



Strål
säkerhets
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Swedish Radiation Safety Authority

Report

Radiological Consequences of Fallout from Nuclear Explosions

Appendix 5 – Detailed Results (Adults)

2023:05e

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1. Introduction

This appendix presents calculation results for radiation doses to adults, 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, totalling 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).
- Results are calculated for an adult.
- 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 a one-year-old child, and these results are presented in Appendix 4 (Detailed Results (Children)).

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 on 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	Protection against all exposure pathways considered	0.1
	<i>This includes apartments in multifamily buildings, schools, etc.¹</i>		
Sheltering indoors	Protective shelter (SR 15 ²)	Protection against external exposure from radioactive material deposited on the ground ³	0.025
Sheltering indoors	Basement	Protection against external exposure from radioactive material deposited on the ground	0.01
	<i>Basements in large concrete buildings</i>		
Sheltering indoors	Protective Shelter (basement)	Protection against external exposure from radioactive material deposited on the ground ⁵	0.001
		<i>Protective shelter in the basement of a large concrete building or the equivalent⁴</i>	
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, "Skyddsrumregler SR 15 (MSB748)", MSB, 2014.

³ Protective shelters under this standard are designed to be sufficiently sealed to provide protection against chemical and biological warfare agents and fire gases. This means that protection against internal exposure from inhalation of radioactive material in the air outside the protective shelter should be very effective.

⁴ In this report, the Swedish Radiation Safety Authority assumes that this type of premises provides an order of magnitude better protection than a normal basement in a large concrete building.

⁵ Protection against internal exposure from inhalation of radioactive material in the air outside the protective shelter should be at least as effective as for protective shelters designed according to SR 15.

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 results for the 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. Maximum distance 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	220 km	240 km	280 km
1 day	Evacuated	140 km	160 km	190 km
2 days	Evacuated	160 km	180 km	210 km

3 days	Evacuated	170 km	190 km	210 km
7 days	Evacuated	180 km	200 km	220 km
1 day	House	190 km	210 km	240 km
2 days	House	190 km	220 km	250 km
3 days	House	200 km	220 km	260 km
7 days	House	200 km	230 km	260 km
1 day	House, evacuated after 1 month	180 km	200 km	230 km
2 days	House, evacuated after 1 month	180 km	210 km	230 km
3 days	House, evacuated after 1 month	180 km	210 km	240 km
7 days	House, evacuated after 1 month	190 km	210 km	240 km
1 day	House, evacuated after 1 week	170 km	190 km	210 km
2 days	House, evacuated after 1 week	170 km	190 km	220 km
3 days	House, evacuated after 1 week	170 km	200 km	220 km
1 day	Large building	170 km	190 km	220 km
2 days	Large building	180 km	200 km	240 km
3 days	Large building	190 km	210 km	240 km
7 days	Large building	190 km	220 km	250 km
1 day	Large building, evacuated after 1 month	160 km	180 km	210 km
2 days	Large building, evacuated after 1 month	170 km	200 km	220 km
3 days	Large building, evacuated after 1 month	180 km	200 km	230 km
7 days	Large building, evacuated after 1 month	180 km	210 km	230 km
1 day	Large building, evacuated after 1 week	160 km	180 km	200 km
2 days	Large building, evacuated after 1 week	170 km	190 km	210 km
3 days	Large building, evacuated after 1 week	170 km	190 km	220 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	100 km	110 km	130 km
2 days	Evacuated	110 km	120 km	140 km
3 days	Evacuated	110 km	130 km	140 km
7 days	Evacuated	120 km	130 km	150 km
1,2 days	House	150 km	170 km	200 km
3 days	House	150 km	160 km	190 km
7 days	House	140 km	160 km	190 km
1,2,3 days	House, evacuated after 1 month	130 km	150 km	170 km

7 days	House, evacuated after 1 month	130 km	140 km	170 km
1 day	House, evacuated after 1 week	120 km	130 km	160 km
2,3 days	House, evacuated after 1 week	120 km	130 km	150 km
1,2,3,7 days	Large building	130 km	150 km	170 km
1 day	Large building, evacuated after 1 month	120 km	130 km	160 km
2,3 days	Large building, evacuated after 1 month	120 km	140 km	160 km
7 days	Large building, evacuated after 1 month	130 km	140 km	160 km
1 day	Large building, evacuated after 1 week	110 km	130 km	150 km
2,3 days	Large building, evacuated after 1 week	120 km	130 km	150 km

Table 2c. Maximum 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	44 km	50 km	55 km
2 days	Evacuated	49 km	54 km	60 km
3 days	Evacuated	50 km	56 km	64 km
7 days	Evacuated	54 km	60 km	69 km
1 day	House	130 km	140 km	160 km
2 days	House	120 km	140 km	160 km
3 days	House	110 km	130 km	140 km
7 days	House	100 km	120 km	140 km
1 day	House, evacuated after 1 month	110 km	120 km	140 km
2 days	House, evacuated after 1 month	99 km	100 km	120 km
3 days	House, evacuated after 1 month	94 km	100 km	110 km
7 days	House, evacuated after 1 month	89 km	90 km	110 km
1 day	House, evacuated after 1 week	91 km	100 km	110 km
2 days	House, evacuated after 1 week	81 km	91 km	110 km
3 days	House, evacuated after 1 week	75 km	89 km	96 km
1 day	Large building	99 km	110 km	130 km
2 days	Large building	96 km	100 km	120 km
3 days	Large building	94 km	100 km	120 km
7 days	Large building	91 km	99 km	120 km
1 day	Large building, evacuated after 1 month	89 km	95 km	110 km
2 days	Large building, evacuated after 1 month	85 km	91 km	100 km
3 days	Large building, evacuated after 1 month	83 km	89 km	100 km
7 days	Large building, evacuated after 1 month	74 km	75 km	88 km

