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CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

IRONBARK

25 JUL 1962

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : Chapter XI of SECRET Soviet Manual on Atomic Weapons and Antiatomic Protection

1. Enclosed is a verbatim translation of Chapter XI of a Soviet SECRET document entitled "A Guide to the Combat Characteristics of Atomic Weapons and to the Means of Antiatomic Protection". It was published in 1957 by the Ministry of Defense, USSR.

2. For convenience of reference by USIB agencies, the codeword IRONBARK has been assigned to this series of TOP SECRET CSDB reports containing documentary Soviet material. The word IRONBARK is classified CONFIDENTIAL and is to be used only among persons authorized to read and handle this material.

3. In the interests of protecting our source, IRONBARK material should be handled on a need-to-know basis within your office. Requests for extra copies of this report or for utilization of any part of this document in any other form should be addressed to the originating office.

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Richard Helms

Richard Helms
Deputy Director (Plans)

Enclosure

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Original: The Director of Central Intelligence

cc: The Director of Intelligence and Research, Department of State

The Director, Defense Intelligence Agency

The Director for Intelligence, The Joint Staff

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence Department of the Navy

The Assistant Chief of Staff, Intelligence U. S. Air Force

The Director, National Security Agency

Director, Division of Intelligence Atomic Energy Commission

National Indications Center

Chairman, Guided Missiles and Astronautics Intelligence Committee

Deputy Director for Research

Deputy Director for Intelligence

Assistant Director for National Estimates

Assistant Director for Current Intelligence

Assistant Director for Research and Reports

Assistant Director for Scientific Intelligence

Director, National Photographic Interpretation Center

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COUNTRY : USSR

SUBJECT : Soviet Manual on Atomic Weapons and Antiatomic Protection (Chapter XI)

DATE OF INFO : 1957

APPRAISAL OF CONTENT : Documentary

SOURCE : A reliable source (B).

Following is a verbatim translation of Chapter XI of a Soviet SECRET document titled "A Guide to the Combat Characteristics of Atomic Weapons and to the Means of Antiatomic Protection." This manual was published in 1957 by the USSR Ministry of Defense as a replacement for a similar 1954 manual (CSDB-35586), and is referenced in the Information Collection of the Artillery (cf. CSDB-3/649,649). It had not been superseded as of late 1961. A similar, more general document was also published by the 6th Directorate of the Ministry of Defense in 1959 (CSDB-3/649,686).

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Chapter XI

Protection of Troops Against Injury by Radioactive Materials During Operations on Contaminated Terrain

Troop protection against injury by radioactive substances during operations on contaminated terrain is accomplished by:

-- skilful and timely use of individual means of antichemical protection;

-- employment of defense installations, above all, those equipped for antichemical protection;

-- strict adherence of personnel to the measures intended to prevent radioactive substances from getting on the skin, uniform and equipment or even more, inside the body;

-- radiation control of personnel and limitation of the time spent on contaminated terrain;

-- performance of sanitary processing and decontamination.

38. Employment of Antichemical Protective Means and Defense Installations During Operations on Contaminated Terrain

The skilful and timely use of individual means of antichemical protection provides protection to personnel against radioactive materials getting into the body and against contamination of the skin, uniform, shoes and equipment.

Depending on the combat situation, the possibilities of dust formation and the state of the weather, various individual means of antichemical protection are used, as shown in Table 146.

