

CIVIL DEFENCE · FIELD REFERENCE



NUCLEAR EVENT SURVIVAL

MASTER GUIDE

Get Inside · Stay Inside · Stay Informed

A complete, evidence-based survival reference for the first minutes, hours and weeks.

Version 4.0 · Complete Edition

Print this guide and keep it in your emergency kit alongside your radiation meter (GMC-800 / GMC-500+) and potassium-iodide tablets.

Compiled from FEMA · CDC REMM · WHO · IAEA · Nuclear War Survival Skills (Kearny) · Glasstone & Dolan · Swiss Civil Defence

© survivalmg.com — All rights reserved · No unauthorised copying or reproduction

Nuclear Event Survival Master Guide

Evidence-based survival strategy · **Version 4.0 — Complete Edition** · Print & keep in your emergency kit

This guide condenses the essentials of surviving a nuclear detonation and the fallout that follows — what happens and when, where to shelter, how to read radiation levels, how to treat injuries, and what to stock beforehand. It is written to be **printed and kept on paper**, because in a real event the electricity, mobile networks and internet you rely on now may all be down.

⚠ IMPORTANT — PLEASE READ FIRST

This is an educational preparedness reference, not professional medical, legal or emergency-services advice. It cannot replace trained clinicians, official civil-defence instructions, or the guidance of your local authorities. Where official emergency broadcasts are available, always follow them first.

Medication & dosing notes (antibiotics, potassium iodide, painkillers) describe general adult reference information drawn from published austere-medicine and public-health sources. Doses vary by age, weight, pregnancy, allergies, kidney/liver function and interactions. Use prescription medicines only when a qualified professional is genuinely unreachable, ideally after consulting one in advance, and never give antibiotics or iodine to children, or during pregnancy, without checking the specific cautions in this guide.

Verify and rehearse. Check that supplies, batteries and medicines are in date, and practise your shelter and ventilation plan *before* an emergency. Figures for radiation, blast and fallout are planning estimates — real outcomes depend on weapon yield, burst type, weather and terrain.

Contents

Tap any entry on screen to jump to that section. The guide is organised roughly in the order you would need it: immediate actions first, then shelter, monitoring, medical care, and long-term recovery.

01 The 7-10 Rule: Radiation Decay

02 Types of Nuclear Radiation

03 Phase 1: Blast & EMP Timeline by Distance

04 Long-Range Effects: 100km to 3000km Downwind

05 EMP Protection & Equipment Survival

06 Phase 2: Shelter - Protection Factor Guide

07 Choosing a Geiger Counter

08 Using Your GMC-800 / GMC-500+ Geiger Counter

09 Water Purification (Including Radioactive Contamination)

10 Air Quality & Respiratory Protection

11 Breathable Air: Sealed Room Survival Time

12 Decontamination Procedures

13 Radiation Injury & Medical Response

14 Evacuation Decision Making

15 Food Safety & Contamination

16 Psychological Preparation & Group Dynamics

17 Long-Term Survival (Weeks to Months)

18 Fallout Patterns & Wind

19 Quick Reference Tables

20 Fallout Plume: Wind Direction & Your Location

21 Emergency Communications Guide

22 Burn Treatment (Thermal & Beta Burns)

23

Children, Pregnant Women & Vulnerable Populations

24

Long-Term Recovery (Months to Years)

25

Makeshift Shelter Construction

26

Pre-Event Supplies Checklist

27

Decision Flowchart

28

Reference: Eight Attack Scenarios



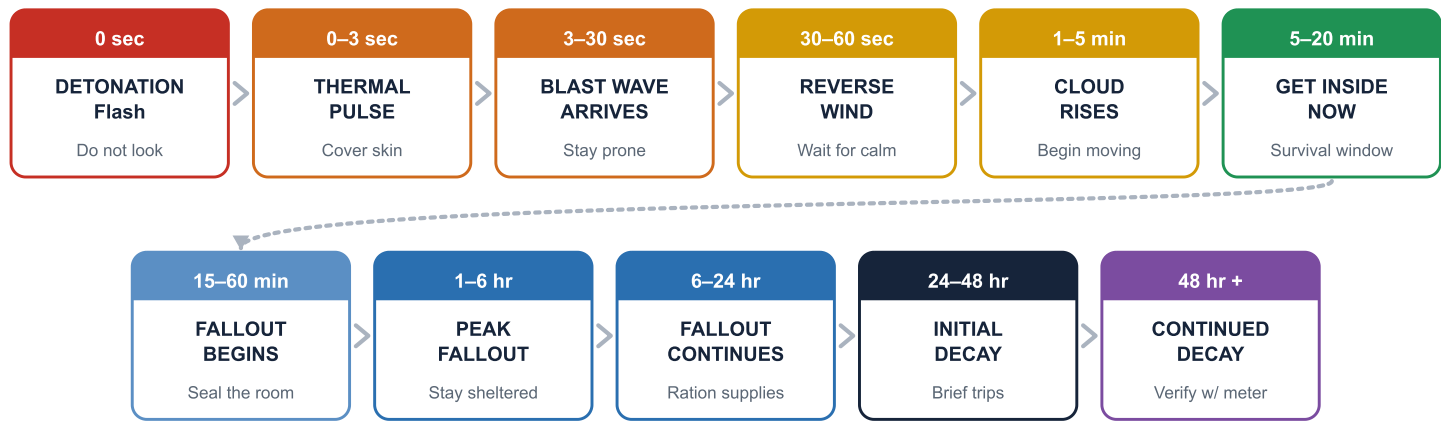
Nuclear Event Survival Master Guide

Enhanced High-Precision Survival Strategy | Version 3.8 Complete | Print & Keep in Emergency Kit

⚠ THE THREE CRITICAL RULES - MEMORIZE THESE

- 1. **GET INSIDE:** Move to the center of a sturdy building immediately. Basement is best.
- 2. **STAY INSIDE:** Minimum 24 hours, ideally 48-72 hours. Fallout decays rapidly.
- 3. **STAY TUNED:** Monitor emergency broadcasts for official instructions.

Nuclear Blast Sequence — What Happens & When To Act



KEY TIMING — you have 10-20 MINUTES between blast and fallout.
Use this time to get to shelter. Every minute counts.

The sequence of a nuclear detonation and the narrow window you have to reach shelter before fallout begins to arrive.

⚡ Nuclear Blast Sequence — Text Timeline (Print Reference)

Time	Event	Effects	Action Required
0 seconds	DETONATION / FLASH	Blinding light (brighter than sun), instant blindness if looking at it, retinal burns possible 15+ km away	DO NOT LOOK — turn away, close eyes, drop to ground
0-3 seconds	THERMAL PULSE	Intense heat wave, 3rd degree burns within 5 km, clothing/paper ignites, fires start	Stay down, cover exposed skin, get behind any solid object

3-30 seconds	BLAST WAVE ARRIVES	Overpressure destroys buildings, flying debris (glass, masonry), wind speeds 100-500+ mph near GZ	Stay prone, cover head, away from windows, under sturdy furniture
30-60 seconds	NEGATIVE PRESSURE / REVERSE WIND	Air rushes back toward fireball, secondary debris hazard, buildings further damaged	Remain in protected position until winds stop completely
1-5 minutes	MUSHROOM CLOUD RISES	Fireball rises, debris drawn upward, initial radiation pulse complete	BEGIN MOVING — you have 10-20 minutes before fallout arrives
5-20 minutes	SURVIVAL WINDOW	Fallout not yet arrived (unless very close to GZ), air relatively clear	GET INSIDE solid building NOW — basement is best, centre room if no basement
15-60 minutes	FALLOUT BEGINS	Radioactive particles start falling (visible as ash/dust), gamma radiation intensifies	BE INSIDE with room sealed, do not go outside, begin decontamination if exposed
1-6 hours	PEAK FALLOUT	Heaviest fallout deposition, maximum radiation levels (potentially 1000+ R/hr near GZ)	STAY SHELTERED — no exceptions, this is the most dangerous period
6-24 hours	FALLOUT CONTINUES	Radiation levels begin declining per 7-10 rule, still extremely dangerous outside	Remain sheltered, ration supplies, monitor radiation if possible
24-48 hours	INITIAL DECAY	Radiation reduced to ~1% of 1-hour level, still dangerous but improving	Brief essential trips possible (<30 min) if absolutely necessary
48+ hours	CONTINUED DECAY	Radiation continues declining, outdoor activity increasingly possible	Follow 7-10 rule, verify with Geiger counter before extending outdoor time

KEY TIMING: You have approximately **10-20 MINUTES** between the blast and fallout arrival. **USE THIS TIME TO GET TO SHELTER.** Every minute counts — the difference between life and death.

The 7-10 Rule: Radiation Decay

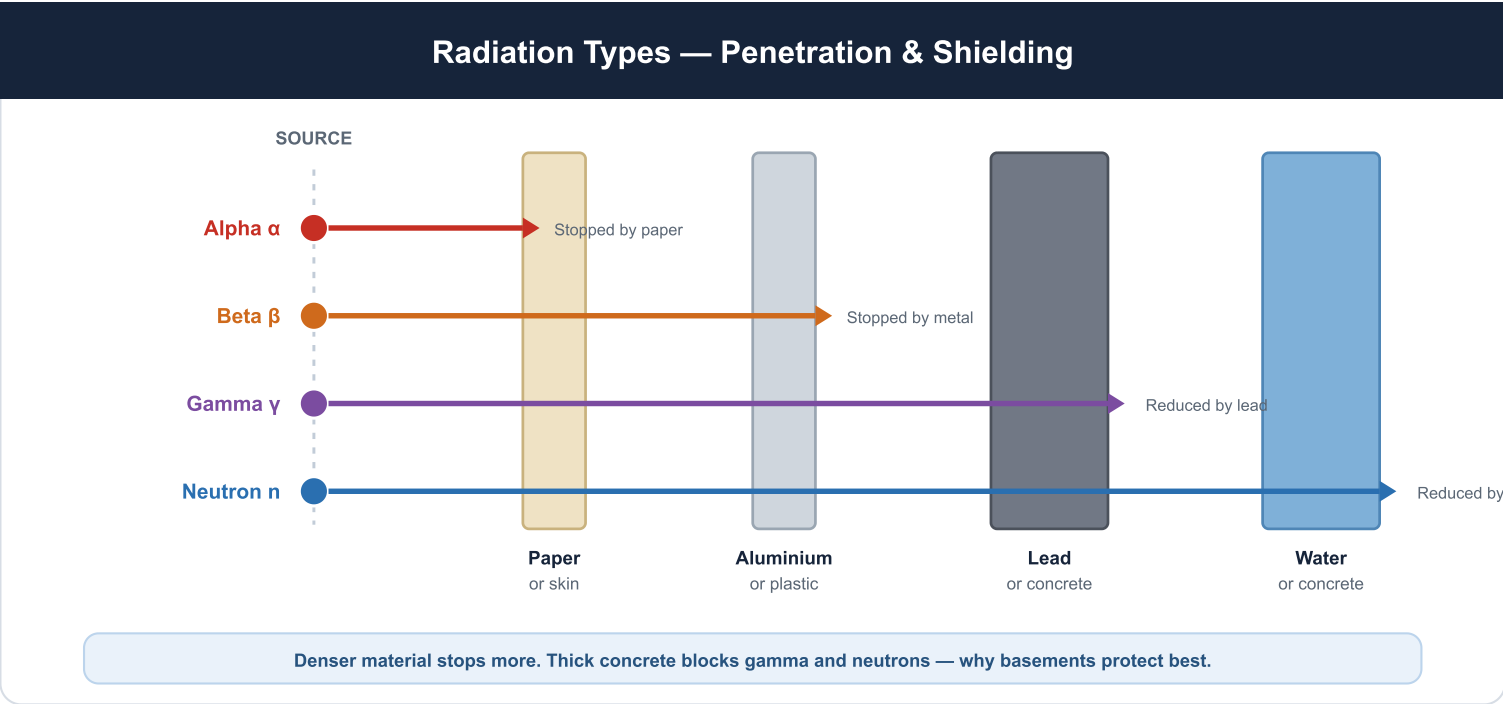
CRITICAL KNOWLEDGE: For every 7-fold increase in time after detonation, radiation decreases by a factor of 10. This is your key to survival timing.

Example: If radiation is 1000 R/hr at Hour 1:

Time After Blast	Radiation Level	Decay Factor	Safety Status
1 hour	1000 R/hr (10,000,000 μ Sv/h)	1×	LETHAL
7 hours	100 R/hr (1,000,000 μ Sv/h)	÷10	EXTREME DANGER
49 hours (~2 days)	10 R/hr (100,000 μ Sv/h)	÷100	HIGH DANGER
343 hours (~2 weeks)	1 R/hr (10,000 μ Sv/h)	÷1000	Relocation Window
2,401 hours (~100 days)	0.1 R/hr (1,000 μ Sv/h)	÷10,000	Manageable

Types of Nuclear Radiation

Understanding Radiation Types: Nuclear weapons and fallout produce four main types of ionizing radiation. Each type has different properties, penetration depths, and shielding requirements. Knowing these differences helps you understand why certain protective measures work.



How far each type of radiation travels and what stops it — denser, thicker material gives better shielding.

Type	What It Is	Penetration	External Hazard	Internal Hazard	Shielding
Alpha (α)	Helium nucleus (2 protons + 2 neutrons), +2 charge	Very low — stopped by paper, skin, few cm of air	Minimal — can't penetrate outer skin layer	EXTREME — if inhaled/ingested, causes severe tissue damage	Paper, clothing, skin

Beta (β)	High-speed electron (β ⁻) or positron (β ⁺)	Low-moderate — stopped by ~1 cm plastic, 1-2 cm tissue	Moderate — can cause skin burns (beta burns), eye damage	High — damages internal organs if ingested	Plastic, glass, aluminium, clothing
Gamma (γ)	High-energy electromagnetic wave (photon), no charge	Very high — penetrates entire body, requires dense shielding	HIGH — whole-body exposure, primary fallout hazard	High — but external exposure is main concern	Lead, steel, concrete, earth, water (thick layers)
Neutron (n)	Uncharged particle from fission/fusion reactions	Very high — passes through lead, stopped by hydrogen-rich materials	SEVERE — 10× more biologically damaging than gamma	Severe — but mainly external (only from active reactions)	Water, plastic, concrete, boron compounds



FALLOUT RADIATION CONCERNS

Primary hazard: GAMMA radiation from fission products on the ground, roofs, and surfaces. This is what your Geiger counter mainly detects.

Secondary hazard: BETA particles cause skin burns (beta burns) if fallout contacts skin. Remove contaminated clothing!

Internal hazard: ALPHA and BETA particles from inhaled/ingested fallout cause severe internal damage. Wear masks, don't eat contaminated food.

Neutrons: Only present during the actual detonation (first second). Not a fallout concern.

✓ WHY DENSE MATERIALS WORK

Gamma rays: Absorbed by electron interactions. Denser materials = more electrons = more shielding. Lead is ideal due to high density.

Neutrons: Slowed by collisions with light atoms (especially hydrogen). Water, plastic, and paraffin are excellent. Lead is actually poor for neutrons!

Practical note: Concrete is good for both — contains water (hydrogen) for neutrons and is dense for gamma. This is why concrete basements offer excellent protection.

Key Takeaway: For fallout protection, focus on GAMMA shielding (dense materials like concrete, earth, lead). For preventing internal contamination, focus on keeping alpha and beta-emitting particles OUT of your body — seal rooms, wear masks, filter water, don't eat contaminated food. Your skin protects you from alpha; clothing and distance protect from beta; dense mass protects from gamma.

Key Radioactive Isotopes to Know

Isotope	Half-Life	Radiation Type	Primary Concern	Protection
Iodine-131	8 days	Beta, Gamma	Thyroid cancer (concentrates in thyroid)	Potassium Iodide (KI) blocks uptake
Cesium-137	30 years	Beta, Gamma	Whole body exposure, muscle tissue	Prussian Blue enhances excretion
Strontium-90	29 years	Beta	Bone cancer (mimics calcium)	Calcium supplements may reduce uptake
Plutonium-239	24,000 years	Alpha	Lung cancer if inhaled, bone if ingested	DTPA chelation therapy

Understanding Radiation & Fallout

 **RADIATION IS INVISIBLE:** You cannot see, smell, taste, or feel radiation. Without a Geiger counter, you have NO WAY to detect it. This is why shelter timing and the 7-10 rule are critical — you must assume danger until enough time has passed.

WHAT IS FALLOUT?

- **Fine radioactive dust/ash** — soil, debris sucked into mushroom cloud
- **Settles like snow or sand** — covers surfaces, roofs, ground
- **Can blow around** — wind redistributes it, rain washes it into drains/soil
- **Particle sizes vary** — larger particles fall first (closer), finer particles travel further
- **Colour:** Grey, white, or sandy — looks like ash or fine grit
- **Danger:** External gamma radiation + internal alpha/beta if inhaled/ingested

FALLOUT BEHAVIOUR

- **Arrives downwind** — check wind direction, fallout plume is elongated
- **Accumulates on horizontal surfaces** — roofs, cars, ground, shoulders
- **Penetrates gaps** — open windows, vents, cracks under doors
- **Sticks to wet surfaces** — rain makes decontamination harder
- **Decays over time** — 7-10 rule applies to the particles
- **Can be washed off** — decontamination removes particles, not the radiation they emit

Fallout: Ground Burst vs Airburst

- **Ground burst:** Fireball touches earth, vaporises soil/debris → HEAVY fallout, dangerous for 100+ km downwind
- **Airburst:** Fireball doesn't touch ground → MINIMAL fallout, mostly weapon residue (90-95% less than ground burst)
- **Visual clue:** Dark "stem" connecting mushroom cloud to ground = ground burst = expect severe fallout. "Floating" cloud = airburst = less fallout but still shelter.

Phase 1: Blast & EMP Timeline by Distance

Physical effects comparison showing **both Ground Burst and Airburst** profiles. Ground burst = more fallout, less blast range. Airburst = less fallout, more blast range.

1 Megaton Reference — Ground Burst vs Airburst

Distance	Ground Burst (Surface)			Airburst (~2.4 km altitude)		
	Wind/Damage	Thermal	Fallout	Wind/Damage	Thermal	Fallout
2 km	500+ mph Total destruction	Instant incineration	N/A (crater)	600+ mph Total destruction	Instant incineration	Minimal
5 km	200+ mph Total destruction	3rd degree burns	Heavy ~2-3 min	300+ mph Total destruction	3rd degree burns	Minimal
7 km	160 mph Severe damage	3rd degree burns	Heavy ~3-4 min	200+ mph Total destruction	3rd degree burns	Minimal
10 km	80 mph Moderate damage	2nd-3rd degree	Heavy ~4-6 min	120 mph Severe damage	3rd degree burns	Minimal
15 km	40 mph Light damage	2nd degree burns	Moderate ~8-12 min	70 mph Moderate damage	2nd-3rd degree	Minimal

25 km	20 mph Windows break	1st degree burns	Light ~15-25 min	35 mph Light damage	2nd degree burns	Minimal
50 km	Minimal blast	Flash only	Trace ~30-60 min	Window cracks	1st degree possible	None

Understanding Overpressure vs Wind Damage

CRITICAL DISTINCTION: Nuclear blast damage is caused primarily by **overpressure** (sudden pressure increase), NOT wind speed alone. A 20 mph normal wind won't break windows, but a 1 psi overpressure wave traveling at 20 mph absolutely will. The pressure differential is what shatters glass and collapses structures.

WHAT IS OVERPRESSURE?

- **Normal air pressure:** ~14.7 psi (pounds per square inch)
- **Overpressure:** Pressure ABOVE normal caused by blast wave
- **1 psi overpressure** = 144 pounds of force per square foot
- **Instantaneous:** Hits in milliseconds, not sustained like weather wind
- **Followed by wind:** High-pressure air rushes outward behind the wave

WHY LOW WIND SPEED STILL CAUSES DAMAGE

- **Pressure differential:** Glass flexes then shatters from uneven pressure
- **Impulse loading:** Sudden force vs gradual — structures can't flex in time
- **Negative phase:** After overpressure comes suction (can pull walls outward)
- **Wind follows:** The wind speed listed accompanies the pressure wave

OVERPRESSURE DAMAGE REFERENCE

Overpressure	Wind Speed	Structural Effects	Human Effects
0.5 psi	~15 mph	Some windows crack or shatter	None — may be knocked down if standing
1 psi	~35 mph	Most windows shatter, light damage to frames	Flying glass injuries likely
2 psi	~70 mph	Window frames blown in, doors damaged, roof tiles displaced	Eardrum rupture possible, thrown by blast
3-5 psi	~100-160 mph	Wood-frame houses collapse, brick walls crack, vehicles overturned	Serious injury from debris, lung damage possible
5-10 psi	~160-290 mph	Reinforced concrete damaged, most buildings destroyed	Fatal injuries likely from displacement and debris
10-20 psi	~290-500 mph	Reinforced concrete destroyed, craters form	Lethal — body cannot survive pressure differential
>20 psi	>500 mph	Only deep bunkers survive	Instantly fatal

 **Reading the Tables Below:** When you see "~1 psi, 35 mph" this means the overpressure wave of 1 psi arrives with winds of approximately 35 mph behind it. The OVERPRESSURE causes the structural damage (windows, walls), while the WIND carries debris and can knock people down. Both are dangerous, but don't confuse nuclear blast wind with normal weather — it's fundamentally different physics.

