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Report

Radiological Consequences of Fallout from Nuclear Explosions

Appendix 4 – Detailed Results (Children)

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Appendix 4 – Detailed Results (Children)

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1. Introduction

This appendix presents the results of calculations relating to radiation doses to one-year-old children, with few comments and explanations.

Appendix 3 (Dispersion and Dose Calculations) describes how the calculations and the processing of the data were performed.

1.1. Standard calculation

Unless otherwise stated, the following applies to the results presented:

- The calculations have been done for a representative location, a Swedish city in the interior about 200 km from the coast.
- The calculations have been done for weather at 13-hour intervals between 23 January 2021 and 21 January 2022, a total of 663 individual calculations, using SMHI's *MATCH-BOMB* calculation model with numerical weather data from the *AROME* model on a grid with a resolution of 2.5 km.
- The results apply to a nuclear explosion, a 100 kiloton ground-level explosion with a 50 % fusion component, using the nuclide vector developed by SSM and described in Appendix 2 (Nuclide Composition).
- The results are calculated for a one-year-old child.
- Protection factors have been applied according to Section 1.3.

1.2. Other results from the calculations

Calculations have also been made for radiation doses to adults, and these results are presented in Appendix 5 (Detailed Results (Adults)).

Calculations that do not relate to radiation doses or that do not depend upon the age of the exposed person are presented in Appendix 6 (Detailed Results (General)).

1.3. Protection factors

When calculating how different forms of sheltering indoors affect the received radiation doses, protection factors as shown in Table 1 have been used. A more detailed discussion of the protection factors can be found in Appendix 1 (Radiation Protection).

In addition to the protection factors in Table 1, the protection provided by the timely administration of iodine tablets against absorbed and equivalent dose to the thyroid gland from inhaled iodine has been assessed by applying a protection factor of 0.1 when calculating the dose to the thyroid gland for this protective measure.

For the calculation of radiation doses from the ground to people residing over time (*i.e.* after the initial protection against fallout by sheltering indoors has ceased), a yearly average of 80 % staying indoors has been assumed.

Table 1. Protection factors used in the dose calculations.

Type of protection	Type of premises	Exposure pathways	Protection factor
Unprotected	Outdoors	-	1
Sheltering indoors	House	Protection against external exposure from radioactive material deposited on the ground	0.4
		Protection against internal exposure from inhalation of radioactive material in the air	0.5
		Weighted protection against all exposure pathways considered	0.5
Sheltering indoors	Large building *This includes apartments in multifamily buildings, schools, etc.*[1]	Protection against all exposure pathways considered	0.1
Sheltering indoors	Protective shelter (SR 15 [2])	Protection against external exposure from radioactive material deposited on the ground[3]	0.025
Sheltering indoors	Basement *Basements in large concrete buildings*	Protection against external exposure from radioactive material deposited on the ground	0.01
Sheltering indoors	Protective shelter (basement) *Protective shelter in the basement of a large concrete building or the equivalent*[4]	Protection against external exposure from radioactive material deposited on the ground[5]	0.001
Fully protected	-	-	0
Normal residency over time	House	Protection against external exposure from radioactive material deposited on the ground	0.52
Normal residency over time	Multifamily residential buildings, schools, etc.	Protection against external exposure from radioactive material deposited on the ground	0.28

[1] This report uses the identical protection factor for all exposure pathways. For many types of premises in this category, this assumption should be conservative.

[2] B. Ekengren, "Skyddsrumsregler SR 15 (MSB748)", MSB, 2014.

2. Radiation doses after combinations of protective actions

This chapter presents the results of calculations of the total effective dose after various combinations of protective actions. The exposure pathways that were considered are external dose from ground contamination and from the plume, and internal dose from inhalation.

The estimation of dose after combinations of protective actions has involved the subtraction of numbers of similar magnitude in some cases. These numbers are also obtained from the calculation results by linear interpolation. Furthermore, the results are presented with greater precision than the accuracy of the calculations and data processing actually support, in order to illustrate overall trends more clearly. Taken together, this leads to some results deviating from expected values for numerical reasons (*e.g.* distances for the 80th percentile turn out to be slightly further than distances for the 90th percentile). Considering that this does not affect any of the report's conclusions, remedying the situation by, for example, redoing the calculations with more densely spaced calculation criteria has not been considered warranted, but rather such unphysical consequences have been retained in the tables and indicated in *italics*.

2.1. Greatest distances for radiation doses after protective measures

Tables 2-4 present the results for greatest distances at which given total effective doses are exceeded for different percentiles of occurring weather cases. Results for increasing levels of initial protection (see Table 1) are shown in sub-tables a (completely unprotected – protection factor 1) through g (completely protected – protection factor 0).

Greatest distances at which the total effective dose exceeds 100 mSv in the first year after a nuclear explosion for different percentiles of weather cases are shown in Table 2a-g.

Greatest distances at which the total effective dose exceeds 500 mSv in the first year after a nuclear explosion for different percentiles of weather cases are shown in Table 3a-g.

Greatest distances at which the total effective dose exceeds 1,000 mSv in the first year after a nuclear explosion for different percentiles of weather cases are shown in Table 4a-g.

Table 2a. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given **unprotected** initial exposure and various combinations of conditions during the remainder of the first year. In addition, the theoretical extreme case of "unprotected" also exists for the remainder of the year (*i.e.* 100 mSv annual dose to an unprotected person).

Unprotected initial exposure	Protection during the remainder of the first year	70 %	80 %	90 %
	Unprotected for the entire year after the explosion	250 km	280 km	320 km
1 day	Evacuated	160 km	180 km	210 km
2 days	Evacuated	180 km	200 km	230 km

3 days	Evacuated	190 km	210 km	240 km
7 days	Evacuated	200 km	220 km	250 km
1 day	House	210 km	240 km	270 km
2 days	House	220 km	250 km	280 km
3 days	House	230 km	250 km	290 km
7 days	House	230 km	260 km	290 km
1 day	House, evacuated after 1 month	200 km	220 km	260 km
2 days	House, evacuated after 1 month	210 km	230 km	260 km
3, 7 days	House, evacuated after 1 month	210 km	240 km	270 km
1 day	House, evacuated after 1 week	190 km	210 km	240 km
2 days	House, evacuated after 1 week	190 km	220 km	250 km
3 days	House, evacuated after 1 week	200 km	220 km	250 km
1 day	Large building	190 km	220 km	250 km
2 days	Large building	200 km	230 km	260 km
3 days	Large building	210 km	240 km	270 km
7 days	Large building	220 km	250 km	280 km
1 day	Large building, evacuated after 1 month	180 km	210 km	240 km
2 days	Large building, evacuated after 1 month	200 km	220 km	250 km
3 days	Large building, evacuated after 1 month	200 km	230 km	260 km
7 days	Large building, evacuated after 1 month	210 km	240 km	270 km
1 day	Large building, evacuated after 1 week	180 km	200 km	230 km
2 days	Large building, evacuated after 1 week	190 km	210 km	240 km
3 days	Large building, evacuated after 1 week	190 km	220 km	250 km

Table 2b. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **house** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	110 km	130 km	140 km
2 days	Evacuated	120 km	140 km	150 km
3 days	Evacuated	120 km	140 km	160 km
7 days	Evacuated	130 km	150 km	170 km
1,2,3 days	House	170 km	190 km	220 km
7 days	House	170 km	190 km	210 km
1,2,3 days	House, evacuated after 1 month	150 km	170 km	200 km
7 days	House, evacuated after 1 month	150 km	170 km	190 km
1 day	House, evacuated after 1 week	140 km	150 km	180 km

2 days	House, evacuated after 1 week	130 km	150 km	180 km
3 days	House, evacuated after 1 week	130 km	150 km	170 km
1 day	Large building	150 km	170 km	190 km
2,3,7 days	Large building	150 km	170 km	200 km
1 day	Large building, evacuated after 1 month	140 km	150 km	180 km
2,3 days	Large building, evacuated after 1 month	140 km	160 km	180 km
7 days	Large building, evacuated after 1 month	140 km	160 km	190 km
1 day	Large building, evacuated after 1 week	130 km	140 km	160 km
2 days	Large building, evacuated after 1 week	130 km	140 km	170 km
3 days	Large building, evacuated after 1 week	130 km	150 km	170 km

