam pipe section

##	Z_{min}, cm	Z_{max}, cm	R_{min}, cm	R_{max}, cm	Mass, kg	Comment
1	870	871.4	2.9	4.3	0.346	Flange
2	871.4	1046.5	2.9	3	2.530	Tube
3	878.5	1039.3	3.9	4	3.111	Tube
4	1046.5	1050.7	3.5	3.6	0.073	Cone
5	1050.7	1298.5	4	4.1	4.916	Tube
6	1298.5	1300.7	4	6.3	1.276	Flange

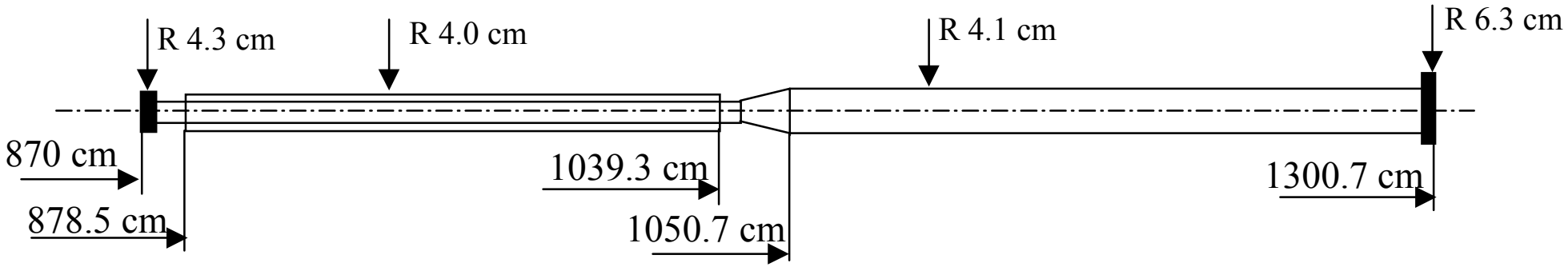

Fig. 1 Sketch of the VT Beam pipe section.

Table 2

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 100d, t=1d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	1219	6539											2939	902
5	1106	6214	5136	5491	5414	5152	3442	1878	1668	1482	1391	1907	2909	827
7	1007	2818	3153	3453	3418	3237	2244	1144	1005	896	839	1292	2878	744
10	846	1592	1978	2249	2239	2108	1485	764	664	592	555	869	1162	590
15	628	926	1155	1399	1406	1314	947	509	434	387	363	504	515	381
20	487	647	786	991	1005	935	690	388	326	289	271	330	314	262
25	393	493	584	752	769	713	538	316	262	232	217	238	221	194
50	187	210	232	294	311	291	241	167	135	117	105	92	86	80
75	115	124	132	160	170	163	144	111	91	77	67	57	53	51
100	79	83	87	101	107	105	97	80	67	57	48	41	39	37
125	57	60	62	70	74	73	69	60	52	44	38	32	31	30
150	44	45	47	51	54	54	52	47	41	36	31	27	25	25
175	35	36	36	39	41	42	40	37	33	29	25	22	21	21
200	28	29	29	31	32	33	32	30	27	25	22	19	18	18
225	23	24	24	25	26	27	26	25	23	21	18	17	16	16

Table 2 (continuation)

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 100 d, t=5 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	874	4687											2089	641
5	793	4455	3682	3933	3876	3689	2463	1336	1184	1051	988	1353	2068	588
7	722	2020	2260	2473	2447	2318	1606	814	714	636	596	917	2047	529
10	606	1141	1418	1611	1603	1509	1062	544	471	420	394	617	826	419
15	450	664	828	1002	1007	941	677	362	308	275	258	358	366	271
20	349	464	563	710	720	669	493	276	231	205	193	234	223	186
25	282	353	418	538	551	510	385	225	186	165	154	169	157	138
50	134	150	166	211	222	208	172	119	96	83	75	66	61	57
75	82	89	95	114	122	117	103	79	65	55	47	40	38	36
100	56	59	62	72	77	75	69	57	48	41	34	29	28	27
125	41	43	45	50	53	53	50	43	37	32	27	23	22	21
150	31	32	33	37	39	39	37	33	29	25	22	19	18	18
175	25	25	26	28	29	30	29	26	24	21	18	16	15	15
200	20	20	21	22	23	23	23	21	20	18	15	14	13	13
225	17	17	17	18	19	19	19	18	16	15	13	12	11	11