Multi-Yield Comparison — Ground Burst (Worst-Case Fallout Scenario)

Distance	100kt (Tactical)	500kt (City)	1mt (Strategic)	10mt (Heavy)	50mt (Tsar)
5 km	~10 psi, 290 mph Severe structural 3rd° burns <i>Fallout: 2-3 min</i>	~20 psi, 500+ mph Total destruction 3rd° burns <i>Fallout: 2-3 min</i>	FIREBALL Vaporized	FIREBALL Vaporized	FIREBALL Vaporized
10 km	~3 psi, 70 mph Moderate structural 2nd° burns <i>Fallout: 4-6 min</i>	~7 psi, 120 mph Severe structural 3rd° burns <i>Fallout: 4-6 min</i>	~12 psi, 200+ mph Total destruction 3rd° burns <i>Fallout: 4-6 min</i>	FIREBALL Vaporized	FIREBALL Vaporized
25 km	~1 psi, 35 mph Glass shatters 1st° possible <i>Fallout: 12-18 min</i>	~2 psi, 70 mph Light structural 2nd° burns <i>Fallout: 12-18 min</i>	~5 psi, 160 mph Severe structural 2nd-3rd° burns <i>Fallout: 10-15 min</i>	~12 psi, 200+ mph Total destruction 3rd° burns <i>Fallout: 8-12 min</i>	~20 psi, 300+ mph Total destruction 3rd° burns <i>Fallout: 6-10 min</i>
50 km	Minimal Safe outside <i>Fallout: 25-40 min</i>	~0.5 psi Some glass cracks Flash only <i>Fallout: 20-35 min</i>	~1.5 psi, 40 mph Glass shatters 1st° possible <i>Fallout: 18-30 min</i>	~4 psi, 130 mph Moderate structural 2nd° burns <i>Fallout: 12-20 min</i>	~7 psi, 180 mph Severe structural 3rd° burns <i>Fallout: 10-15 min</i>
100 km	Safe <i>Fallout: 1-2 hrs</i>	Safe <i>Fallout: 50-90 min</i>	Minimal Flash only <i>Fallout: 45-75 min</i>	~1 psi, 35 mph Glass shatters 1st° possible <i>Fallout: 35-60 min</i>	~2.5 psi, 80 mph Light structural 2nd° burns <i>Fallout: 25-45 min</i>

Multi-Yield Comparison — Airburst (Maximum Blast Damage Scenario)

Distance	100kt (Tactical)	500kt (City)	1mt (Strategic)	10mt (Heavy)	50mt (Tsar)
5 km	~15 psi, 300+ mph Total destruction 3rd° burns <i>No local fallout</i>	Near FIREBALL Severe radiation	FIREBALL Vaporized	FIREBALL Vaporized	FIREBALL Vaporized
10 km	~5 psi, 160 mph Severe structural 2nd-3rd° burns <i>No local fallout</i>	~10 psi, 250 mph Total destruction 3rd° burns <i>No local fallout</i>	~15 psi, 300+ mph Total destruction 3rd° burns <i>No local fallout</i>	Near FIREBALL Severe radiation	FIREBALL Vaporized
25 km	~1.5 psi, 45 mph Glass shatters 1st° burns <i>No local fallout</i>	~3.5 psi, 100 mph Moderate structural 2nd° burns <i>No local fallout</i>	~6 psi, 170 mph Severe structural 2nd-3rd° burns <i>No local fallout</i>	~15 psi, 300+ mph Total destruction 3rd° burns <i>No local fallout</i>	~25 psi, 450+ mph Total destruction 3rd° burns <i>No local fallout</i>
50 km	Minimal <i>No local fallout</i>	~1 psi, 35 mph Glass shatters Flash only <i>No local fallout</i>	~2 psi, 70 mph Light structural 1st° burns <i>No local fallout</i>	~6 psi, 170 mph Severe structural 2nd-3rd° burns <i>No local fallout</i>	~10 psi, 250 mph Severe structural 3rd° burns <i>No local fallout</i>
100 km	Safe <i>No local fallout</i>	Safe <i>No local fallout</i>	~0.5 psi Rumble felt Flash only <i>No local fallout</i>	~2 psi, 70 mph Light structural 1st° burns <i>No local fallout</i>	~4 psi, 130 mph Moderate structural 2nd° burns <i>No local fallout</i>

Flash Blindness & Retinal Burns by Yield and Distance

 **EYE DAMAGE IS THE FARTHEST-REACHING INJURY EFFECT:** The blink reflex takes ~0.15-0.25 seconds — too slow to protect against the initial flash. Retinal burns can occur at distances far beyond blast or thermal burn ranges. **NEVER look toward a nuclear flash.**

Yield	Flash Blindness (Temporary)		Retinal Burns (Permanent)		Recovery Time (Flash Blindness)
	Day (Clear)	Night (Clear)	Looking at Fireball	Peripheral Vision	
100 kt	~10 km (6 mi)	~40 km (25 mi)	~25 km (15 mi)	~8 km (5 mi)	Day: 2-10 sec Night: 2-10 min
500 kt	~16 km (10 mi)	~65 km (40 mi)	~40 km (25 mi)	~15 km (9 mi)	Day: 2-30 sec Night: 5-20 min
1 Mt	~21 km (13 mi)	~85 km (53 mi)	~55 km (35 mi)	~20 km (12 mi)	Day: 2-60 sec Night: 10-40 min
10 Mt	~45 km (28 mi)	~180 km (110 mi)	~120 km (75 mi)	~50 km (30 mi)	Day: 10-120 sec Night: 15-40+ min
50 Mt	~80 km (50 mi)	~320 km (200 mi)	~250 km (155 mi)	~100 km (60 mi)	Day: 30-180 sec Night: 20-40+ min

FLASH BLINDNESS (TEMPORARY)

- **Cause:** Bleaching of visual pigments (rhodopsin) in retina by intense light
- **Effect:** Temporary vision loss — like camera flash but much more intense
- **Day vs Night:** Night-adapted eyes have dilated pupils, admit 16× more light
- **Recovery:** Pigment regenerates — seconds (day) to 40+ minutes (night)
- **Danger:** Driving, operating machinery, fleeing to safety — all impaired

RETINAL BURNS (PERMANENT)

- **Cause:** Eye lens focuses thermal energy onto retina, burning tissue
- **Effect:** Permanent blind spot (scotoma) in field of vision
- **Direct view:** Burns central vision — reading, driving severely impaired
- **Peripheral:** Burns edge of retina — less debilitating but still permanent
- **No treatment:** Damage is irreversible — prevention is the only option

✓ Eye Protection Actions:

- **If you see a bright flash:** IMMEDIATELY close eyes, turn away, drop face-down. DO NOT look toward the light.
- **Hands over eyes:** Provides additional protection against continued thermal pulse.
- **Behind cover:** Any opaque object between you and the fireball blocks the dangerous light.
- **Never look at the mushroom cloud:** Even after the initial flash, the fireball remains bright enough to cause damage for several seconds.

Long-Range Effects: 100km to 3000km Downwind

CRITICAL FOR DISTANT POPULATIONS: Even hundreds or thousands of kilometres from a nuclear detonation, you may still be affected by fallout, EMP, or need to take protective action. This section covers what to expect and do at long range.

What Yield Should You Assume? (Practical Guidance)

⚠ YOU CANNOT DETERMINE WEAPON YIELD OR TYPE FROM A DISTANCE. There is no simple way for civilians to identify whether a weapon is 100kt or 1Mt, fission or thermonuclear, ground burst or airburst — especially in the critical first hours when decisions matter most.

WHAT YOU CAN'T KNOW

- **Exact yield:** Fireball size is hard to judge at distance, especially at night
- **Weapon type:** Fission vs thermonuclear looks identical to observers
- **Isotope composition:** Requires laboratory analysis of fallout samples
- **Burst height:** Ground vs airburst is only clear if you see the stem forming
- **Number of weapons:** Multiple smaller weapons can look like one large one

WHAT YOU CAN OBSERVE

- **Direction:** Where did the flash come from?
- **Time to blast wave:** Gives rough distance estimate (~3 sec/km)
- **Mushroom cloud stem:** Dark stem to ground = ground burst = heavy fallout
- **Wind direction:** Are you downwind? Check smoke, flags, clouds
- **Your Geiger counter:** Only reliable way to know if fallout is arriving

✓ **PRACTICAL ASSUMPTION:** For planning purposes, **assume a 500kt-1Mt ground burst** unless you have specific information otherwise. This represents a realistic "modern strategic warhead" scenario and errs on the side of caution for fallout planning. Most current nuclear arsenals contain warheads in the 100kt-800kt range, with some larger weapons still deployed.

Why this assumption works:

- Covers the most common deployed warhead yields (US: ~300-475kt, Russia: ~500-800kt typical)
- Ground burst assumption = worst-case fallout (airburst would mean less fallout, so you're safe either way)
- If the actual weapon is smaller, you've over-prepared (safe). If larger, the tables scale predictably.
- Multiple smaller weapons on one target produce similar fallout to one larger weapon

MODERN NUCLEAR ARSENAL CONTEXT

Nation	Typical Strategic Yield	Typical Tactical Yield	Notes
United States	300-475 kt (W87, W88)	0.3-50 kt (B61 variable)	Trend toward lower yields, higher accuracy
Russia	500-800 kt (typical ICBM)	10-100 kt (various)	Some larger warheads still deployed

China	200-500 kt (estimated)	Unknown	Rapidly modernizing arsenal
UK/France	100-300 kt	N/A	Submarine-based deterrent
Others	10-250 kt (estimated)	Unknown	Less reliable yield estimates

Long-Range Effects — Ground Burst (1 Mt Reference)

Assuming: 1 Mt ground burst, 25 km/h wind speed, you are DOWNWIND of the detonation. Effects scale with yield — double these distances for 10 Mt, halve for 100 kt.

Distance Downwind	Blast/Thermal	Fallout Arrival	Peak Radiation (unshielded)	Shelter Duration	Health Guidance
100 km	None felt Flash visible	4-6 hours	10-100 R/hr (100,000-1M μSv/h)	48-72 hours minimum	Full shelter protocol. KI if available. Seal room, filter air.
250 km	None Flash visible	10-15 hours	1-10 R/hr (10,000-100,000 μSv/h)	24-48 hours	Shelter strongly advised. Limit outdoor exposure. Monitor Geiger.
500 km	None May see glow	20-30 hours	0.1-1 R/hr (1,000-10,000 μSv/h)	12-24 hours	Shelter recommended. Avoid outdoor activity during peak. Cover water.
1000 km	None	40-60 hours	0.01-0.1 R/hr (100-1,000 μSv/h)	Optional (monitor)	Stay informed. Shelter if readings rise. Fallout may be patchy.
2000 km	None	3-5 days	<0.01 R/hr (<100 μSv/h)	Not usually needed	Monitor news. Fallout diluted but may concentrate in rain. Food chain concerns later.
3000 km	None	5-8 days	Trace (<10 μSv/h typical)	Not needed	Long-term food monitoring. Avoid rainwater collection initially. Low acute risk.

Long-Range Effects — Airburst (1 Mt Reference)

Key difference: Airburst produces 90-95% LESS local fallout than ground burst. Main concerns at distance are EMP (if high-altitude) and global fallout (weeks-months later).

Distance	Blast/Thermal	Local Fallout	EMP Risk	Action Required
100 km	None felt Flash visible	Minimal — mostly weapon residue	Moderate (surface burst EMP)	Monitor for fallout. EMP may affect electronics. Less urgent than ground burst.
250 km	None	Negligible	Low-Moderate	Stay informed. Shelter not usually needed unless wind shifts or multiple detonations.
500 km+	None	Negligible	Low (unless HEMP)	Monitor news. Main concern is societal disruption, not direct radiation.

- FALLOUT IS NOT UNIFORM:** These tables show typical values, but fallout distribution is highly irregular:

 - Rain:** Precipitation "washes out" fallout, creating local hotspots under rain clouds — potentially dangerous even far from the blast
 - Wind shifts:** Upper atmosphere winds may differ from surface winds, spreading fallout unpredictably
 - Terrain:** Valleys and depressions can accumulate fallout; hilltops may have less
 - Multiple detonations:** Overlapping fallout plumes create complex patterns
 - Your Geiger counter is the only reliable guide** — these tables are for planning, not precision

⚡ **EMP Effects at Long Range**

- Two types of EMP concern:**
- Surface burst EMP:** Affects electronics within ~50-100 km, rapidly decreasing with distance
 - High-Altitude EMP (HEMP):** Detonation 30-400 km altitude affects continent-scale areas (1000+ km radius)

Distance from Surface Burst	EMP Field Strength	Expected Effects	Protection Needed
<10 km	Extreme (>50 kV/m)	All unprotected electronics destroyed	Faraday cage (may not be sufficient)
10-50 km	High (10-50 kV/m)	Most electronics damaged, vehicles may fail	Faraday cage recommended
50-100 km	Moderate (1-10 kV/m)	Sensitive electronics damaged, power surges	Surge protectors may help, Faraday for critical items
100-200 km	Low (<1 kV/m)	Some sensitive equipment affected, grid instability	Unplug sensitive electronics as precaution
>200 km	Minimal	Unlikely direct damage, possible grid effects	Standard surge protection sufficient

HIGH-ALTITUDE EMP (HEMP) — SPECIAL CASE

- A nuclear weapon detonated at 30-400 km altitude (in space) produces HEMP affecting huge areas:
- Coverage:** 1000-2000+ km radius — a single burst could affect most of a continent
 - No blast/thermal:** Too high for ground effects — EMP is the only direct weapon effect
 - No fallout:** No material lifted from ground — minimal radiation concern
 - Grid collapse:** Long power lines act as antennas, potentially destroying transformers nationwide
 - Cascading failure:** Loss of power = loss of water pumping, fuel distribution, communications, food refrigeration
 - Your Geiger counter survives in Faraday cage** — but there may be little radiation to measure
- HEMP is a societal disruption weapon, not a radiation weapon.** Your survival concerns shift from radiation to infrastructure collapse — water, food, medicine, civil order.

 Health Guidance by Distance (Downwind)

Distance	Immediate Actions (0-6 hrs)	Short-Term (6-72 hrs)	Long-Term (weeks-months)
100 km	Shelter immediately. Seal room. Take KI if available. Do NOT go outside.	Remain sheltered. Monitor Geiger. Ration water. Wait for official guidance or readings to drop.	Avoid locally-grown food. Test water. Monitor for ARS symptoms. Long-term cancer risk elevated.
250 km	Go inside. Close windows. Prepare to shelter. Monitor for fallout arrival.	Shelter if Geiger readings rise. Limit outdoor time. Cover water supplies.	Avoid food from contaminated areas. Rainwater may be contaminated. Monitor official guidance.
500 km	Stay informed. Prepare shelter supplies. No immediate radiation risk.	Shelter if advised. Fallout may arrive 20-30 hours later. Monitor readings.	Be cautious with dairy, leafy vegetables from affected regions. Iodine-131 concern for 8-10 weeks.
1000 km	Monitor news. No immediate action needed unless wind toward you.	Fallout usually diluted. Shelter only if readings indicate. Rain may concentrate fallout.	Food chain monitoring. Cesium-137 and Strontium-90 accumulate in meat and dairy over months.
2000-3000 km	Stay informed. Prepare for societal disruption more than radiation.	Acute radiation risk minimal. Focus on supply chain disruption, refugee movements.	Global fallout (months later) adds small increased dose. Food testing advisable for years.

- ✓ **Key Isotopes and Timing for Long-Range Concern:**
- **Iodine-131 (8-day half-life):** Primary concern for first 8-10 weeks. Take KI, avoid fresh dairy/leafy veg from affected areas.
 - **Cesium-137 (30-year half-life):** Enters food chain via grass → cattle → meat/dairy. Long-term avoidance of affected regions' produce.
 - **Strontium-90 (29-year half-life):** Concentrates in bones. Avoid dairy from affected areas. Calcium supplements may reduce uptake.
 - **Plutonium-239 (24,000-year half-life):** Heavy, doesn't travel far. Only concern if very close to ground zero or in direct fallout path.

 If You're NOT Downwind (Crosswind or Upwind)

- Good news:** If you're crosswind or upwind of a detonation, your fallout risk is dramatically lower. However:
- **Wind can shift:** Upper atmosphere winds may carry fallout in unexpected directions
 - **Multiple detonations:** Other targets may put you downwind of a different blast
 - **Rain:** Fallout can be deposited by rain even outside the main plume
 - **Global fallout:** Fine particles circle the globe — everyone gets some exposure eventually
- Action:** Still monitor your Geiger counter. Still avoid rainwater. Still prepare shelter supplies. Just with less urgency than those directly downwind.

 EMP Protection & Equipment Survival

An Electromagnetic Pulse (EMP) from a nuclear detonation can disable electronics across a wide area. High-altitude bursts (30-400 km) can affect entire countries.

⚠️ EMP EFFECTS BY DISTANCE

- **<5 km:** All electronics destroyed, vehicles disabled
- **5-50 km:** Most unprotected electronics damaged
- **50-200 km:** Sensitive equipment damaged, power grid failures
- **High-altitude (HEMP):** Continent-wide grid collapse possible

✓ FARADAY CAGE PROTECTION

- **Metal bin with lid:** Line with cardboard, tape all seams
- **Microwave oven:** Unplugged, provides ~30dB shielding
- **Aluminium foil:** 3+ layers, completely sealed, no gaps
- **Ammo can:** Rubber seal removed, lined with cardboard

PRIORITY ITEMS FOR EMP PROTECTION

1. **Geiger counter (GMC-800 or GMC-500+)** — Essential for radiation detection
2. **Battery-powered AM/FM/SW radio** — Emergency broadcasts
3. **Torch/flashlight with spare batteries** + glow sticks (backup)
4. **Spare mobile phone** — Even if networks down, stored data useful
5. **USB drives with important documents/maps**
6. **Solar charger/power bank**

⚠️ **EMP RANGE WARNING:** EMP range far exceeds blast and thermal effects. A ground-level burst produces EMP covering ~5-10 km. However, a **high-altitude burst (30-400 km up)** — designed specifically as an EMP weapon — can affect entire continents:

- **40 km altitude:** ~700 km radius affected (~1.5 million km²)
- **100 km altitude:** ~1,100 km radius — covers most of UK or all of Western Europe
- **400 km altitude:** ~2,200 km radius — entire continental USA or Europe
- **Satellites:** Low Earth Orbit (200-2000 km) satellites directly exposed — GPS, Starlink, communications satellites at risk of permanent damage

Key point: You may experience NO blast, NO flash, NO fallout — but ALL electronics fail. If lights/phones/cars suddenly stop working over a wide area with no explanation, assume high-altitude EMP. Retrieve Faraday-stored equipment.

🔧 FARADAY CAGE CONSTRUCTION

- Use solid metal container with tight-fitting lid (galvanized trash can works)
- Line interior with cardboard/cloth - devices **MUST NOT** touch metal
- Wrap items in heavy-duty aluminum foil (2-3 layers)
- Seal all gaps with conductive tape
- **Test:** Place phone inside, try calling - if it rings, seal is inadequate

📊 EQUIPMENT VULNERABILITY

- **HIGH RISK:** Radios, Geiger counters, solar controllers, Starlink, phones, laptops
- **MODERATE:** Vehicles (metal body provides some protection)
- **LIKELY SURVIVE:** Simple lead-acid batteries, unplugged solar panels (~50% efficiency)
- **WILL FAIL:** "Smart" batteries with circuit boards, plugged-in equipment

Phase 2: Shelter - Protection Factor Guide

Protection Factor (PF): How many times the radiation exposure is reduced. PF 40 means you receive 1/40th of the outside radiation dose. Higher = better.

Location	Protection Factor	Notes
Outdoors	PF 1	Full exposure — AVOID
Car/Vehicle	PF 2-3	Minimal protection, only for evacuation
Wood-frame house (centre)	PF 3-5	Poor — stay away from windows/walls
Brick/stone house (centre)	PF 10-20	Moderate — better than nothing
Basement (wood house)	PF 10-20	Good — below ground helps significantly
Basement (brick/concrete)	PF 40-100	Very good — recommended minimum
Underground car park	PF 100-200	Excellent — multiple floors above
Purpose-built shelter	PF 500-1000+	Ideal — Swiss civil defence standard

Protection Factor by Location — Where to Shelter

WORST

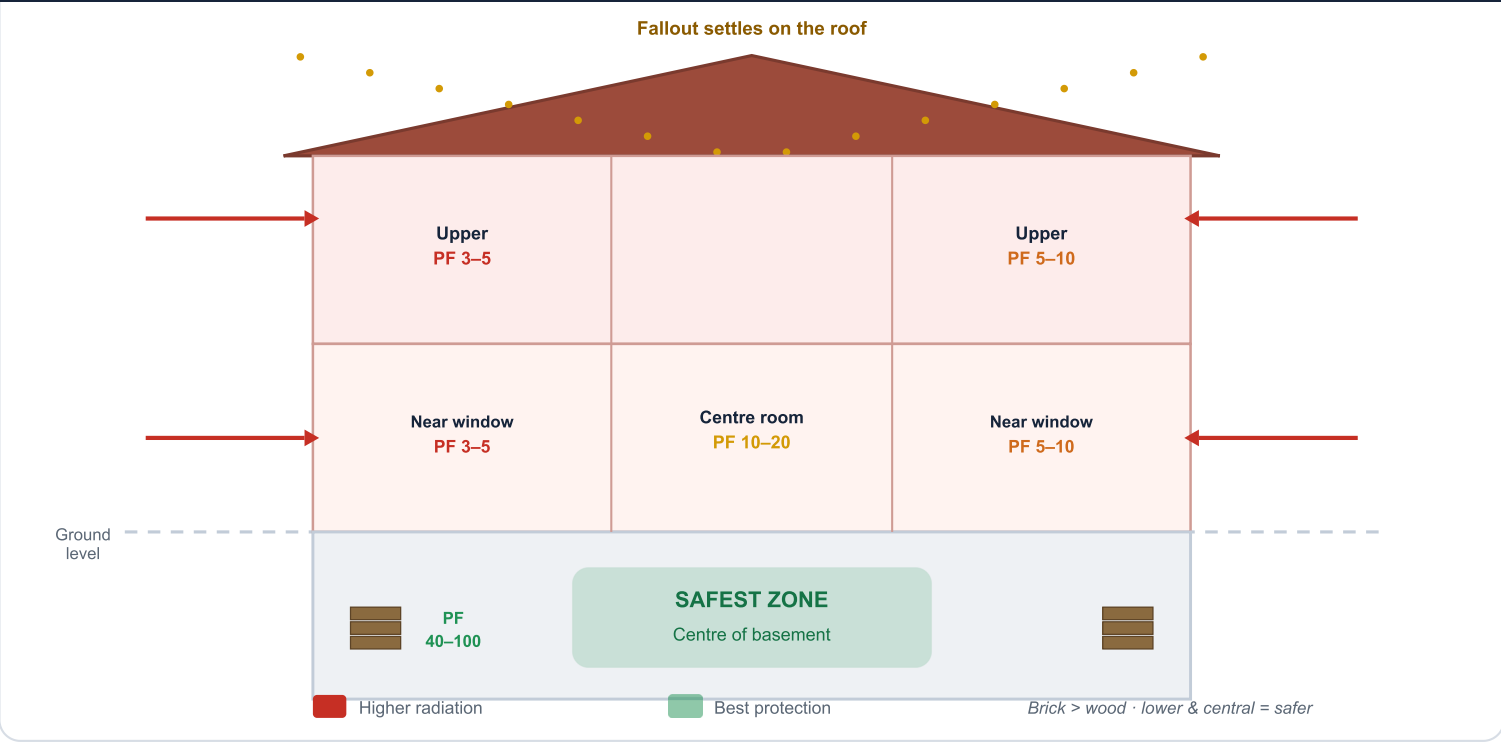
BEST



GOAL: reach PF 10 minimum (90% reduction). Aim for PF 40+ in heavy fallout.