Table 2c. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **large building** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	54 km	59 km	67 km
2 days	Evacuated	59 km	64 km	74 km
3 days	Evacuated	61 km	67 km	78 km
7 days	Evacuated	65 km	72 km	83 km
1 day	House	150 km	160 km	190 km
2 days	House	140 km	160 km	180 km
3 days	House	140 km	150 km	170 km
7 days	House	130 km	130 km	140 km
1 day	House, evacuated after 1 month	130 km	140 km	160 km
2 days	House, evacuated after 1 month	120 km	120 km	140 km
3 days	House, evacuated after 1 month	110 km	120 km	140 km
7 days	House, evacuated after 1 month	98 km	110 km	130 km
1 day	House, evacuated after 1 week	110 km	110 km	140 km
2 days	House, evacuated after 1 week	96 km	100 km	120 km
3 days	House, evacuated after 1 week	89 km	94 km	120 km
1 day	Large building	120 km	130 km	140 km
2 days	Large building	110 km	120 km	130 km
3, 7 days	Large building	110 km	120 km	130 km
1 day	Large building, evacuated after 1 month	100 km	110 km	130 km
2 days	Large building, evacuated after 1 month	97 km	110 km	130 km
3 days	Large building, evacuated after 1 month	93 km	110 km	120 km

7 days	Large building, evacuated after 1 month	84 km	96 km	110 km
1 day	Large building, evacuated after 1 week	90 km	97 km	120 km
2 days	Large building, evacuated after 1 week	81 km	86 km	100 km
3 days	Large building, evacuated after 1 week	74 km	81 km	95 km

Table 2d. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **protective shelter (SR 15)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	20 km	23 km	27 km
2 days	Evacuated	23 km	25 km	29 km
3 days	Evacuated	23 km	26 km	30 km
7 days	Evacuated	25 km	28 km	32 km
1 day	House	140 km	150 km	180 km
2 days	House	130 km	140 km	160 km
3 days	House	130 km	130 km	140 km
7 days	House	110 km	120 km	130 km
1 day	House, evacuated after 1 month	120 km	120 km	150 km
2 days	House, evacuated after 1 month	100 km	110 km	130 km
3 days	House, evacuated after 1 month	96 km	110 km	130 km
7 days	House, evacuated after 1 month	67 km	73 km	86 km
1 day	House, evacuated after 1 week	96 km	100 km	120 km
2 days	House, evacuated after 1 week	62 km	69 km	79 km
3 days	House, evacuated after 1 week	53 km	65 km	69 km
1 day	Large building	110 km	120 km	130 km
2 days	Large building	100 km	110 km	120 km
3 days	Large building	90 km	100 km	120 km
7 days	Large building	73 km	81 km	94 km
1 day	Large building, evacuated after 1 month	88 km	99 km	120 km
2 days	Large building, evacuated after 1 month	65 km	72 km	85 km
3 days	Large building, evacuated after 1 month	62 km	69 km	79 km
7 days	Large building, evacuated after 1 month	45 km	49 km	55 km
1 day	Large building, evacuated after 1 week	59 km	65 km	75 km
2 days	Large building, evacuated after 1 week	52 km	61 km	67 km
3 days	Large building, evacuated after 1 week	40 km	54 km	49 km

Table 2e. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **basement** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	9 km	10 km	12 km
2 days	Evacuated	10 km	11 km	14 km
3 days	Evacuated	10 km	12 km	14 km
7 days	Evacuated	11 km	13 km	14 km
1 day	House	140 km	150 km	180 km
2 days	House	130 km	140 km	160 km
3 days	House	120 km	130 km	140 km
7 days	House	110 km	120 km	130 km
1 day	House, evacuated after 1 month	120 km	120 km	150 km
2 days	House, evacuated after 1 month	100 km	110 km	130 km
3 days	House, evacuated after 1 month	75 km	110 km	120 km
7 days	House, evacuated after 1 month	60 km	66 km	77 km
1 day	House, evacuated after 1 week	94 km	100 km	120 km
2 days	House, evacuated after 1 week	60 km	67 km	76 km
3 days	House, evacuated after 1 week	44 km	*63 km*	*61 km*
1 day	Large building	110 km	120 km	130 km
2 days	Large building	95 km	110 km	120 km
3 days	Large building	76 km	84 km	98 km
7 days	Large building	69 km	77 km	89 km
1 day	Large building, evacuated after 1 month	85 km	86 km	110 km
2 days	Large building, evacuated after 1 month	61 km	68 km	80 km
3 days	Large building, evacuated after 1 month	58 km	65 km	70 km
7 days	Large building, evacuated after 1 month	42 km	47 km	53 km
1 day	Large building, evacuated after 1 week	55 km	63 km	71 km
2 days	Large building, evacuated after 1 week	39 km	*56 km*	*49 km*
3 days	Large building, evacuated after 1 week	36 km	*39 km*	*33 km*

Table 2f. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **protective shelter (basement)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km

		70 %	80 %	90 %
1 day	House	140 km	150 km	180 km
2 days	House	130 km	140 km	150 km
3 days	House	120 km	130 km	140 km
7 days	House	110 km	120 km	130 km
1 day	House, evacuated after 1 month	110 km	120 km	150 km
2 days	House, evacuated after 1 month	99 km	110 km	130 km
3 days	House, evacuated after 1 month	70 km	93 km	120 km
7 days	House, evacuated after 1 month	52 km	53 km	68 km
1 day	House, evacuated after 1 week	93 km	99 km	120 km
2 days	House, evacuated after 1 week	57 km	66 km	74 km
3 days	House, evacuated after 1 week	40 km	*61 km*	*49 km*
1 day	Large building	100 km	110 km	130 km
2 days	Large building	86 km	87 km	110 km
3 days	Large building	72 km	81 km	95 km
7 days	Large building	67 km	75 km	87 km
1 day	Large building, evacuated after 1 month	74 km	74 km	99 km
2 days	Large building, evacuated after 1 month	59 km	66 km	77 km
3 days	Large building, evacuated after 1 month	48 km	62 km	63 km
7 days	Large building, evacuated after 1 month	*34 km*	*30 km*	49 km
1 day	Large building, evacuated after 1 week	54 km	61 km	69 km
2 days	Large building, evacuated after 1 week	36 km	*46 km*	*42 km*
3 days	Large building, evacuated after 1 week	*27 km*	*26 km*	27 km

Table 2g. Greatest distances at which **100 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given **complete** initial protection and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	House	140 km	150 km	180 km
2 days	House	130 km	140 km	150 km
3 days	House	120 km	130 km	140 km
7 days	House	110 km	120 km	130 km
1 day	House, evacuated after 1 month	110 km	120 km	140 km
2 days	House, evacuated after 1 month	99 km	110 km	130 km
3 days	House, evacuated after 1 month	70 km	91 km	120 km
7 days	House, evacuated after 1 month	51 km	52 km	68 km
1 day	House, evacuated after 1 week	93 km	99 km	120 km
2 days	House, evacuated after 1 week	57 km	66 km	74 km

3 days	House, evacuated after 1 week	40 km	*60 km*	*47 km*
1 day	Large building	100 km	110 km	130 km
2 days	Large building	85 km	85 km	110 km
3 days	Large building	72 km	81 km	94 km
7 days	Large building	67 km	74 km	86 km
1 day	Large building, evacuated after 1 month	73 km	74 km	99 km
2 days	Large building, evacuated after 1 month	59 km	66 km	76 km
3 days	Large building, evacuated after 1 month	45 km	62 km	62 km
7 days	Large building, evacuated after 1 month	*33 km*	*30 km*	37 km
1 day	Large building, evacuated after 1 week	53 km	61 km	69 km
2 days	Large building, evacuated after 1 week	34 km	*41 km*	*40 km*
3 days	Large building, evacuated after 1 week	*26 km*	*25 km*	26 km

Table 3a. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given **unprotected** initial exposure and various combinations of conditions during the remainder of the first year. In addition, the theoretical extreme case of "unprotected" also exists for the remainder of the year (*i.e.* 500 mSv annual dose to an unprotected person).