Table 2 (continuation)

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 100 d, t=100 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	151.8	813.8											355.8	109.2
5	137.8	772.9	641.9	683.8	673.1	639.9	423.3	226.7	198.8	174.8	165.7	228.7	352.7	100.1
7	125.5	350.9	394.0	430.1	424.9	401.9	276.2	138.2	120.0	105.8	100.0	155.4	349.7	90.1
10	105.4	198.4	247.1	280.2	278.4	261.6	182.8	92.5	79.3	70.1	66.1	104.6	140.8	71.4
15	78.3	115.5	144.2	174.3	174.8	162.9	116.6	61.7	51.9	45.9	43.3	60.7	62.3	46.1
20	60.7	80.7	98.1	123.5	125.0	115.9	85.0	47.1	39.0	34.4	32.4	39.7	38.0	31.6
25	49.0	61.5	72.8	93.6	95.6	88.4	66.4	38.4	31.5	27.6	25.9	28.6	26.7	23.4
50	23.3	26.1	28.8	36.6	38.6	36.0	29.7	20.4	16.3	14.0	12.6	11.1	10.3	9.7
75	14.3	15.4	16.5	19.9	21.1	20.2	17.8	13.6	11.0	9.4	8.1	6.9	6.4	6.1
100	9.8	10.3	10.8	12.5	13.3	13.0	11.9	9.8	8.2	6.9	5.9	5.0	4.7	4.5
125	7.1	7.4	7.7	8.7	9.1	9.1	8.6	7.4	6.3	5.4	4.6	3.9	3.7	3.6
150	5.4	5.6	5.8	6.4	6.7	6.7	6.4	5.7	5.0	4.4	3.7	3.2	3.1	3.0
175	4.3	4.4	4.5	4.9	5.1	5.1	5.0	4.6	4.1	3.6	3.1	2.7	2.6	2.5
200	3.5	3.5	3.6	3.9	4.0	4.0	4.0	3.7	3.4	3.0	2.6	2.3	2.3	2.2
225	2.9	2.9	3.0	3.1	3.2	3.3	3.2	3.1	2.8	2.6	2.3	2.0	2.0	1.9

Table 2 (continuation)

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 10 y, t=1 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	1329	7126											3212	985
5	1206	6772	5604	5996	5911	5620	3754	2048	1818	1617	1516	2083	3180	904
7	1098	3072	3440	3770	3732	3532	2448	1247	1096	977	915	1412	3147	813
10	922	1736	2158	2456	2445	2300	1620	833	723	646	605	949	1270	645
15	686	1011	1261	1527	1535	1434	1033	555	473	422	396	550	563	416
20	531	706	858	1082	1097	1020	752	423	355	315	296	360	344	286
25	429	538	637	820	839	778	587	345	286	253	237	260	242	212
50	204	229	253	321	339	317	263	182	147	127	114	101	94	88
75	125	135	144	174	186	178	157	121	99	84	73	62	58	55
100	86	91	95	110	117	115	106	87	73	62	53	45	43	41
125	63	65	68	76	81	80	76	65	56	48	41	35	34	32
150	48	49	51	56	59	59	57	51	45	39	33	29	28	27
175	38	39	40	43	45	45	44	40	36	32	28	24	23	23
200	31	31	32	34	35	36	35	33	30	27	23	21	20	20
225	25	26	26	28	29	29	29	27	25	23	20	18	18	17

Table 2 (continuation)

