



Fig. A2.1 Sketch of the VA Beam pipe section.

Table A2.1

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	357.8	3406.9											2540.6	414.8
5	342.6	3305.9	2502.6	2566.8	2100.6	2669.3	4926.9	3712.1	2852.9	2533.3	2513.5	1764.9	2432.2	380.1
7	329.6	1589.9	1808.1	1804.0	1406.1	1753.6	3111.5	2395.1	1848.8	1645.4	1615.9	1230.7	1144.1	352.8
10	306.1	939.4	1185.2	1223.6	960.4	1196.1	2024.4	1600.2	1240.4	1105.1	1070.6	842.0	657.9	309.2
15	264.6	564.3	677.4	749.7	641.2	793.4	1258.5	1033.1	805.8	718.3	682.8	538.9	392.5	246.4
20	227.2	396.9	454.4	517.8	485.3	595.3	895.8	759.4	595.9	531.2	496.8	388.0	281.7	201.3
25	196.5	302.8	336.8	387.6	390.5	475.6	685.3	597.2	471.3	420.1	387.5	299.1	220.5	169.3
50	111.8	136.1	143.8	163.4	190.9	228.4	288.7	275.6	223.5	199.0	175.1	132.6	107.2	93.9
75	77.3	88.1	91.7	102.1	120.7	142.1	169.3	169.1	140.7	125.2	108.0	83.3	71.1	64.9
100	58.8	65.1	67.2	73.5	85.6	98.8	114.1	116.7	99.4	88.6	76.1	60.1	53.0	49.4
125	47.2	51.3	52.6	56.8	64.8	73.5	83.2	86.1	74.8	66.9	57.7	46.7	42.0	39.7
150	39.2	42.0	42.9	45.7	51.3	57.2	63.7	66.4	58.6	52.7	45.8	37.9	34.6	33.0
175	33.2	35.2	35.9	37.9	41.9	46.0	50.7	52.8	47.3	42.9	37.6	31.6	29.2	28.0
200	28.7	30.1	30.6	32.1	35.0	38.0	41.4	43.1	39.1	35.6	31.5	27.0	25.1	24.2
225	25.0	26.1	26.5	27.6	29.8	32.0	34.5	35.9	32.8	30.1	26.9	23.4	21.9	21.2

Table A2.1 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	402.0	3824.9											2858.0	466.6
5	384.9	3711.8	2810.0	2879.9	2364.8	3008.9	5571.7	4182.9	3209.7	2850.7	2827.7	1984.6	2735.9	427.6
7	370.3	1785.3	2030.4	2024.6	1582.7	1976.9	3518.2	2698.8	2080.0	1851.5	1817.9	1384.0	1287.0	396.9
10	344.0	1055.0	1331.1	1373.6	1080.8	1348.6	2288.8	1803.1	1395.5	1243.5	1204.5	946.9	740.0	347.8
15	297.3	633.9	760.9	841.9	721.6	894.6	1422.5	1164.1	906.6	808.4	768.1	606.1	441.5	277.2
20	255.4	445.9	510.5	581.7	546.2	671.3	1012.3	855.8	670.4	597.8	559.0	436.4	316.8	226.4
25	220.8	340.3	378.5	435.6	439.6	536.4	774.3	673.0	530.3	472.8	436.0	336.5	248.0	190.4
50	125.8	153.1	161.8	183.9	215.0	257.6	326.0	310.6	251.5	223.9	197.1	149.2	120.6	105.7
75	87.0	99.2	103.3	114.9	136.0	160.2	191.1	190.6	158.4	140.9	121.6	93.7	80.0	73.1
100	66.2	73.3	75.7	82.8	96.4	111.4	128.7	131.5	111.9	99.7	85.6	67.7	59.6	55.6
125	53.2	57.8	59.3	64.0	73.0	82.9	93.8	97.0	84.2	75.3	64.9	52.5	47.3	44.7
150	44.1	47.3	48.3	51.5	57.8	64.5	71.9	74.8	66.0	59.4	51.6	42.6	38.9	37.1
175	37.4	39.7	40.4	42.7	47.2	51.9	57.1	59.5	53.3	48.3	42.3	35.6	32.9	31.5
200	32.3	33.9	34.5	36.2	39.4	42.8	46.6	48.6	44.0	40.1	35.5	30.4	28.3	27.3
225	28.2	29.5	29.9	31.1	33.5	36.1	38.9	40.4	37.0	33.9	30.3	26.3	24.7	23.9