Unprotected initial exposure	Protection during the remainder of the first year	70 %	80 %	90 %
	Unprotected for the entire year after the explosion	120 km	130 km	140 km
1 day	Evacuated	81 km	91 km	100 km
2 days	Evacuated	90 km	99 km	110 km
3 days	Evacuated	94 km	100 km	120 km
7 days	Evacuated	99 km	110 km	130 km
1 day	House	100 km	110 km	130 km
2,3 days	House	110 km	120 km	130 km
7 days	House	110 km	120 km	140 km
1 day	House, evacuated after 1 month	97 km	110 km	120 km
2 days	House, evacuated after 1 month	99 km	110 km	130 km
3, 7 days	House, evacuated after 1 month	100 km	110 km	130 km
1 day	House, evacuated after 1 week	93 km	100 km	120 km
2 days	House, evacuated after 1 week	95 km	100 km	120 km
3 days	House, evacuated after 1 week	97 km	110 km	120 km
1 day	Large building	95 km	100 km	120 km
2 days	Large building	99 km	110 km	130 km
3 days	Large building	100 km	110 km	130 km
7 days	Large building	110 km	120 km	130 km

1 day	Large building, evacuated after 1 month	91 km	100 km	110 km
2 days	Large building, evacuated after 1 month	95 km	110 km	120 km
3 days	Large building, evacuated after 1 month	98 km	110 km	120 km
7 days	Large building, evacuated after 1 month	100 km	110 km	130 km
1 day	Large building, evacuated after 1 week	88 km	97 km	110 km
2 days	Large building, evacuated after 1 week	93 km	100 km	120 km
3 days	Large building, evacuated after 1 week	95 km	100 km	120 km

Table 3b. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered given initial protection in a **house** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	46 km	50 km	58 km
2 days	Evacuated	50 km	55 km	63 km
3 days	Evacuated	53 km	58 km	66 km
7 days	Evacuated	56 km	63 km	71 km
1 day	House	76 km	83 km	96 km
2 days	House	74 km	82 km	94 km
3 days	House	73 km	81 km	94 km
7 days	House	73 km	80 km	93 km
1 day	House, evacuated after 1 month	66 km	73 km	85 km
2 days	House, evacuated after 1 month	65 km	72 km	83 km
3 days	House, evacuated after 1 month	64 km	71 km	82 km
7 days	House, evacuated after 1 month	64 km	70 km	81 km
1 day	House, evacuated after 1 week	59 km	66 km	75 km
2 days	House, evacuated after 1 week	58 km	65 km	74 km
3 days	House, evacuated after 1 week	58 km	64 km	73 km
1 day	Large building	64 km	71 km	81 km
2,3 days	Large building	65 km	72 km	83 km
7 days	Large building	66 km	73 km	84 km
1 day	Large building, evacuated after 1 month	58 km	64 km	74 km
2 days	Large building, evacuated after 1 month	59 km	65 km	75 km
3 days	Large building, evacuated after 1 month	59 km	65 km	76 km
7 days	Large building, evacuated after 1 month	60 km	67 km	77 km
1 day	Large building, evacuated after 1 week	54 km	60 km	68 km
2 days	Large building, evacuated after 1 week	55 km	61 km	69 km
3 days	Large building, evacuated after 1 week	55 km	62 km	70 km

Table 3c. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **large building** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	17 km	19 km	22 km
2 days	Evacuated	19 km	21 km	24 km
3 days	Evacuated	19 km	22 km	25 km
7 days	Evacuated	20 km	23 km	27 km
1 day	House	57 km	62 km	73 km
2 days	House	52 km	56 km	65 km
3 days	House	49 km	53 km	61 km
7 days	House	47 km	49 km	58 km
1 day	House, evacuated after 1 month	44 km	51 km	54 km
2 days	House, evacuated after 1 month	40 km	46 km	50 km
3 days	House, evacuated after 1 month	39 km	45 km	48 km
7 days	House, evacuated after 1 month	29 km	32 km	39 km
1 day	House, evacuated after 1 week	37 km	43 km	47 km
2 days	House, evacuated after 1 week	29 km	33 km	35 km
3 days	House, evacuated after 1 week	25 km	28 km	32 km
1 day	Large building	43 km	47 km	54 km
2 days	Large building	40 km	44 km	51 km
3 days	Large building	40 km	43 km	50 km
7 days	Large building	34 km	37 km	45 km
1 day	Large building, evacuated after 1 month	34 km	39 km	44 km
2 days	Large building, evacuated after 1 month	29 km	32 km	37 km
3 days	Large building, evacuated after 1 month	28 km	30 km	35 km
7 days	Large building, evacuated after 1 month	25 km	28 km	33 km
1 day	Large building, evacuated after 1 week	25 km	29 km	34 km
2 days	Large building, evacuated after 1 week	24 km	27 km	30 km
3 days	Large building, evacuated after 1 week	23 km	25 km	29 km

Table 3d. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial

protection in a **protective shelter (SR 15)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	50 km	54 km	64 km
2 days	House	47 km	50 km	58 km
3 days	House	45 km	48 km	55 km
7 days	House	*34 km*	*33 km*	47 km
1 day	House, evacuated after 1 month	38 km	45 km	49 km
2 days	House, evacuated after 1 month	25 km	29 km	33 km
3 days	House, evacuated after 1 month	24 km	27 km	31 km
7 days	House, evacuated after 1 month	18 km	23 km	28 km
1 day	House, evacuated after 1 week	23 km	25 km	29 km
2 days	House, evacuated after 1 week	18 km	21 km	26 km
3 days	House, evacuated after 1 week	*16 km*	*14 km*	*15 km*
1 day	Large building	28 km	32 km	38 km
2 days	Large building	25 km	29 km	34 km
3 days	Large building	24 km	28 km	33 km
7 days	Large building	23 km	27 km	31 km
1 day	Large building, evacuated after 1 month	22 km	24 km	29 km
2 days	Large building, evacuated after 1 month	20 km	23 km	27 km
3 days	Large building, evacuated after 1 month	17 km	21 km	26 km
7 days	Large building, evacuated after 1 month	11 km	14 km	14 km
1 day	Large building, evacuated after 1 week	18 km	20 km	23 km
2 days	Large building, evacuated after 1 week	13 km	13 km	14 km
3 days	Large building, evacuated after 1 week	10 km	*12 km*	*11 km*

Table 3e. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **basement** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	49 km	54 km	63 km
2 days	House	46 km	49 km	57 km
3 days	House	43 km	47 km	54 km
7 days	House	31 km	31 km	41 km

1 day	House, evacuated after 1 month	37 km	43 km	47 km
2 days	House, evacuated after 1 month	24 km	28 km	32 km
3 days	House, evacuated after 1 month	23 km	25 km	30 km
7 days	House, evacuated after 1 month	14 km	21 km	22 km
1 day	House, evacuated after 1 week	22 km	24 km	28 km
2 days	House, evacuated after 1 week	*16 km*	*14 km*	19 km
3 days	House, evacuated after 1 week	*13 km*	*10 km*	*11 km*
1 day	Large building	25 km	30 km	34 km
2 days	Large building	24 km	28 km	32 km
3 days	Large building	24 km	27 km	31 km
7 days	Large building	21 km	25 km	28 km
1 day	Large building, evacuated after 1 month	21 km	23 km	28 km
2 days	Large building, evacuated after 1 month	15 km	20 km	23 km
3 days	Large building, evacuated after 1 month	13 km	15 km	16 km
7 days	Large building, evacuated after 1 month	< 8 km	*12 km*	*11 km*
1 day	Large building, evacuated after 1 week	*16 km*	*15 km*	18 km
2 days	Large building, evacuated after 1 week	8 km	9 km	11 km
3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 3f. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **protective shelter (basement)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	49 km	53 km	62 km
2 days	House	45 km	48 km	56 km
3 days	House	42 km	46 km	52 km
7 days	House	29 km	30 km	36 km
1 day	House, evacuated after 1 month	35 km	40 km	46 km
2 days	House, evacuated after 1 month	23 km	27 km	31 km
3 days	House, evacuated after 1 month	23 km	24 km	28 km
7 days	House, evacuated after 1 month	12 km	*18 km*	*17 km*
1 day	House, evacuated after 1 week	21 km	24 km	28 km
2 days	House, evacuated after 1 week	*14 km*	*12 km*	16 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	9 km
1 day	Large building	25 km	29 km	34 km
2 days	Large building	23 km	27 km	31 km