1 day	Large building, evacuated after 1 week	77 km	86 km	96 km
2 days	Large building, evacuated after 1 week	68 km	78 km	86 km
3 days	Large building, evacuated after 1 week	61 km	73 km	77 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 the occurring weather-cases are considered, given initial protection in a **protective shelter (SR 15)** and varying 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	21 km
1 day	Evacuated	18 km	20 km	23 km
3 days	Evacuated	19 km	21 km	24 km
7 days	Evacuated	20 km	23 km	25 km
1 day	House	120 km	130 km	150 km
2 days	House	110 km	120 km	140 km
3 days	House	100 km	110 km	130 km
7 days	House	95 km	100 km	130 km
1 day	House, evacuated after 1 month	100 km	110 km	120 km
2 days	House, evacuated after 1 month	90 km	95 km	110 km
3 days	House, evacuated after 1 month	86 km	91 km	100 km
7 days	House, evacuated after 1 month	56 km	59 km	68 km
1 day	House, evacuated after 1 week	81 km	91 km	100 km
2 days	House, evacuated after 1 week	52 km	58 km	65 km
3 days	House, evacuated after 1 week	44 km	47 km	57 km
1 day	Large building	91 km	99 km	120 km
2 days	Large building	85 km	91 km	110 km
3 days	Large building	78 km	87 km	110 km
7 days	Large building	60 km	65 km	76 km
1 day	Large building, evacuated after 1 month	77 km	80 km	93 km
2 days	Large building, evacuated after 1 month	54 km	59 km	68 km
3 days	Large building, evacuated after 1 month	52 km	56 km	64 km
7 days	Large building, evacuated after 1 month	45 km	51 km	57 km
1 day	Large building, evacuated after 1 week	48 km	53 km	60 km
2 days	Large building, evacuated after 1 week	41 km	46 km	45 km
3 days	Large building, evacuated after 1 week	34 km	39 km	43 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 varying 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	< 8 km	8 km	9 km
2 days	Evacuated	< 8 km	9 km	10 km
3 days	Evacuated	8 km	9 km	10 km
7 days	Evacuated	9 km	9 km	10 km
1 day	House	120 km	130 km	140 km
2 days	House	100 km	110 km	130 km
3 days	House	99 km	110 km	130 km
7 days	House	93 km	100 km	120 km
1 day	House, evacuated after 1 month	98 km	100 km	110 km
2 days	House, evacuated after 1 month	88 km	93 km	110 km
3 days	House, evacuated after 1 month	73 km	79 km	85 km
7 days	House, evacuated after 1 month	52 km	54 km	64 km
1 day	House, evacuated after 1 week	80 km	90 km	100 km
2 days	House, evacuated after 1 week	49 km	54 km	62 km
3 days	House, evacuated after 1 week	35 km	40 km	45 km
1 day	Large building	89 km	97 km	110 km
2 days	Large building	81 km	86 km	110 km
3 days	Large building	62 km	70 km	79 km
7 days	Large building	57 km	63 km	72 km
1 day	Large building, evacuated after 1 month	64 km	67 km	74 km
2 days	Large building, evacuated after 1 month	51 km	56 km	64 km
3 days	Large building, evacuated after 1 month	49 km	53 km	61 km
7 days	Large building, evacuated after 1 month	37 km	40 km	45 km
1 day	Large building, evacuated after 1 week	46 km	50 km	58 km
2 days	Large building, evacuated after 1 week	33 km	38 km	42 km
3 days	Large building, evacuated after 1 week	20 km	30 km	25 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 varying 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	110 km	130 km	140 km
2 days	House	100 km	110 km	130 km
3 days	House	98 km	110 km	130 km
7 days	House	92 km	99 km	120 km
1 day	House, evacuated after 1 month	97 km	100 km	110 km
2 days	House, evacuated after 1 month	88 km	91 km	110 km
3 days	House, evacuated after 1 month	69 km	72 km	75 km
7 days	House, evacuated after 1 month	49 km	53 km	62 km
1 day	House, evacuated after 1 week	77 km	89 km	98 km
2 days	House, evacuated after 1 week	46 km	49 km	61 km
3 days	House, evacuated after 1 week	28 km	36 km	42 km
1 day	Large building	88 km	95 km	110 km
2 days	Large building	70 km	74 km	99 km
3 days	Large building	59 km	67 km	75 km
7 days	Large building	55 km	61 km	70 km
1 day	Large building, evacuated after 1 month	55 km	59 km	68 km
2 days	Large building, evacuated after 1 month	50 km	54 km	63 km
3 days	Large building, evacuated after 1 month	46 km	51 km	59 km
7 days	Large building, evacuated after 1 month	24 km	25 km	32 km
1 day	Large building, evacuated after 1 week	44 km	48 km	56 km
2 days	Large building, evacuated after 1 week	28 km	33 km	28 km
3 days	Large building, evacuated after 1 week	18 km	21 km	22 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	110 km	130 km	140 km
2 days	House	100 km	110 km	130 km
3 days	House	98 km	110 km	130 km
7 days	House	92 km	99 km	120 km
1 day	House, evacuated after 1 month	96 km	100 km	110 km
2 days	House, evacuated after 1 month	87 km	90 km	110 km
3 days	House, evacuated after 1 month	68 km	71 km	74 km
7 days	House, evacuated after 1 month	49 km	53 km	62 km
1 day	House, evacuated after 1 week	77 km	88 km	98 km
2 days	House, evacuated after 1 week	46 km	49 km	60 km