Table A2.1 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	60.8	568.8											440.7	72.1
5	58.2	552.1	421.6	436.7	359.9	466.2	901.6	666.9	504.4	443.1	438.4	306.8	421.6	66.1
7	56.0	267.0	305.5	307.2	241.3	306.9	568.8	430.2	326.8	287.9	281.9	214.0	198.5	61.3
10	52.1	158.6	200.9	208.6	165.1	209.9	369.6	287.4	219.3	193.5	186.8	146.5	114.2	53.8
15	45.2	95.9	115.2	128.1	110.6	139.6	229.4	185.5	142.4	125.9	119.2	93.8	68.3	42.9
20	38.9	67.7	77.5	88.7	84.0	105.0	163.0	136.4	105.3	93.2	86.8	67.6	49.0	35.1
25	33.7	51.8	57.7	66.5	67.7	84.1	124.5	107.3	83.3	73.7	67.7	52.2	38.4	29.5
50	19.4	23.6	24.9	28.4	33.4	40.6	52.1	49.5	39.6	35.0	30.7	23.2	18.8	16.4
75	13.5	15.4	16.0	17.9	21.3	25.3	30.4	30.3	24.9	22.1	19.0	14.6	12.5	11.4
100	10.3	11.4	11.8	12.9	15.1	17.6	20.5	20.9	17.6	15.7	13.4	10.6	9.3	8.7
125	8.3	9.1	9.3	10.0	11.5	13.1	14.9	15.4	13.3	11.8	10.2	8.2	7.4	7.0
150	6.9	7.4	7.6	8.1	9.1	10.2	11.4	11.9	10.4	9.3	8.1	6.7	6.1	5.8
175	5.9	6.2	6.4	6.7	7.4	8.2	9.0	9.4	8.4	7.6	6.6	5.6	5.2	5.0
200	5.1	5.3	5.4	5.7	6.2	6.8	7.4	7.7	6.9	6.3	5.6	4.8	4.4	4.3
225	4.4	4.6	4.7	4.9	5.3	5.7	6.2	6.4	5.8	5.3	4.8	4.1	3.9	3.8

Table A2.1 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	91.8	862.4											664.8	108.6
5	87.9	837.2	637.5	657.2	543.3	705.1	1350.6	995.2	755.4	666.1	660.2	462.0	636.0	99.6
7	84.6	404.2	461.6	462.5	364.1	463.8	852.0	641.9	489.4	432.8	424.4	322.2	299.3	92.4
10	78.7	239.9	303.4	314.2	249.1	316.9	553.8	428.8	328.3	290.8	281.3	220.5	172.2	81.0
15	68.1	144.7	173.9	193.0	166.8	210.6	343.7	276.9	213.3	189.2	179.4	141.2	102.8	64.6
20	58.7	102.1	117.0	133.6	126.5	158.3	244.2	203.6	157.7	140.0	130.6	101.7	73.8	52.8
25	50.8	78.2	86.9	100.2	102.1	126.6	186.6	160.1	124.8	110.8	101.9	78.5	57.8	44.4
50	29.2	35.5	37.5	42.8	50.3	61.0	78.1	73.9	59.2	52.6	46.1	34.9	28.2	24.7
75	20.3	23.2	24.1	26.9	32.0	38.0	45.6	45.3	37.3	33.1	28.5	22.0	18.7	17.1
100	15.5	17.2	17.8	19.5	22.7	26.4	30.7	31.3	26.4	23.5	20.1	15.9	14.0	13.1
125	12.5	13.6	14.0	15.1	17.3	19.6	22.3	23.0	19.9	17.7	15.3	12.3	11.1	10.5
150	10.4	11.1	11.4	12.2	13.7	15.3	17.1	17.8	15.6	14.0	12.1	10.0	9.2	8.7
175	8.8	9.4	9.5	10.1	11.2	12.3	13.6	14.1	12.6	11.4	10.0	8.4	7.7	7.4
200	7.6	8.0	8.2	8.5	9.3	10.1	11.1	11.5	10.4	9.5	8.4	7.2	6.7	6.4
225	6.7	7.0	7.1	7.4	7.9	8.5	9.2	9.6	8.7	8.0	7.2	6.2	5.8	5.6