3 days	Large building	23 km	26 km	30 km
7 days	Large building	18 km	18 km	24 km
1 day	Large building, evacuated after 1 month	20 km	23 km	27 km
2 days	Large building, evacuated after 1 month	13 km	17 km	21 km
3 days	Large building, evacuated after 1 month	11 km	14 km	14 km
7 days	Large building, evacuated after 1 month	< 8 km	*10 km*	*9 km*
1 day	Large building, evacuated after 1 week	10 km	13 km	15 km
2 days	Large building, evacuated after 1 week	< 8 km	< 8 km	10 km
3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 3g. Greatest distances at which **500 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given **complete** initial protection and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90%
1 day	House	49 km	53 km	62 km
2 days	House	45 km	48 km	56 km
3 days	House	42 km	46 km	51 km
7 days	House	29 km	30 km	35 km
1 day	House, evacuated after 1 month	35 km	40 km	46 km
2 days	House, evacuated after 1 month	23 km	27 km	31 km
3 days	House, evacuated after 1 month	23 km	24 km	28 km
7 days	House, evacuated after 1 month	11 km	17 km	17 km
1 day	House, evacuated after 1 week	21 km	23 km	28 km
2 days	House, evacuated after 1 week	*14 km*	*11 km*	16 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	9 km
1 day	Large building	25 km	29 km	33 km
2 days	Large building	23 km	27 km	31 km
3 days	Large building	23 km	26 km	30 km
7 days	Large building	18 km	18 km	23 km
1 day	Large building, evacuated after 1 month	20 km	23 km	27 km
2 days	Large building, evacuated after 1 month	13 km	16 km	20 km
3 days	Large building, evacuated after 1 month	11 km	14 km	14 km
7 days	Large building, evacuated after 1 month	< 8 km	9 km	9 km
1 day	Large building, evacuated after 1 week	10 km	13 km	15 km
2 days	Large building, evacuated after 1 week	< 8 km	< 8 km	9 km
3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 4a. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90%, respectively, of occurring weather cases are considered, given **unprotected** initial exposure and various combinations of conditions during the remainder of the first year. In addition, the theoretical extreme case of "unprotected" also exists for the remainder of the year (*i.e.* 1,000 mSv annual dose to an unprotected person).

Unprotected initial exposure	Protection during the remainder of the first year	70 %	80 %	90 %
	Unprotected for the entire year after the explosion	80 km	88 km	100 km
1 day	Evacuated	54 km	59 km	67 km
2 days	Evacuated	59 km	64 km	74 km
3 days	Evacuated	61 km	67 km	78 km
7 days	Evacuated	65 km	72 km	83 km
1 day	House	69 km	77 km	88 km
2 days	House	71 km	79 km	90 km
3 days	House	72 km	80 km	92 km
7 days	House	74 km	82 km	94 km
1 day	House, evacuated after 1 month	64 km	71 km	81 km
2 days	House, evacuated after 1 month	66 km	73 km	84 km
3 days	House, evacuated after 1 month	67 km	74 km	86 km
7 days	House, evacuated after 1 month	69 km	76 km	88 km
1 day	House, evacuated after 1 week	60 km	67 km	76 km
2 days	House, evacuated after 1 week	62 km	69 km	79 km
3 days	House, evacuated after 1 week	63 km	70 km	80 km
1 day	Large building	63 km	70 km	80 km
2 days	Large building	66 km	73 km	84 km
3 days	Large building	68 km	75 km	86 km
7 days	Large building	71 km	78 km	89 km
1 day	Large building, evacuated after 1 month	60 km	67 km	76 km
2 days	Large building, evacuated after 1 month	63 km	69 km	80 km
3 days	Large building, evacuated after 1 month	65 km	71 km	82 km
7 days	Large building, evacuated after 1 month	68 km	75 km	86 km
1 day	Large building, evacuated after 1 week	58 km	64 km	72 km
2 days	Large building, evacuated after 1 week	61 km	67 km	77 km
3 days	Large building, evacuated after 1 week	62 km	69 km	79 km

Table 4b. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **house** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	31 km	34 km	39 km
2 days	Evacuated	33 km	37 km	43 km
3 days	Evacuated	34 km	38 km	44 km
7 days	Evacuated	36 km	41 km	46 km
1 day	House	48 km	52 km	60 km
2,3 days	House	47 km	52 km	59 km
7 days	House	47 km	51 km	58 km
1 day	House, evacuated after 1 month	42 km	47 km	52 km
2 days	House, evacuated after 1 month	41 km	47 km	51 km
3 days	House, evacuated after 1 month	41 km	46 km	51 km
7 days	House, evacuated after 1 month	40 km	46 km	51 km
1 day	House, evacuated after 1 week	38 km	43 km	48 km
2 days	House, evacuated after 1 week	37 km	43 km	47 km
3 days	House, evacuated after 1 week	37 km	42 km	47 km
1 day	Large building	41 km	45 km	52 km
2,3 days	Large building	42 km	46 km	53 km
7 days	Large building	42 km	47 km	54 km
1 day	Large building, evacuated after 1 month	37 km	42 km	47 km
2,3 days	Large building, evacuated after 1 month	38 km	43 km	48 km
7 days	Large building, evacuated after 1 month	38 km	44 km	49 km
1 day	Large building, evacuated after 1 week	35 km	39 km	44 km
2 days	Large building, evacuated after 1 week	35 km	40 km	45 km
3 days	Large building, evacuated after 1 week	36 km	40 km	46 km

Table 4c. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **large building** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	Evacuated	9 km	10 km	12 km
2 days	Evacuated	10 km	11 km	14 km
3 days	Evacuated	10 km	12 km	14 km
7 days	Evacuated	11 km	13 km	14 km
1 day	House	30 km	36 km	45 km

		70 %	80 %	90 %
2 days	House	27 km	30 km	35 km
3 days	House	26 km	29 km	34 km
7 days	House	24 km	28 km	33 km
1 day	House, evacuated after 1 month	24 km	26 km	31 km
2 days	House, evacuated after 1 month	22 km	24 km	29 km
3 days	House, evacuated after 1 month	21 km	24 km	28 km
7 days	House, evacuated after 1 month	17 km	22 km	26 km
1 day	House, evacuated after 1 week	19 km	22 km	26 km
2 days	House, evacuated after 1 week	17 km	18 km	23 km
3 days	House, evacuated after 1 week	16 km	16 km	20 km
1 day	Large building	23 km	26 km	30 km
2 days	Large building	22 km	25 km	29 km
3 days	Large building	22 km	24 km	28 km
7 days	Large building	21 km	23 km	27 km
1 day	Large building, evacuated after 1 month	19 km	22 km	26 km
2 days	Large building, evacuated after 1 month	17 km	21 km	24 km
3 days	Large building, evacuated after 1 month	16 km	20 km	23 km
7 days	Large building, evacuated after 1 month	14 km	17 km	19 km
1 day	Large building, evacuated after 1 week	16 km	17 km	21 km
2 days	Large building, evacuated after 1 week	14 km	15 km	17 km
3 days	Large building, evacuated after 1 week	13 km	14 km	15 km

Table 4d. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **protective shelter (SR 15)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	25 km	29 km	34 km
2 days	House	24 km	27 km	31 km
3 days	House	23 km	26 km	30 km
7 days	House	20 km	23 km	27 km
1 day	House, evacuated after 1 month	21 km	23 km	28 km
2 days	House, evacuated after 1 month	14 km	20 km	23 km
3 days	House, evacuated after 1 month	13 km	15 km	15 km
7 days	House, evacuated after 1 month	< 8 km	*12 km*	*11 km*
1 day	House, evacuated after 1 week	*15 km*	*14 km*	17 km

2 days	House, evacuated after 1 week	9 km	10 km	11 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	8 km
1 day	Large building	18 km	21 km	25 km
2 days	Large building	14 km	15 km	19 km
3 days	Large building	14 km	14 km	18 km
7 days	Large building	12 km	13 km	16 km
1 day	Large building, evacuated after 1 month	10 km	14 km	14 km
2 days	Large building, evacuated after 1 month	< 8 km	*12 km*	*11 km*
3 days	Large building, evacuated after 1 month	< 8 km	*11 km*	*10 km*
7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	9 km
1 day	Large building, evacuated after 1 week	< 8 km	10 km	12 km
2 days	Large building, evacuated after 1 week	< 8 km	< 8 km	9 km
3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 4e. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **basement** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	24 km	28 km	33 km
2 days	House	23 km	27 km	31 km
3 days	House	23 km	26 km	29 km
7 days	House	18 km	18 km	23 km
1 day	House, evacuated after 1 month	20 km	22 km	27 km
2 days	House, evacuated after 1 month	13 km	16 km	20 km
3 days	House, evacuated after 1 month	11 km	14 km	14 km
7 days	House, evacuated after 1 month	< 8 km	10 km	10 km
1 day	House, evacuated after 1 week	10 km	13 km	15 km
2 days	House, evacuated after 1 week	< 8 km	< 8 km	10 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	15 km	15 km	21 km
2 days	Large building	13 km	14 km	17 km
3 days	Large building	12 km	13 km	16 km
7 days	Large building	8 km	*11 km*	*10 km*
1 day	Large building, evacuated after 1 month	< 8 km	13 km	13 km
2 days	Large building, evacuated after 1 month	< 8 km	10 km	10 km
3 days	Large building, evacuated after 1 month	< 8 km	< 8 km	9 km