3 days	House, evacuated after 1 week	28 km	35 km	42 km
1 day	Large building	88 km	95 km	110 km
2 days	Large building	69 km	73 km	98 km
3 days	Large building	59 km	66 km	75 km
7 days	Large building	55 km	61 km	70 km
1 day	Large building, evacuated after 1 month	55 km	59 km	68 km
2 days	Large building, evacuated after 1 month	50 km	54 km	63 km
3 days	Large building, evacuated after 1 month	46 km	50 km	58 km
7 days	Large building, evacuated after 1 month	23 km	24 km	25 km
1 day	Large building, evacuated after 1 week	44 km	48 km	56 km
2 days	Large building, evacuated after 1 week	27 km	32 km	25 km
3 days	Large building, evacuated after 1 week	18 km	20 km	21 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	100 km	110 km	130 km
1 day	Evacuated	70 km	76 km	88 km
2 days	Evacuated	76 km	84 km	95 km
3 days	Evacuated	79 km	87 km	99 km
7 days	Evacuated	85 km	95 km	110 km
1 day	House	90 km	98 km	120 km
2 days	House	92 km	100 km	120 km
3 days	House	93 km	100 km	120 km
7 days	House	95 km	100 km	120 km
1 day	House, evacuated after 1 month	85 km	92 km	110 km
2 days	House, evacuated after 1 month	87 km	95 km	110 km
3 days	House, evacuated after 1 month	88 km	96 km	110 km
7 days	House, evacuated after 1 month	91 km	98 km	110 km
1 day	House, evacuated after 1 week	79 km	88 km	99 km
2 days	House, evacuated after 1 week	82 km	91 km	100 km
3 days	House, evacuated after 1 week	83 km	92 km	100 km
1 day	Large building	81 km	89 km	100 km
2 days	Large building	86 km	94 km	110 km

3 days	Large building	88 km	96 km	110 km
7 days	Large building	91 km	100 km	120 km
1 day	Large building, evacuated after 1 month	78 km	85 km	97 km
2 days	Large building, evacuated after 1 month	83 km	91 km	100 km
3 days	Large building, evacuated after 1 month	85 km	92 km	110 km
7 days	Large building, evacuated after 1 month	88 km	97 km	110 km
1 day	Large building, evacuated after 1 week	75 km	83 km	94 km
2 days	Large building, evacuated after 1 week	79 km	88 km	100 km
3 days	Large building, evacuated after 1 week	81 km	90 km	100 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	39 km	44 km	49 km
2 days	Evacuated	43 km	47 km	54 km
3 days	Evacuated	44 km	49 km	55 km
7 days	Evacuated	47 km	52 km	59 km
1 day	House	63 km	69 km	79 km
2 days	House	61 km	68 km	78 km
3 days	House	61 km	68 km	77 km
7 days	House	60 km	67 km	76 km
1 day	House, evacuated after 1 month	55 km	60 km	68 km
2 days	House, evacuated after 1 month	54 km	59 km	68 km
3 days	House, evacuated after 1 month	54 km	59 km	67 km
7 days	House, evacuated after 1 month	53 km	58 km	66 km
1 day	House, evacuated after 1 week	49 km	54 km	61 km
2 days	House, evacuated after 1 week	48 km	53 km	60 km
3 days	House, evacuated after 1 week	48 km	53 km	59 km
1 day	Large building	53 km	59 km	67 km
2 days	Large building	53 km	60 km	68 km
3 days	Large building	54 km	60 km	68 km
7 days	Large building	54 km	61 km	69 km
1 day	Large building, evacuated after 1 month	48 km	53 km	61 km
2,3 days	Large building, evacuated after 1 month	49 km	54 km	62 km
7 days	Large building, evacuated after 1 month	50 km	55 km	63 km
1 day	Large building, evacuated after 1 week	44 km	49 km	56 km

2 days	Large building, evacuated after 1 week	45 km	50 km	57 km
3 days	Large building, evacuated after 1 week	46 km	51 km	58 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	14 km	15 km	18 km
2 days	Evacuated	15 km	17 km	19 km
3 days	Evacuated	15 km	17 km	20 km
7 days	Evacuated	17 km	19 km	21 km
1 day	House	46 km	52 km	59 km
2 days	House	39 km	46 km	53 km
3 days	House	38 km	44 km	50 km
7 days	House	37 km	42 km	48 km
1 day	House, evacuated after 1 month	38 km	42 km	47 km
2 days	House, evacuated after 1 month	34 km	38 km	42 km
3 days	House, evacuated after 1 month	32 km	37 km	41 km
7 days	House, evacuated after 1 month	24 km	25 km	31 km
1 day	House, evacuated after 1 week	32 km	35 km	40 km
2 days	House, evacuated after 1 week	23 km	25 km	28 km
3 days	House, evacuated after 1 week	19 km	23 km	25 km
1 day	Large building	34 km	38 km	44 km
2 days	Large building	32 km	36 km	41 km
3 days	Large building	30 km	35 km	39 km
7 days	Large building	25 km	29 km	35 km
1 day	Large building, evacuated after 1 month	28 km	31 km	37 km
2 days	Large building, evacuated after 1 month	23 km	25 km	30 km
3 days	Large building, evacuated after 1 month	22 km	24 km	29 km
7 days	Large building, evacuated after 1 month	20 km	22 km	27 km
1 day	Large building, evacuated after 1 week	20 km	23 km	25 km
2 days	Large building, evacuated after 1 week	19 km	22 km	24 km
3 days	Large building, evacuated after 1 week	18 km	20 km	23 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 possible weather-related events occurring 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	39 km	45 km	53 km
2 days	House	36 km	41 km	46 km
3 days	House	32 km	39 km	45 km
7 days	House	23 km	25 km	30 km
1 day	House, evacuated after 1 month	33 km	36 km	42 km
2 days	House, evacuated after 1 month	20 km	23 km	26 km
3 days	House, evacuated after 1 month	18 km	21 km	24 km
7 days	House, evacuated after 1 month	15 km	15 km	15 km
1 day	House, evacuated after 1 week	19 km	20 km	24 km
2 days	House, evacuated after 1 week	14 km	16 km	21 km
3 days	House, evacuated after 1 week	9 km	12 km	10 km
1 day	Large building	20 km	24 km	29 km
2 days	Large building	19 km	22 km	25 km
3 days	Large building	19 km	21 km	25 km
7 days	Large building	17 km	19 km	23 km
1 day	Large building, evacuated after 1 month	17 km	19 km	23 km
2 days	Large building, evacuated after 1 month	16 km	17 km	21 km
3 days	Large building, evacuated after 1 month	10 km	16 km	15 km
7 days	Large building, evacuated after 1 month	< 8 km	9 km	11 km
1 day	Large building, evacuated after 1 week	12 km	16 km	17 km
2 days	Large building, evacuated after 1 week	9 km	9 km	9 km
3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	8 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	39 km	44 km	50 km
2 days	House	35 km	40 km	45 km
3 days	House	27 km	36 km	42 km
7 days	House	21 km	24 km	28 km