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Table 146

Antichemical Protective Means for Use During Operations on Contaminated Terrain

Operational Circumstances	Individual means of antichemical defense used for protection against radioactive substances: In summer — Dry, windy weather	In summer — Dry, calm weather	In summer — Damp weather after rain	In summer — Calm weather	In winter — Wind-driven snow	In winter — Snow fall
Carrying out radiation reconnaissance	Gas mask, suit LG-1 or cotton coveralls	Gas mask, protective gloves and footwear	Protective footwear and gloves (when operating on foot)		Gas mask, protective footwear and gloves	Gas mask (also protective footwear and gloves for operations on foot)
Crossing contaminated sectors:						
in trucks (or armored personnel carriers)	Gas mask, gloves, poncho (protective cape)		Poncho		Gas mask, protective footwear and gloves	Gas mask
on tanks	Gas mask, protective footwear and gloves		Gas mask, protective footwear and gloves		Gas mask, protective footwear and gloves	
in tanks, assault guns, in the cab of a truck (or armored personnel carrier)	Gas mask		No protective gear		Gas mask	
on foot	Gas mask, protective footwear and gloves		Protective footwear and gloves		Gas mask, protective footwear and gloves	Protective footwear and gloves
dismounted, in prone position	Gas mask, protective footwear and gloves		Protective gloves, footwear and poncho		Gas mask, protective footwear and gloves	

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Operational Circumstances	In summer				In winter	
	Dry, windy weather	Dry, calm weather	Damp weather after rain	Calm weather	Wind-driven snow	Snow fall
For prolonged periods on contaminated terrain outside shelter	Gas mask, protective footwear and gloves		Protective footwear and gloves		Gas mask, protective footwear and gloves	
In field defensive installations (blindages, covered sectors of trenches, slit trenches and the like)						
with radiation levels in the installations less than 0.5 r/hr	No protective gear					
with radiation levels in the installations more than 0.5 r/hr	Gas mask		No protective gear (in the absence of dust in the installation)		Gas mask	No protective gear
in shelters equipped with ventilating-filtering units	No protective gear					

Notes: 1. With a radioactive cloud over the area of troop operations, personnel put on the gas mask and poncho (protective cape).

2. If there is dust in the air, the gas mask must be worn at all times.

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During operations on contaminated terrain, in addition to using individual antichemical protective gear, the following should be observed:

-- avoid raising dust;

-- do not lie down on the ground, if not required by the combat situation;

-- don't eat, drink or smoke.

The use of shelters, even the simplest trenches, not only lessens the probability of getting radioactive substances on the skin, uniform or inside the body, but also reduces the radiation dose. The degrees of dose reduction are shown in Table 147.

Table 147

Decrease in Radiation Dose for Various Shelters

Shelter type	Dose reduction (in number of times)
Full profile trenches	10 to 20
Covered portions of trenches	25 to 30
Blindage	Radiation practically eliminated
Shelters, light type	Radiation practically eliminated
Shelters, heavy type	Radiation practically eliminated

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39. Permissible Time for Remaining on Terrain Contaminated with Radioactive Substances

The time spent on terrain contaminated with radioactive substances is determined by the radiation levels on it, by the nature of the radioactive contamination, and by the harmless doses of the overall external irradiation.

The harmless dose of overall external radiation is that dose which is sustained by a man without noticeable harm to his health.

The harmless gamma radiation dose within the overall irradiation of personnel is as follows:

Once in the course of one day--50 r;

Repeatedly in the course of ten days--10 r/day.

Notes: 1. In some cases of repeated irradiation, a 15 to 20 r/day dose may be permitted under conditions where the total dose for 10 days does not exceed 100 r.

2. The irradiation of personnel who have sustained 50 r at one time or 100 r over ten days is permitted during the next two months only in extreme circumstances.

3. The safe time for personnel on contaminated terrain is determined, as a rule, from the gamma radiation. Beta radiation is considered only when, during measurements at a height of 0.7m, the roentgenometer reading with the lid open is double that with the lid closed. In the latter case the safe dose of gamma radiation is decreased by 30 percent.

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Personnel radiation control is organized in order to determine the permissible exposure time for personnel on contaminated terrain. Radiation control is either group or individual.

Group radiation control is organized in all subunits for the purpose of determining the average radiation dose for personnel during operations on contaminated terrain.