Protection Factor (PF) by location. A higher PF means a greater reduction in the radiation dose you receive.

Shelter Position Matters — Protection by Location in a Building



Where to shelter within a building. The centre of a basement, away from outside walls and the roof, is safest.

Halving Thickness — Shielding Materials

Each "halving thickness" reduces radiation by 50%. Two layers = 75% reduction. Three layers = 87.5% reduction.

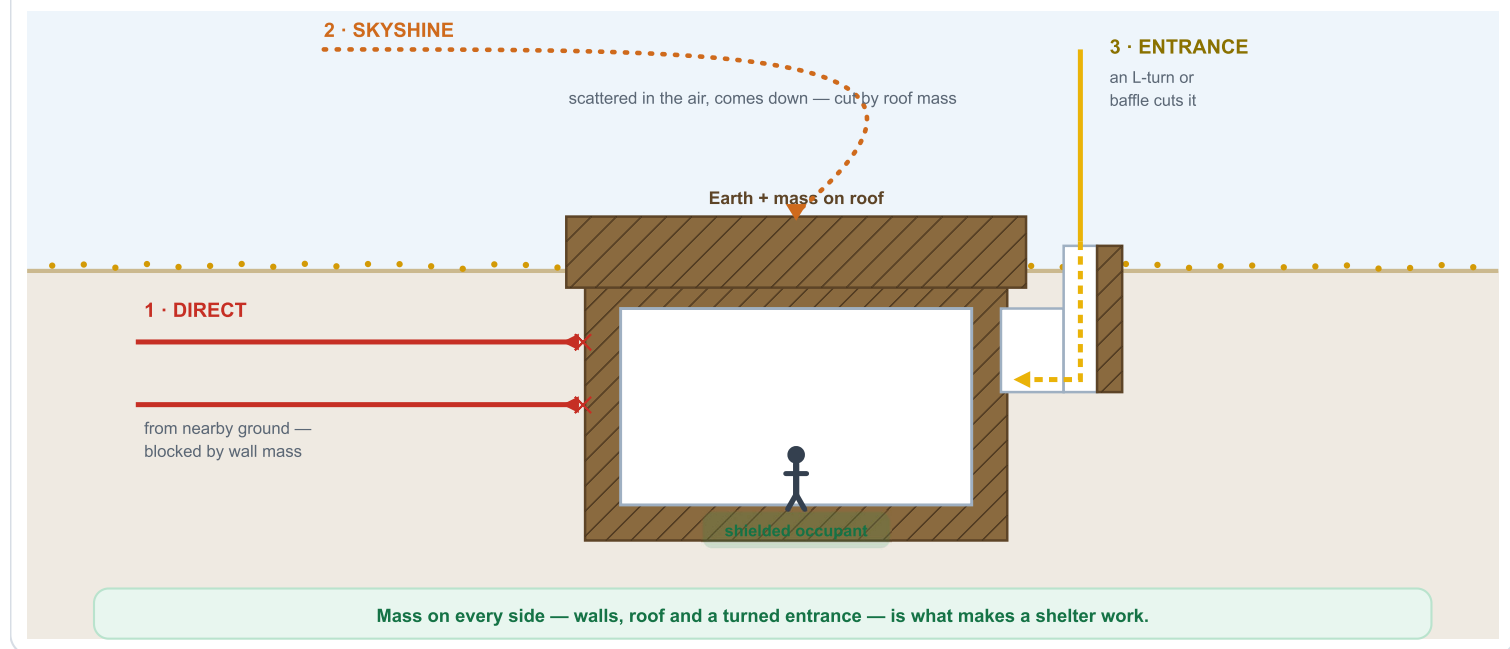
Material	Halving Thickness	For PF 32 (97%)	Practical Notes
Lead	1 cm (0.4")	5 cm (2")	Best, but heavy and expensive
Steel	2.5 cm (1")	12.5 cm (5")	Good — vehicle bodies, filing cabinets
Concrete	6 cm (2.4")	30 cm (12")	Widely available — walls, floors
Packed Earth/Soil	9 cm (3.5")	45 cm (18")	Free — use sandbags, fill containers
Water	18 cm (7")	90 cm (35")	Bathtubs, water containers around shelter
Wood	29 cm (11")	145 cm (57")	Poor — avoid relying on wood alone

- ✓ Quick Shelter Improvement Tips:
- Stack books, furniture, mattresses against walls facing outside
 - Fill bathtub and sinks — water provides shielding and drinking supply
 - Move to room with fewest exterior walls
 - Block windows with earth-filled bags, drawers, or heavy items
 - If no basement: interior cupboard on ground floor is better than open room

Radiation Direction & The Shadow Technique

Gamma radiation travels in straight lines like light. Understanding this helps you position shielding effectively.

How Radiation Reaches a Shelter — The Three Paths



The three routes radiation uses to reach a shelter — and why mass on every side, plus a turned entrance, matters.

HOW RADIATION REACHES YOU

- **Direct radiation:** Straight line from fallout to you (most dangerous)
- **Skyshine:** Radiation scattered downward by atmosphere (~10-20% of dose)
- **Ground scatter:** Radiation bouncing off floors/ground (~5-15% of dose)
- **Wall scatter:** Minimal — gamma mostly passes through or is absorbed
- **Fallout location:** Roof and ground outside are main sources

Key insight: ~70-80% of your dose comes from direct line-of-sight radiation. Block this first.

THE SHADOW TECHNIQUE

- **Principle:** Place mass between you and radiation sources
- **Roof fallout:** Add shielding above you (sandbags on ceiling/floor above)
- **Ground fallout:** Get below ground level OR shield walls facing outside
- **Create a "shadow":** Like blocking sunlight, block radiation paths
- **Central position:** Maximises distance from all exterior surfaces
- **Corner position:** Only 2 walls exposed instead of 4 — natural 50% reduction

Distance Effect: Every metre away from exterior walls reduces dose. Centre of a 10m wide building receives ~50% less radiation than standing against an exterior wall. Basements are ideal because earth shields from ground-level fallout and the floor above shields from roof fallout.

⚠️ **NO FLOOR ABOVE YOU?** If you're on the top floor or in a single-storey building, roof fallout is your biggest threat. You **MUST** create overhead shielding:

- **Improvised ceiling:** Lay doors/tables flat, pile sandbags, soil bags, or water containers on top
- **Lean-to shelter:** Prop doors against wall at 45°, cover with mattresses + heavy items
- **Bathtub shelter:** Get in bathtub, cover with door/mattress, pile books/clothes on top
- **Target:** 12" (30cm) of soil/sand or 23" (58cm) of water/books above you for PF 10

Without overhead protection in a single-storey building, your PF may be only 2-4 even with good wall shielding.

Choosing a Geiger Counter

Essential Features for Nuclear Survival: Your Geiger counter must detect **Gamma, Beta, and X-ray** radiation. It needs sufficient measurement range to tell you when it's safe to go outside, and should be portable with reliable power options.

Key Selection Criteria

Feature	Why It Matters	Minimum Requirement
Radiation Types	Fallout emits gamma (penetrating), beta (skin/ingestion danger), and X-rays	Must detect: Gamma, Beta, X-ray
Upper Measurement Range	Early fallout can exceed 1000 µSv/h — you need to know when levels are dangerously high	Minimum 2,000 µSv/h (ideally higher)
Lower Sensitivity	Need to detect low-level contamination on food, water, surfaces	Should read down to 0.1 µSv/h or lower
Power Options	Batteries may be scarce — USB power extends usability	Replaceable batteries + USB power option
Battery Type	Common batteries easier to find/stockpile	AA, AAA, or 14500 (rechargeable AA-size)
Portability	Must be able to carry during evacuation, check multiple locations	Handheld, pocket-sized preferred

Recommended Models

GMC-800 — BEST VALUE OPTION

- **Detection:** Gamma, Beta, X-ray ✓
- **Range:** 0-2,000 µSv/h (0-200 mR/hr)
- **Battery:** 1× 14500 rechargeable (or AA with adapter)
- **USB:** Charges battery, can run without battery
- **Display:** LCD with real-time µSv/h, CPM, cumulative dose
- **Size:** Pocket-sized, lightweight
- **Price:** £100-150 / \$120-180

Best for: General fallout monitoring, shelter readings, day 2+ outdoor checks, contamination detection

GMC-500+ (PLUS) — ADVANCED OPTION

- **Detection:** Gamma, Beta, X-ray ✓
- **Range:** 0-42,500 µSv/h (0-4,250 mR/hr) — *dual tube!*
- **Battery:** 2× AA replaceable
- **USB:** Can run directly from USB power without batteries
- **Display:** Large LCD, multiple display modes
- **Size:** Slightly larger than GMC-800
- **Price:** £180-250 / \$220-300

Best for: Early fallout (day 1-2), high contamination areas, professional use, extended monitoring

⚠ Why Upper Range Matters:

- If your meter maxes out at 2,000 µSv/h and reads that value, actual levels could be much higher — **DO NOT GO OUTSIDE**
- The GMC-500+ with 42,500 µSv/h range can measure early fallout peaks more accurately
- Either model will accurately measure shelter levels and outdoor levels after day 2-3 when radiation has decayed
- At maximum reading, assume conditions are worse than displayed — wait for decay

✓ Pre-Event Preparation:

- Store your Geiger counter in a **Faraday container** (metal box lined with cardboard) to protect from EMP
- Keep spare batteries (14500 for GMC-800, AA for GMC-500+) in the same container
- Practice using it NOW — learn the buttons, modes, and what readings mean
- Record your local background radiation (typically 0.1-0.3 µSv/h) for comparison

Using Your GMC-800 / GMC-500+ Geiger Counter

Your Geiger counter is your most critical survival tool. It shows you what you cannot see, smell, or feel. Learn these readings BEFORE an emergency.

Reading Interpretation — Dose Rate

GMC-800 Reading	Roentgen Equivalent	Status	Action Required
<0.5 µSv/h	<0.00005 R/hr	Normal Background	No action — safe to move freely
0.5-10 µSv/h	0.00005-0.001 R/hr	Slightly Elevated	Monitor — may be natural variation
10-100 µSv/h	0.001-0.01 R/hr	Elevated	Limit exposure time, seek better shelter
100-1,000 µSv/h	0.01-0.1 R/hr	High	Shelter immediately, minimize time outside

1,000-10,000 µSv/h	0.1-1 R/hr	Very High	Maximum shielding, only essential movement
> 10,000 µSv/h	> 1 R/hr	Extreme/Lethal	Do NOT exit shelter — wait for decay

Cumulative Dose Thresholds — What Matters for Health

Total Dose	Effect	Recovery
< 100 mSv (10 rem)	No immediate symptoms	Full recovery, slight increased cancer risk
100-500 mSv (10-50 rem)	Mild nausea possible, blood changes	Full recovery expected
500-1,000 mSv (50-100 rem)	Nausea, fatigue, blood count drop	Recovery likely with rest and fluids
1,000-2,000 mSv (100-200 rem)	Acute Radiation Syndrome (mild)	Medical treatment improves outcomes
2,000-6,000 mSv (200-600 rem)	Severe ARS — hair loss, bleeding	50% fatal without treatment (LD50 ~4,500 mSv)
> 6,000 mSv (>600 rem)	Fatal ARS — GI and CNS damage	Almost always fatal even with treatment

 **GEIGER COUNTER SATURATION WARNING**

All Geiger counters may **saturate** (show lower false readings) at extremely high dose rates. The GMC-800 saturates above ~100 mR/hr (2,000 µSv/h). The GMC-500+ handles up to ~4,250 mR/hr (42,500 µSv/h). If the counter clicks continuously without pauses, assume lethal conditions even if the number displayed seems moderate.

 **TRACKING YOUR DOSE**

Log readings every hour. Calculate cumulative exposure: (µSv/h × hours) = total µSv. Keep total under 100,000 µSv (100 mSv) if possible over first week. Prioritize shelter during high readings.

GMC-800 / GMC-500+ Usage Tips

- **Spare batteries:** Keep fresh batteries in Faraday protection — GMC-800 uses 14500 (or AA with adapter), GMC-500+ uses 2×AA
- **Survey technique:** Move the detector slowly (~1 second per position) for accurate readings
- **Contamination check:** Hold 1-2 cm from surfaces to check for fallout particles
- **Audio mode:** Use clicking sound to quickly identify hot spots without watching screen
- **Background baseline:** Know your normal background reading (typically 0.1-0.3 µSv/h)
- **False positives:** Some foods (bananas, brazil nuts), granite, smoke detectors trigger minor readings
- **USB power:** Both models can run from USB power — useful for extended monitoring without draining batteries

 Radiation Unit Conversion Table

Your GMC-800 or GMC-500+ Geiger counter typically displays in **µSv/h (microsieverts per hour)**. Use this table to convert between common units found in different references.

Unit	Equivalent To	Conversion Factor	Notes
1 Sv (Sievert)	1,000 mSv = 1,000,000 µSv = 100 rem	×1,000,000 → µSv	Large doses, acute exposure

1 mSv (millisievert)	1,000 μSv = 0.001 Sv = 100 mrem	×1,000 → μSv	Annual limits, medical imaging
1 μSv (microsievert)	0.001 mSv = 0.1 mrem	GMC-800 native unit	Your Geiger counter display
1 rem	10 mSv = 10,000 μSv	×10,000 → μSv	Older US/military documents
1 mrem (millirem)	0.01 mSv = 10 μSv	×10 → μSv	US occupational limits
1 R (Roentgen)	≈ 10 mSv = 10,000 μSv (for gamma)	×10,000 → μSv	Older civil defense documents
1 Gy (Gray)	≈ 1 Sv = 1,000,000 μSv (for gamma/beta)	×1,000,000 → μSv	Absorbed dose (medical)

QUICK REFERENCE: COMMON DOSE LEVELS IN MSV

Exposure	Dose	GMC-800 Reading
Normal background (per hour)	0.1-0.3 μSv/h	0.1-0.3 μSv/h
Chest X-ray (single)	100 μSv total	-
CT scan (chest)	7,000 μSv total	-
Annual public limit	1,000 μSv/year (1 mSv)	~0.11 μSv/h continuous
Occupational limit (annual)	50,000 μSv/year (50 mSv)	~5.7 μSv/h (work hours)
Emergency worker limit (life-saving)	250,000 μSv (250 mSv)	-
Mild radiation sickness threshold	500,000 μSv (500 mSv = 0.5 Sv)	Sustained high readings
Severe ARS threshold	1,000,000 μSv (1 Sv = 100 rem)	EVACUATE
LD50 (50% fatal without treatment)	4,000,000 μSv (4 Sv = 400 rem)	LETHAL ZONE

- GMC-800 Interpretation:**
- <0.5 μSv/h: Normal/Safe - background radiation
 - 0.5-10 μSv/h: Elevated - monitor, limit time outdoors
 - 10-100 μSv/h: High - limit exposure to 15-30 min/day
 - 100-1,000 μSv/h: Dangerous - emergency exits only
 - >1,000 μSv/h: Extreme - stay sheltered, life-threatening exposure in hours

 Water Purification (Including Radioactive Contamination)

 **CRITICAL:** Fill all containers IMMEDIATELY after blast — water pressure may fail within hours. Stored water before the event is SAFE. Tap water after fallout begins is NOT.

Contamination Types & Treatment

Contamination	Treatment Method	Effectiveness	Notes
---------------	------------------	---------------	-------

Biological (bacteria, viruses)	Boiling 1 min (rolling boil)	99.9%+	Or use purification tablets, bleach (8 drops/gallon)
Particulate fallout	Filtering (cloth, sand, charcoal)	90-99%	Removes radioactive PARTICLES, not dissolved isotopes
Dissolved radioactive isotopes	Distillation	99%+	Only reliable method for dissolved contamination
Iodine-131	Wait 80 days (10 half-lives)	99.9%	Decays naturally — store water in sealed containers

Emergency Water Sources (Priority Order)

1. **Pre-stored water** — Sealed before event = SAFE
2. **Hot water tank** — Turn off electricity/gas first, drain from bottom valve
3. **Toilet cistern** — Tank water only (NOT bowl), if no chemical cleaners used
4. **Canned fruit/veg liquid** — Sealed = safe
5. **Deep well water** — Underground sources less contaminated
6. **Covered rain barrels** — If covered before fallout, may be usable
7. **Running streams** — After 2+ weeks, if upstream of contamination

DIY Distillation Method:

1. Large pot with contaminated water on heat source
2. Smaller pot or bowl floating/raised in center
3. Inverted lid on large pot (handle pointing down into small pot)
4. Heat to boiling — steam condenses on lid, drips into collection bowl
5. Result: Pure water (dissolved radioactive isotopes left behind in main pot)

EFFECTIVE DECONTAMINATION METHODS

- **Earth Filtration:** MOST EFFECTIVE field method. Filter through 6+ inches of packed soil/sand.
- **Reverse Osmosis (RO):** Excellent - removes most radionuclides. Needs power.
- **Ion Exchange:** Effective for Cesium-137 and Strontium-90.
- **Activated Carbon:** Good for radioactive iodine. Combine with other methods.
- **Distillation:** Removes most contaminants but NOT radioactive gases.
- **Settling:** Let sit 24-48 hrs, decant top 80%.

NOTE: Fallout-contaminated rainwater becomes safer over time as radioactive iodine decays (8-day half-life). After 2-3 weeks, iodine contamination is minimal.

 Air Quality & Respiratory Protection

Fallout particles in the air are a serious threat — inhaled or ingested radioactive particles cause internal exposure that continues damaging tissue from inside.

Respiratory Protection Hierarchy

Protection Level	Equipment	Effectiveness
Best	Full-face respirator with P100/HEPA filters	99.97% of particles ≥0.3 μm
Very Good	Half-face respirator with P100 filters	99.97% (but no eye protection)

Good	N95/FFP2 mask (properly fitted)	95% of particles $\geq 0.3\text{ }\mu\text{m}$
Moderate	Surgical mask	~60-80% (loose fit)
Minimal	Wet cloth/t-shirt over nose and mouth	~30-50% (better than nothing)

Eye Protection

- **Best:** Sealed safety goggles — prevents fallout particles entering eyes
- **Good:** Swim goggles — sealed, widely available
- **Moderate:** Safety glasses with side shields
- **Improvised:** Cut transparent plastic (from bottles, packaging) and tape across eyes — not ideal but better than nothing

Improvised Goggles: If no goggles available, cut clear plastic from a water bottle or food packaging. Hold over eyes and secure with tape around edges. This blocks particles but limits peripheral vision — use only when necessary.

Sealing a Room

1. **Choose an interior room** with fewest windows/vents
2. **Tape plastic sheeting** (bin bags, shower curtains) over windows
3. **Seal gaps under doors** with wet towels
4. **Cover vents and chimneys** with plastic and tape
5. **Turn off HVAC/ventilation systems** — they circulate outside air
6. **Create a HEPA filter:** Tape HEPA filter over a box fan (intake side)

Duration: Maintain seal for minimum 24 hours, ideally 48-72 hours. After this, fallout levels drop significantly. Ventilate BRIEFLY only when Geiger readings show it's safer outside, then reseal.



Breathable Air: Sealed Room Survival Time

If you seal a room to keep out fallout dust, CO₂ buildup becomes your limit. (Assumes 2m ceiling height, sitting still, minimal activity)

Room Size	2 People	4 People	6 People	10 People	20 People	30 People
12 m ² (24 m ³)	12 hrs	6 hrs	4 hrs	2.5 hrs	1 hr	48 min
20 m ² (40 m ³)	20 hrs	10 hrs	6.5 hrs	4 hrs	2 hrs	1.3 hrs
36 m ² (72 m ³)	36 hrs	18 hrs	12 hrs	7 hrs	3.5 hrs	2.4 hrs
50 m ² (100 m ³)	50 hrs	25 hrs	16 hrs	10 hrs	5 hrs	3.3 hrs
100 m ² (200 m ³)	100 hrs	50 hrs	33 hrs	20 hrs	10 hrs	6.6 hrs

Formula: Safe time (hours) = **(Room volume in m³) ÷ (Number of people)**

This assumes ~1 m³ of air per person per hour before CO₂ reaches dangerous levels (3-4%). At rest, a person produces ~0.2 L/min of CO₂.

Room volume = floor area × ceiling height.

Example: 30 m² room × 2.5m ceiling = 75 m³ ÷ 5 people = **15 hours** safe time.

Strategy: If air feels stuffy, do NOT open outside door. Crack internal door to draw air from rest of house. Use HEPA filter or wet cloth over vents for limited fresh air intake.