1 day	House, evacuated after 1 month	31 km	32 km	41 km
2 days	House, evacuated after 1 month	19 km	22 km	25 km
3 days	House, evacuated after 1 month	17 km	19 km	23 km
7 days	House, evacuated after 1 month	9 km	9 km	9 km
1 day	House, evacuated after 1 week	17 km	19 km	23 km
2 days	House, evacuated after 1 week	11 km	12 km	14 km
3 days	House, evacuated after 1 week	< 8 km	8 km	8 km
1 day	Large building	19 km	23 km	26 km
2 days	Large building	18 km	21 km	24 km
3 days	Large building	17 km	20 km	23 km
7 days	Large building	13 km	14 km	21 km
1 day	Large building, evacuated after 1 month	16 km	17 km	21 km
2 days	Large building, evacuated after 1 month	10 km	10 km	15 km
3 days	Large building, evacuated after 1 month	9 km	9 km	12 km
7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	Large building, evacuated after 1 week	9 km	11 km	11 km
2,3 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	38 km	44 km	50 km
2 days	House	34 km	39 km	44 km
3 days	House	25 km	30 km	39 km
7 days	House	20 km	23 km	28 km
1 day	House, evacuated after 1 month	29 km	30 km	39 km
2 days	House, evacuated after 1 month	19 km	21 km	24 km
3 days	House, evacuated after 1 month	16 km	17 km	22 km
7 days	House, evacuated after 1 month	< 8 km	8 km	8 km
1 day	House, evacuated after 1 week	17 km	18 km	23 km
2 days	House, evacuated after 1 week	10 km	10 km	11 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	19 km	22 km	25 km
2 days	Large building	17 km	20 km	24 km
3 days	Large building	16 km	19 km	22 km

7 days	Large building	10 km	13 km	16 km
1 day	Large building, evacuated after 1 month	16 km	15 km	21 km
2 days	Large building, evacuated after 1 month	9 km	9 km	13 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	9 km	9 km	10 km
2,3 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	38 km	44 km	50 km
2 days	House	33 km	39 km	44 km
3 days	House	25 km	30 km	38 km
7 days	House	20 km	23 km	28 km
1 day	House, evacuated after 1 month	28 km	30 km	38 km
2 days	House, evacuated after 1 month	19 km	20 km	24 km
3 days	House, evacuated after 1 month	16 km	17 km	21 km
7 days	House, evacuated after 1 month	< 8 km	8 km	8 km
1 day	House, evacuated after 1 week	17 km	18 km	23 km
2 days	House, evacuated after 1 week	10 km	10 km	10 km
3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	19 km	22 km	25 km
2 days	Large building	17 km	20 km	24 km
3 days	Large building	16 km	19 km	22 km
7 days	Large building	10 km	13 km	16 km
1 day	Large building, evacuated after 1 month	15 km	15 km	20 km
2 days	Large building, evacuated after 1 month	9 km	9 km	13 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	9 km	9 km
2,3 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.

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	68 km	74 km	85 km
1 day	Evacuated	44 km	50 km	55 km
2 days	Evacuated	49 km	54 km	60 km
3 days	Evacuated	50 km	56 km	64 km
7 days	Evacuated	54 km	60 km	69 km
1 day	House	58 km	64 km	73 km
2 days	House	59 km	66 km	75 km
3 days	House	60 km	67 km	76 km
7 days	House	62 km	69 km	78 km
1 day	House, evacuated after 1 month	54 km	59 km	67 km
2 days	House, evacuated after 1 month	55 km	61 km	69 km
3 days	House, evacuated after 1 month	56 km	62 km	71 km
7 days	House, evacuated after 1 month	58 km	63 km	72 km
1 day	House, evacuated after 1 week	50 km	56 km	63 km
2 days	House, evacuated after 1 week	52 km	58 km	65 km
3 days	House, evacuated after 1 week	53 km	58 km	66 km
1 day	Large building	53 km	59 km	66 km
2 days	Large building	55 km	61 km	69 km
3 days	Large building	57 km	62 km	71 km
7 days	Large building	59 km	65 km	74 km
1 day	Large building, evacuated after 1 month	50 km	55 km	63 km
2 days	Large building, evacuated after 1 month	52 km	58 km	66 km
3 days	Large building, evacuated after 1 month	54 km	59 km	68 km
7 days	Large building, evacuated after 1 month	56 km	62 km	71 km
1 day	Large building, evacuated after 1 week	48 km	53 km	60 km
2 days	Large building, evacuated after 1 week	50 km	56 km	63 km
3 days	Large building, evacuated after 1 week	52 km	57 km	65 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	25 km	28 km	32 km

2 days	Evacuated	27 km	31 km	36 km
3 days	Evacuated	29 km	32 km	37 km
7 days	Evacuated	31 km	34 km	39 km
1 day	House	39 km	44 km	49 km
2,3 days	House	38 km	43 km	49 km
7 days	House	38 km	43 km	48 km
1,2 days	House, evacuated after 1 month	35 km	39 km	44 km
3 days	House, evacuated after 1 month	34 km	39 km	44 km
7 days	House, evacuated after 1 month	34 km	38 km	43 km
1 day	House, evacuated after 1 week	32 km	36 km	40 km
2 days	House, evacuated after 1 week	32 km	35 km	40 km
3 days	House, evacuated after 1 week	31 km	35 km	39 km
1 day	Large building	33 km	37 km	43 km
2,3 days	Large building	34 km	38 km	44 km
7 days	Large building	34 km	39 km	44 km
1 day	Large building, evacuated after 1 month	31 km	34 km	39 km
2 days	Large building, evacuated after 1 month	31 km	35 km	40 km
3 days	Large building, evacuated after 1 month	32 km	35 km	41 km
7 days	Large building, evacuated after 1 month	32 km	36 km	41 km
1 day	Large building, evacuated after 1 week	29 km	32 km	37 km
2 days	Large building, evacuated after 1 week	29 km	33 km	38 km
3 days	Large building, evacuated after 1 week	30 km	33 km	38 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	< 8 km	8 km	9 km
2 days	Evacuated	< 8 km	9 km	10 km
3 days	Evacuated	8 km	9 km	10 km
7 days	Evacuated	9 km	9 km	10 km
1 day	House	23 km	26 km	34 km
2 days	House	20 km	24 km	28 km
3 days	House	20 km	23 km	27 km
7 days	House	19 km	22 km	25 km
1 day	House, evacuated after 1 month	19 km	20 km	24 km
2 days	House, evacuated after 1 month	17 km	19 km	23 km