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 10 y, t=5 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	982	5268											2352	722
5	891	5007	4140	4423	4359	4148	2769	1509	1337	1186	1115	1526	2328	662
7	812	2271	2542	2782	2752	2607	1806	919	806	717	673	1034	2305	595
10	681	1283	1594	1812	1803	1697	1195	614	532	474	444	695	930	472
15	506	747	931	1127	1132	1058	762	409	348	310	291	403	413	305
20	393	522	633	799	810	753	555	312	261	232	218	264	252	209
25	317	397	470	605	619	574	433	254	210	186	174	190	177	155
50	151	169	187	237	250	234	194	134	109	94	84	74	69	64
75	92	100	107	129	137	131	116	89	73	62	54	46	43	41
100	63	67	70	81	86	85	78	64	54	46	39	33	31	30
125	46	48	50	56	59	59	56	48	42	36	30	26	25	24
150	35	37	38	41	43	44	42	37	33	29	25	21	20	20
175	28	29	29	32	33	33	33	30	27	24	20	18	17	17
200	23	23	24	25	26	26	26	24	22	20	17	15	15	14
225	19	19	19	20	21	21	21	20	18	17	15	13	13	13

Table 2 (continuation)

Equivalent dose rate induced by high-energy hadrons from VT Beam Pipe for T= 10y, t=100d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	228.2	1223.0											541.4	166.2
5	207.1	1161.5	964.8	1029.0	1012.8	963.2	638.9	345.7	304.3	268.2	253.6	349.6	536.6	152.4
7	188.6	527.4	592.2	647.2	639.4	605.0	416.9	210.6	183.6	162.3	153.1	237.2	531.7	137.1
10	158.4	298.2	371.4	421.7	419.0	393.9	276.0	140.9	121.3	107.4	101.2	159.7	214.3	108.7
15	117.8	173.7	216.8	262.3	263.1	245.4	176.1	93.9	79.4	70.3	66.2	92.5	94.9	70.2
20	91.3	121.4	147.5	185.8	188.1	174.6	128.3	71.6	59.6	52.7	49.6	60.6	57.8	48.2
25	73.7	92.4	109.5	140.9	143.9	133.2	100.2	58.4	48.0	42.2	39.6	43.6	40.7	35.6
50	35.1	39.3	43.4	55.1	58.1	54.2	44.9	30.9	24.9	21.4	19.2	17.0	15.8	14.8
75	21.5	23.2	24.8	29.9	31.8	30.4	26.8	20.5	16.8	14.2	12.3	10.4	9.8	9.3
100	14.7	15.5	16.3	18.9	20.0	19.6	18.0	14.8	12.4	10.5	8.9	7.6	7.2	6.9
125	10.7	11.2	11.6	13.1	13.8	13.7	12.9	11.1	9.6	8.2	6.9	6.0	5.7	5.5
150	8.2	8.5	8.7	9.6	10.1	10.1	9.7	8.7	7.6	6.6	5.6	4.9	4.7	4.5
175	6.5	6.6	6.8	7.4	7.7	7.7	7.5	6.9	6.2	5.4	4.7	4.1	4.0	3.9
200	5.2	5.3	5.5	5.8	6.1	6.1	6.0	5.6	5.1	4.6	4.0	3.5	3.4	3.3
225	4.3	4.4	4.5	4.7	4.9	4.9	4.9	4.6	4.3	3.9	3.4	3.1	3.0	2.9