 **GAS COOKER/HEATER WARNING:** NEVER use gas appliances (cookers, heaters, BBQs, camping stoves) in a sealed room. They consume oxygen rapidly and produce carbon monoxide (CO) — an odourless, invisible gas that kills. A single gas ring uses as much oxygen as 10 people. CO poisoning symptoms: headache, dizziness, nausea, confusion, then unconsciousness and death. If you must cook, ensure ventilation or use only for brief periods with door cracked.



Decontamination Procedures

REMOVING OUTER CLOTHING ELIMINATES UP TO 90% OF RADIOACTIVE CONTAMINATION

⚠ Decontamination removes radioactive **PARTICLES** from surfaces. It does **NOT** reduce radiation already absorbed by the body. Act quickly — particles on skin continue emitting radiation.

Personal Decontamination (Priority Order)

1. **Remove outer clothing** immediately upon entering shelter — this removes ~90% of external contamination. Bag it, seal it, put it outside or in a far corner.
2. **Remove shoes** — these track in fallout. Leave them outside or bag them.
3. **Shower or wash thoroughly** — lukewarm water (not hot — opens pores). Shampoo hair 3+ times. Do NOT use conditioner (binds particles to hair).
4. **Blow nose, clean ears** — particles collect in nasal passages and ear canals.
5. **Brush teeth, rinse mouth** — do NOT swallow.
6. **Use Geiger counter** to check — rescan hair, hands, face after washing.
7. **Clean under fingernails** — use nail brush or file.
8. **Put on clean clothes** from sealed storage.

Pet Decontamination

- Brush coat **OUTSIDE** or in separate room
- Wash with soap and water if possible
- Do not allow pets that were outside to lick themselves or others

Surface Decontamination

- **Smooth surfaces:** Wipe with damp cloth (dispose of cloth safely)
- **Floors:** Wet mop, do NOT sweep (spreads particles into air)
- **Carpets:** Vacuum with HEPA filter, then dispose of bag carefully
- **Food prep surfaces:** Soap and water, rinse, check with Geiger
- **Vehicles:** Hose down exterior before entering, remove floor mats

Disposal: All contaminated items (clothing, cleaning cloths, mop water) should be sealed in plastic bags and stored away from living areas — bury outside at least 1 metre deep if possible after radiation levels drop.

☢ Radiation Injury & Medical Response

ACCUMULATED DOSE THRESHOLDS

- **100 mSv (100,000 µSv):** Cancer risk begins to increase measurably
- **500 mSv:** Mild radiation sickness possible

- **1,000 mSv (1 Sv):** Acute Radiation Syndrome - seek medical care immediately
- **4,000 mSv:** LD50 (50% fatality rate without treatment)
- **6,000+ mSv:** Near 100% fatal without intensive medical intervention

Acute Radiation Syndrome (ARS) Stages

Phase	Timing	Symptoms	What It Means
Prodromal	Minutes to hours	Nausea, vomiting, diarrhoea, fatigue	Earlier onset = higher dose. Vomiting <1 hour = very serious.
Latent	Hours to weeks	Patient feels better, symptoms subside	Deceptive "walking ghost" phase — damage is progressing internally.
Manifest Illness	Days to weeks	Infection, bleeding, hair loss, GI damage	Bone marrow failure, immune collapse. Requires medical intervention.
Recovery or Death	Weeks to months	Gradual improvement or organ failure	Depends on dose, treatment, and individual factors.

Vomiting Onset — Dose Estimation

Time to Vomiting After Exposure	Estimated Dose	Prognosis
>4 hours or no vomiting	<1 Gy (100 rem)	Likely survivable without medical intervention
2-4 hours	1-2 Gy (100-200 rem)	Survivable with supportive care
1-2 hours	2-4 Gy (200-400 rem)	Serious — requires medical treatment
30 min - 1 hour	4-6 Gy (400-600 rem)	Severe — intensive care needed, ~50% fatal
<30 minutes	>6 Gy (>600 rem)	Critical — likely fatal even with treatment

Treatment Priorities (What You Can Do)

SUPPORTIVE CARE

- **Hydration:** Essential — vomiting and diarrhoea cause fluid loss
- **Electrolytes:** Oral rehydration salts, sports drinks, or improvised (salt + sugar + water)
- **Rest:** Energy conservation is critical for recovery
- **Clean environment:** Infection is the major killer — maintain hygiene
- **Nutrition:** Bland, easy-to-digest foods when able to eat

MEDICAL SUPPLIES TO PRIORITIZE

- **Potassium iodide (KI):** Blocks thyroid uptake of I-131. Take BEFORE or within 4 hours of exposure.
- **Anti-emetics:** Ondansetron, metoclopramide — control nausea
- **Antibiotics:** For infections when immune system is compromised
- **Antidiarrhoeals:** Loperamide — manage fluid loss
- **Wound care supplies:** Bandages, antiseptic — healing is slow after radiation

⚠️ **POTASSIUM IODIDE (KI) DOSAGE**

Age	Dose	Duration
Adults (18+)	130 mg	Daily until exposure ends
12-18 years	65 mg	Daily until exposure ends
3-12 years	65 mg	Daily until exposure ends
1 month - 3 years	32 mg	Daily until exposure ends
Newborn - 1 month	16 mg	Single dose only (thyroid sensitivity)

Note: KI ONLY protects the thyroid from radioactive iodine. It does NOT protect against other isotopes or external radiation. Not effective if taken more than 24 hours after exposure.

 Evacuation Decision Making

⚠️ Evacuating at the wrong time can be MORE dangerous than sheltering. Use your Geiger counter and these guidelines to make informed decisions.

When to Shelter vs Evacuate

Scenario	Action	Reasoning
First 24-48 hours after blast	SHELTER	Radiation levels are highest — stay inside
Readings stable <10 µSv/h outdoors	Consider evacuation	Safe for brief travel — wear protection
Readings 10-100 µSv/h outdoors	Shelter preferred	Evacuate only if travel <1 hour and shelter at destination is better
Readings >100 µSv/h outdoors	SHELTER	Too dangerous to travel — wait for decay
Better shelter available nearby	Quick move (2-5 min)	Worth brief exposure for significant protection improvement

Evacuation Route Planning

- **Move perpendicular to wind** — not directly upwind or downwind (fallout plume is elongated)
- **Avoid valleys and low ground** — fallout can accumulate in depressions
- **Have 3+ route options** — roads may be blocked, bridges damaged
- **Travel in sealed vehicle** — windows closed, ventilation off (external mode)
- **Cover skin completely** — long sleeves, gloves, hat, mask, goggles
- **Monitor with Geiger counter** — avoid driving through hot spots
- **Destination must be better** — don't leave good shelter for worse

Food Safety & Contamination

Food Safety Hierarchy

Category	Examples	Safety	Notes
Sealed before event	Tinned goods, sealed bottles, vacuum-packed	SAFE	Wash/wipe exterior before opening
Refrigerator/freezer (sealed)	Food in sealed containers, wrapped	SAFE	Fallout cannot enter sealed appliances
Unwrapped but covered	Food in cupboards, covered bowls	Probably safe	Check with Geiger if possible, wash thoroughly
Exposed indoors	Open containers, fruit bowls	Risk	May have fallout particles — wash or discard
Exposed outdoors	Gardens, outdoor markets	CONTAMINATED	Do NOT eat — fallout directly on surface

Processing Contaminated Food (Emergency Only)

- **Washing:** Removes surface particles — use clean water, peel skins
- **Boiling:** Does NOT remove radioactivity (only kills germs) — but may redistribute isotopes into water (discard water)
- **Outer layers:** Remove and discard outer leaves of vegetables, peel fruits
- **Meat:** Remove bone (strontium-90 concentrates in bone) and outer fat layer
- **Root vegetables:** Higher risk — absorb isotopes from soil. Peel thickly.

Priority: Eat uncontaminated stored food first. Only consider processing contaminated food if facing starvation. Even then, choose items with lowest contamination (sealed packages, items from deep storage).

Hunting/Growing After Fallout

- **Animals:** Avoid organ meat (concentrates radiation). Muscle meat from healthy-looking animals is safer. Cook thoroughly.
- **Growing:** Remove 5-10 inches of topsoil OR plow fallout under before planting. Greenhouse with plastic sheeting provides some protection.
- **Avoid:** Leafy vegetables (surface contamination), milk from grazing animals (Iodine-131, Strontium-90)

Psychological Preparation & Group Dynamics

Survival is as much psychological as physical. Mental preparedness, calm decision-making, and group cohesion can mean the difference between life and death.

MAINTAIN ROUTINE

- Keep regular sleep/wake cycles
- Assign tasks and responsibilities
- Maintain meal times (even if rations)
- Create a schedule for watch duties
- Include rest and recreation periods
- Stay informed via radio — reduces uncertainty
- Limit constant disaster news — increases stress

SUPPORT EACH OTHER

- Talk about fears — don't suppress
- Share information honestly
- Watch for signs of panic or despair
- Keep children occupied and reassured
- Celebrate small victories
- Physical activity when safe — helps stress
- Focus on controllables: supplies, tasks

Group Leadership & Conflict Resolution

- **Designate leader:** Clear decision-making reduces conflict
- **Assign tasks:** Everyone contributes, everyone has purpose
- **Ration fairly:** Visible, equal distribution prevents suspicion
- **Schedule alone time:** Even brief privacy reduces tension
- **Address conflicts early:** Small issues become dangerous under stress

Signs of Acute Stress Reaction

- **Dissociation:** Feeling detached, "unreal," or numb
- **Hypervigilance:** Excessive alertness, startling easily
- **Intrusive thoughts:** Flashbacks, nightmares about the event
- **Avoidance:** Refusing to discuss the situation or participate
- **Physical symptoms:** Rapid heartbeat, sweating, trembling, shortness of breath

Signs of Crisis (Seek Help/Monitor Closely)

- Talking about suicide or wanting to die
- Extreme withdrawal or aggression
- Delusions or break from reality
- Inability to care for basic needs
- Giving away possessions

Children's Psychological Needs

- Honest, age-appropriate explanations
- Maintain comfort objects (toys, blankets)
- Games, drawing, storytelling for normalcy
- Physical contact and reassurance
- Expect regression (bedwetting, clinginess) — this is normal

✓ **Coping Strategies:** Deep breathing exercises, grounding techniques (name 5 things you see, 4 you hear, 3 you feel, 2 you smell, 1 you taste), physical activity when safe, journaling, maintaining hope through planning for the future.

Long-Term Survival (Weeks to Months)

Shelter Timeline & Recovery Phases

Time After Blast	Radiation Level*	Activity Allowed	Priority Actions
0-1 hour	1000 R/hr (10,000,000 μ Sv/h)	STAY INSIDE. No exceptions.	Seal room, decontaminate, hydrate
1-7 hours	~100 R/hr (1,000,000 μ Sv/h)	STAY INSIDE. Emergency only.	Monitor radiation, ration supplies
7-49 hours	~10 R/hr (100,000 μ Sv/h)	Brief trips (<30 min) if essential	Short waste disposal, gather supplies
2-14 days	~1 → 0.1 R/hr (10,000 → 1,000 μ Sv/h)	Increasing outdoor time possible	Decontaminate area, source food/water
2-4 weeks	<0.1 R/hr (<1,000 μ Sv/h)	4+ hours/day outdoor work	Sweep/wash fallout into trenches
1-3 months	<0.01 R/hr (<100 μ Sv/h)	Near normal activity	Still sleep in shelter if possible

*Assumes heavy fallout area (ground burst). Lighter areas recover faster. ALWAYS verify with Geiger counter. Conversion: 1 R/hr $\approx$ 10,000 μ Sv/h

Shelter Sanitation & Waste Disposal

- **Toilet with gravity sewage:** Will work with bucket flush (pour 1 gal into bowl)
- **Bucket toilet:** 5-gal bucket with seat, plastic bag liner, near air exhaust
- **Keep tightly covered** when not in use (fly prevention critical)
- **Separate urine if possible** — Less odor, easier disposal
- **Add small amount of dirt/ash** after each use to reduce smell
- **When full:** Tie bag, place outside shelter in covered container

FLY & PEST CONTROL (CRITICAL)

Fly populations will EXPLODE after nuclear event (dead animals, compromised sanitation). Flies spread disease that kills weakened survivors.

- **Keep all waste covered** at all times
- **Fly bait:** Sprinkle on waste container lid
- **Screen vents/openings** with mesh
- **Locate toilet at exhaust end** of shelter

Timeline Expectations

Period	Conditions	Priorities
Day 1-3	Maximum danger, shelter essential	Stay inside, ration supplies, monitor radiation
Day 3-14	Radiation declining but still dangerous	Brief foraging trips possible, decontaminate on return
Week 2-4	Safe for longer outdoor activities	Gather resources, assess damage, make contact with others

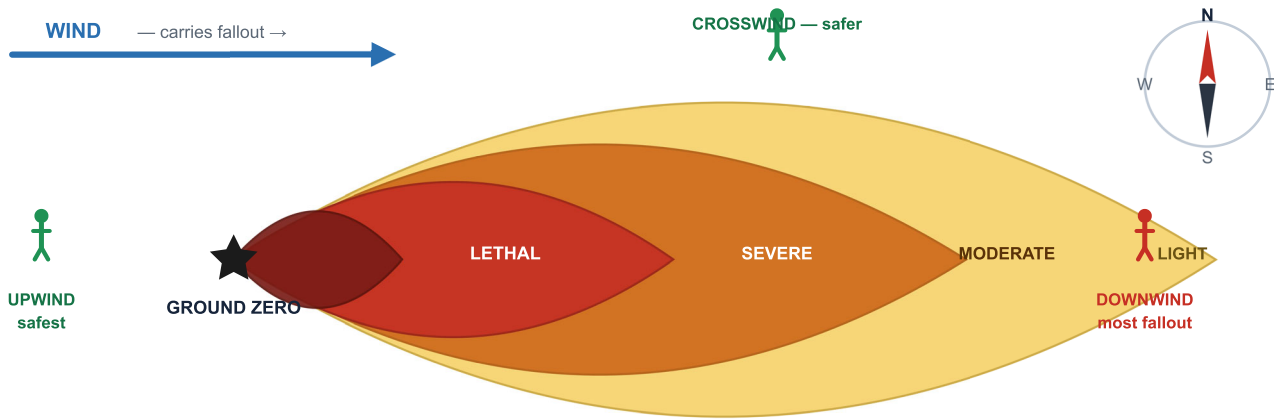
Month 1-3	Long-term shelter concerns	Establish sustainable water/food, build community
Months 3+	New normal — long-term isotopes remain	Avoid contaminated zones, monitor food sources

Key Long-Term Concerns

- **Cesium-137:** 30-year half-life — contaminates soil for decades. Avoid eating locally grown food until tested.
- **Strontium-90:** 29-year half-life — concentrates in bones. Avoid dairy from contaminated areas.
- **Groundwater:** May remain safe longer than surface water — test with Geiger if possible.
- **Medical supplies:** Preserve antibiotics, wound care items — no resupply.
- **Social order:** Cooperate with neighbours, establish communication, share resources.

📖 Fallout Patterns & Wind

Wind Direction Is Critical — Stay Out of the Plume



If you are downwind, move CROSSWIND (90° to the wind) to leave the plume — not straight away from it.

Fallout travels downwind. If you are caught downwind, move crosswind (at 90° to the wind) to leave the plume.

Key Fallout Facts:

- Fallout plume extends primarily DOWNWIND — 100-500+ km depending on yield and wind speed
- Width of plume: typically 20-80 km for a 1Mt weapon
- Heavier particles fall first (closest) — finer particles travel further
- Rain "washes out" fallout — localized hot spots under rain clouds
- Wind shifts change plume direction — monitor weather if possible



Quick Reference Tables

Unit Conversions

Unit	Equivalent	Use
1 Sievert (Sv)	100 rem = 1,000 mSv = 1,000,000 μSv	Modern SI unit for biological dose
1 rem	0.01 Sv = 10 mSv = 10,000 μSv	Older US unit, still common in literature
1 Roentgen (R)	≈ 0.01 Sv ≈ 10 mSv (for gamma)	Exposure unit — roughly equals rem for gamma
1 Gray (Gy)	= 1 Sv (for gamma/beta) = 100 rad	Absorbed dose — same as Sv for gamma

7-10 Rule Quick Reference

Time	Multiplier	Example (if H+1 = 1000 R/hr)
1 hour (H+1)	×1	1000 R/hr
7 hours	×0.1	100 R/hr
2 days (49 hr)	×0.01	10 R/hr
2 weeks (343 hr)	×0.001	1 R/hr
3 months (2401 hr)	×0.0001	0.1 R/hr

Action Thresholds

Reading	Action
<0.5 μSv/h	Normal — no action needed
0.5-10 μSv/h	Monitor — slight elevation
10-100 μSv/h	Limit outdoor time, seek better shelter
100-1000 μSv/h	Shelter essential — minimize exposure
1000-10,000 μSv/h	Maximum shielding — do not go outside
>10,000 μSv/h	LETHAL — remain in best available shelter

Emergency Radio Frequencies (UK)

Service	Frequency	Notes
---------	-----------	-------

BBC Radio 4	198 kHz LW / 92-95 FM	Primary emergency broadcast station
BBC World Service	Multiple SW frequencies	International news if UK stations down
PMR446	446.0-446.2 MHz	Licence-free walkie-talkies for local comms
Amateur Radio	2m (144-146 MHz), 70cm (430-440 MHz)	Ham operators may relay information

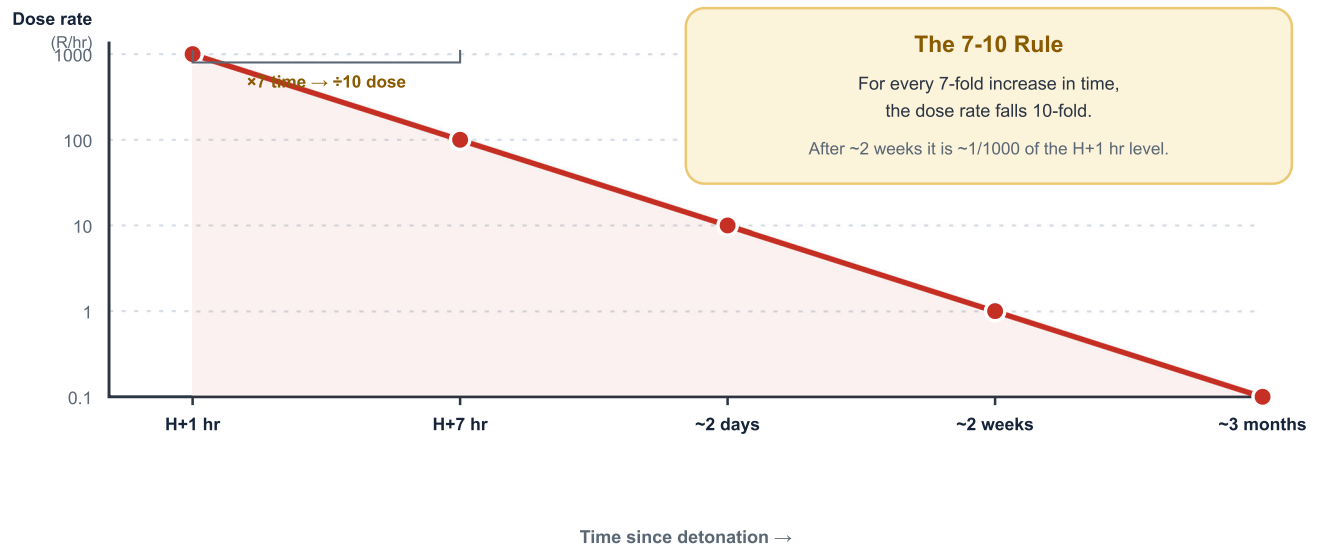
 Remember the Core Principles

- 1. **TIME:** Every hour you wait in shelter, radiation drops. The 7-10 rule is your friend.
- 2. **DISTANCE:** Get as far from fallout sources as possible — every metre helps.
- 3. **SHIELDING:** Put dense material between you and radiation — basements, concrete, earth.
- 4. **CONTAMINATION:** Keep radioactive particles OUT of your body — seal shelter, filter air, protect water/food.

 What NOT To Do

- DON'T look at the flash — permanent eye damage
- DON'T go outside in the first 24-48 hours unless shelter is critically damaged
- DON'T eat or drink anything exposed to fallout
- DON'T assume radiation is safe because you can't detect it without a meter
- DON'T panic — calm, informed decisions save lives

The 7-10 Rule — How Fast Fallout Decays

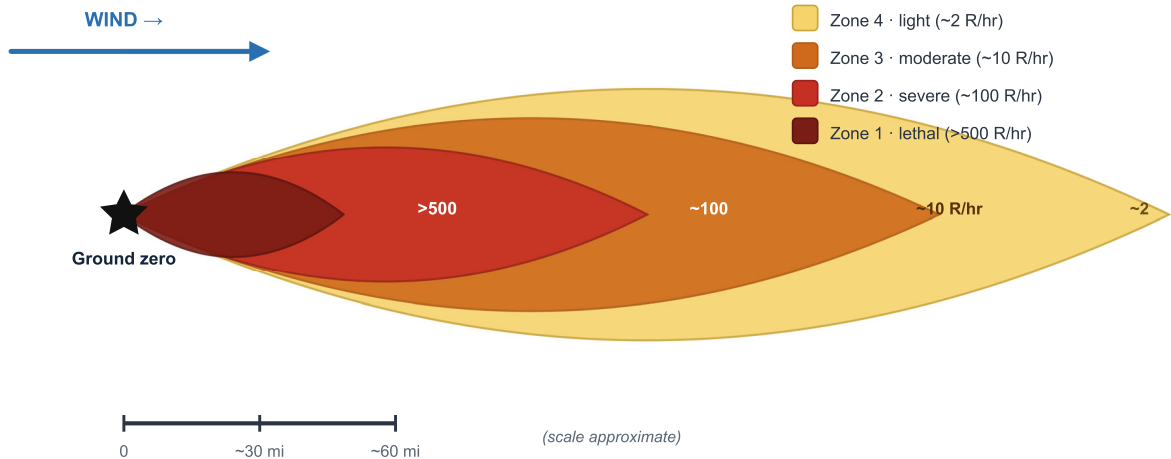


The 7-10 rule: for every sevenfold increase in time, the radiation dose rate falls roughly tenfold.