7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	Large building, evacuated after 1 week	< 8 km	< 8 km	10 km
2,3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 4f. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 %, respectively, of occurring weather cases are considered, given initial protection in a **protective shelter (basement)** and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1,2,3,7 days	Evacuated	< 8 km	< 8 km	< 8 km
1 day	House	24 km	28 km	32 km
2 days	House	23 km	26 km	30 km
3 days	House	22 km	25 km	29 km
7 days	House	17 km	17 km	21 km
1 day	House, evacuated after 1 month	19 km	22 km	26 km
2 days	House, evacuated after 1 month	12 km	15 km	15 km
3 days	House, evacuated after 1 month	10 km	13 km	13 km
7 days	House, evacuated after 1 month	< 8 km	< 8 km	9 km
1 day	House, evacuated after 1 week	9 km	12 km	15 km
2 days	House, evacuated after 1 week	< 8 km	< 8 km	9 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	14 km	15 km	19 km
2 days	Large building	12 km	14 km	15 km
3 days	Large building	11 km	13 km	13 km
7 days	Large building	< 8 km	*10 km*	*9 km*
1 day	Large building, evacuated after 1 month	< 8 km	12 km	13 km
2 days	Large building, evacuated after 1 month	< 8 km	< 8 km	9 km
3 days	Large building, evacuated after 1 month	< 8 km	< 8 km	8 km
7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	Large building, evacuated after 1 week	< 8 km	< 8 km	10 km
2,3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

Table 4g. Greatest distances at which **1,000 mSv total effective dose** in the first year is exceeded when 70 %, 80 % and 90 % of occurring weather cases are considered, given **complete** initial protection and various combinations of conditions during the remainder of the first year.

Initial protection	Protection during the remainder of the first year	70 %	80 %	90 %
1 day	House	24 km	28 km	32 km

2 days	House	23 km	26 km	30 km
3 days	House	22 km	25 km	29 km
7 days	House	16 km	16 km	21 km
1 day	House, evacuated after 1 month	19 km	22 km	26 km
2 days	House, evacuated after 1 month	12 km	15 km	15 km
3 days	House, evacuated after 1 month	10 km	*13 km*	*12 km*
7 days	House, evacuated after 1 month	< 8 km	< 8 km	9 km
1 day	House, evacuated after 1 week	9 km	12 km	14 km
2 days	House, evacuated after 1 week	< 8 km	< 8 km	9 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	14 km	15 km	19 km
2 days	Large building	12 km	13 km	15 km
3 days	Large building	11 km	12 km	12 km
7 days	Large building	< 8 km	*10 km*	*9 km*
1 day	Large building, evacuated after 1 month	< 8 km	12 km	13 km
2 days	Large building, evacuated after 1 month	< 8 km	< 8 km	9 km
3, 7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	Large building, evacuated after 1 week	< 8 km	< 8 km	10 km
2,3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km

2.2. Alternative tabulation of distances for total effective dose

Some results from Tables 2-4 are presented here with a different sorting, to facilitate comparison between different types of initial protection (Table 5) and between different initial protection times (Table 6).

The greatest distances for which the total effective dose during the first year exceeds the levels of 100 mSv, 500 mSv and 1,000 mSv when 70 %, 80 % and 90 % of the occurring weather cases are considered are presented in Tables 5a, b and c, respectively, for given initial protection during the first 24 hours. The data in the table are taken from Tables 2-4.

The greatest distances for which the total effective dose in the first year exceeds the levels of 100 mSv, 500 mSv and 1,000 mSv when 70 %, 80 % and 90 % of the occurring weather cases are considered, given complete initial protection (*i.e.* no radiation dose) for the given number of days, are presented in Tables 6 a, b and c, respectively. The data in the table are taken from Tables 2-4.

Table 5a. Greatest distances for which varying levels of total effective dose during the first year are exceeded when **70 %** of the occurring weather cases are considered, with residing in a **house** or in a **large building** given **different initial protection** during the first 24 hours.

Initial protection during the first 24 hours	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
Unprotected	210 km	100 km	69 km	190 km	95 km	63 km
House	170 km	76 km	48 km	150 km	64 km	41 km
Large building	150 km	57 km	30 km	120 km	43 km	23 km
Protective shelter (SR 15)	140 km	50 km	25 km	110 km	28 km	18 km
Basement	140 km	49 km	24 km	110 km	25 km	15 km
Protective Shelter (basement)	140 km	49 km	24 km	100 km	25 km	14 km
Fully protected	140 km	49 km	24 km	100 km	25 km	14 km

Table 5b. Greatest distances at which varying levels of total effective dose in the first year are exceeded when **80 %** of the occurring weather cases are considered, with residing in a **house** or in a **large building** given **different initial protection** in the first 24 hours.

Initial protection during the first 24 hours	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
Unprotected	240 km	110 km	77 km	220 km	100 km	70 km
House	190 km	83 km	52 km	170 km	71 km	45 km
Large building	160 km	62 km	36 km	130 km	47 km	26 km
Protective shelter (SR 15)	150 km	54 km	29 km	120 km	30 km	21 km
Basement	150 km	54 km	28 km	120 km	30 km	15 km
Protective Shelter (basement)	150 km	53 km	28 km	110 km	29 km	15 km
Fully protected	150 km	53 km	28 km	110 km	29 km	15 km

Table 5c. Greatest distances for which varying levels of total effective dose in the first year are exceeded when **90 %** of the occurring weather cases are considered, with residing in a **house** or in a **large building** given **different initial protection** in the first 24 hours.

Initial protection during the first 24 hours	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
Unprotected	270 km	130 km	88 km	250 km	120 km	88 km
House	220 km	96 km	60 km	190 km	81 km	52 km

Large building	190 km	73 km	45 km	140 km	54 km	30 km
Protective shelter (SR 15)	180 km	64 km	34 km	130 km	38 km	25 km
Basement	180 km	63 km	33 km	130 km	34 km	21 km
Protective Shelter (basement)	180 km	62 km	32 km	130 km	34 km	19 km
Fully protected	180 km	62 km	32 km	130 km	33 km	19 km

Table 6a. Greatest distances for which varying levels of total effective dose in the first year are exceeded when **70 %** of the occurring weather cases are considered, for residing in a **house** or in a **large building** given complete initial protection (no radiation dose) for **varying numbers of days**.

Initial time in complete protection	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
1 day	140 km	49 km	24 km	100 km	25 km	14 km
2 days	130 km	45 km	23 km	85 km	23 km	12 km
3 days	120 km	42 km	22 km	72 km	23 km	11 km
7 days	110 km	29 km	16 km	67 km	18 km	< 8 km

Table 6b. Greatest distances for which varying levels of total effective dose in the first year are exceeded when **80 %** of the occurring weather cases are considered, with residing in a **house** or in a **large building** given complete initial protection (no radiation dose) for **varying numbers of days**.

Initial time in complete protection	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
1 day	150 km	53 km	28 km	110 km	29 km	15 km
2 days	140 km	48 km	26 km	85 km	27 km	13 km
3 days	130 km	46 km	25 km	81 km	26 km	12 km
7 days	120 km	30 km	16 km	74 km	18 km	*10 km*

Table 6c. Greatest distances for which varying levels of total effective dose in the first year are exceeded when **90 %** of the occurring weather cases are considered, with residing in a **house** or in a **large building** given complete initial protection (no radiation dose) for varying numbers of days.

Initial time in complete protection	Normal residency during the remainder of the first year					
	House			Large building		
	100 mSv	500 mSv	1,000 mSv	100 mSv	500 mSv	1,000 mSv
1 day	180 km	62 km	32 km	130 km	33 km	19 km
2 days	150 km	56 km	30 km	110 km	31 km	15 km
3 days	140 km	51 km	29 km	94 km	30 km	12 km

| 7 days | 130 km | 35 km | 21 km | 86 km | 23 km | *9 km* |

2.3. Highest radiation doses at specified distances

The results for the highest total effective dose at specified distances are presented here.