Table 3

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 100 d, t= 1 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	17.73	91.83											60.58	18.90
5	16.10	96.91	73.12	83.37	81.24	74.51	41.13	28.77	24.88	21.08	19.00	33.83	62.75	17.36
7	14.65	41.49	44.91	51.44	50.41	46.11	27.72	17.44	15.01	12.78	11.69	24.09	64.92	15.60
10	12.28	23.06	28.41	33.22	32.76	29.88	19.00	11.59	9.91	8.49	7.90	16.57	24.95	12.27
15	9.11	13.39	16.72	20.55	20.44	18.59	12.56	7.64	6.47	5.58	5.31	9.51	10.43	7.70
20	7.06	9.38	11.41	14.51	14.57	13.23	9.34	5.78	4.85	4.20	4.06	6.09	6.10	5.12
25	5.70	7.15	8.48	10.98	11.12	10.09	7.39	4.67	3.89	3.38	3.29	4.29	4.16	3.68
50	2.72	3.05	3.36	4.27	4.48	4.14	3.41	2.43	1.99	1.74	1.64	1.55	1.46	1.38
75	1.66	1.79	1.92	2.31	2.45	2.34	2.06	1.61	1.34	1.16	1.04	0.91	0.86	0.83
100	1.14	1.20	1.26	1.46	1.55	1.51	1.39	1.16	0.99	0.85	0.74	0.65	0.62	0.59
125	0.83	0.87	0.90	1.01	1.07	1.06	1.00	0.87	0.76	0.66	0.57	0.50	0.48	0.46
150	0.64	0.66	0.68	0.74	0.78	0.78	0.76	0.68	0.61	0.53	0.46	0.41	0.39	0.38
175	0.50	0.52	0.53	0.57	0.60	0.60	0.59	0.54	0.49	0.44	0.38	0.34	0.33	0.32
200	0.41	0.42	0.42	0.45	0.47	0.48	0.47	0.44	0.40	0.36	0.32	0.29	0.28	0.27
225	0.34	0.34	0.35	0.37	0.38	0.39	0.38	0.36	0.34	0.31	0.28	0.25	0.24	0.24

Table 3 (continuation)

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 100 d, t=5 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	16.97	87.90											57.74	18.01
5	15.41	92.74	70.00	79.78	77.74	71.29	39.35	27.50	23.77	20.13	18.13	32.24	59.80	16.54
7	14.02	39.71	42.99	49.23	48.24	44.12	26.52	16.66	14.34	12.21	11.15	22.96	61.86	14.87
10	11.75	22.07	27.20	31.80	31.35	28.59	18.18	11.07	9.47	8.11	7.53	15.79	23.77	11.70
15	8.72	12.82	16.00	19.66	19.56	17.79	12.01	7.30	6.18	5.33	5.07	9.07	9.94	7.34
20	6.75	8.97	10.92	13.89	13.94	12.65	8.93	5.52	4.63	4.01	3.87	5.81	5.82	4.88
25	5.45	6.84	8.12	10.51	10.64	9.66	7.07	4.47	3.72	3.23	3.14	4.09	3.96	3.50
50	2.60	2.92	3.22	4.08	4.28	3.96	3.26	2.32	1.91	1.66	1.56	1.47	1.39	1.31
75	1.59	1.72	1.84	2.21	2.34	2.24	1.97	1.54	1.28	1.11	0.99	0.87	0.82	0.79
100	1.09	1.15	1.21	1.40	1.48	1.45	1.33	1.11	0.94	0.82	0.71	0.62	0.59	0.57
125	0.80	0.83	0.86	0.97	1.02	1.01	0.96	0.83	0.73	0.63	0.55	0.48	0.46	0.44
150	0.61	0.63	0.65	0.71	0.75	0.75	0.72	0.65	0.58	0.51	0.44	0.39	0.37	0.36
175	0.48	0.49	0.51	0.55	0.57	0.58	0.56	0.52	0.47	0.42	0.36	0.32	0.31	0.30
200	0.39	0.40	0.41	0.43	0.45	0.46	0.45	0.42	0.39	0.35	0.31	0.28	0.27	0.26
225	0.32	0.33	0.33	0.35	0.37	0.37	0.37	0.35	0.32	0.29	0.26	0.24	0.23	0.23

Table 3 (continuation)