3 days	House, evacuated after 1 month	17 km	18 km	21 km
7 days	House, evacuated after 1 month	14 km	15 km	17 km
1 day	House, evacuated after 1 week	15 km	18 km	20 km
2 days	House, evacuated after 1 week	13 km	16 km	18 km
3 days	House, evacuated after 1 week	11 km	14 km	14 km
1 day	Large building	17 km	19 km	23 km
2,3 days	Large building	17 km	19 km	22 km
7 days	Large building	16 km	16 km	21 km
1 day	Large building, evacuated after 1 month	14 km	17 km	19 km
2 days	Large building, evacuated after 1 month	13 km	15 km	17 km
3 days	Large building, evacuated after 1 month	12 km	14 km	15 km
7 days	Large building, evacuated after 1 month	10 km	12 km	14 km
1 day	Large building, evacuated after 1 week	11 km	14 km	16 km
2 days	Large building, evacuated after 1 week	10 km	11 km	13 km
3 days	Large building, evacuated after 1 week	10 km	10 km	12 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	19 km	22 km	25 km
2 days	House	18 km	21 km	24 km
3 days	House	17 km	19 km	23 km
7 days	House	13 km	14 km	20 km
1 day	House, evacuated after 1 month	16 km	17 km	21 km
2 days	House, evacuated after 1 month	10 km	10 km	14 km
3 days	House, evacuated after 1 month	8 km	9 km	12 km
7 days	House, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	House, evacuated after 1 week	9 km	10 km	10 km
2,3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	10 km	15 km	17 km
2 days	Large building	9 km	10 km	14 km
3 days	Large building	8 km	10 km	13 km
7 days	Large building	< 8 km	< 8 km	13 km
1 day	Large building, evacuated after 1 month	< 8 km	8 km	9 km
2,3,7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km

1,2,3 days	Large building, evacuated after 1 week	< 8 km	< 8 km	< 8 km
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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	19 km	21 km	24 km
2 days	House	17 km	20 km	23 km
3 days	House	16 km	18 km	22 km
7 days	House	10 km	13 km	16 km
1 day	House, evacuated after 1 month	15 km	15 km	20 km
2 days	House, evacuated after 1 month	9 km	9 km	13 km
3 days	House, evacuated after 1 month	< 8 km	8 km	10 km
7 days	House, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	House, evacuated after 1 week	9 km	9 km	9 km
2,3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	9 km	11 km	15 km
2 days	Large building	8 km	9 km	13 km
3 days	Large building	< 8 km	< 8 km	13 km
7 days	Large building	< 8 km	< 8 km	12 km
1,2,3,7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1,2,3 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 % 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	18 km	21 km	24 km
2 days	House	17 km	19 km	23 km
3 days	House	15 km	18 km	21 km
7 days	House	9 km	12 km	15 km
1 day	House, evacuated after 1 month	10 km	14 km	19 km
2 days	House, evacuated after 1 month	9 km	9 km	11 km
3, 7 days	House, evacuated after 1 month	< 8 km	< 8 km	< 8 km

1 day	House, evacuated after 1 week	8 km	9 km	9 km
2,3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	9 km	10 km	14 km
2 days	Large building	< 8 km	< 8 km	13 km
3 days	Large building	< 8 km	< 8 km	12 km
7 days	Large building	< 8 km	< 8 km	11 km
1,2,3,7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1,2,3 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 %, respectively, of occurring weather cases are considered, given **complete** initial protection and varying 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	18 km	21 km	24 km
2 days	House	17 km	19 km	23 km
3 days	House	15 km	17 km	21 km
7 days	House	9 km	12 km	15 km
1 day	House, evacuated after 1 month	10 km	14 km	19 km
2 days	House, evacuated after 1 month	9 km	9 km	11 km
3, 7 days	House, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1 day	House, evacuated after 1 week	< 8 km	9 km	9 km
2,3 days	House, evacuated after 1 week	< 8 km	< 8 km	< 8 km
1 day	Large building	9 km	10 km	14 km
2 days	Large building	< 8 km	< 8 km	13 km
3 days	Large building	< 8 km	< 8 km	12 km
7 days	Large building	< 8 km	< 8 km	11 km
1,2,3,7 days	Large building, evacuated after 1 month	< 8 km	< 8 km	< 8 km
1,2,3 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 at 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 are presented in Tables 5a, b and c respectively, for the given initial protection in 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	190 km	90 km	58 km	170 km	81 km	53 km
House	150 km	63 km	39 km	130 km	53 km	33 km
Large building	130 km	46 km	23 km	99 km	34 km	17 km
Protective shelter (SR 15)	120 km	39 km	19 km	91 km	20 km	10 km
Basement	120 km	39 km	19 km	89 km	19 km	9 km
Protective Shelter (basement)	110 km	38 km	18 km	88 km	19 km	9 km
Fully protected	110 km	38 km	18 km	88 km	19 km	9 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	210 km	98 km	64 km	190 km	89 km	59 km
House	170 km	69 km	44 km	150 km	59 km	37 km
Large building	140 km	52 km	26 km	110 km	38 km	19 km
Protective shelter (SR 15)	130 km	45 km	22 km	99 km	24 km	15 km
Basement	130 km	44 km	21 km	97 km	23 km	11 km
Protective Shelter (basement)	130 km	44 km	21 km	95 km	22 km	10 km
Fully protected	130 km	44 km	21 km	95 km	22 km	10 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	240 km	120 km	73 km	200 km	100 km	66 km
House	200 km	79 km	49 km	170 km	67 km	43 km
Large building	160 km	59 km	34 km	130 km	44 km	23 km
Protective shelter (SR 15)	150 km	53 km	25 km	120 km	29 km	17 km
Basement	140 km	50 km	24 km	110 km	26 km	15 km
Protective Shelter (basement)	140 km	50 km	24 km	110 km	25 km	14 km
Fully protected	140 km	50 km	24 km	110 km	25 km	14 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	110 km	38 km	18 km	88 km	19 km	9 km
2 days	100 km	33 km	17 km	69 km	17 km	< 8 km
3 days	98 km	25 km	15 km	59 km	16 km	< 8 km
7 days	92 km	20 km	9 km	55 km	10 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	130 km	44 km	21 km	95 km	22 km	10 km
2 days	110 km	39 km	19 km	73 km	20 km	< 8 km
3 days	110 km	30 km	17 km	66 km	19 km	< 8 km
7 days	99 km	23 km	12 km	61 km	13 km	< 8 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	140 km	50 km	24 km	110 km	25 km	14 km
2 days	130 km	44 km	23 km	98 km	24 km	13 km
3 days	130 km	38 km	21 km	75 km	22 km	12 km
7 days	120 km	28 km	15 km	70 km	19 km	11 km