Fallout Plume: Wind Direction & Your Location

For ground bursts, your position relative to the wind direction is **critical** for fallout exposure. The fallout plume extends primarily downwind, creating vastly different hazard zones.

Fallout Plume — Top-Down View (≈1 Mt Ground Burst)



Idealised — real fallout is patchy and hotspot-prone, and depends on yield, weather and terrain.

An idealised downwind fallout pattern from a large ground burst. Real fallout is patchy and weather-dependent.

↓ DOWNWIND (WORST CASE)

- **Maximum fallout exposure** — directly in plume path
- Lethal radiation possible 50-150+ km from blast
- Fallout arrives in minutes to hours depending on distance
- Heavy accumulation on all surfaces
- **Action:** SHELTER IMMEDIATELY, minimum 2 weeks
- If time permits, evacuate perpendicular to wind (crosswind)

↑ UPWIND (BEST CASE)

- **Minimal fallout** — wind carries plume away from you
- Main hazards: blast, thermal, prompt radiation only
- May receive trace fallout from wind shifts or rain
- Still shelter 24-48 hours as precaution
- **Action:** Shelter, but recovery much faster
- Monitor for wind direction changes

↔ CROSSWIND (LATERAL)

- **Moderate exposure** — at edge of plume
- Fallout depends on plume width and wind variability
- Plume spreads 15-30° from centre line
- Closer to blast = wider plume affects you
- **Action:** Shelter, monitor conditions
- Best evacuation direction if downwind

🔄 VARIABLE WINDS

- **Unpredictable exposure** — plume may shift
- Wind can change direction at different altitudes
- Urban areas create local turbulence
- Mountains/valleys channel wind unpredictably
- **Action:** Assume worst case, shelter fully
- Don't rely on initial wind direction

 FALLOUT PLUME DIMENSIONS (1 MEGATON GROUND BURST REFERENCE)

Wind Speed	Lethal Zone Length (Downwind)	Lethal Zone Width	Dangerous Zone Length	Fallout Arrival (50km)
Light (5-10 mph)	~80-120 km	~15-25 km	~150-200 km	~3-6 hours
Moderate (15-25 mph)	~120-180 km	~20-40 km	~250-350 km	~1.5-2.5 hours
Strong (30-50 mph)	~200-300 km	~30-60 km	~400-500+ km	~45-90 minutes

Lethal zone = >400 rem (4 Sv) in first 48 hours without shelter. Dangerous zone = >100 rem (1 Sv). Values for open terrain; hills/buildings affect local patterns.

 HOW TO DETERMINE WIND DIRECTION

Before the Event:

- Check weather forecast/apps for wind direction
- Note prevailing winds in your area (UK: typically SW)
- Flags, smoke, tree movement show direction
- Wind direction = where wind comes FROM

After the Event:

- Observe mushroom cloud drift direction
- Wet finger method (cool side = wind source)
- Grass, leaves, dust movement
- Radio broadcasts may report plume direction

 **UK Prevailing Winds:** UK typically has south-westerly winds. A ground burst in central England would typically send fallout toward the northeast. However, wind patterns vary seasonally and daily — easterly winds occur in spring, and high-pressure systems can bring winds from any direction. **NEVER assume wind direction — always verify.**

 EVACUATION DECISION MATRIX

Your Position	Distance from Blast	Time Available	Recommendation
Downwind	<30 km	<30 min	SHELTER IN PLACE — no time to escape plume
Downwind	30-80 km	30-90 min	EVACUATE CROSSWIND if vehicle ready, otherwise shelter
Downwind	>80 km	1-3 hours	EVACUATE CROSSWIND or upwind — good chance to escape
Crosswind	Any	Variable	Shelter initially, evacuate further crosswind if plume approaching
Upwind	>Blast zone	N/A	SHELTER 24-48 hrs precaution — minimal fallout expected

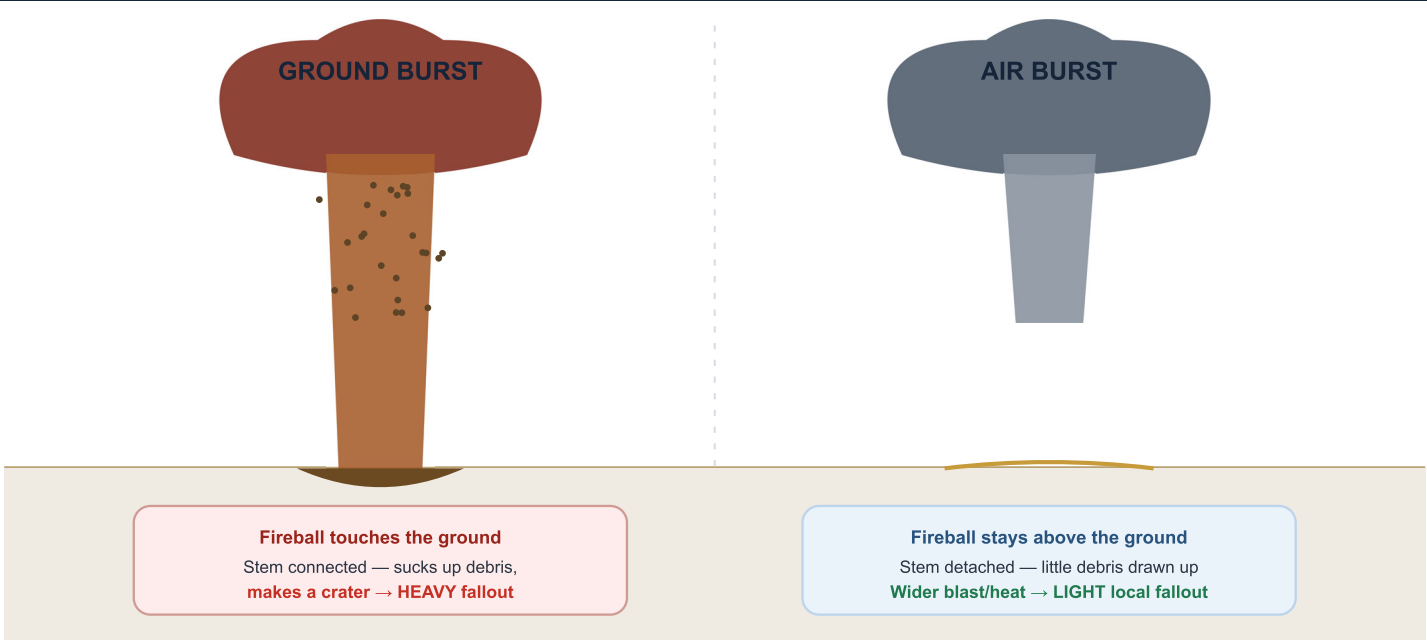
EVACUATION WARNINGS:

- **Don't drive into the plume** — verify wind direction before moving
- **Crosswind evacuation** is safest — move perpendicular to wind, not toward or away from blast
- **Traffic jams = death traps** — if roads are gridlocked, return to shelter immediately
- **Close all vehicle vents** — recirculate air, don't draw in outside air
- **If fallout starts falling, STOP** — find nearest building, don't continue driving through fallout

Multiple Detonations: In a nuclear war scenario with multiple blasts, fallout plumes may overlap from different directions. Wind patterns at different altitudes can carry fallout in unexpected directions. In this case, shelter is almost always safer than evacuation — you may drive out of one plume and into another. Wait for official guidance or use Geiger counter to find lowest-radiation route.

Mushroom Cloud Comparison — How to Identify Burst Type

Mushroom Cloud — Ground Burst vs Air Burst



Ground bursts draw debris into the fireball and create heavy local fallout; air bursts produce far less local fallout.

⚠ Human Risk Assessment by Distance (1 Megaton Reference)

Percentage risk of injury/death for persons **outside and exposed** vs **improved indoor shelter**. Based on 1mt ground burst.

Distance	Flying Debris Injury		Thermal Burns (exposed skin)		Radiation: Mild (0.5-2 Gy)		Radiation: Lethal (>4 Gy)	
	Outside	Indoors	Outside	Indoors	Outside	Shelter*	Outside	Shelter*
2 km	100%	95%	100%	80%	100%	100%	100%	100%
5 km	95%	60%	100%	40%	100%	90%	95%	50%
10 km	70%	25%	90%	10%	85%	40%	60%	10%
15 km	40%	10%	60%	5%	50%	15%	25%	3%
25 km	15%	3%	25%	1%	20%	5%	5%	<1%
50 km	3%	<1%	5%	<1%	8%	1%	1%	<1%
75 km	<1%	<1%	1%	<1%	3%	<1%	<1%	<1%
100 km	<1%	<1%	<1%	<1%	1%	<1%	<1%	<1%

*Shelter = improvised indoor shelter (PF 10-40): central room, away from windows, some mass shielding. Basement with overhead cover = much better protection.

FLYING DEBRIS RISK FACTORS

- >160 mph: 90%+ injury from glass, masonry, vehicles
- 100-160 mph: 50-80% serious injury risk
- 40-100 mph: 20-50% injury from glass shards
- <40 mph: Minor cuts likely, serious injury <10%
- Indoors helps: Avoid windows, get behind solid walls

THERMAL BURN RISK FACTORS

- Direct line of sight: 3rd degree burns in seconds
- Light clothing: Ignites, increases burn severity
- Dark clothing: Absorbs more heat, worse burns
- Indoors/shadow: 90%+ reduction if not at window
- Duck and cover: Reduce exposed skin area

Radiation Risk Notes: Radiation percentages assume first 48 hours cumulative exposure. "Outside" = no shelter, full fallout exposure. "Shelter" = improvised PF 10-40 shelter for duration. **Mild exposure (0.5-2 Gy)** causes radiation sickness but is survivable. **Lethal exposure (>4 Gy)** has >50% mortality without medical care.

 Improved Shielding Materials

Use household items to build shielding. **Target: 3-4 halving thicknesses = PF 8-16.** Stack materials between you and exterior walls/ceiling.

Understanding Halving Thickness: This is the thickness of *solid material* needed to block 50% of radiation. For hollow or air-filled objects (fridges, washing machines, hollow blocks), only the actual material counts — not the air gaps. A 70cm deep fridge with 2cm of steel provides ~2cm of shielding, not 70cm. To improve hollow objects, fill empty spaces with water, sand, or other dense materials.

Material	Halving Thickness	For PF 10 (~3.3 layers)	Notes
Lead	0.4" (1 cm)	1.3" (3.3 cm)	Best shielding — car batteries, pipe, sheet
Steel/Iron	1" (2.5 cm)	3.3" (8.4 cm)	Filing cabinets, appliances, car body panels
Fridge/Freezer	Empty: minimal Filled: uses water (7"/18cm)	1 unit filled ≈ PF 6-8 Stack 2 units for PF 10+	~60-70cm deep. Fill with water bottles. Empty shell provides little protection
Washing Machine	Empty: minimal Filled: uses sand (3.5"/9cm) or water	1 unit + sand ≈ PF 10-16 1 unit + water ≈ PF 4-6	~50cm drum. Fill with sand (best) or water. Has concrete counterweight (~10kg)
Concrete (solid)	2.4" (6 cm)	8" (20 cm)	Walls, solid blocks, paving slabs
Brick (solid)	2.4" (6 cm)	8" (20 cm)	Similar to concrete density
Hollow Concrete Block	Empty: ~6cm concrete only Filled: uses sand (3.5"/9cm)	1 block (21cm) filled ≈ PF 4 2 blocks (42cm) filled ≈ PF 16	Standard 21cm block has ~6cm concrete (two walls). Fill cores with sand for solid mass
Soil/Sand (packed)	3.5" (9 cm)	12" (30 cm)	Best readily available material

Cat Litter (varies)	Clay: ~4" (10 cm) Silica: ~8" (20 cm) Wood/Paper: ~10" (25 cm)	Clay: 13" (33 cm) Silica: 26" (66 cm) Wood: 33" (84 cm)	Clay (bentonite) is densest & best. Silica gel is lighter. Wood/paper least effective
Water (in containers)	7" (18 cm)	23" (58 cm)	Wheelie bins, bottles, bathtubs
Books/Magazines	7" (18 cm)	23" (58 cm)	Stack tightly, no gaps
Rice/Wheat/Beans	7" (18 cm)	23" (58 cm)	Use stored food supplies
Clothing (compressed)	~9" (23 cm)	30" (76 cm)	Pack tightly in bags, compress as much as possible
Mattress (sprung)	~12-14" (30-35 cm)	40-46" (100-117 cm)	Low density — better than nothing, stack multiple
Wood/Plywood	11" (28 cm)	36" (91 cm)	Low density, supplement with other materials
Wheelie Bin (filled)	Depends on fill	Water: 23" / Soil: 12"	~240L bin = excellent barrier when filled

Quick Build Strategy: Move to basement or central room. Stack sandbags/soil against exterior walls (12" +). Place water containers and filled wheelie bins as barriers. Cover overhead with plywood + sandbags if on ground floor. Layer books/food supplies to fill gaps. A corner position with 2 shielded walls already provides partial protection.

Understanding Your Geiger Counter: Dose Rate vs Accumulated Dose

This is one of the most important concepts for using your Geiger counter effectively. Understanding the difference between **dose rate** and **accumulated dose** can save your life.

DOSE RATE (MSV/H, MSV/H)

What it means: How much radiation you're receiving *right now*, per unit of time. Like a speedometer showing your current speed.

- Unit:** $\mu\text{Sv/h}$ (microsieverts per hour) or mSv/h
- The "/h" is critical** — it means "per hour"
- GMC-800 display:** Shows dose RATE by default
- Changes constantly** as you move or conditions change
- Use for:** Deciding if an area is safe to enter

Example: Reading of 100 $\mu\text{Sv/h}$ means IF you stayed there for 1 full hour, you'd accumulate 100 μSv total dose.

ACCUMULATED DOSE (MSV, MSV, SV)

What it means: The TOTAL radiation your body has absorbed over time. Like an odometer showing total distance traveled.

- Unit:** μSv , mSv , or Sv (NO "/h")
- No "/h"** — it's a total, not a rate
- GMC-800:** Check "accumulated dose" mode
- Only increases** — your body doesn't "reset"
- Use for:** Tracking your total exposure over days/weeks

Example: After spending 30 minutes in a 100 $\mu\text{Sv/h}$ area, your accumulated dose is 50 μSv (half an hour $\times$ 100).

HOW TO CALCULATE YOUR ACCUMULATED DOSE

Formula: Accumulated Dose = Dose Rate $\times$ Time

Dose Rate ($\mu\text{Sv/h}$)	15 min exposure	1 hour exposure	8 hours exposure	24 hours exposure
10 $\mu\text{Sv/h}$ (elevated)	2.5 μSv	10 μSv	80 μSv	240 μSv
100 $\mu\text{Sv/h}$ (high)	25 μSv	100 μSv	800 μSv	2,400 μSv (2.4 mSv)

1,000 µSv/h (dangerous)	250 µSv	1,000 µSv (1 mSv)	8,000 µSv (8 mSv)	24,000 µSv (24 mSv)
10,000 µSv/h (extreme)	2,500 µSv (2.5 mSv)	10,000 µSv (10 mSv)	80,000 µSv (80 mSv)	240,000 µSv (240 mSv)
100,000 µSv/h (lethal zone)	25,000 µSv (25 mSv)	100,000 µSv (100 mSv)	800,000 µSv (800 mSv)	2,400,000 µSv (2.4 Sv) - FATAL

 PRACTICAL DECISION-MAKING EXAMPLES

Scenario 1: Quick Supply Run
Outside reads: **500 µSv/h**
You need 20 minutes to grab supplies.
Accumulated dose: $500 \times 0.33 \text{ hr} = \sim 165 \text{ µSv}$
Acceptable — equivalent to a few X-rays

Scenario 2: Extended Outdoor Work
Outside reads: **500 µSv/h**
You want to work outside for 4 hours.
Accumulated dose: $500 \times 4 = 2,000 \text{ µSv (2 mSv)}$
Caution — limit total daily exposure

Scenario 3: Shelter Assessment
Inside shelter reads: **50 µSv/h**
You'll stay 24 hours.
Accumulated dose: $50 \times 24 = 1,200 \text{ µSv (1.2 mSv)}$
Acceptable — shelter is working

Scenario 4: Emergency Evacuation
Route reads: **5,000 µSv/h**
Drive time: 30 minutes (0.5 hr)
Accumulated dose: $5,000 \times 0.5 = 2,500 \text{ µSv (2.5 mSv)}$
Worth it — if destination is safer

 **Key Safety Thresholds (Accumulated Dose):**

- **<1,000 µSv (1 mSv):** Safe — annual public limit, no health effects
- **1,000-10,000 µSv (1-10 mSv):** Low concern — equivalent to CT scan, minimal risk
- **10,000-100,000 µSv (10-100 mSv):** Elevated — slight increase in cancer risk over lifetime
- **100,000-250,000 µSv (100-250 mSv):** Significant — clear elevated cancer risk, may see blood changes
- **250,000-1,000,000 µSv (250 mSv - 1 Sv):** Dangerous — radiation sickness likely, medical attention needed
- **>1,000,000 µSv (1 Sv / 100 rem):** Severe ARS — hospitalisation required
- **>4,000,000 µSv (4 Sv / 400 rem):** LD50 — 50% fatal without treatment

GMC-800 Tip: Most Geiger counters have both a real-time dose rate display AND an accumulated dose counter. Check your manual for how to switch between modes. Reset your accumulated dose counter at the start of each day to track daily exposure. Keep a written log of your daily accumulated dose to monitor your total exposure over time.

 Antibiotic Guide for Radiation-Induced Immunosuppression

 **CRITICAL:** Radiation-induced immunosuppression dramatically increases infection risk. Infections that would normally be minor can become life-threatening. Early, aggressive antibiotic treatment is essential. When in doubt, treat empirically — the risk of untreated infection far exceeds antibiotic side effects in this context.

Understanding This Guide: Antibiotics are listed by treatment line: **1st Line** = preferred first choice, **2nd Line** = alternative if 1st unavailable or allergic, **3rd Line** = use only if others unavailable. Coverage type indicates which bacteria the antibiotic targets (see Gram Classification section below). In a crisis, **Doxycycline** may be the only antibiotic available — it provides broad coverage and is effective for many infections.

Infection Type	Line	NO Penicillin Allergy	Coverage	Penicillin ALLERGY	Coverage
General / Unknown Source <i>Fever without clear origin</i>	1st	Augmentin 875mg 2×/day	G+/G−/Ana	Doxycycline 100mg 2×/day	G+/G−/Atyp
	2nd	Amoxicillin 500mg 3×/day	G+ mainly	Ciprofloxacin 500mg 2×/day	G− mainly
	3rd	Cephalexin 500mg 4×/day	G+/some G−	Azithromycin 500mg day 1, 250mg days 2-5	G+/Atyp
Skin / Wound Infection <i>Cellulitis, infected cuts, abscesses</i>	1st	Cephalexin 500mg 4×/day	G+/some G−	Doxycycline 100mg 2×/day ✓	G+/G−/MRSA
	2nd	Augmentin 875mg 2×/day	G+/G−/Ana	TMP-SMX DS 2×/day	G+/G−/MRSA
	3rd	Dicloxacillin 500mg 4×/day	G+ only	Clindamycin 300mg 4×/day	G+/Ana
Respiratory / Pneumonia <i>Cough, fever, breathing difficulty</i>	1st	Augmentin 875mg 2×/day	G+/G−/Ana	Doxycycline 100mg 2×/day ✓	G+/G−/Atyp
	2nd	Amoxicillin 1g 3×/day	G+ mainly	Azithromycin 500mg day 1, 250mg days 2-5	G+/Atyp
	3rd	Cephalexin 500mg 4×/day	G+/some G−	Levofloxacin 750mg 1×/day	G+/G−/Atyp
Urinary Tract (Cystitis) <i>Painful urination, frequency, lower back pain</i>	1st	Nitrofurantoin 100mg 2×/day × 5 days	G+/G− (bladder)	Nitrofurantoin 100mg 2×/day × 5 days	G+/G− (bladder)
	2nd	Trimethoprim 200mg 2×/day × 3 days	G+/G−	TMP-SMX DS 2×/day × 3 days	G+/G−
	3rd	Doxycycline 100mg 2×/day × 7 days	G+/G−	Ciprofloxacin 500mg 2×/day × 3 days	G− mainly
Pyelonephritis (Kidney) <i>Fever, flank pain, vomiting + UTI symptoms</i>	1st	Ciprofloxacin 500mg 2×/day × 7 days	G− mainly	Ciprofloxacin 500mg 2×/day × 7 days	G− mainly
	2nd	Augmentin 875mg 2×/day × 10-14 days	G+/G−/Ana	TMP-SMX DS 2×/day × 10-14 days	G+/G−
	3rd	Cephalexin 500mg 4×/day × 10-14 days	G+/some G−	Doxycycline 100mg 2×/day × 10-14 days	G+/G−
GI / Diarrhea (Bloody) <i>Bloody stool, severe cramping, fever</i>	1st	Metronidazole 500mg 3×/day	Anaerobes/Parasites	Metronidazole 500mg 3×/day	Anaerobes/Parasites
	2nd	Ciprofloxacin 500mg 2×/day	G− mainly	Ciprofloxacin 500mg 2×/day	G− mainly
	3rd	Azithromycin 500mg 1×/day	G+/G−/Atyp	Doxycycline 100mg 2×/day	G+/G−

Tick-borne / Unknown Fever with Rash — **Doxycycline 100mg 2×/day** is FIRST CHOICE for ALL patients regardless of allergy status (Lyme, RMSF, Ehrlichiosis, Anaplasmosis). Coverage: **G+/G−/Rickettsia**

Severe Sepsis / Life-threatening <i>High fever, confusion, rapid heart rate, low BP</i>	1st	Augmentin 875mg 2×/day + Ciprofloxacin 500mg 2×/day	Broad	Ciprofloxacin 500mg 2×/day + Metronidazole 500mg 3×/day	Broad
	2nd	Cephalexin 1g 4×/day + Metronidazole 500mg 3×/day	G+/G−/Ana	Doxycycline 100mg 2×/day + Metronidazole 500mg 3×/day	Broad
	3rd	Use whatever antibiotics are available — any coverage is better than none in sepsis			

COVERAGE KEY

- G+ only** = Gram-positive bacteria only
- G− mainly** = Primarily Gram-negative bacteria
- G+/G−** = Both Gram-positive and Gram-negative
- G+/G−/Atyp** = Gram+, Gram−, plus atypical organisms
- G+/G−/Ana** = Gram+, Gram−, plus anaerobes
- Broad** = Covers most common bacteria

UTI NOTES — CRITICAL DISTINCTIONS

- Nitrofurantoin:** ONLY for simple bladder infections (cystitis). Does NOT reach kidneys — never use for pyelonephritis or fever.
- Doxycycline for UTI:** Less ideal than nitrofurantoin or TMP-SMX because it doesn't concentrate well in urine. Use 7 days minimum, increase fluid intake significantly.
- Pyelonephritis (kidney infection):** Requires antibiotics that reach kidney tissue — use ciprofloxacin, TMP-SMX, or augmentin. Longer course (7-14 days).
- If fever present:** Assume kidney involvement — do NOT use nitrofurantoin.