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 100 d, t= 100 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	7.43	38.47											25.60	7.98
5	6.75	40.59	30.64	34.96	34.07	31.25	17.25	12.04	10.42	8.84	7.99	14.29	26.52	7.33
7	6.14	17.38	18.82	21.57	21.14	19.34	11.63	7.30	6.29	5.36	4.92	10.18	27.43	6.59
10	5.15	9.66	11.91	13.93	13.74	12.54	7.97	4.85	4.15	3.56	3.32	7.00	10.54	5.18
15	3.82	5.61	7.01	8.62	8.57	7.80	5.27	3.20	2.71	2.34	2.23	4.02	4.40	3.25
20	2.96	3.93	4.78	6.09	6.11	5.55	3.92	2.42	2.03	1.76	1.71	2.57	2.58	2.16
25	2.39	3.00	3.56	4.60	4.67	4.23	3.10	1.96	1.63	1.42	1.39	1.81	1.75	1.55
50	1.14	1.28	1.41	1.79	1.88	1.73	1.43	1.02	0.84	0.73	0.69	0.65	0.61	0.58
75	0.70	0.75	0.80	0.97	1.03	0.98	0.86	0.67	0.56	0.49	0.44	0.38	0.36	0.35
100	0.48	0.50	0.53	0.61	0.65	0.63	0.58	0.49	0.41	0.36	0.31	0.27	0.26	0.25
125	0.35	0.36	0.38	0.42	0.45	0.44	0.42	0.37	0.32	0.28	0.24	0.21	0.20	0.19
150	0.27	0.28	0.28	0.31	0.33	0.33	0.32	0.29	0.25	0.22	0.19	0.17	0.16	0.16
175	0.21	0.22	0.22	0.24	0.25	0.25	0.25	0.23	0.21	0.18	0.16	0.14	0.14	0.13
200	0.17	0.17	0.18	0.19	0.20	0.20	0.20	0.18	0.17	0.15	0.14	0.12	0.12	0.11
225	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.15	0.14	0.13	0.12	0.10	0.10	0.10

Table 3 (continuation)

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 10 y, t= 1 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	23.38	120.90											85.02	26.53
5	21.24	127.94	96.30	110.40	107.54	98.78	54.56	38.81	33.57	28.77	26.34	47.62	88.19	24.37
7	19.33	54.71	59.18	68.10	66.71	61.14	36.81	23.52	20.25	17.44	16.20	33.88	91.36	21.91
10	16.20	30.40	37.47	43.97	43.35	39.62	25.26	15.62	13.37	11.57	10.94	23.28	35.07	17.23
15	12.02	17.67	22.07	27.18	27.06	24.65	16.70	10.29	8.73	7.60	7.35	13.35	14.64	10.81
20	9.32	12.38	15.07	19.20	19.29	17.54	12.43	7.77	6.54	5.72	5.61	8.54	8.55	7.17
25	7.53	9.44	11.21	14.52	14.73	13.39	9.84	6.28	5.25	4.60	4.55	6.00	5.82	5.14
50	3.60	4.03	4.45	5.65	5.93	5.49	4.54	3.26	2.69	2.36	2.25	2.14	2.02	1.91
75	2.20	2.38	2.54	3.06	3.25	3.10	2.74	2.15	1.80	1.57	1.42	1.25	1.19	1.14
100	1.51	1.59	1.68	1.94	2.05	2.01	1.86	1.55	1.33	1.16	1.01	0.88	0.84	0.81
125	1.10	1.15	1.20	1.34	1.42	1.41	1.34	1.17	1.02	0.90	0.78	0.68	0.65	0.63
150	0.84	0.87	0.90	0.99	1.04	1.04	1.01	0.91	0.81	0.72	0.62	0.55	0.53	0.51
175	0.67	0.68	0.70	0.76	0.79	0.80	0.78	0.73	0.66	0.59	0.52	0.46	0.44	0.43
200	0.54	0.55	0.56	0.60	0.63	0.64	0.63	0.59	0.54	0.49	0.43	0.39	0.38	0.37
225	0.45	0.45	0.46	0.49	0.51	0.52	0.51	0.49	0.45	0.41	0.37	0.34	0.33	0.32

Table 3 (continuation)