2.3. Highest radiation doses at specified distances

The results for 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.

Tables 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 [1] for the given number of days, if 70 %, 80 % and 90 % of all possible 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	4.3 Sv	4.2 Sv	4.2 Sv	4.1 Sv	1.5 Sv	1.4 Sv	1.3 Sv	1.2 Sv
25 km	1.7 Sv	1.7 Sv	1.6 Sv	1.6 Sv	0.63 Sv	0.57 Sv	0.54 Sv	0.50 Sv
30 km	1.5 Sv	1.4 Sv	1.4 Sv	1.4 Sv	0.58 Sv	0.54 Sv	0.50 Sv	0.45 Sv
50 km	0.71 Sv	0.70 Sv	0.69 Sv	0.68 Sv	0.28 Sv	0.26 Sv	0.26 Sv	0.24 Sv
100 km	0.24 Sv	0.23 Sv	0.23 Sv	0.22 Sv	0.098 Sv	0.088 Sv	0.083 Sv	0.076 Sv
200 km	0.059 Sv	0.057 Sv	0.056 Sv	0.055 Sv	0.027 Sv	0.024 Sv	0.022 Sv	0.020 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 a house** and a **large building with residing in a large building**) for 1, 2, 3 or 7 days.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	4.9 Sv	4.9 Sv	4.8 Sv	4.8 Sv	1.7 Sv	1.6 Sv	1.6 Sv	1.5 Sv
25 km	1.9 Sv	1.9 Sv	1.9 Sv	1.8 Sv	0.68 Sv	0.63 Sv	0.61 Sv	0.57 Sv
30 km	1.6 Sv	1.6 Sv	1.6 Sv	1.5 Sv	0.62 Sv	0.56 Sv	0.53 Sv	0.49 Sv
50 km	0.83 Sv	0.81 Sv	0.80 Sv	0.79 Sv	0.33 Sv	0.31 Sv	0.29 Sv	0.27 Sv
100 km	0.29 Sv	0.29 Sv	0.28 Sv	0.28 Sv	0.12 Sv	0.11 Sv	0.11 Sv	0.098 Sv
200 km	0.077 Sv	0.075 Sv	0.074 Sv	0.073 Sv	0.034 Sv	0.031 Sv	0.029 Sv	0.028 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	6.3 Sv	6.2 Sv	6.2 Sv	6.2 Sv	2.4 Sv	2.3 Sv	2.2 Sv	2.2 Sv
25 km	2.3 Sv	2.2 Sv	2.2 Sv	2.2 Sv	0.83 Sv	0.78 Sv	0.76 Sv	0.73 Sv
30 km	1.9 Sv	1.8 Sv	1.8 Sv	1.8 Sv	0.68 Sv	0.62 Sv	0.60 Sv	0.56 Sv
50 km	0.98 Sv	0.95 Sv	0.94 Sv	0.92 Sv	0.39 Sv	0.35 Sv	0.34 Sv	0.31 Sv
100 km	0.38 Sv	0.38 Sv	0.37 Sv	0.36 Sv	0.16 Sv	0.15 Sv	0.14 Sv	0.13 Sv
200 km	0.099 Sv	0.097 Sv	0.095 Sv	0.093 Sv	0.043 Sv	0.039 Sv	0.037 Sv	0.034 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	1.6 Sv	1.4 Sv	1.3 Sv	1.1 Sv	0.95 Sv	0.82 Sv	0.77 Sv	0.64 Sv
25 km	0.77 Sv	0.67 Sv	0.56 Sv	0.42 Sv	0.44 Sv	0.38 Sv	0.33 Sv	0.26 Sv
30 km	0.76 Sv	0.60 Sv	0.51 Sv	0.41 Sv	0.44 Sv	0.36 Sv	0.31 Sv	0.26 Sv
50 km	0.38 Sv	0.34 Sv	0.31 Sv	0.25 Sv	0.21 Sv	0.19 Sv	0.18 Sv	0.15 Sv
100 km	0.14 Sv	0.11 Sv	0.10 Sv	0.082 Sv	0.079 Sv	0.065 Sv	0.058 Sv	0.048 Sv
200 km	0.042 Sv	0.035 Sv	0.030 Sv	0.024 Sv	0.023 Sv	0.020 Sv	0.017 Sv	0.014 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	2.0 Sv	1.7 Sv	1.6 Sv	1.4 Sv	1.1 Sv	1.0 Sv	0.96 Sv	0.84 Sv
25 km	0.80 Sv	0.65 Sv	0.61 Sv	0.49 Sv	0.46 Sv	0.39 Sv	0.35 Sv	0.30 Sv
30 km	0.78 Sv	0.65 Sv	0.58 Sv	0.44 Sv	0.46 Sv	0.37 Sv	0.35 Sv	0.27 Sv
50 km	0.45 Sv	0.39 Sv	0.35 Sv	0.29 Sv	0.26 Sv	0.22 Sv	0.20 Sv	0.17 Sv
100 km	0.18 Sv	0.15 Sv	0.13 Sv	0.11 Sv	0.098 Sv	0.082 Sv	0.077 Sv	0.065 Sv
200 km	0.053 Sv	0.044 Sv	0.040 Sv	0.034 Sv	0.029 Sv	0.025 Sv	0.023 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	3.0 Sv	2.7 Sv	2.6 Sv	2.4 Sv	1.7 Sv	1.6 Sv	1.5 Sv	1.4 Sv
25 km	0.98 Sv	0.86 Sv	0.81 Sv	0.71 Sv	0.57 Sv	0.51 Sv	0.48 Sv	0.43 Sv
30 km	0.84 Sv	0.65 Sv	0.59 Sv	0.48 Sv	0.47 Sv	0.38 Sv	0.36 Sv	0.30 Sv
50 km	0.52 Sv	0.41 Sv	0.39 Sv	0.31 Sv	0.29 Sv	0.24 Sv	0.23 Sv	0.18 Sv
100 km	0.24 Sv	0.20 Sv	0.18 Sv	0.14 Sv	0.13 Sv	0.11 Sv	0.10 Sv	0.082 Sv
200 km	0.066 Sv	0.055 Sv	0.050 Sv	0.041 Sv	0.036 Sv	0.031 Sv	0.028 Sv	0.023 Sv