Why Doxycycline is an Excellent Stockpile Choice:

- Broad spectrum:** Covers Gram-positive, Gram-negative, atypicals (Mycoplasma, Chlamydia, Legionella), MRSA, Rickettsia, Lyme disease
- Long shelf life:** 2-3 years properly stored; often effective years beyond expiration
- Easy to obtain:** Available as "fish antibiotics" (Fish Doxy) or via telemedicine
- Oral only:** No need for IV/injection equipment
- Excellent bioavailability:** ~95% absorbed orally — nearly as good as IV
- Well-tolerated:** Fewer side effects than fluoroquinolones or clindamycin

DOXYCYCLINE CAUTIONS

- NOT for children <8 years** (permanent tooth staining) — use Azithromycin instead
- NOT for pregnancy** (fetal harm) — use Azithromycin instead
- Take with food and FULL glass of water** (severe esophageal irritation possible — do not lie down for 30 min after)
- Avoid dairy/antacids/iron within 2 hours** (reduces absorption by 50-90%)
- Causes sun sensitivity** — cover skin if outdoors, even through window glass
- Duration:** 7-14 days depending on infection severity; complete full course even if feeling better

RECOMMENDED ANTIBIOTIC STOCKPILE (PRIORITY ORDER)

Priority	Antibiotic	Quantity per Person	Coverage	Primary Uses
1	Doxycycline 100mg	60+ tablets	G+/G−/Atyp/MRSA	Most infections; first-line if limited options
2	Nitrofurantoin 100mg	20+ tablets	G+/G− (bladder)	Uncomplicated UTI (cystitis only)
3	Amoxicillin 500mg	40+ capsules	G+ mainly	Strep throat, ear infections, dental (if no PCN allergy)

4	Augmentin 875mg	30+ tablets	G+ /G- /Ana	Animal bites, severe skin, respiratory, abdominal
5	Metronidazole 500mg	30+ tablets	Anaerobes/Parasites	GI infections, abdominal, dental abscess (pairs with others)
6	Azithromycin 250mg	12+ tablets	G+ /Atyp	Respiratory (Z-pack); safe for kids/pregnancy
7	Ciprofloxacin 500mg	20+ tablets	G- mainly	Severe UTI/kidney, GI infections, anthrax
8	TMP-SMX DS (Bactrim)	20+ tablets	G+ /G- /MRSA	UTI, skin/MRSA, respiratory
9	Cephalexin 500mg	40+ capsules	G+ /some G-	Skin, soft tissue, UTI (alternative)
10	Clindamycin 300mg	20+ capsules	G+ /Ana	Dental, skin (PCN-allergic); toxic shock adjunct



Understanding Gram Classification & Antibiotic Coverage

Why This Matters: Bacteria are classified as Gram-positive or Gram-negative based on their cell wall structure. This classification determines which antibiotics will be effective. Knowing this helps you choose the right antibiotic when medical guidance isn't available.

GRAM-POSITIVE BACTERIA (G+)

Structure: Thick peptidoglycan cell wall, no outer membrane

Appearance: Stain purple/blue in lab tests

Common infections:

- **Staphylococcus aureus (Staph)** — skin infections, abscesses, wound infections, pneumonia
- **MRSA** — methicillin-resistant staph (requires specific antibiotics)
- **Streptococcus (Strep)** — strep throat, cellulitis, necrotizing fasciitis
- **Strep. pneumoniae** — pneumonia, sinusitis, meningitis
- **Enterococcus** — UTI, abdominal, wound infections
- **Clostridium** — tetanus, gas gangrene, C. diff diarrhea

Effective antibiotics: Penicillins, cephalosporins, vancomycin, clindamycin, doxycycline

GRAM-NEGATIVE BACTERIA (G-)

Structure: Thin peptidoglycan wall + outer lipid membrane (harder to penetrate)

Appearance: Stain pink/red in lab tests

Common infections:

- **E. coli** — most UTIs, traveler's diarrhea, wound infections
- **Klebsiella** — pneumonia, UTI, wound infections
- **Pseudomonas** — wound infections, pneumonia (difficult to treat)
- **Salmonella** — food poisoning, typhoid fever
- **Shigella** — bloody diarrhea (dysentery)
- **Proteus** — UTI, wound infections
- **Haemophilus** — respiratory infections, meningitis

Effective antibiotics: Fluoroquinolones (cipro), aminoglycosides, 3rd-gen cephalosporins, TMP-SMX

ADDITIONAL BACTERIAL CATEGORIES

ANAEROBIC BACTERIA

Characteristic: Cannot survive in oxygen; found in gut, dental, deep wounds

Common infections:

- **Bacteroides** — abdominal infections, abscesses
- **Clostridium** — gas gangrene, C. diff colitis, tetanus
- **Fusobacterium** — dental infections, lung abscess
- **Peptostreptococcus** — pelvic, dental, wound infections

Effective antibiotics: Metronidazole, clindamycin, augmentin, carbapenems

Clue to anaerobic infection: Foul-smelling pus or wound, gas in tissues, deep abscess

ATYPICAL BACTERIA

Characteristic: Lack cell wall or live inside cells; require special antibiotics

Common infections:

- **Mycoplasma pneumoniae** — "walking pneumonia"
- **Chlamydia pneumoniae** — respiratory infections
- **Legionella** — Legionnaire's disease (severe pneumonia)
- **Chlamydia trachomatis** — STI, eye infections
- **Rickettsia** — Rocky Mountain spotted fever, typhus

Effective antibiotics: Doxycycline (excellent), azithromycin, fluoroquinolones

Note: Penicillins and cephalosporins do NOT work against atypicals

COMMON ANTIBIOTIC COVERAGE SUMMARY

Antibiotic	Gram-Positive	Gram-Negative	Anaerobes	Atypicals	MRSA	Key Notes
Doxycycline	✓ Good	✓ Good	Limited	✓ Excellent	✓ Yes	Best single-agent for stockpiling
Amoxicillin	✓ Good	Limited	Some	✗ No	✗ No	Strep, dental; not Staph or E.coli
Augmentin	✓ Good	✓ Good	✓ Good	✗ No	✗ No	Broad; animal bites, abdominal
Cephalexin	✓ Good	Some	✗ No	✗ No	✗ No	Skin infections, simple UTI
Ciprofloxacin	Limited	✓ Excellent	✗ No	✓ Good	✗ No	UTI, GI, anthrax; add metronidazole for anaerobes
Azithromycin	✓ Good	Limited	✗ No	✓ Excellent	✗ No	Respiratory, STIs; safe in pregnancy
Metronidazole	✗ No	✗ No	✓ Excellent	✗ No	✗ No	Anaerobes ONLY; must combine with other agents
TMP-SMX (Bactrim)	✓ Good	✓ Good	✗ No	✗ No	✓ Yes	UTI, MRSA skin; sulfa allergy common
Nitrofurantoin	✓ Good	✓ Good	✗ No	✗ No	✗ No	BLADDER ONLY — does not reach blood/kidneys
Clindamycin	✓ Good	✗ No	✓ Good	✗ No	~50%	Dental, skin; high C.diff risk

⚠️ **Practical Application:**

- **Don't know what type of infection?** → Use broad-spectrum (Doxycycline or Augmentin covers most)
- **Foul-smelling wound or pus?** → Add Metronidazole for anaerobic coverage
- **Skin infection with pus/boil?** → Think Staph (possibly MRSA) → Doxycycline or TMP-SMX
- **UTI?** → Usually E. coli (Gram-negative) → Nitrofurantoin first line
- **Pneumonia?** → Could be Gram-positive, Gram-negative, OR atypical → Doxycycline covers all three
- **Animal or human bite?** → Mixed Gram+/Gram-/Anaerobes → Augmentin is ideal

✓ **If You Only Have Doxycycline:** You can treat most community-acquired infections. It covers Gram-positive bacteria (including ~90% of MRSA), Gram-negative bacteria (E.coli, Klebsiella), and atypical pathogens (Mycoplasma, Chlamydia, Rickettsia). Its main gaps are: (1) Pseudomonas — rare in community infections; (2) Anaerobes — for abdominal/dental abscesses, you'd ideally add metronidazole; (3) Severe UTI — works but not ideal (use if nothing else available). For most post-nuclear survival scenarios where you're treating skin infections, respiratory infections, wound infections, and tick-borne diseases, doxycycline alone will cover the majority of threats.

 Emergency Communications Guide

ASSUME: Internet, Starlink, and Cellular are DOWN. Have backup communication ready in Faraday cage.

GB UK FREQUENCIES

Purpose	Frequency	Notes
BBC Radio 4 (Emergency)	198 kHz LW / 92-95 FM	Primary UK emergency broadcast
PMR446 Emergency	446.00625 MHz (Ch 1)	Licence-free, EU-wide calling
PMR446 Alt Emergency	446.09375 MHz (Ch 8)	CTCSS 88.5 Hz - UK prepper
UK CB Emergency	27.065 MHz (Ch 9)	UK CEPT standard, truckers
HAM 2m UK Calling	145.500 MHz	FM simplex calling
HAM 70cm UK Calling	433.500 MHz	FM simplex calling
Maritime Distress	156.80 MHz (Ch 16)	Coastguard monitors 24/7
Aviation Distress	121.5 / 243.0 MHz	International emergency

us US FREQUENCIES

Purpose	Frequency	Notes
Emergency News (AM)	530-1710 kHz	EAS broadcasts
NOAA Weather	162.400-162.550 MHz	24/7 automated broadcasts
GMRS Emergency	462.675 MHz (Ch 20)	CTCSS 141.3 Hz

FRS Emergency	462.5625 MHz (Ch 1)	No licence needed
CB Emergency	27.065 MHz (Ch 9)	Truckers, local help
HAM 2m Simplex	146.52 MHz	No repeater needed
FEMA Primary	138.225 MHz	Disaster relief ops
HAM HF Emergency	3.985 / 7.290 MHz	Long range, worldwide

PMR446 Tip: Channel 1 (446.00625 MHz) with no CTCSS/DCS code (carrier squelch) is the de facto European emergency calling channel. For prepper/survivalist networks, use Channel 1 with CTCSS code 1 (67.0 Hz). Radios are licence-free, cheap (£20-50), and work across all EU countries.

Shelter Ventilation System

CRITICAL: A sealed room with multiple occupants will become dangerously hot and CO₂-filled within hours. You **MUST** have filtered ventilation, especially in warm weather or with more than 2-3 people.

FILTERED AIR INTAKE SYSTEM

- **HEPA filter:** H13/H14 grade or furnace filter (MERV 13+)
- **Pre-filter:** Standard furnace filter to catch large particles first
- **Flexible ducting:** 4-6" diameter, 2-3 metres length
- **Duct tape:** To seal filter to ducting
- **Air intake options (choose one):**
 - 12V DC inline duct fan (quiet, low power, use with battery)
 - Fireplace bellows or fire blower (manual, no power needed)
 - Hand-crank bilge blower (marine supply stores)
 - Kearny Air Pump (DIY from cardboard/plastic - see NWSS book)
 - Large manual air pump (camping/mattress inflator)
- **Gooseneck intake:** Bend ducting downward outside to prevent fallout entry

VENTILATION REQUIREMENTS

Occupants	Min Air Flow	Notes
2 people	6 CFM (10 m ³ /hr)	CO ₂ control only
4 people	12 CFM (20 m ³ /hr)	Moderate
6+ people	20+ CFM (35+ m ³ /hr)	Hot weather: 40+ CFM

Setup: Intake at one end, exhaust crack at opposite end. Filter mounted on intake outside shelter. Gooseneck prevents fallout entering directly. Pre-filter → HEPA → ducting → shelter.

EMP Protection: Faraday Cage Storage

DIY FARADAY CAGE OPTIONS

- **Galvanised metal bin/bucket with lid:** 20-30L capacity, tight-fitting lid
- **Metal ammo can:** Remove rubber gasket, ensure metal-to-metal contact
- **Galvanised dustbin:** Larger capacity for more items
- **Metal biscuit/popcorn tin:** Smaller items
- **Aluminium foil tape:** Seal any gaps around lid
- **Cardboard/bubble wrap:** Line interior — devices must NOT touch metal walls

Test: Place mobile phone inside, close lid, try calling it. If it rings, the seal is inadequate — add more foil tape around lid edges.

ELECTRONICS TO PROTECT

- Spare radio(s) — AM/FM, PMR446, HAM
- LED torches/flashlights + glow sticks (no-battery backup)
- Geiger counter (GMC-800 or GMC-500+)
- Battery bank / solar charger
- Spare batteries (AA, AAA, 14500, 18650)
- USB drives with important documents
- Small solar panel
- Wind-up radio/torch (backup)

Note: Remove batteries from devices before storage to prevent drain and corrosion. Store batteries separately in original packaging.

EMP Effects: What Will & Won't Work

A nuclear EMP (NEMP) or high-altitude EMP (HEMP) can disable electronics over hundreds of miles. Effects vary by distance, altitude of burst, and device vulnerability.

VEHICLES

Type	Likely Status
Pre-1980s petrol/diesel	LIKELY OK — mechanical ignition, no ECU
1980s-2000s vehicles	POSSIBLY OK — basic ECU, may need restart
Modern petrol/diesel (2010+)	AT RISK — complex ECU, sensors, may be disabled
Electric vehicles (EV)	HIGH RISK — battery management, inverters vulnerable
Hybrid vehicles	HIGH RISK — dual systems, complex electronics
Diesel engines (mechanical injection)	LIKELY OK — no spark ignition needed
Petrol generators (older)	LIKELY OK — simple magneto ignition

Note: Even if vehicle survives, fuel pumps at petrol stations require grid power. Store fuel.

INFRASTRUCTURE & COMMUNICATIONS

System	Expected Status
--------	-----------------

Grid electricity	DOWN — transformers, substations damaged
Mobile phone networks	DOWN — towers, switches need power
Internet / WiFi	DOWN — routers, exchanges, data centres
Landline phones	DOWN — exchanges need power
Satellite signals (GPS, TV)	DOWN — receivers damaged, satellites may survive
Solar panels (connected)	DAMAGED — inverters, charge controllers fried
Solar panels (disconnected)	POSSIBLY OK — panels may survive, store controller in Faraday cage
Battery-powered radio (shielded)	OK — if stored in Faraday cage
Manual tools, mechanical items	OK — no electronics to damage

Recovery Timeline: Grid power may take months to years to restore after major EMP. Assume extended period without electricity, communications, or fuel supply. Prepare for self-sufficiency.

Burn Treatment (Thermal & Beta Burns)

Thermal Flash Range (3rd degree burns on exposed skin):

Yield	Ground Burst	Airburst (optimised)	Note
100 kt	~5 km	~6 km	Clear day, exposed skin
1 Mt	~12 km	~15 km	Clothing may ignite
10 Mt	~30 km	~40 km	2nd degree burns to 50+ km
50 Mt	~60 km	~80 km	Burns reported 100+ km (Tsar Bomba)

Airburst produces ~20-30% greater thermal range than ground burst (fireball not obscured by debris). Haze, fog, or cloud cover significantly reduces thermal effects.

RULE OF NINES — ESTIMATE BURN SIZE (%)

Body Area	Adult %	Child %
Head & Neck	9%	18%
Each Arm	9%	9%
Chest (front)	9%	9%
Abdomen (front)	9%	9%
Upper Back	9%	9%
Lower Back	9%	9%


LIFE-THREATENING Burns — Seek/Provide Intensive Care:

- Burns >20% body surface (adult) or >10% (child/elderly)
- Burns to face, airway, hands, feet, genitals, or major joints
- Circumferential burns (completely encircling limb or chest)
- Electrical burns or lightning strikes
- Chemical burns
- Burns with inhalation injury (singed nasal hair, soot in mouth, hoarse voice)
- Full-thickness (3rd degree) burns of any significant size

Each Leg (front)	9%	7%
Each Leg (back)	9%	7%
Groin	1%	1%

Palm Method: Patient's palm (with closed fingers) ≈ 1% body surface area

BURN DEPTH CLASSIFICATION & TREATMENT

Degree	Depth	Appearance	Pain Level	Treatment & Healing
1st Degree (Superficial)	Epidermis only <i>Like sunburn</i>	Red, dry, no blisters. Blanches white when pressed.	PAINFUL	Cool water, aloe vera, moisturiser. Heals 3-5 days without scarring. No dressing needed.
2nd Degree (Superficial Partial)	Epidermis + upper dermis	Blisters, wet/weeping, bright pink/red. Blanches. Hair follicles intact.	VERY PAINFUL	Cool, clean, non-stick dressing. Don't pop small blisters. Heals 2-3 weeks . Minimal scarring.
2nd Degree (Deep Partial)	Epidermis + deep dermis	Blisters (may be broken), mottled white/pink/red. Sluggish blanching. Hair follicles damaged.	Moderate pain <i>(nerve damage)</i>	Clean, antibiotic ointment, non-stick dressing. Heals 3-8 weeks . May scar. May need grafts if not healed by 3 weeks.
3rd Degree (Full Thickness)	Through entire dermis into fat	White, tan, brown, or charred. Leathery texture. No blanching. No blisters. Hair falls out easily.	NO PAIN <i>(nerves destroyed)</i>	Cover loosely with clean, dry dressing. Cannot heal on own — requires skin grafts. DO NOT apply creams. Prevent infection.
4th Degree (Deep)	Through skin into muscle, tendon, or bone	Charred, black eschar. Underlying tissue visible. May see bone/tendon.	NO PAIN	Catastrophic injury. Cover, prevent hypothermia. Will require amputation or extensive surgery. High mortality without hospital care.

Key Assessment Points:

- **Blanching:** Press on burn for 2 seconds — if it turns white and returns to red, blood flow intact (good sign)
- **Sensation:** Gently touch burn with sterile object — if NO pain, burn is likely full thickness (bad sign)
- **Most burns are mixed depth** — treat for the deepest component
- **Burns can "convert"** to deeper injuries over 24-72 hours if poorly managed (infection, inadequate cooling, poor blood flow)

BURN FIRST AID — THE CRITICAL FIRST 20 MINUTES

1. **STOP the burning process**

- Extinguish flames (drop and roll)
- Remove from heat source
- Remove clothing near burn (NOT if stuck)
- Remove jewellery/watches before swelling

2. **COOL with running water — 20 MINUTES**

- Cool running tap water is ideal (15-25°C)
- NOT ice, ice water, or frozen items (causes frostbite)
- 20 minutes is critical — reduces burn depth and pain
- Effective up to 3 hours after injury
- Watch for hypothermia in children/elderly/large burns

3. **COVER with cling film or clean dressing**

✗ DO NOT:

- Apply ice or ice-cold water
- Apply butter, oil, toothpaste, egg white, or any grease
- Pop blisters (protective barrier against infection)
- Remove clothing stuck to burn
- Apply adhesive bandages directly to burn
- Use fluffy cotton or tissue (fibres stick)
- Wrap cling film circumferentially (tourniquet risk)
- Apply creams to full-thickness burns
- Breathe on or touch the burn

- Cling film is ideal first aid cover (see below)
- Clean, non-fluffy material if no cling film
- DO NOT use cotton wool, tissue, or fluffy towels

- 4. **ELEVATE burned limbs** above heart level
- 5. **HYDRATE** — burns cause massive fluid loss
- 6. **PAIN RELIEF** — paracetamol or ibuprofen

✓ **Cooling Key Facts (British Burns Association):**

- 20 minutes of cooling significantly reduces burn depth
- Still beneficial if started within 3 hours of injury
- Water temperature 15-25°C (cool tap water)
- Use any clean liquid if water unavailable (even milk, soft drinks)

 CLING FILM (PLASTIC WRAP) — IDEAL IMPROVISED BURN DRESSING

Why cling film is excellent for burns:

- **Sterile** — interior of roll is essentially sterile (discard first few cm)
- **Non-adherent** — won't stick to wound or damage new tissue
- **Transparent** — allows wound inspection without removal
- **Retains moisture** — prevents wound drying and reduces pain
- **Impermeable** — barrier against bacteria
- **Allows cooling** — thin enough to permit continued cooling through film
- **Reduces pain** — keeps air off exposed nerve endings
- **Readily available** — found in most kitchens

 Cling Film Application Rules:

- **NEVER wrap circumferentially** around limbs (swelling → tourniquet)
- Apply in **LOOSE LAYERS** lengthwise over burn
- Do NOT use on face (use paraffin/petroleum jelly instead)
- Do NOT use on chemical burns until fully decontaminated
- Temporary only (few hours) — replace with proper dressing when available
- Discard first 5-10cm of roll to ensure sterility

HOW TO APPLY CLING FILM:

1. Cool burn for 20 minutes first
2. Discard first few centimetres of cling film roll
3. Cut or tear strips slightly larger than burn
4. Lay strips **LOOSELY** over the burn
5. For arms/legs: overlap strips like shingles (not wrapped around)
6. Secure edges with tape on healthy skin (not on burn)
7. Leave loose enough to accommodate swelling
8. Cover with clean cloth if needed for protection

NHS, British Burns Association, and Red Cross all recommend cling film as first-choice first aid burn dressing.