Table A2.2

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	10.1	75.8											50.1	8.3
5	9.8	76.8	66.0	62.0	39.2	83.4	322.4	148.9	61.3	55.1	51.5	30.4	52.6	7.7
7	9.4	40.1	52.2	46.1	28.5	57.5	200.0	94.8	40.0	35.6	33.0	21.7	23.1	7.1
10	8.9	25.8	36.1	33.0	21.5	41.6	128.0	63.0	27.3	24.1	22.0	15.3	12.9	6.2
15	7.9	16.5	20.6	21.0	16.2	29.7	77.6	40.7	18.3	15.9	14.2	10.2	7.7	5.0
20	6.9	11.9	13.8	14.8	13.4	23.4	53.8	30.0	13.9	11.9	10.5	7.6	5.6	4.1
25	6.1	9.2	10.3	11.4	11.6	19.3	40.2	23.7	11.3	9.6	8.3	6.0	4.5	3.5
50	3.8	4.5	4.8	5.5	6.9	9.9	15.2	11.1	6.0	4.9	4.0	2.9	2.4	2.1
75	2.8	3.2	3.3	3.7	4.7	6.2	8.3	6.8	4.1	3.3	2.7	2.0	1.7	1.6
100	2.2	2.5	2.6	2.8	3.5	4.3	5.3	4.7	3.0	2.5	2.0	1.5	1.4	1.3
125	1.8	2.0	2.1	2.2	2.7	3.1	3.7	3.4	2.4	2.0	1.6	1.3	1.1	1.1
150	1.5	1.7	1.7	1.8	2.1	2.4	2.7	2.6	1.9	1.6	1.3	1.1	1.0	0.9
175	1.3	1.4	1.4	1.5	1.7	1.9	2.1	2.0	1.6	1.3	1.1	0.9	0.9	0.8
200	1.1	1.2	1.2	1.3	1.4	1.6	1.7	1.7	1.3	1.1	1.0	0.8	0.8	0.7
225	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.1	1.0	0.9	0.7	0.7	0.7

Table A2.2 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	20.5	147.1											67.0	11.2
5	19.8	149.7	144.8	133.4	89.4	143.6	425.4	187.9	81.7	73.4	68.5	40.7	70.5	10.2
7	19.1	82.4	117.8	101.9	62.2	96.6	263.9	120.0	53.2	47.5	43.9	29.1	31.0	9.5
10	18.0	55.1	82.3	73.8	44.6	68.2	168.9	80.0	36.3	32.1	29.3	20.5	17.3	8.3
15	15.8	35.4	45.8	46.1	31.8	47.2	102.5	51.8	24.3	21.1	19.0	13.6	10.3	6.7
20	13.7	25.0	29.5	31.5	25.3	36.4	71.3	38.3	18.5	15.9	14.0	10.1	7.5	5.5
25	11.9	18.9	21.3	23.3	21.1	29.6	53.4	30.4	15.0	12.7	11.1	8.0	6.0	4.7
50	6.8	8.2	8.7	9.8	11.4	14.7	20.5	14.4	7.9	6.5	5.4	3.9	3.2	2.9
75	4.6	5.3	5.5	6.2	7.4	9.1	11.3	8.9	5.4	4.4	3.6	2.7	2.3	2.1
100	3.5	3.9	4.0	4.4	5.2	6.2	7.3	6.2	4.0	3.3	2.7	2.1	1.8	1.7
125	2.8	3.1	3.2	3.4	3.9	4.5	5.1	4.5	3.2	2.6	2.1	1.7	1.5	1.4
150	2.3	2.5	2.6	2.7	3.1	3.5	3.8	3.5	2.6	2.2	1.8	1.4	1.3	1.3
175	2.0	2.1	2.1	2.2	2.5	2.7	3.0	2.8	2.1	1.8	1.5	1.3	1.2	1.1
200	1.7	1.8	1.8	1.9	2.0	2.2	2.4	2.3	1.8	1.5	1.3	1.1	1.0	1.0
225	1.4	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.5	1.3	1.2	1.0	0.9	0.9