Individual radiation control is conducted for more accurate determination of the radiation dose sustained by individuals during operations on contaminated terrain. Individual radiation control is primarily carried out by personnel of reconnaissance subunits and those subunits charged with elimination of the aftereffects of an atomic attack.

Group radiation control is carried out with the aid of miniature ionization chambers and other means of radiation control, with direct measurement of the radiation dose sustained.

Individual radiation control is accomplished with the aid of miniature ionization chambers from the individual radiation control kit (DP-21) or with the aid of a pocket dosimeter, with direct reading of the radiation dose. The use of the miniature ionization chambers from the DP-21 kit for individual radiation control does not remove the necessity for simultaneous group radiation control.

The radiation dose for personnel in subunits can be determined approximately from roentgenometer readings, from the graph of total radiation dose (see below, Figure 166) or from radiation doses measured by means of individual radiation control.

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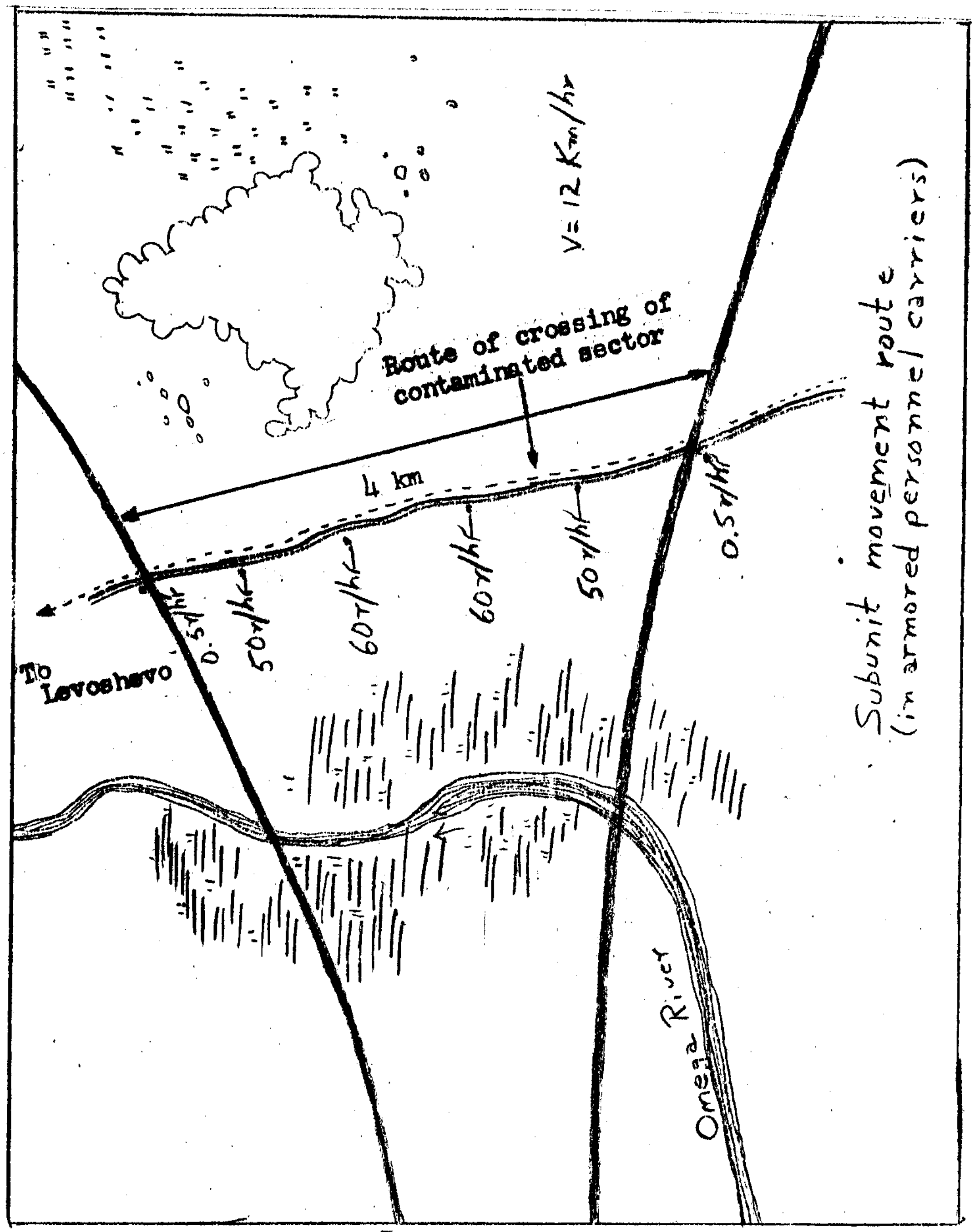
Figure 164. Sketch of the Wake of a Radioactive Cloud and the Radiation Levels on the Line of March of a Subunit