IMPROVISED BURN TREATMENTS (WHEN MEDICAL SUPPLIES UNAVAILABLE)

Treatment	Evidence	How to Use	Notes
Raw Honey (unprocessed)	STRONG evidence	Apply thin layer directly to 1st/2nd degree burns. Cover with clean dressing. Change 1-2x daily.	Studies show faster healing than silver sulfadiazine. Antibacterial, anti-inflammatory, promotes tissue regeneration. Use raw/unprocessed honey only.
Aloe Vera Gel (fresh plant)	Good evidence	Cut leaf, scrape clear gel, apply to 1st/2nd degree burns. Reapply 2-3x daily.	Anti-inflammatory, moisturising, promotes healing. Best for superficial burns. Store-bought must be 99%+ pure (no additives).
Vaseline/Petroleum Jelly + non-stick dressing	Standard care	Apply thin layer to burn, cover with non-stick gauze. Change daily.	Creates moist healing environment. Prevents dressing adherence. Good for ongoing care of healing burns.
Saline Solution (homemade)	Standard care	1 teaspoon salt in 1 litre boiled (cooled) water. Use for gentle wound cleaning.	Safe for cleaning burns. Non-irritating. Use within 24 hours of making.
Clean Cloth Strips (boiled if possible)	Acceptable	Use clean, non-fluffy cloth. Boil for sterility if possible. Layer loosely over burn.	Cotton sheets or t-shirts work. Avoid fluffy materials (terry cloth, cotton wool).
Antibiotic Ointment (bacitracin, polysporin)	Standard care	Thin layer on 1st/2nd degree burns after cleaning. Change dressing daily.	Prevents infection. Silver sulfadiazine traditionally used but honey may be superior.

Tea Bags (black tea)	Limited evidence	Soak in cool water, apply to minor burns as compress.	Tannic acid may have astringent properties. More traditional remedy — use only if nothing else available.
-------------------------	---------------------	--	--

- ✗ NEVER Use These on Burns:
- **Butter/Oils/Grease** — traps heat, increases infection risk
 - **Egg whites (raw)** — bacterial contamination risk
 - **Toothpaste** — irritating chemicals, no benefit
 - **Ice** — causes frostbite, worsens injury
 - **Essential oils (undiluted)** — can cause chemical burns

☢️ Beta Burns (Radiation Burns from Fallout)

⚠️ **Beta Burns Are Different from Thermal Burns:** Beta burns are caused by radioactive fallout particles resting on skin, emitting beta radiation. They are shallow surface burns (beta particles only penetrate ~1-2mm) but can cover large areas if fallout contact was prolonged.

CHARACTERISTICS OF BETA BURNS:

- **Delayed onset:** Appear 24-48 hours to 2-3 weeks after exposure
- **Progression:** Itching → tingling → redness → blistering → ulceration → healing
- **Location:** Usually on exposed areas where fallout landed (face, neck, hands, back of neck)
- **Pattern:** May follow clothing lines (fallout trapped in collar, waistband)
- **Depth:** Usually superficial to mid-partial thickness (beta doesn't penetrate deep)
- **Often painless initially** — becomes painful as blisters form
- **Healing:** Usually heals in weeks, may leave depigmented scars

Historical Cases:

- **Rongelap Islanders (1954)** — widespread beta burns from Castle Bravo fallout. Those who washed promptly had no skin lesions.
- **Daigo Fukuryū Maru crew (1954)** — fishing boat caught in fallout. Developed beta burns 1.7-6.0 Gy dose.
- **Chernobyl (1986)** — firefighters had massive beta burns from clothes soaked in radioactive water. 30% had burns >10% body surface.

PREVENTION OF BETA BURNS:

✓ WASHING PREVENTS BETA BURNS:

People who promptly washed fallout off their skin did NOT develop beta burns. Decontamination is the primary prevention!

- Remove contaminated clothing immediately
- Shower/wash with soap and water
- Do NOT use conditioner (binds particles to hair)
- Do NOT scrub hard (can push particles into skin)
- Gently blot dry

TREATMENT OF BETA BURNS:

- **First:** Complete decontamination (wash away any remaining fallout)
- **Then:** Treat like equivalent thermal burns
- **Blisters:** Keep intact if small, derroof large blisters carefully
- **Wound care:** Clean with saline, apply non-stick dressing
- **Honey:** Can use honey for anti-bacterial/healing properties
- **DO NOT scrub** (can worsen damage)
- **Monitor for infection** — immunocompromise from whole-body radiation increases risk
- **Expect depigmentation** — healed areas may be lighter/darker

BETA BURNS VS THERMAL BURNS — KEY DIFFERENCES

Feature	Thermal Burns	Beta Burns (Radiation)

Onset	Immediate	Delayed 24-48 hours to 2-3 weeks
Cause	Heat energy (flame, flash, contact)	Ionizing radiation from fallout particles on skin
Depth	Can be any depth depending on heat/duration	Usually superficial to mid-partial (beta has limited penetration ~1-2mm)
Prevention	Physical protection, clothing, shelter	Prompt decontamination (washing) prevents burns entirely
Pain	Usually immediate and severe	Often painless initially; pain develops with blistering
Healing	Depends on depth	Usually heals in 2-8 weeks but may have delayed/impaired healing
Scarring	Depends on depth; hypertrophic scarring possible	Usually minimal but depigmentation/colour changes common
Systemic effects	Fluid loss, infection risk (local)	May have concurrent whole-body radiation sickness (immunosuppression)

FLUID REPLACEMENT FOR MAJOR BURNS


Major burns (>15-20% TBSA) cause massive fluid shifts and can lead to shock and death without adequate fluid replacement.

PARKLAND FORMULA (HOSPITAL STANDARD)

First 24 hours:

$$4\text{ mL} \times \text{body weight (kg)} \times \% \text{TBSA burned}$$

- Give half in first 8 hours (from time of burn, not arrival)
- Give remaining half over next 16 hours
- Use crystalloid (saline, Ringer's lactate)
- Target urine output: 0.5 mL/kg/hr (adults), 1 mL/kg/hr (children)

Example: 70kg adult with 30% burns = 4 × 70 × 30 = 8,400mL in 24 hours (4,200mL in first 8 hrs)

WITHOUT IV ACCESS — ORAL REHYDRATION

If IV not available, oral fluids can partially compensate:

- ORS (Oral Rehydration Solution)** is ideal
- If no ORS: water with added salt and sugar
- Drink frequently in small amounts (not gulps)
- Target: clear/pale urine output

Improved ORS Recipe:

- 1 litre clean water
- 6 teaspoons sugar
- ½ teaspoon salt

Mix thoroughly. Tastes slightly salty.

Oral fluids are NOT adequate for burns >30% TBSA — IV access critical for survival.

BURN INFECTION SIGNS — WHEN TO START ANTIBIOTICS

Signs of infected burn:

- Increasing pain (especially after initial improvement)
- Spreading redness beyond burn edges
- Red streaking from burn site
- Swelling, warmth, or tenderness increasing
- Pus or foul-smelling discharge
- Fever (>38°C / 100.4°F)
- Wound darkening or developing black spots
- Delayed healing (no progress after 2 weeks)


Antibiotics for Burn Infections:

- Most burn infections:** Staphylococcus (including MRSA)
- 1st line:** Doxycycline 100mg 2×/day (covers MRSA)
- Alternatives:** TMP-SMX DS 2×/day or Clindamycin 300mg 4×/day
- Severe/systemic infection:** Add Ciprofloxacin for Gram-negative coverage
- Duration:** 7-14 days depending on response

See Antibiotic Guide section for dosing details.

Time After Blast	Radiation Level*	Activity Allowed	Priority Actions
0-1 hour	1000 R/hr (10,000,000 µSv/h)	STAY INSIDE. No exceptions.	Seal room, decontaminate, hydrate
1-7 hours	~100 R/hr (1,000,000 µSv/h)	STAY INSIDE. Emergency only.	Monitor radiation, ration supplies
7-49 hours	~10 R/hr (100,000 µSv/h)	Brief trips (<30 min) if essential	Short waste disposal, gather supplies
2-14 days	~1 → 0.1 R/hr (10,000 → 1,000 µSv/h)	Increasing outdoor time possible	Decontaminate area, source food/water
2-4 weeks	<0.1 R/hr (<1,000 µSv/h)	4+ hours/day outdoor work	Sweep/wash fallout into trenches
1-3 months	<0.01 R/hr (<100 µSv/h)	Near normal activity	Still sleep in shelter if possible

*Assumes heavy fallout area (ground burst). Lighter areas recover faster. ALWAYS verify with Geiger counter before extending outdoor time. Conversion: 1 R/hr ≈ 10,000 µSv/h

Swiss Civil Defense Guideline: Remain sheltered minimum 2 weeks. Brief exit (1 hour) allowed end of first week. Increase outdoor time gradually to 4 hours/day by week 3. Continue sleeping in shelter for several months.



Children, Pregnant Women & Vulnerable Populations

CHILDREN'S MEDICATION DOSING

Medication	Age/Weight	Dose
Potassium Iodide (KI)	Adults/Adolescents >68 kg	130 mg/day
	Children 3-18 yrs (<68 kg)	65 mg/day
	Children 1 mo - 3 yrs	32 mg/day
	Newborns <1 month	16 mg/day
Azithromycin (for children <8 yrs)	Children	10 mg/kg Day 1, then 5 mg/kg Days 2-5
	Max dose	500 mg Day 1, 250 mg Days 2-5
Paracetamol/Acetaminophen	Children 6 mo - 12 yrs	10-15 mg/kg every 4-6 hrs
	Max daily	75 mg/kg/day (max 4g)
Ibuprofen	Children 6 mo+	5-10 mg/kg every 6-8 hrs
	Max daily	40 mg/kg/day (max 1.2g)

SPECIAL CONSIDERATIONS

Children:

- More sensitive to radiation than adults
- Higher thyroid uptake of I-131 → KI more critical
- Smaller bodies = faster dehydration
- Cannot use Doxycycline (<8 yrs) or Fluoroquinolones (<18 yrs)
- Add name tags to clothing in case of separation

Pregnant Women:

- Fetus highly sensitive to radiation (especially weeks 8-15)
- KI: Take 130 mg/day, but limit to 3-4 days if possible (fetal thyroid)
- AVOID: Doxycycline, Ciprofloxacin → Use Azithromycin
- Prioritize for best shelter location

Elderly & Immunocompromised:

- Adults >40: KI only if very high exposure (>500 mSv thyroid dose)
- More susceptible to infection → strict hygiene
- Ensure adequate prescription medications stocked

Infants (Formula/Breastfeeding):

- Use ready-to-feed formula if available
- If mixing powder: use bottled water only until tap tested
- Breastfeeding generally safe to continue

Long-Term Recovery (Months to Years)

AREA DECONTAMINATION

- **Sweep/hose fallout** from roofs, pavement into shallow trenches
- **Remove 5-10 inches topsoil** from garden/growing areas
- **OR plow fallout under** — buries radiation, allows planting above
- **Wash exterior surfaces** repeatedly over weeks
- **HEPA vacuum indoors** if power available

HEALTH MONITORING (LONG-TERM)

- Track any radiation exposure received (dose log)
- Watch for delayed symptoms: fatigue, infection, bruising
- Annual thyroid checks (especially children)
- Cancer screening when medical services resume

REBUILDING PRIORITIES

1. **Secure clean water source** — Well, rainwater collection, filtration
2. **Establish food production** — Seeds, decontaminated soil, greenhouse
3. **Restore communication** — HAM radio network, message systems
4. **Community security** — Mutual defense, conflict resolution
5. **Medical supplies** — Scavenge, trade, grow medicinal plants

WHAT WILL STILL WORK

- Mechanical tools (no electronics to fry)
- Gravity-fed water systems
- Solar panels (if protected from EMP or undamaged)

- Vehicles older than ~1980 (no computer chips)
- Hand-crank radios/flashlights



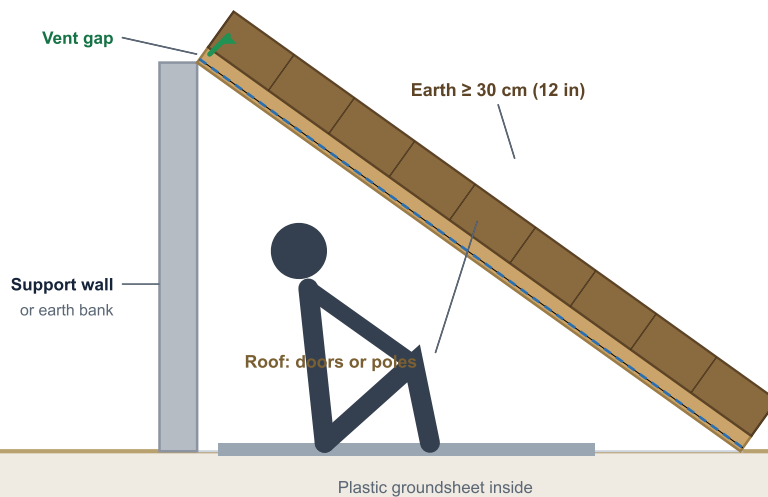
Makeshift Shelter Construction

GOAL: Create a shelter with Protection Factor (PF) of 10+ as quickly as possible. Remember: mass between you and radiation sources is key. Earth, concrete, water, and dense materials block gamma radiation.

Expedient Lean-To Shelter (30-60 minutes)

Best for: When you have a solid wall (building, earth bank) to work against. Provides PF 10-40 depending on mass.

Lean-To Shelter — Cross-Section



Build notes

- Lean panels at 45–60°
- Pile ≥30 cm packed earth
- Plastic sheet under the soil
- Leave a small vent at the top
- ~1 m of headroom inside
- Block the open end with mass
- once you are inside

An expedient lean-to built against a wall or bank and covered with at least 30 cm (12 in) of packed earth.

CONSTRUCTION STEPS

1. **Find solid support:** Exterior wall, earth bank, large vehicle, or sturdy fence
2. **Lean doors/panels:** Place at 45-60° angle against support wall
3. **Cover with mass:** Pile earth, sandbags, or heavy items on top (minimum 12"/30cm)
4. **Seal gaps:** Pack earth/debris around edges, leave small ventilation gap
5. **Create floor:** Plastic sheeting or boards to stay off damp ground
6. **Interior lining:** Cardboard or cloth for insulation

MATERIALS NEEDED

- □ 2-4 solid doors, plywood sheets, or table tops
- □ Earth/soil (50+ sandbags worth ideal)
- □ Plastic sheeting for waterproofing
- □ Sandbags, rubble, or heavy items
- □ Duct tape for sealing
- □ Shovel/spade

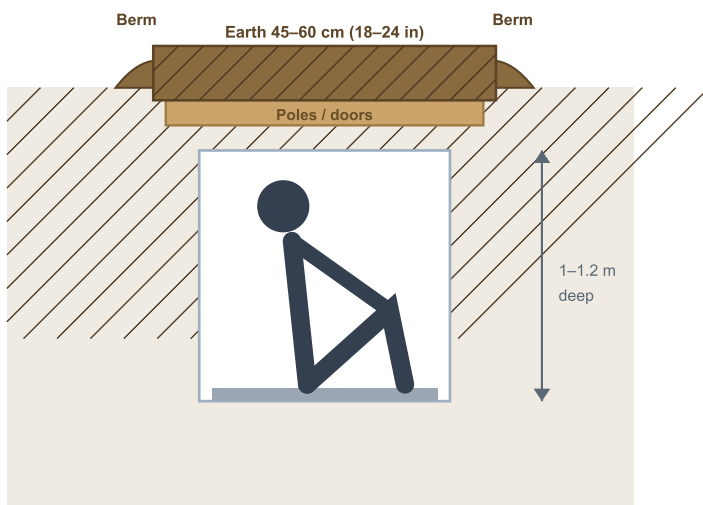
Target dimensions: 3ft (1m) wide × 6ft (2m) long per person × 3ft (1m) headroom minimum

● Expedient Trench Shelter (2-4 hours with 2+ people)

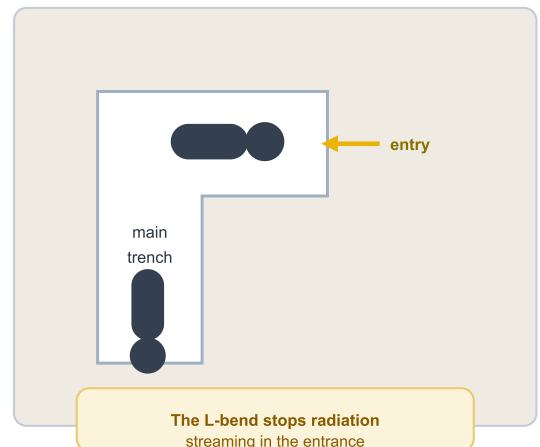
Best for: Open areas with diggable soil. Provides PF 40-300+ depending on depth and overhead cover.

Trench Shelter — Cross-Section & Plan

CROSS-SECTION



PLAN VIEW



A trench shelter with an earth-covered roof and an L-shaped entrance to stop radiation streaming inside.

CONSTRUCTION STEPS

- 1. **Mark trench:** 3ft (1m) wide × 6ft (2m) long per 2 people
- 2. **Dig to 4ft (1.2m) depth:** Pile earth on sides for additional shielding
- 3. **Create roof supports:** Lay doors, poles, or strong branches across
- 4. **Add waterproofing:** Plastic sheeting over roof supports
- 5. **Cover with earth:** Minimum 18" (45cm), ideally 24"+ (60cm+)
- 6. **Create entrance:** L-shaped or covered to block radiation scatter
- 7. **Ventilation:** Two openings at opposite ends, below ground level

PROTECTION FACTORS ACHIEVED

Earth Cover	PF
12" (30cm)	~10
18" (45cm)	~20
24" (60cm)	~40
36" (90cm)	~100
48" (120cm)	~300

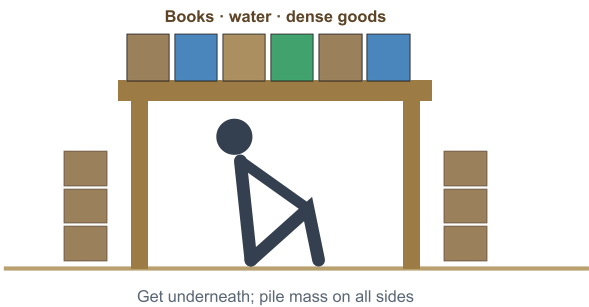
Important: Entry must be shielded or angled to prevent radiation streaming in.

 Indoor Expedient Shelter (15-30 minutes)

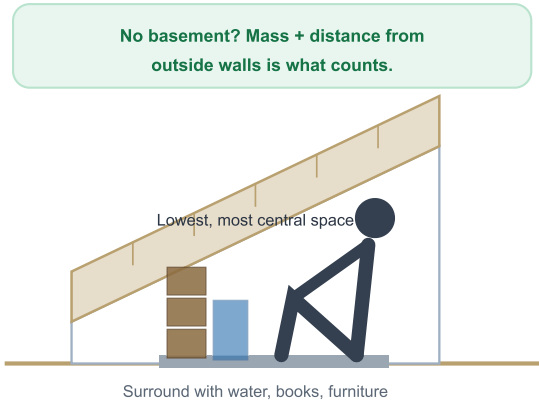
Best for: When you cannot go outside. Build inside existing structure for quick protection.

Indoor Expedient Shelters — Add Mass Around You

A · Heavy Table (innermost room)



B · Closet / Under-Stairs



With no basement, build mass around you — under a sturdy table, or in a central closet or under-stairs space.

TABLE/DESK SHELTER

1. Place sturdy table in centre room or basement corner
2. Stack books, water containers, heavy items on top
3. Surround sides with filled bookcases, furniture, boxes of books
4. Leave one side partially open for entry
5. Add mattress on top if available
6. Place water containers around perimeter (water = shielding)

PF achieved: 5-15 depending on mass added

CLOSET/CUPBOARD SHELTER

1. Choose interior closet (no exterior walls)
2. Remove shelves if needed for space
3. Stack heavy items outside door and walls
4. Fill gaps with clothing, books, water containers
5. If in basement, you already have earth shielding from sides
6. Add overhead mass if possible (boxes on shelf above)

PF achieved: 10-30 in basement closet, 5-10 on ground floor



Vehicle-Based Emergency Shelter

Last resort only — vehicles provide PF 2-3. Only use if no buildings available.

- **Park in depression:** Ditch, underpass, or against earth bank
- **Cover with earth:** Pile soil, sandbags against sides and on roof if structurally safe
- **Block windows:** Use earth, bags, or heavy items inside against glass
- **Seal vents:** Turn off ventilation, tape gaps with cloth/tape
- **Stay low:** Lie on floor between seats for maximum shielding from sides

Critical Shelter Rules:

- **Entry protection:** NEVER have direct line-of-sight from outside to shelter interior — use L-shaped or covered entry
- **Overhead mass:** Most fallout lands on roof/ground above — overhead shielding is critical
- **Ventilation:** Include filtered air intake (HEPA or layered cloth) and exhaust
- **Floor elevation:** Stay off bare ground — use plastic, boards, or raised platform
- **Structural safety:** Ensure roof supports can hold weight of earth/mass (1 cubic foot of earth $\approx$ 100 lbs / 45 kg)



Pre-Event Supplies Checklist

GOAL: Achieve a Protection Factor (PF) of at least 10 (reducing exposure to ~10% of outdoor levels). FEMA considers PF 10 adequate for survival in most fallout scenarios. Stock supplies NOW — they won't be available after an event.