Table A2.2 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	4.8	35.8											22.0	3.7
5	4.7	36.3	32.1	30.0	19.3	38.4	140.3	64.3	26.8	24.1	22.6	13.3	23.1	3.4
7	4.5	19.2	25.6	22.5	13.8	26.3	87.0	41.0	17.5	15.6	14.4	9.5	10.1	3.1
10	4.2	12.5	17.7	16.1	10.3	18.9	55.7	27.3	11.9	10.5	9.6	6.7	5.7	2.7
15	3.7	8.0	10.1	10.2	7.7	13.4	33.8	17.6	8.0	7.0	6.2	4.5	3.4	2.2
20	3.3	5.7	6.7	7.2	6.3	10.5	23.4	13.0	6.1	5.2	4.6	3.3	2.5	1.8
25	2.9	4.4	4.9	5.4	5.4	8.7	17.5	10.3	4.9	4.2	3.6	2.6	2.0	1.5
50	1.7	2.1	2.2	2.5	3.1	4.4	6.7	4.8	2.6	2.1	1.8	1.3	1.1	0.9
75	1.3	1.5	1.5	1.7	2.1	2.8	3.6	3.0	1.8	1.4	1.2	0.9	0.8	0.7
100	1.0	1.1	1.2	1.3	1.5	1.9	2.3	2.0	1.3	1.1	0.9	0.7	0.6	0.6
125	0.8	0.9	0.9	1.0	1.2	1.4	1.6	1.5	1.0	0.9	0.7	0.6	0.5	0.5
150	0.7	0.7	0.8	0.8	0.9	1.1	1.2	1.1	0.8	0.7	0.6	0.5	0.4	0.4
175	0.6	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.7	0.6	0.5	0.4	0.4	0.4
200	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3
225	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.3



Table A2.2 (continuation)

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

R/Z, cm	350	365	370	385	415	450	500	600	700	750	800	850	870	880
0	14.1	99.2											33.9	5.7
5	13.6	101.2	103.8	94.8	65.2	90.1	212.3	89.2	41.3	37.1	34.6	20.6	35.8	5.2
7	13.2	57.3	85.5	73.3	44.5	59.6	131.7	57.1	26.9	24.0	22.2	14.8	15.7	4.8
10	12.4	39.0	60.0	53.3	31.2	41.3	84.3	38.2	18.3	16.2	14.8	10.4	8.8	4.2
15	10.8	25.1	33.0	33.0	21.6	27.9	51.3	24.8	12.3	10.7	9.6	6.9	5.2	3.4
20	9.4	17.6	21.0	22.2	16.8	21.2	35.8	18.4	9.3	8.0	7.1	5.1	3.8	2.8
25	8.1	13.1	14.9	16.2	13.7	17.1	26.8	14.7	7.6	6.4	5.6	4.1	3.0	2.4
50	4.4	5.3	5.6	6.3	6.9	8.2	10.5	7.1	4.0	3.3	2.7	2.0	1.6	1.5
75	2.9	3.3	3.4	3.7	4.3	5.0	5.8	4.4	2.7	2.2	1.8	1.4	1.2	1.1
100	2.1	2.3	2.4	2.6	3.0	3.4	3.8	3.1	2.0	1.7	1.4	1.1	0.9	0.9
125	1.6	1.8	1.8	2.0	2.2	2.5	2.7	2.3	1.6	1.3	1.1	0.9	0.8	0.7
150	1.3	1.4	1.4	1.5	1.7	1.9	2.0	1.8	1.3	1.1	0.9	0.7	0.7	0.6
175	1.1	1.2	1.2	1.2	1.4	1.5	1.6	1.4	1.1	0.9	0.8	0.6	0.6	0.6
200	0.9	1.0	1.0	1.0	1.1	1.2	1.3	1.2	0.9	0.8	0.7	0.6	0.5	0.5
225	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	0.8	0.7	0.6	0.5	0.5	0.5