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 10 y, t= 5 d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	22.52	116.46											81.83	25.54
5	20.45	123.23	92.76	106.34	103.58	95.14	52.55	37.36	32.32	27.70	25.36	45.83	84.88	23.46
7	18.62	52.70	57.00	65.59	64.26	58.88	35.45	22.64	19.50	16.79	15.60	32.61	87.92	21.09
10	15.60	29.28	36.09	42.35	41.76	38.16	24.33	15.04	12.87	11.14	10.53	22.40	33.75	16.58
15	11.58	17.02	21.25	26.18	26.06	23.74	16.09	9.91	8.40	7.32	7.08	12.85	14.09	10.40
20	8.97	11.92	14.51	18.49	18.58	16.90	11.97	7.49	6.30	5.50	5.40	8.22	8.23	6.90
25	7.25	9.10	10.79	13.99	14.19	12.89	9.47	6.05	5.06	4.43	4.38	5.78	5.60	4.95
50	3.46	3.88	4.29	5.44	5.71	5.29	4.37	3.14	2.59	2.27	2.16	2.06	1.95	1.84
75	2.12	2.29	2.45	2.95	3.13	2.99	2.64	2.07	1.73	1.51	1.36	1.21	1.14	1.10
100	1.45	1.54	1.61	1.87	1.98	1.94	1.79	1.49	1.28	1.11	0.97	0.85	0.81	0.78
125	1.06	1.11	1.15	1.29	1.37	1.36	1.29	1.13	0.99	0.86	0.75	0.65	0.63	0.61
150	0.81	0.84	0.87	0.95	1.00	1.00	0.97	0.88	0.78	0.69	0.60	0.53	0.51	0.49
175	0.64	0.66	0.68	0.73	0.77	0.77	0.76	0.70	0.63	0.57	0.50	0.44	0.43	0.41
200	0.52	0.53	0.54	0.58	0.60	0.61	0.60	0.57	0.52	0.47	0.42	0.38	0.36	0.35
225	0.43	0.44	0.45	0.47	0.49	0.50	0.49	0.47	0.44	0.40	0.36	0.32	0.31	0.31

Table 3 (continuation)

Equivalent dose rate induced by low-energy neutrons from VT Beam Pipe for T= 10y, t=100d

R/Z, cm	860	870	880	920	960	1000	1040	1100	1150	1200	1250	1290	1300.7	1310
0	11.33	58.49											44.01	13.74
5	10.29	62.07	46.60	53.76	52.34	48.16	26.62	19.24	16.66	14.45	13.45	24.72	45.72	12.62
7	9.37	26.51	28.66	33.14	32.47	29.81	17.98	11.66	10.05	8.75	8.27	17.57	47.42	11.35
10	7.85	14.73	18.16	21.39	21.10	19.32	12.35	7.74	6.63	5.80	5.58	12.06	18.18	8.92
15	5.83	8.57	10.70	13.22	13.17	12.03	8.17	5.10	4.33	3.81	3.75	6.91	7.58	5.59
20	4.52	6.01	7.31	9.34	9.39	8.56	6.08	3.85	3.25	2.86	2.86	4.41	4.42	3.70
25	3.65	4.58	5.44	7.06	7.17	6.53	4.82	3.11	2.61	2.31	2.32	3.09	3.00	2.65
50	1.75	1.96	2.16	2.75	2.89	2.68	2.22	1.61	1.33	1.18	1.14	1.09	1.03	0.98
75	1.07	1.16	1.24	1.49	1.59	1.52	1.35	1.06	0.89	0.79	0.71	0.64	0.60	0.58
100	0.74	0.78	0.82	0.95	1.00	0.98	0.91	0.76	0.66	0.58	0.51	0.44	0.42	0.41
125	0.54	0.56	0.58	0.66	0.69	0.69	0.66	0.58	0.51	0.45	0.39	0.34	0.33	0.32
150	0.41	0.43	0.44	0.48	0.51	0.51	0.50	0.45	0.40	0.36	0.31	0.27	0.26	0.26
175	0.33	0.33	0.34	0.37	0.39	0.39	0.39	0.36	0.33	0.29	0.26	0.23	0.22	0.21
200	0.26	0.27	0.28	0.30	0.31	0.31	0.31	0.29	0.27	0.24	0.22	0.19	0.19	0.18
225	0.22	0.22	0.23	0.24	0.25	0.25	0.25	0.24	0.22	0.21	0.18	0.17	0.16	0.16