Tables 7a-c present the highest total effective dose exceeded in the first year for different distances, given initial protection in a building of the same type as the occupant normally resides in (*i.e.* in a house or in a large building) for a given number of days, if 70 %, 80 % and 90 % of all occurring weather cases are considered.

Table 8a-c show the highest total effective dose exceeded in the first year for different distances, given initial protection in a protective shelter complying with SR 15 for the given number of days, if 70 %, 80 % and 90 % of all occurring weather cases are considered.

Tables 9a-c show the highest total effective dose exceeded in the first year for different distances, given initial shelter in a protective shelter (basement) for the given number of days, if 70 %, 80 % and 90 % of all occurring weather cases are considered.

Table 7a. Highest total effective dose exceeded during the first year at specified distances when **70 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a structure of the same type (a **house with residing in a house** and a **large building with residing in a large building**) for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	**House**				**Large building**			
	1 day	**2 days**	**3 days**	**7 days**	**1 day**	**2 days**	**3 days**	**7 days**
10 km	6.2 Sv	6.2 Sv	6.1 Sv	6.0 Sv	2.3 Sv	2.2 Sv	2.2 Sv	2.0 Sv
25 km	2.2 Sv	2.2 Sv	2.1 Sv	2.1 Sv	0.79 Sv	0.75 Sv	0.73 Sv	0.69 Sv
30 km	1.8 Sv	1.7 Sv	1.7 Sv	1.7 Sv	0.65 Sv	0.59 Sv	0.58 Sv	0.53 Sv
50 km	0.91 Sv	0.89 Sv	0.87 Sv	0.85 Sv	0.36 Sv	0.34 Sv	0.31 Sv	0.28 Sv
100 km	0.33 Sv	0.33 Sv	0.32 Sv	0.31 Sv	0.14 Sv	0.13 Sv	0.12 Sv	0.11 Sv
200 km	0.078 Sv	0.076 Sv	0.075 Sv	0.074 Sv	0.035 Sv	0.032 Sv	0.030 Sv	0.028 Sv

Table 7b. Highest total effective dose exceeded in the first year at specified distances, when **80 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a structure of the same type (a **house with residing in house** and a **large building with residing in a large building**) for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	**House**				**Large building**			
	1 day	**2 days**	**3 days**	**7 days**	**1 day**	**2 days**	**3 days**	**7 days**
10 km	7.0 Sv	6.9 Sv	6.8 Sv	6.7 Sv	2.7 Sv	2.5 Sv	2.4 Sv	2.2 Sv
25 km	2.7 Sv	2.7 Sv	2.7 Sv	2.6 Sv	1.0 Sv	0.99 Sv	0.96 Sv	0.90 Sv
30 km	2.0 Sv	2.0 Sv	2.0 Sv	2.0 Sv	0.75 Sv	0.69 Sv	0.67 Sv	0.63 Sv

	1.1 Sv	1.1 Sv	1.1 Sv	1.0 Sv	0.45 Sv	0.40 Sv	0.38 Sv	0.35 Sv
50 km	1.1 Sv	1.1 Sv	1.1 Sv	1.0 Sv	0.45 Sv	0.40 Sv	0.38 Sv	0.35 Sv
100 km	0.39 Sv	0.38 Sv	0.38 Sv	0.37 Sv	0.16 Sv	0.15 Sv	0.14 Sv	0.13 Sv
200 km	0.090 Sv	0.088 Sv	0.086 Sv	0.084 Sv	0.039 Sv	0.036 Sv	0.033 Sv	0.029 Sv

Table 7c. Highest total effective dose exceeded in the first year at specified distances, when **90 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a structure of the same type (a **house with residing in a house** and a **large building with residing in a large building**) for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	7.8 Sv	7.5 Sv	7.5 Sv	7.4 Sv	2.9 Sv	2.5 Sv	2.4 Sv	2.3 Sv
25 km	3.4 Sv	3.3 Sv	3.3 Sv	3.2 Sv	1.3 Sv	1.2 Sv	1.2 Sv	1.1 Sv
30 km	2.6 Sv	2.5 Sv	2.5 Sv	2.5 Sv	0.97 Sv	0.92 Sv	0.90 Sv	0.85 Sv
50 km	1.4 Sv	1.4 Sv	1.4 Sv	1.3 Sv	0.56 Sv	0.52 Sv	0.50 Sv	0.47 Sv
100 km	0.47 Sv	0.45 Sv	0.45 Sv	0.44 Sv	0.19 Sv	0.17 Sv	0.16 Sv	0.14 Sv
200 km	0.13 Sv	0.13 Sv	0.12 Sv	0.12 Sv	0.056 Sv	0.050 Sv	0.047 Sv	0.044 Sv

Table 8a. Highest total effective dose exceeded during the first year at specified distances when **70 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial shelter in a **protective shelter (SR 15)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	2.9 Sv	2.7 Sv	2.4 Sv	1.9 Sv	1.7 Sv	1.5 Sv	1.5 Sv	1.2 Sv
25 km	0.94 Sv	0.82 Sv	0.77 Sv	0.64 Sv	0.55 Sv	0.48 Sv	0.46 Sv	0.39 Sv
30 km	0.84 Sv	0.69 Sv	0.68 Sv	0.54 Sv	0.48 Sv	0.40 Sv	0.39 Sv	0.32 Sv
50 km	0.49 Sv	0.42 Sv	0.36 Sv	0.30 Sv	0.28 Sv	0.24 Sv	0.21 Sv	0.17 Sv
100 km	0.20 Sv	0.18 Sv	0.16 Sv	0.13 Sv	0.11 Sv	0.099 Sv	0.090 Sv	0.075 Sv
200 km	0.056 Sv	0.046 Sv	0.042 Sv	0.033 Sv	0.031 Sv	0.026 Sv	0.024 Sv	0.020 Sv

Table 8b. Highest total effective dose exceeded in the first year at specified distances when **80 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a **protective shelter (SR 15)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	3.5 Sv	*3.0 Sv*	*2.6 Sv*	*2.1 Sv*	2.0 Sv	*1.7 Sv*	*1.6 Sv*	*1.3 Sv*
25 km	1.4 Sv	1.2 Sv	1.1 Sv	0.97 Sv	0.77 Sv	0.70 Sv	0.65 Sv	0.57 Sv

Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
30 km	0.91 Sv	0.75 Sv	0.68 Sv	0.58 Sv	0.52 Sv	0.44 Sv	0.41 Sv	0.35 Sv
50 km	0.63 Sv	0.50 Sv	0.45 Sv	0.35 Sv	0.35 Sv	0.29 Sv	0.26 Sv	0.21 Sv
100 km	0.24 Sv	0.19 Sv	0.17 Sv	0.14 Sv	0.13 Sv	0.11 Sv	0.10 Sv	0.083 Sv
200 km	0.058 Sv	0.050 Sv	0.044 Sv	0.034 Sv	0.032 Sv	0.028 Sv	0.025 Sv	0.020 Sv

Table 8c. Highest total effective dose exceeded in the first year at specified distances when **90 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a **protective shelter (SR 15)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	3.6 Sv	*2.6 Sv*	*2.3 Sv*	*1.9 Sv*	2.0 Sv	*1.6 Sv*	*1.4 Sv*	*1.2 Sv*
25 km	1.8 Sv	1.5 Sv	1.4 Sv	1.1 Sv	1.0 Sv	0.90 Sv	0.81 Sv	0.66 Sv
30 km	1.2 Sv	1.1 Sv	1.0 Sv	0.89 Sv	0.71 Sv	0.64 Sv	0.60 Sv	0.53 Sv
50 km	0.77 Sv	0.66 Sv	0.58 Sv	0.49 Sv	0.43 Sv	0.38 Sv	0.35 Sv	0.30 Sv
100 km	0.27 Sv	0.21 Sv	0.19 Sv	0.14 Sv	0.15 Sv	0.12 Sv	0.11 Sv	0.085 Sv
200 km	0.086 Sv	0.070 Sv	0.062 Sv	0.051 Sv	0.048 Sv	0.039 Sv	0.035 Sv	0.030 Sv