[redacted]

The most typical examples are given below for determining the radiation dose for personnel of a subunit on the basis of roentgenometer readings:

1. When crossing an area contaminated as a result of radioactive fallout from the cloud of an atomic burst, the radiation dose is determined by multiplying one half the value of the maximum radiation level along the route of march by the crossing time:

$$D = \frac{1}{2k} \underline{R}_{\gamma}\max\ t;$$

where D -- radiation dose in r;

$\underline{R}_{\gamma}\max$ -- maximum radiation (gamma) levels, in r/hr

t -- crossing time in hours;

k -- coefficient of the attenuation of radiation; for trucks, 2; for armored personnel carriers, 4; for tanks, 10.

For example, if the route of march is crossed by the path of a radioactive cloud for a distance of 4 km with a maximum radiation level $\underline{R}_{\gamma}\max = 60$ r/hr (Figure 164), then, during the movement of a subunit in armored personnel carriers at a speed of 12 km/hr, the crossing time is:

$$t = \frac{L}{v} = \frac{4}{12} = \frac{1}{3}\text{hr}$$

and the radiation dose sustained by personnel is:

$$D = \frac{1}{2 \cdot 4} \quad 60 \quad \frac{1}{3} = 2.5\text{r}.$$

2. The radiation dose for personnel, when crossing an area contaminated with radioactive material, is determined by multiplying the average radiation level, $\underline{R}_{\gamma}\underline{sr}$, along the route of march by the crossing time, t:

$$D = \frac{\underline{R}_{\gamma}\underline{sr}}{k} \quad t.$$

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The value of $R_{\gamma\,sr}$, for measuring the radiation level on a route of march at equal intervals along the route, is determined by the equation:

$$R_{\gamma}\,sr = \frac{\ell}{L}\left(R_{\gamma 1} + R_{\gamma 2} + R_{\gamma 3} + \ldots + R_{\gamma n}\right)$$

where ℓ = length of equal intervals on the line of march in meters;

L = total length of route of march in meters;

$R_{\gamma 1}$, $R_{\gamma 2}$, $R_{\gamma 3}$ — = values for radiation levels in r/hr.

For example, in crossing a contaminated sector in trucks, where L = 4000 m (Figure 165), the radiation levels every 800 m (taking account of the coefficient of attenuation) were as follows:

$R_{\gamma 1}$ = 10 r/hr; $R_{\gamma 2}$ = 12.5 r/hr; $R_{\gamma 3}$ = 15 r/hr;

$R_{\gamma 4}$ = 12 r/hr; $R_{\gamma 5}$ = 0.5 r/hr.