Table 9a. Highest total effective dose exceeded in the first year that is exceeded 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	1.5 Sv	1.3 Sv	1.2 Sv	0.94 Sv	0.81 Sv	0.69 Sv	0.65 Sv	0.51 Sv
25 km	0.72 Sv	0.62 Sv	0.50 Sv	0.36 Sv	0.39 Sv	0.33 Sv	0.27 Sv	0.20 Sv
30 km	0.70 Sv	0.53 Sv	0.44 Sv	0.36 Sv	0.38 Sv	0.29 Sv	0.24 Sv	0.20 Sv
50 km	0.35 Sv	0.31 Sv	0.29 Sv	0.21 Sv	0.19 Sv	0.17 Sv	0.16 Sv	0.11 Sv
100 km	0.13 Sv	0.11 Sv	0.092 Sv	0.073 Sv	0.073 Sv	0.057 Sv	0.050 Sv	0.039 Sv
200 km	0.041 Sv	0.034 Sv	0.028 Sv	0.022 Sv	0.022 Sv	0.018 Sv	0.015 Sv	0.012 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	1.8 Sv	1.5 Sv	1.4 Sv	1.1 Sv	0.96 Sv	0.79 Sv	0.75 Sv	0.62 Sv
25 km	0.75 Sv	0.60 Sv	0.56 Sv	0.40 Sv	0.40 Sv	0.33 Sv	0.30 Sv	0.22 Sv
30 km	0.71 Sv	0.57 Sv	0.50 Sv	0.39 Sv	0.38 Sv	0.31 Sv	0.27 Sv	0.21 Sv
50 km	0.43 Sv	0.36 Sv	0.32 Sv	0.25 Sv	0.23 Sv	0.20 Sv	0.17 Sv	0.13 Sv
100 km	0.17 Sv	0.14 Sv	0.12 Sv	0.10 Sv	0.090 Sv	0.073 Sv	0.067 Sv	0.054 Sv
200 km	0.051 Sv	0.042 Sv	0.038 Sv	0.031 Sv	0.028 Sv	0.023 Sv	0.021 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.

Distance	Normal residency during the remainder of the first year							
	House				Large building			
	1 day	2 days	3 days	7 days	1 day	2 days	3 days	7 days
10 km	2.8 Sv	2.5 Sv	2.4 Sv	2.2 Sv	1.5 Sv	1.3 Sv	1.3 Sv	1.2 Sv
25 km	0.90 Sv	0.77 Sv	0.72 Sv	0.61 Sv	0.48 Sv	0.42 Sv	0.39 Sv	0.33 Sv
30 km	0.78 Sv	0.59 Sv	0.53 Sv	0.40 Sv	0.42 Sv	0.32 Sv	0.29 Sv	0.22 Sv
50 km	0.49 Sv	0.38 Sv	0.35 Sv	0.27 Sv	0.27 Sv	0.20 Sv	0.19 Sv	0.14 Sv
100 km	0.23 Sv	0.18 Sv	0.16 Sv	0.13 Sv	0.12 Sv	0.099 Sv	0.088 Sv	0.068 Sv
200 km	0.064 Sv	0.053 Sv	0.047 Sv	0.038 Sv	0.034 Sv	0.028 Sv	0.025 Sv	0.021 Sv

3. Effective dose in 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 for 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 for 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 durations of exposure (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	270 km	140 km	69 km	44 km
2 days unprotected	> 330 km	310 km	160 km	76 km	48 km
3 days unprotected	> 330 km	330 km	170 km	79 km	50 km
7 days unprotected	> 330 km	> 330 km	180 km	85 km	54 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	250 km	190 km	100 km	38 km	25 km
2 days in a house	280 km	210 km	110 km	42 km	27 km
3 days in a house	300 km	220 km	110 km	43 km	28 km
7 days in a house	330 km	240 km	120 km	46 km	30 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	140 km	110 km	44 km	13 km	< 8 km
2 days in a large building	160 km	120 km	48 km	14 km	< 8 km
3 days in a large building	170 km	120 km	50 km	15 km	< 8 km
7 days in a large building	180 km	130 km	54 km	16 km	< 8 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)	78 km	54 km	16 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	87 km	59 km	18 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	90 km	61 km	18 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	97 km	64 km	19 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	44 km	28 km	< 8 km	< 8 km	< 8 km
2 days in a basement	48 km	31 km	< 8 km	< 8 km	< 8 km
3 days in a basement	50 km	32 km	< 8 km	< 8 km	< 8 km
7 days in a basement	54 km	34 km	< 8 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)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km
3 days in a protective shelter (basement)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km
7 days in a protective shelter (basement)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km