Table 9a. Highest total effective dose exceeded in the first year at specified distances when **70 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a **protective shelter (basement)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	2.7 Sv	*2.3 Sv*	*2.0 Sv*	*1.5 Sv*	1.5 Sv	*1.3 Sv*	*1.1 Sv*	*0.80 Sv*
25 km	0.86 Sv	0.73 Sv	0.68 Sv	0.55 Sv	0.47 Sv	0.40 Sv	0.37 Sv	0.30 Sv
30 km	0.79 Sv	0.64 Sv	0.62 Sv	0.49 Sv	0.43 Sv	0.34 Sv	0.34 Sv	0.27 Sv
50 km	0.46 Sv	0.39 Sv	0.33 Sv	0.26 Sv	0.25 Sv	0.21 Sv	0.18 Sv	0.14 Sv
100 km	0.20 Sv	0.17 Sv	0.15 Sv	0.11 Sv	0.11 Sv	0.090 Sv	0.080 Sv	0.062 Sv
200 km	0.054 Sv	0.044 Sv	0.040 Sv	0.030 Sv	0.029 Sv	0.024 Sv	0.022 Sv	0.016 Sv

Table 9b. Highest total effective dose exceeded in the first year at specified distances when **80 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a **protective shelter (basement)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	3.2 Sv	*2.8 Sv*	*2.4 Sv*	*1.8 Sv*	1.7 Sv	*1.5 Sv*	*1.3 Sv*	*0.99 Sv*

Distance								
25 km	1.3 Sv	1.1 Sv	1.0 Sv	0.85 Sv	0.68 Sv	061 Sv	0.55 Sv	0.46 Sv
30 km	083 Sv	0.67 Sv	0.60 Sv	0.49 Sv	0.45 Sv	0.36 Sv	0.32 Sv	0.26 Sv
50 km	0.60 Sv	0.46 Sv	0.41 Sv	0.30 Sv	0.32 Sv	0.25 Sv	0.22 Sv	0.16 Sv
100 km	0.23 Sv	0.18 Sv	0.16 Sv	*0.13 Sv*	0.12 Sv	0.096 Sv	0.088 Sv	*0.068 Sv*
200 km	0.056 Sv	0.048 Sv	0.041 Sv	0.032 Sv	0.030 Sv	0.026 Sv	0.022 Sv	0.017 Sv

Table 9c. Highest total effective dose exceeded in the first year at specified distances when **90 %** of the occurring weather cases are considered, with residing in a house or in a large building given initial protection in a **protective shelter (basement)** for 1, 2, 3 or 7 days.

	Normal residency during the remainder of the first year							
Distance	**House**				**Large building**			
	1 day	**2 days**	**3 days**	**7 days**	**1 day**	**2 days**	**3 days**	**7 days**
10 km	3.3 Sv	*2.3 Sv*	*2.0 Sv*	*1.6 Sv*	1.8 Sv	*1.2 Sv*	*1.1 Sv*	*0.85 Sv*
25 km	1.7 Sv	1.4 Sv	1.2 Sv	0.88 Sv	0.90 Sv	0.75 Sv	0.64 Sv	0.48 Sv
30 km	1.2 Sv	1.0 Sv	0.93 Sv	0.78 Sv	0.62 Sv	0.54 Sv	0.51 Sv	0.42 Sv
50 km	0.73 Sv	0.59 Sv	0.51 Sv	0.41 Sv	0.39 Sv	0.32 Sv	0.28 Sv	0.22 Sv
100 km	0.25 Sv	0.19 Sv	0.17 Sv	*0.12 Sv*	0.14 Sv	0.11 Sv	0.092 Sv	*0.066 Sv*
200 km	0.083 Sv	0.066 Sv	0.058 Sv	0.047 Sv	0.045 Sv	0.036 Sv	0.031 Sv	0.025 Sv

3. Effective dose during the first days

This chapter presents the results of calculations of total effective dose during the first days after the nuclear explosion. The exposure pathways that were considered are external dose from ground contamination and from the plume and internal dose from inhalation.

3.1. Greatest distances for total effective dose over 1-7 days

The results for greatest distances at which a given total effective dose is exceeded are presented below in a separate subsection for each percentile of occurring weather cases (70 %, 80 % and 90 % respectively). Results are presented for integration times between 1 and 7 days.

3.1.1. Greatest distances when 70 % of the weather cases are considered

Table 10-15 shows the greatest distances at which a certain total effective dose is exceeded when 70 % of the occurring weather cases are considered, for given protection during given durations of exposure.

Table 10. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given duration of the exposures (starting from the explosion) are exceeded for an **unprotected** person when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day unprotected	> 330 km	300 km	160 km	81 km	53 km
2 days unprotected	> 330 km	> 330 km	180 km	89 km	58 km
3 days unprotected	> 330 km	> 330 km	180 km	93 km	60 km
7 days unprotected	> 330 km	> 330 km	200 km	99 km	65 km

Table 11. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **house** when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a house	280 km	210 km	110 km	46 km	31 km
2 days in a house	320 km	240 km	120 km	50 km	33 km
3 days in a house	> 330 km	250 km	120 km	53 km	33 km
7 days in a house	> 330 km	270 km	130 km	56 km	36 km

Table 12. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation)

during the given durations of exposure (starting from the explosion) are exceeded for a person in a large building when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a large building	160 km	120 km	53 km	17 km	8 km
2 days in a large building	180 km	130 km	58 km	18 km	9 km
3 days in a large building	180 km	140 km	60 km	18 km	9 km
7 days in a large building	200 km	150 km	65 km	20 km	10 km

Table 13. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (SR 15)** when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (SR 15)	93 km	62 km	20 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	100 km	70 km	22 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	100 km	73 km	23 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	110 km	79 km	24 km	< 8 km	< 8 km

Table 14. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **basement** when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a basement	53 km	35 km	8 km	< 8 km	< 8 km
2 days in a basement	58 km	37 km	9 km	< 8 km	< 8 km
3 days in a basement	60 km	37 km	9 km	< 8 km	< 8 km
7 days in a basement	65 km	40 km	10 km	< 8 km	< 8 km

Table 15. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (basement)** when **70 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (basement)	8 km	< 8 km	< 8 km	< 8 km	< 8 km

2 days in a protective shelter (basement)	9 km	< 8 km	< 8 km	< 8 km	< 8 km
3 days in a protective shelter (basement)	9 km	< 8 km	< 8 km	< 8 km	< 8 km
7 days in a protective shelter (basement)	10 km	< 8 km	< 8 km	< 8 km	< 8 km

3.1.2. Greatest distances when 80 % of the weather cases are considered

Tables 16-21 show the greatest distances at which a given total effective dose is exceeded when 80 % of the occurring weather cases are considered, for given protection during given durations of exposure.

Table 16. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for an **unprotected** person when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day unprotected	> 330 km	> 330 km	180 km	91 km	59 km
2 days unprotected	> 330 km	> 330 km	200 km	99 km	64 km
3 days unprotected	> 330 km	> 330 km	210 km	100 km	66 km
7 days unprotected	> 330 km	> 330 km	220 km	110 km	72 km

Table 17. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **house** when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a house	310 km	240 km	130 km	50 km	34 km
2 days in a house	> 330 km	270 km	140 km	55 km	37 km
3 days in a house	> 330 km	280 km	140 km	57 km	38 km
7 days in a house	> 330 km	300 km	150 km	63 km	41 km

Table 18. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **large building** when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a large building	180 km	140 km	59 km	19 km	9 km
2 days in a large building	200 km	150 km	64 km	20 km	10 km
3 days in a large building	210 km	150 km	66 km	21 km	11 km

7 days in a large building	220 km	160 km	72 km	22 km	12 km

Table 19. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (SR 15)** when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (SR 15)	100 km	71 km	22 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	110 km	78 km	24 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	110 km	80 km	26 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	120 km	85 km	27 km	< 8 km	< 8 km

Table 20. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **basement** when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a basement	59 km	38 km	9 km	< 8 km	< 8 km
2 days in a basement	64 km	42 km	10 km	< 8 km	< 8 km
3 days in a basement	66 km	43 km	11 km	< 8 km	< 8 km
7 days in a basement	72 km	46 km	12 km	< 8 km	< 8 km

Table 21. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (basement)** when **80 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (basement)	9 km	< 8 km	< 8 km	< 8 km	< 8 km
2 days in a protective shelter (basement)	10 km	< 8 km	< 8 km	< 8 km	< 8 km
3 days in a protective shelter (basement)	11 km	< 8 km	< 8 km	< 8 km	< 8 km
7 days in a protective shelter (basement)	12 km	< 8 km	< 8 km	< 8 km	< 8 km

3.1.3. Greatest distances when 90 % of weather cases are considered

Tables 22-27 show the greatest distances at which a certain total effective dose is exceeded when 90 % of the occurring weather cases are considered, for given protection during given durations of exposure.