Crossing time $t = \frac{L}{v} = \frac{1}{4}$ hr.

$$R_{\gamma}\,sr = \frac{800}{4000}\left(10 + 12.5 + 15 + 12 + 0.5\right) =$$

$$0.2 \times 50 \simeq 10 \text{ r/hr}.$$

The radiation dose sustained by personnel is:

$$D = 10 \quad \frac{1}{4} = 2.5 \text{ r}.$$

Where the measurement of the radiation levels on the line of march is made at irregular intervals, then the value $R_{\gamma}\,sr$ is determined from the equation:

$$R_{\gamma}\,sr = \frac{R_{\gamma 1}\ell_1 + R_{\gamma 2}\ell_2 + R_{\gamma 3}\ell_3 + \ldots + R_{\gamma n}\ell_n}{L}$$

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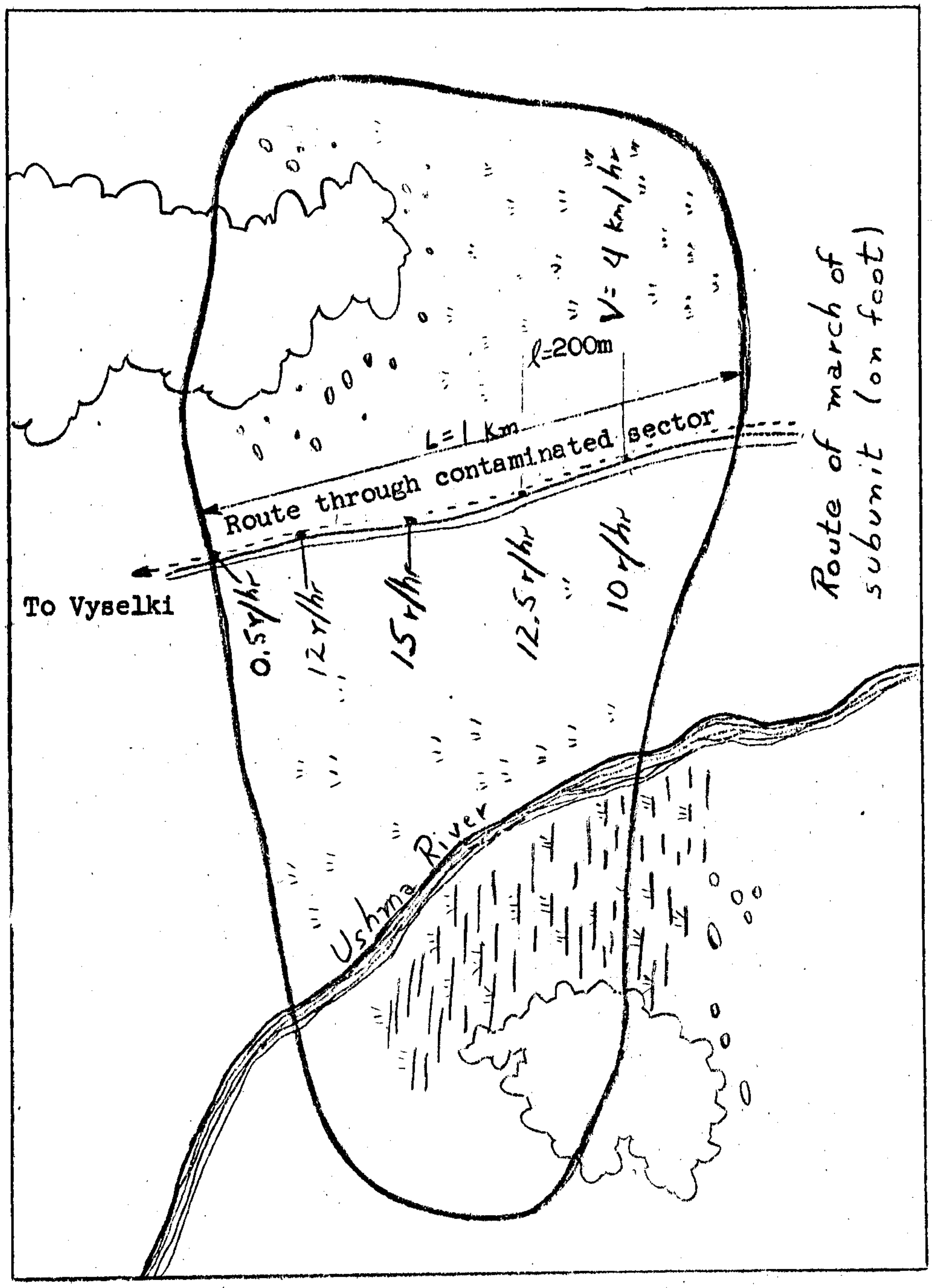
Figure 165. Sketch of a Sector of Terrain Contaminated with Radioactive Material, and the Radiation Levels on the Route of March of a Subunit.