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

Tables 16-21 show the greatest distances for 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 for 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	310 km	160 km	76 km	50 km
2 days unprotected	> 330 km	> 330 km	180 km	84 km	53 km
3 days unprotected	> 330 km	> 330 km	190 km	86 km	55 km
7 days unprotected	> 330 km	> 330 km	200 km	94 km	60 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	280 km	220 km	110 km	43 km	28 km
2 days in a house	310 km	240 km	120 km	47 km	30 km
3 days in a house	330 km	250 km	130 km	49 km	31 km
7 days in a house	> 330 km	270 km	130 km	51 km	33 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	160 km	130 km	50 km	15 km	< 8 km
2 days in a large building	180 km	130 km	53 km	16 km	< 8 km

3 days in a large building	190 km	140 km	55 km	17 km	< 8 km
7 days in a large building	200 km	140 km	60 km	18 km	8 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 (counted 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)	86 km	59 km	18 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	96 km	63 km	19 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	100 km	66 km	20 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	110 km	74 km	22 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	50 km	32 km	< 8 km	< 8 km	< 8 km
2 days in a basement	53 km	35 km	< 8 km	< 8 km	< 8 km
3 days in a basement	55 km	36 km	< 8 km	< 8 km	< 8 km
7 days in a basement	60 km	38 km	8 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 (counted 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)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km
2 days in a protective shelter (basement)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km
3 days in a protective shelter (basement)	< 8 km	< 8 km	< 8 km	< 8 km	< 8 km
7 days in a protective shelter (basement)	8 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 for 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	> 300 km	190 km	87 km	55 km
2 days unprotected	> 330 km	> 330 km	210 km	95 km	60 km
3 days unprotected	> 330 km	> 330 km	210 km	99 km	63 km
7 days unprotected	> 330 km	> 330 km	220 km	110 km	68 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	320 km	240 km	130 km	49 km	32 km
2 days in a house	> 330 km	270 km	140 km	53 km	35 km
3 days in a house	> 330 km	290 km	140 km	54 km	36 km
7 days in a house	> 330 km	310 km	150 km	58 km	38 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 multifamily residential building	190 km	140 km	55 km	17 km	< 8 km
2 days in a multifamily residential building	210 km	150 km	60 km	18 km	9 km
3 days in a multifamily residential building	210 km	160 km	63 km	20 km	9 km
7 days in a multifamily residential building	220 km	170 km	68 km	21 km	10 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 (counted 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)	99 km	67 km	21 km	< 8 km	< 8 km
2 days in a protective shelter (SR 15)	110 km	74 km	22 km	< 8 km	< 8 km
3 days in a protective shelter (SR 15)	110 km	78 km	23 km	< 8 km	< 8 km
7 days in a protective shelter (SR 15)	120 km	82 km	25 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	55 km	36 km	< 8 km	< 8 km	< 8 km
2 days in a basement	60 km	40 km	9 km	< 8 km	< 8 km
3 days in a basement	63 km	41 km	9 km	< 8 km	< 8 km
7 days in a basement	68 km	43 km	10 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)	< 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

3.2. 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 here 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	7.2 Sv	0.62 Sv	0.046 Sv	0.023 Sv
25 km	2.5 Sv	0.28 Sv	0.012 Sv	0.011 Sv
30 km	1.9 Sv	0.25 Sv	0.010 Sv	0.010 Sv
50 km	0.84 Sv	0.12 Sv	0.004 Sv	0.005 Sv
100 km	0.26 Sv	0.048 Sv	0.001 Sv	0.001 Sv
200 km	0.034 Sv	0.016 Sv	-	-
300 km	0.014 Sv	0.005 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	8.2 Sv	0.79 Sv	0.053 Sv	0.027 Sv
25 km	2.8 Sv	0.32 Sv	0.014 Sv	0.013 Sv
30 km	2.2 Sv	0.27 Sv	0.012 Sv	0.012 Sv
50 km	1.0 Sv	0.14 Sv	0.005 Sv	0.006 Sv
100 km	0.31 Sv	0.053 Sv	0.001 Sv	0.002 Sv
200 km	0.050 Sv	0.016 Sv	-	-
300 km	0.019 Sv	0.007 Sv	-	-

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

Distance	Ground, day 1	Ground, day 2	Clouds	Inhalation
10 km	9.6 Sv	0.85 Sv	0.066 Sv	0.032 Sv
25 km	3.4 Sv	0.35 Sv	0.018 Sv	0.016 Sv
30 km	2.7 Sv	0.28 Sv	0.016 Sv	0.015 Sv
50 km	1.3 Sv	0.16 Sv	0.006 Sv	0.009 Sv
100 km	0.39 Sv	0.062 Sv	0.001 Sv	0.003 Sv
200 km	0.080 Sv	0.019 Sv	-	-
300 km	0.029 Sv	0.008 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	45 km	55 km	68 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	< 8 km
House	20 km	27 km	35 km
Large building, fallout 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	20 km	27 km	35 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	< 8 km
House	< 8 km	< 8 km	11 km
Large building, fallout 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	< 8 km
Unprotected + iodine thyroid blocking	< 8 km	< 8 km	< 8 km
House	< 8 km	< 8 km	< 8 km
Large building, fallout 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 exposure starts 6 hours after the explosion, 1,000 mGy to an adult can be exceeded at a greatest distance of 15 km if 90 % of occurring 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	20 km	23 km	27 km
6 hours	11 km	12 km	15 km
12 hours	< 8 km	< 8 km	< 8 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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