Table 22. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for an **unprotected** person when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day unprotected	> 330 km	> 330 km	210 km	100 km	66 km
2 days unprotected	> 330 km	> 330 km	230 km	110 km	73 km
3 days unprotected	> 330 km	> 330 km	240 km	110 km	77 km
7 days unprotected	> 330 km	> 330 km	250 km	120 km	82 km

Table 23. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **house** when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a house	> 330 km	270 km	140 km	57 km	39 km
2 days in a house	> 330 km	300 km	150 km	63 km	42 km
3 days in a house	> 330 km	310 km	160 km	65 km	43 km
7 days in a house	> 330 km	> 330 km	170 km	71 km	45 km

Table 24. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **large building** when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a large building	210 km	160 km	66 km	21 km	11 km
2 days in a large building	230 km	170 km	73 km	23 km	12 km
3 days in a large building	240 km	180 km	77 km	24 km	13 km
7 days in a large building	250 km	190 km	82 km	26 km	13 km

Table 25. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation)

during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (SR 15)** when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (SR 15)	110 km	79 km	26 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	130 km	86 km	29 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	130 km	92 km	30 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	140 km	98 km	31 km	< 8 km	< 8 km

Table 26. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **basement** when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a basement	66 km	44 km	11 km	< 8 km	< 8 km
2 days in a basement	73 km	47 km	12 km	< 8 km	< 8 km
3 days in a basement	77 km	49 km	13 km	< 8 km	< 8 km
7 days in a basement	82 km	51 km	13 km	< 8 km	< 8 km

Table 27. Greatest distances at which varying levels of total effective dose from the considered exposure pathways (external dose from ground contamination and from the plume, and inhalation) during the given durations of exposure (starting from the explosion) are exceeded for a person in a **protective shelter (basement)** when **90 % of the occurring weather cases** are considered.

Exposure	10 mSv	20 mSv	100 mSv	500 mSv	1,000 mSv
1 day in a protective shelter (basement)	11 km	< 8 km	< 8 km	< 8 km	< 8 km
2 days in a protective shelter (basement)	12 km	< 8 km	< 8 km	< 8 km	< 8 km
3 days in a protective shelter (basement)	13 km	< 8 km	< 8 km	< 8 km	< 8 km
7 days in a protective shelter (basement)	13 km	< 8 km	< 8 km	< 8 km	< 8 km

3.2. Effective dose from varying exposure pathways at specified distances

Tables 28-30 show the highest effective dose from the considered exposure pathways that is exceeded when 70 %, 80 % and 90 % of the occurring weather cases are considered, at the specified distances.

The exposure pathways considered are external dose from the ground and from the plume, and internal dose from inhalation. External dose from the plume and internal dose from inhalation are the doses received during the entire time radioactive material is present in the air, *i.e.* during the dispersion phase. External dose from the ground has been integrated during the first 24 hours and the first two days, and the tables show the dose received during the first day and (under the heading "Ground, day 2") the difference between the dose received during the first two days and during the first 24 hours.

Table 28. Highest effective dose from different exposure pathways exceeded when 70 % of occurring weather cases are considered, at specified distances, for an unprotected person outdoors.

Distance	Ground, day 1	Ground, day 2	Plume	Inhalation
10 km	9.4 Sv	0.88 Sv	0.051 Sv	0.039 Sv
25 km	3.3 Sv	0.33 Sv	0.013 Sv	0.018 Sv
30 km	2.5 Sv	0.31 Sv	0.011 Sv	0.017 Sv
50 km	1.1 Sv	0.16 Sv	0.004 Sv	0.009 Sv
100 km	0.34 Sv	0.060 Sv	0.001 Sv	0.003 Sv
200 km	0.050 Sv	0.017 Sv	-	0.001 Sv
300 km	0.019 Sv	0.007 Sv	-	-

Table 29. Highest effective dose from different exposure pathways exceeded when 80 % of occurring weather cases are considered, at specified distances, for an unprotected person outdoors.

Distance	Ground, day 1	Ground, day 2	Plume	Inhalation
10 km	11 Sv	0.95 Sv	0.059 Sv	0.044 Sv
25 km	3.7 Sv	0.37 Sv	0.016 Sv	0.022 Sv
30 km	2.9 Sv	0.36 Sv	0.013 Sv	0.020 Sv
50 km	1.4 Sv	0.18 Sv	0.005 Sv	0.011 Sv
100 km	0.40 Sv	0.073 Sv	0.001 Sv	0.004 Sv
200 km	0.069 Sv	0.022 Sv	-	0.001 Sv
300 km	0.026 Sv	0.009 Sv	-	-

Table 30. Highest effective dose from different exposure pathways exceeded when 90 % of occurring weather cases are considered, at specified distances, for an unprotected person outdoors.

Distance	Ground, day 1	Ground, day 2	Plume	Inhalation
10 km	13 Sv	1.3 Sv	0.075 Sv	0.053 Sv
25 km	4.3 Sv	0.44 Sv	0.020 Sv	0.027 Sv
30 km	3.6 Sv	0.39 Sv	0.017 Sv	0.025 Sv
50 km	1.7 Sv	0.14 Sv	0.007 Sv	0.015 Sv
100 km	0.50 Sv	0.084 Sv	0.001 Sv	0.005 Sv
200 km	0.11 Sv	0.027 Sv	-	0.001 Sv
300 km	0.038 Sv	0.010 Sv	-	-

4. Equivalent dose to the thyroid gland

Tables 31-33 present the results of calculations for equivalent dose to the thyroid gland given different levels of protection.

Table 31. Greatest distances for which **50 mSv equivalent dose to the thyroid** is exceeded when 70 %, 80 % and 90 % of the occurring weather cases are considered, respectively, given varying combinations of protection.

Protection	70 %	80 %	90 %
Unprotected	80 km	90 km	110 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	9 km
House	53 km	62 km	74 km
Large building	< 8 km	< 8 km	9 km
Protective shelter (SR 15), basement, protective shelter (basement)	< 8 km	< 8 km	< 8 km

Table 32. Greatest distances for which **100 mSv equivalent dose to the thyroid** is exceeded when 70 %, 80 % and 90 % of the occurring weather cases are considered, respectively, given varying combinations of protection.

Protection	70 %	80 %	90 %
Unprotected	53 km	62 km	74 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	< 8 km
House	27 km	33 km	43 km
Large building	< 8 km	< 8 km	< 8 km
Protective shelter (SR 15), basement, protective shelter (basement)	< 8 km	< 8 km	< 8 km

Table 33. Greatest distances at which the **500 mSv equivalent dose to the thyroid** is exceeded when 70 %, 80 % and 90 % of occurring weather cases are considered, given varying combinations of protection.

Protection	70 %	80 %	90 %
Unprotected	< 8 km	< 8 km	9 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	< 8 km
House	< 8 km	< 8 km	< 8 km
Large building, protective shelter (SR 15), basement, protective shelter (basement)	< 8 km	< 8 km	< 8 km

5. Absorbed dose to red bone marrow

Table 34 shows the greatest distances at which 1,000 mGy RBE-weighted absorbed dose to red bone marrow can be received in 10 hours at different exposure start times. The table shows, for example, that if the exposure starts 6 hours after the explosion, 1,000 mGy to a one-year-old child can be exceeded at a greatest distance of 19 km if 90 % of the weather cases are considered.

Table 34. Greatest distances for which **1,000 mGy RBE-weighted absorbed dose to red bone marrow** in 10 hours is exceeded when 70 %, 80 % and 90 % of the occurring weather cases are considered, assuming exposure starts at given times after the explosion.

1,000 mGy during 10 hours starting after	70 %	80 %	90 %
3 hours	25 km	28 km	33 km
6 hours	14 km	16 km	19 km
12 hours	< 8 km	< 8 km	9 km
24 hours	< 8 km	< 8 km	< 8 km
36 hours	< 8 km	< 8 km	< 8 km
48 hours	< 8 km	< 8 km	< 8 km

The Swedish Radiation Safety Authority (SSM) works proactively and preventively with nuclear safety, radiation protection, nuclear security, and nuclear non-proliferation to protect people and the environment from the harmful effects of radiation, now and in the future.

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