3. During operations in a contaminated area, the radiation dose, D, is determined by multiplying the average radiation level, $R_{\gamma sr}$, by time, t, spent in that area:

$$D = R_{\gamma sr}\ t = \frac{R_{\gamma 1} + R_{\gamma 2}}{2} t.$$

For example, at the moment of occupying a firing position by an artillery battery, the radiation level in the contaminated terrain was 5.4 r/hr, and after two hours (at the moment the battery left the contaminated area) $R_{\gamma 2} = 2$ r/hr.

$$\text{Thus:}\quad R_{\gamma sr} = \frac{5.4 + 2}{2} = 3.7 \text{ r/hr}; \quad t = 2 \text{ hours};$$

$$D = 3.7 \times 2 = 7.4 \text{ r}.$$

4. To determine the total dose (D_{t_1, t_2}), sustained by personnel in a contaminated sector from the moment t_1 after an atomic burst to moment t_2, one may use the formula (204) in Table 88.

For crossing the area of a surface atomic burst, the total radiation dose may be determined by a graph (Figure 166).

From the radiation doses measured by one member of a unit (team, crew) with the aid of ionization chambers (or other means of individual radiation control), one can estimate the overall radiation sustained by all personnel of the unit (team, crew).

Permissible exposure time for personnel on terrain contaminated by radioactive material from a surface atomic burst depends on the radiation level and the established radiation dose given in Table 148.

Radioactive contamination of terrain by an air atomic burst (one where the fireball does not touch the surface of the earth) does not actually influence troop operations. Heavy contamination in this instance may occur only near ground zero during the first few hours after the burst.

[redacted]

In operations on terrain contaminated with radioactive material one must consider the slow decline of the radiation levels. In this case the permissible exposure time for personnel on contaminated terrain may be approximately established by dividing the established radiation dose by the magnitude of the radiation level on the given terrain, that is:

$$t = \frac{D}{R_\gamma},$$

where: t -- permissible exposure time on contaminated terrain, in hours;

D -- established radiation dose, in r;

R_γ -- radiation level on the terrain in r/hr at the moment of entry into the contaminated area.

Example: Determine the radiation dose sustained by personnel while crossing the area of a burst one hour later in trucks or riding on tanks at a distance of 600 meters from the center of the burst. On the graph, find the intersection of the vertical line marked "1 hour" and the broken oblique line marked "600 meters"; on the vertical axis of the graph this point corresponds to a dose of 9.5 roentgens. When crossing on foot, the radiation dose is determined in the same way, but by using the solid oblique line.

[redacted]

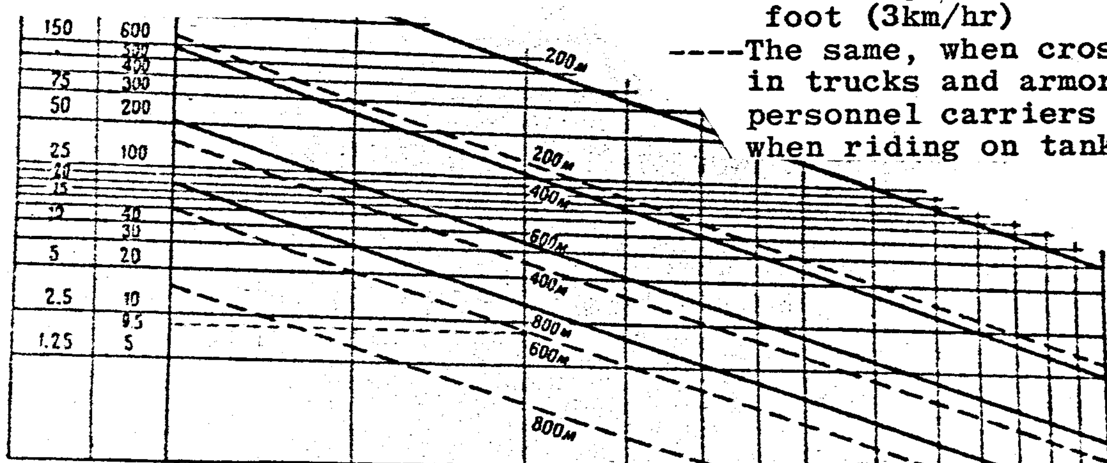
Total radiation dose in roentgens when crossing the area of medium and low yield bursts

Low yield | Medium yield

Legend

——— Lines designating march route distances from the center (or ground zero) of a burst, when crossing an area on foot (3km/hr)

----The same, when crossing in trucks and armored personnel carriers or when riding on tanks (12 km/hr



Note: For tank crews crossing contaminated areas, the radiation dose will be 1/5, and for passengers in armored personnel carriers 1/2 that for personnel in trucks or on tanks.

Figure 166. Graph of the Total Radiation Dose, Depending on Crossing Time of the Area of Surface and Low Air Atomic Bursts for Various Distances from the Center (or Ground Zero) of the Burst.

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Table 146

Permissible Exposure Time on Terrain Contaminated with Radioactive Materials from a Surface Atomic Burst

D / R_γ	Time from the moment of burst to moment of entry onto the contaminated terrain (in hours) 1	2	3	4	5	6	7	8	9	10	12	15	20	24
0.2	Fifteen Minutes													
0.3	Twenty Minutes													
0.4	0-30	Twenty-five Minutes												
0.5	0-40	0-35	Thirty Minutes											
0.6	1-00	0-45	Forty Minutes											
0.7	1-10	0-50	Forty-five Minutes											
0.8	1-30	1-00	Fifty Minutes											
0.9	1-40	1-10		Sixty Minutes				Fifty-five Minutes						
1.0	2-00	1-20		Seventy Minutes				Sixty Minutes						
1.2	3-10	2-00		1-30	1-30	1-30	1-25	Eighty Minutes						
2.0	12-00	4-00	3-10	2-45	2-35	2-30	2-20				2-10		2-00	
2.5	31-00	6-30	4-30	3-50	3-30	3-15	3-00				2-50		2-40	
3.0	unlim-	10-00	6-00	5-00	4-30	4-00	3-50				3-30		3-15	
4.0	ited	24-00	11-00	8-00	7-00	6-00	5-45				5-00		4-30	
6.0	unlimited		36-00	20-00	15-00	12-00	10-30				8-00		7-00	
10.0	unlimited				60-00	40-00	30-00	25-00	23-00	21-00	18-00	16-00	14-00	13-00

[redacted]tes: 1. D -- established radiation dose in r.

R_γ -- radiation level on the terrain in r/hr at the moment of entry onto the contaminated terrain.

(see next page)

<u>Example</u>: An artillery battery occupies a firing position on contaminated terrain 2 hours after an atomic burst. The radiation level in the firing position at that time was 5 r/hr. The radiation dose for personnel was established at 20r.

Solution: Using the table, we determine that for the correlation $\frac{D}{R_\gamma} = \frac{20}{5} = 4$ and for a period of 2 hours after the burst, the safe exposure time for the battery personnel is 24 hours.

[redacted]