SHELTER & SEALING

- ☐ Plastic sheeting: 6-10 mil thickness
- ☐ Duct tape: 4-6 large rolls
- ☐ Plywood sheets: ½" (12mm) thick
- ☐ Long screws + screwdriver/drill
- ☐ Empty sandbags: 50-100 bags
- ☐ Heavy duty bin bags: 30+
- ☐ Wheelie bins (for water/soil)
- ☐ Spade/shovel
- ☐ Hammer and nails (assorted sizes)
- ☐ Axe (for breaching/wood cutting)
- ☐ Crowbar (for entry/leverage)
- ☐ Wood saw (hand-powered)

WATER & FOOD

- ☐ Water: 3-4 litres per person per day (min 2 weeks)
- ☐ Fillable water bags/bladders (collapsible)
- ☐ Canned food (soups, stews, fruit)
- ☐ Dry goods: Rice, pasta, beans, oats
- ☐ Manual can opener: 2 or more
- ☐ Water containers (various sizes)
- ☐ Gravity water filter (optional, for long-term)
- ☐ Water purification tabs
- ☐ Eating utensils (spoons, forks, knives)
- ☐ Plastic cups (reusable, multiple)
- ☐ Pen knife / utility knife

SANITATION & HYGIENE

- ☐ Cat litter (CLAY/bentonite): 2 large bags pp
- ☐ 5-gallon bucket with sealed lid
- ☐ Heavy bin bags
- ☐ Hand sanitiser: Multiple bottles
- ☐ Wet wipes (large supply)
- ☐ Toilet paper: Generous supply
- ☐ Disinfectant (spray/liquid)
- ☐ Thin bleach (fragrance-free, sodium hypochlorite)
- ☐ Zip lock bags: Large supply, various sizes
- ☐ Toothbrush + toothpaste per person
- ☐ Liquid soap / body wash

CLOTHING & PPE

- ☐ Spare clothing: 2-3 complete sets per person
- ☐ Warm clothing: Jackets, jumpers, thermal layers
- ☐ Warm socks and underwear: Multiple pairs
- ☐ Rain coat (After day 3 supply runs in rain)
- ☐ Spare boots/sturdy shoes
- ☐ Blankets: 2+ per person (wool preferred)
- ☐ Survival blankets (foil/mylar)
- ☐ Bivvy bag (emergency sleeping bag)
- ☐ Tyvek suits: 2-4 disposable coveralls
- ☐ 3M FFP3/N100 masks: 10+ per person
- ☐ Safety goggles: Sealed eye protection
- ☐ Disposable hair covers
- ☐ Plastic shoe covers (disposable)
- ☐ Boot covers/plastic bags
- ☐ Nitrile gloves: Box of 100+
- ☐ Safety/work gloves (heavy duty)

Improvised goggles: Cut transparent plastic, tape across eyes if no goggles available

MEDICAL KIT

- ☐ Potassium Iodide (KI) tablets
- ☐ Antibiotics (Doxycycline preferred)
- ☐ Paracetamol/Ibuprofen
- ☐ Aspirin (Clot reduction)
- ☐ Anti-diarrhoeals (Loperamide)
- ☐ Oral Rehydration Salts (ORS)
- ☐ Bandages, gauze pads
- ☐ Burn gel/dressings
- ☐ Cling film: 3-4 rolls (for burns)
- ☐ Trauma Shears (Bandage Scissors)
- ☐ Prescription medications (30+ day supply)
- ☐ Povidone-iodine (Betadine) antiseptic
- ☐ Chlorhexidine gluconate (skin disinfectant)
- ☐ SpO2 monitor (pulse oximeter)
- ☐ Thermometer

TOOLS

- ☐ Multi-tool/knife
- ☐ Pliers (standard + needle-nose)
- ☐ Hammer and nails
- ☐ Crowbar
- ☐ Axe
- ☐ Wood saw (hand-powered)
- ☐ Pen knife / utility knife
- ☐ Scissors (Heavy Duty+Small Sharp - Cut sheeting)
- ☐ Zip ties: Assorted sizes, large quantity
- ☐ Paracord/rope: 50m+
- ☐ Tubing/hose: Various diameters, 5m+
- ☐ Aluminium foil: Heavy duty, multiple rolls
- ☐ Permanent markers
- ☐ Pen and paper (notebook)
- ☐ Sewing kit (needles, thread, buttons)
- ☐ Magnifying glass (fire starting, splinters)
- ☐ Compass (navigation)



ELECTRONICS (FARADAY PROTECTED)

- ☐ Geiger counter (GMC-800 or GMC-500+)
- ☐ 14500 batteries (for GMC-800): 4+ spare
- ☐ AA batteries: 20+ pack (for GMC-500+)
- ☐ AAA batteries: 20+ pack
- ☐ Wind-up torch/flashlight
- ☐ Mini foldable solar panel (5-20W)
- ☐ Battery-powered AM/FM/SW radio
- ☐ USB power bank
- ☐ Spare mobile phone
- ☐ USB drives with documents/maps
- ☐ CO₂ monitor (Must be "NDIR" Carbon Dioxide)
- ☐ Carbon monoxide (CO) monitor

Store all electronics in Faraday container until needed



VENTILATION EQUIPMENT

- ☐ HEPA filters: Multiple replacements
- ☐ Vent pipes: 5-10 inch diameter, 2m+ each
- ☐ Manual air blower #1 (intake/filtered air)
- ☐ Manual air blower #2 (exhaust air)
- ☐ Box fan (if power available)
- ☐ Mesh/screen (for pest exclusion)
- ☐ Tubing/hose: For air routing
- ☐ Activated carbon filter material
- ☐ Layered cloth for improvised filters

Two blowers allow positive pressure filtration



ADDITIONAL ESSENTIALS

- ☐ Camp stove + fuel
- ☐ Matches/lighters (waterproof)
- ☐ Candles: 20+ (light + some heat)
- ☐ Glow sticks: 20+ (backup light, no batteries)
- ☐ Zip lock bags: Large quantity, all sizes
- ☐ Cable ties: 100+ assorted
- ☐ Can of Expanding Foam (optional gap filler)
- ☐ Blankets: Wool or emergency foil
- ☐ Sleeping bags/bedding
- ☐ Whistle (signalling)
- ☐ Mirror (signalling)
- ☐ First aid manual
- ☐ This guide (printed copy)
- ☐ Local maps (paper copies)

✓ Storage Tips:

- **Faraday container:** Store ALL electronics in sealed metal container lined with cardboard — include Geiger counter, radios, solar panel, batteries, monitors
- **Rotation:** Check expiry dates on medications, batteries, and food every 6 months
- **Location:** Store supplies in basement or central room — not in garage or outbuilding
- **Documentation:** Keep inventory list with supplies, update when items used/replaced
- **Manual blowers:** Test ventilation setup before emergency — know how to create positive pressure filtered air intake



Decision Flowchart

IF YOU SEE A BRIGHT FLASH:

→ Turn away, close eyes, drop to ground → Count to 60 → Get inside immediately → Go to basement/center room → Seal room → Stay minimum 24 hours → Monitor radiation → Follow 7-10 rule for exit timing

IF GEIGER COUNTER READS:

- **>1000 $\mu\text{Sv/h}$:** DO NOT GO OUTSIDE
- **100-1000 $\mu\text{Sv/h}$:** Emergency exits only (<5 min)
- **10-100 $\mu\text{Sv/h}$:** Brief trips (<30 min)
- **<10 $\mu\text{Sv/h}$:** Extended activity possible with mask

Reference: Eight Attack Scenarios

If the power and internet are down, you will have no calculator and no maps of blast rings — only what is on paper. This section pre-computes eight worked scenarios so you have concrete reference points: how far each effect reaches, what happens in the first minutes, and what to do at each step. The figures are produced by the same physics model as the on-screen Blast Sequence Calculator (Glasstone & Dolan scaling laws).

⚠ HOW TO READ THESE NUMBERS

These are **illustrative, idealised estimates**, not predictions. Real effects shift with the exact height of burst, weather, visibility, terrain and how buildings are constructed — easily by 20–30%. Distances are measured from ground zero (the point under the detonation).

Air burst vs surface burst matters. A surface (ground) burst pulls soil and debris into the fireball and produces heavy *local* fallout downwind. An air burst maximises the blast area but produces very little local fallout — the main delayed hazard is reduced.

The single biggest factor you control is shelter. The scenarios below deliberately mix good shelter with none, and downwind with upwind, so you can see how much each one matters: at the same yield and distance, the difference between a basement and the open air, or between downwind and upwind, can be the difference between survivable and not (compare Scenarios 5, 6 and 7).

For scale (to picture the distances without a map): a major city's densely built centre is typically 5–10 km across, with continuous built-up suburbs reaching 20–40 km out. So a 5 psi ring of a few kilometres covers much of a city centre, while the 15–80 km positions in the later scenarios sit out in the suburbs or open country — where fallout, not blast, is the danger.

Scenario 1 · City Centre — 10 kt improvised device (surface burst · 2 km downwind)

A crude device smuggled in and detonated at street level. Low yield, but a surface burst that pulls soil and debris into the fireball, so it produces significant local fallout.

Weapon / yield: 10 kt · **Detonation:** surface burst
Target: City Centre (detonation point)
Worked-example position: 2 km (1.2 mi) from ground zero
Your shelter: Brick building, interior room (protection factor 15×) · **Wind:** 15 mph, you are downwind

SURVIVAL PROGNOSIS AT 2 KM

SURVIVABLE

Survival likely with appropriate shelter and precautions.

Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	0.29 km (0.18 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	0.41 km (0.25 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	0.62 km (0.39 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	0.97 km (0.60 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	1.34 km (0.83 mi)	Walls and roofs fail; serious injuries common.

Effect zone	Reaches out to	What it means at the edge of this zone
Light blast — 1 psi	2.59 km (1.61 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	0.98 km (0.61 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	1.36 km (0.85 mi)	Painful blistering burns to exposed skin.
Flash blindness	3.03 km (1.88 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	8.55 km (5.31 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. This surface burst produces heavy local fallout downwind — see the timeline.

What it looks like from where you are — you are 2 km (1.2 mi) downwind of ground zero, sheltering in a brick building, interior room:

Time	Event	What happens & what to do
7 μs	DETONATION / FLASH	Light arrives in 6.7 μs. Visible flash from 10 kt at 2 km. Brief flash blindness 10-30 sec if looking directly. Thermal fluence: 2.16 cal/cm² (90.5 kJ/m²). → Note flash direction - indicates blast wave arriving in 5.5 sec. Prepare to take cover.
7 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 2 km: 1885 V/m. Effect: Computers/phones may be damaged, vehicles likely OK, local outages. EMP effective radius: ~9 km for this 10 kt ground burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-2 seconds	THERMAL PULSE	Light thermal pulse lasts 1.50 sec. At 2 km: 2.16 cal/cm². 1st degree burns (sunburn-like) possible on exposed skin. Painful but not life-threatening. → Minimal thermal risk. Use the 5.5 sec until blast arrives to get to better cover.
5.5 sec	BLAST WAVE ARRIVES	Blast wave arrives at 2 km after 5.5 sec (Mach 1.05). MODERATE: 4.38 psi (30.2 kPa). Wind: 130 mph (209 km/h). Windows shatter. Light structures damaged. Doors blown open. Standing difficult. Positive phase: 0.6 sec. → Take cover immediately. Stay away from windows and glass. Protect face and eyes.
6.1 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase begins at 6.1 sec. Reverse wind ~46 mph (74 km/h) toward ground zero. Duration: 0.8 sec. Loose debris moves. Stay protected. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.
6.9 sec - 12 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~10 km (32473 ft) in ~2 min. Cloud continues rising to maximum ~16 km (52434 ft) over 12 min. At 2 km, initial nuclear radiation dose: 6.6 rem (66 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 5 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
0-10 min	SURVIVAL WINDOW	CRITICAL 10-MINUTE WINDOW at 2 km downwind. Fallout not yet arrived. Air contains non-radioactive dust/debris. Visibility may be reduced. This is your only safe time to move. → GET INSIDE solid building IMMEDIATELY. Basement provides PF 40-100. Center room PF 10-20. You have MAXIMUM 10 minutes. GO NOW.

Time	Event	What happens & what to do
+10 min	FALLOUT ARRIVES	Radioactive particles begin falling - visible as fine gray ash/dust. DO NOT TOUCH. Gamma radiation intensifies rapidly. MODERATE FALLOUT at 2 km downwind: 94.6 R/hr (830.0k µSv/h) outdoors. Brick building, interior room shelter effective: 6.3 R/hr inside. Below acute danger threshold. → BE INSIDE with room sealed. Stay inside. Shelter providing adequate protection. Conserve supplies - plan to stay 48+ hours.
1-6 hours post-det	PEAK FALLOUT INTENSITY	Maximum radiation deposition period. Outdoors at 2 km: 76 R/hr (664.0k µSv/h). In Brick building, interior room: 5.0 R/hr. Estimated 6-hour dose in shelter: ~20 rem. → ABSOLUTE SHELTER - no exceptions. Most fallout deaths occur from premature emergence during this window. Wait it out.
6-24 hours post-det	RADIATION DECAY - PHASE 1	7-10 rule in effect. At 7 hours: ~10% of initial = 9.5 R/hr (83.0k µSv/h) outdoors. In Brick building, interior room: 0.63 R/hr. Cumulative dose building but rate dropping. → Continue sheltering. If you have dosimeter, track cumulative exposure. Ration supplies. Begin planning but don't act yet.
24-48 hours post-det	RADIATION DECAY - PHASE 2	Radiation at ~1% of peak: 0.95 R/hr (8.3k µSv/h) outdoors. In Brick building, interior room: 0.063 R/hr. Significant improvement from initial levels. → Brief essential outdoor trips possible: MAX 120 minutes with full protection (mask, goggles, covered skin). Decontaminate immediately on return - remove outer clothes outside, wash thoroughly.
48 hours - 7 days	EXTENDED DECAY	Continued decay. Day 2: 0.473 R/hr outdoors. Day 7: ~0.0946 R/hr (830.0 µSv/h). Approaching background-safe levels depending on initial intensity. → Day 2: 240 min outdoor OK. Day 7: Extended activity possible. Always use protection. Monitor with dosimeter if available. Plan evacuation or resupply.
14 days (2 weeks)	TWO-WEEK MILESTONE	Radiation at ~0.01% of peak: 0.00946 R/hr (83.00 µSv/h) outdoors. Status: slightly elevated above background. Natural background is ~0.00001-0.00003 R/hr (0.1-0.3 µSv/h). Cumulative ground contamination may persist in hot spots. → Extended outdoor activity: Normal activity possible with monitoring. Continue wearing mask in dusty areas. Avoid consuming local food/water without testing. Check for hot spots before occupying new areas. Long-term cleanup may be needed.

Scenario 2 · City Centre — 100 kt tactical warhead (air burst · 3 km downwind)

A single lower-yield warhead, of the kind held in large numbers, air-burst to maximise the area of blast damage across the city.

Weapon / yield: 100 kt · **Detonation:** air burst
Target: City Centre (detonation point)
Worked-example position: 3 km (1.9 mi) from ground zero
Your shelter: Brick building, interior room (protection factor 15×) · **Wind:** 15 mph, you are downwind

SURVIVAL PROGNOSIS AT 3 KM

SURVIVABLE

Survival likely with appropriate shelter and precautions.

Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	0.91 km (0.57 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	0.88 km (0.55 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	1.35 km (0.84 mi)	Most buildings collapse; most people here are killed.

Effect zone	Reaches out to	What it means at the edge of this zone
Heavy blast — 5 psi	2.09 km (1.30 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	2.88 km (1.79 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	5.57 km (3.46 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	2.53 km (1.57 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	3.50 km (2.17 mi)	Painful blistering burns to exposed skin.
Flash blindness	7.78 km (4.83 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	68.6 km (42.6 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. As an air burst, local fallout is minimal; the delayed radiation hazard is small compared with a surface burst.

What it looks like from where you are — you are 3 km (1.9 mi) downwind of ground zero, sheltering in a brick building, interior room:

Time	Event	What happens & what to do
10 μs	DETONATION / FLASH	Light arrives in 10.0 μs. Bright flash from 100 kt at 3 km - brighter than welding arc. Flash blindness 30-120 sec. Thermal fluence: 11.3 cal/cm² (472.8 kJ/m²). → Avert eyes immediately. Do not look toward the light source.
10 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 3 km: 9711 V/m. Effect: Sensitive electronics destroyed, some vehicles affected, grid disruption. EMP effective radius: ~69 km for this 100 kt air burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-2 seconds	THERMAL PULSE	Significant thermal pulse lasts 2.00 sec. At 3 km: 11.3 cal/cm². 2nd-3rd degree burns on exposed skin. Dark clothing absorbs 2-3x more heat than white. Paper may ignite. → Take cover behind solid object. Cover exposed skin with any material. Stay low.
7.3 sec	BLAST WAVE ARRIVES	Blast wave arrives at 3 km after 7.3 sec (Mach 1.2). HEAVY: 6.74 psi (46.4 kPa). Wind: 160 mph (257 km/h). Most residential buildings destroyed. Windows shatter explosively - glass fragments lethal. Positive phase: 0.7 sec. → Stay prone, away from windows. Under sturdy furniture or in interior room. Cover head and neck.
8.0 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase begins at 8.0 sec. Air rushes BACK toward ground zero at ~56 mph (90 km/h) for 1.1 sec. Secondary debris hazard - rubble pulled toward blast site. Damaged structures may now collapse inward. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.
9.1 sec - 13 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~11 km (37318 ft) in ~3 min. Cloud continues rising to maximum ~18 km (60074 ft) over 13 min. At 3 km, initial nuclear radiation dose: 15.0 rem (150 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately Infinity minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.

Time	Event	What happens & what to do
0-Infinity min	SURVIVAL WINDOW	Air burst at 3 km produces minimal local fallout. Fireball didn't contact ground - no soil/debris irradiated. Primary hazards: fires (likely), structural damage, secondary injuries. → Seek sturdy shelter. Avoid damaged structures and spreading fires. Assist injured if safe. Long-range fallout possible in 24-72 hours.
15+ minutes	MINIMAL LOCAL FALLOUT	Air burst over 3 km away - fireball didn't contact surface. No significant local fallout. Induced radioactivity limited to ~1.4 km of ground zero. Global fallout may arrive in days/weeks via upper atmosphere. → Primary concerns: fires, collapsed structures, injured persons, disrupted infrastructure. Move carefully. Assist others if safe. Monitor for distant fallout warnings.

Scenario 3 · City Centre — 500 kt strategic warhead (air burst · 6 km downwind)

A typical deployed strategic warhead, air-burst over the centre for the widest destruction. Here you are in an ordinary brick building at ground level rather than a basement, so the protection is much lower.

Weapon / yield: 500 kt · **Detonation:** air burst

Target: City Centre (detonation point)

Worked-example position: 6 km (3.7 mi) from ground zero

Your shelter: Brick building, ground floor (protection factor 10×) · **Wind:** 15 mph, you are downwind

SURVIVAL PROGNOSIS AT 6 KM

SURVIVABLE

Survival likely with appropriate shelter and precautions.

Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	1.74 km (1.08 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	1.51 km (0.94 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	2.30 km (1.43 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	3.57 km (2.22 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	4.92 km (3.06 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	9.52 km (5.91 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	4.89 km (3.04 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	6.77 km (4.21 mi)	Painful blistering burns to exposed skin.
Flash blindness	15.1 km (9.35 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	116.6 km (72.4 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. As an air burst, local fallout is minimal; the delayed radiation hazard is small compared with a surface burst.

What it looks like from where you are — you are 6 km (3.7 mi) downwind of ground zero, sheltering in a brick building, ground floor:

Time	Event	What happens & what to do
20 μs	DETONATION / FLASH	Light arrives in 20.0 μs. Bright flash from 500 kt at 6 km - brighter than welding arc. Flash blindness 30-120 sec. Thermal fluence: 13.9 cal/cm ² (581.2 kJ/m ²). → Avert eyes immediately. Do not look toward the light source.
20 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 6 km: 9487 V/m. Effect: Sensitive electronics destroyed, some vehicles affected, grid disruption. EMP effective radius: ~117 km for this 500 kt air burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-3 seconds	THERMAL PULSE	Significant thermal pulse lasts 2.62 sec. At 6 km: 13.9 cal/cm ² . 2nd-3rd degree burns on exposed skin. Dark clothing absorbs 2-3x more heat than white. Paper may ignite. → Take cover behind solid object. Cover exposed skin with any material. Stay low.
15.7 sec	BLAST WAVE ARRIVES	Blast wave arrives at 6 km after 15.7 sec (Mach 1.1). HEAVY: 5.33 psi (36.7 kPa). Wind: 160 mph (257 km/h). Most residential buildings destroyed. Windows shatter explosively - glass fragments lethal. Positive phase: 1.0 sec. → Stay prone, away from windows. Under sturdy furniture or in interior room. Cover head and neck.
16.7 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase begins at 16.7 sec. Air rushes BACK toward ground zero at ~56 mph (90 km/h) for 1.6 sec. Secondary debris hazard - rubble pulled toward blast site. Damaged structures may now collapse inward. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.
18.3 sec - 14 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~13 km (42802 ft) in ~3 min. Cloud continues rising to maximum ~21 km (67935 ft) over 14 min. At 6 km, initial nuclear radiation dose: 2.5 rem (25 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately Infinity minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
0-Infinity min	SURVIVAL WINDOW	Air burst at 6 km produces minimal local fallout. Fireball didn't contact ground - no soil/debris irradiated. Primary hazards: fires (likely), structural damage, secondary injuries. → Seek sturdy shelter. Avoid damaged structures and spreading fires. Assist injured if safe. Long-range fallout possible in 24-72 hours.
15+ minutes	MINIMAL LOCAL FALLOUT	Air burst over 6 km away - fireball didn't contact surface. No significant local fallout. Induced radioactivity limited to ~2.6 km of ground zero. Global fallout may arrive in days/weeks via upper atmosphere. → Primary concerns: fires, collapsed structures, injured persons, disrupted infrastructure. Move carefully. Assist others if safe. Monitor for distant fallout warnings.

Scenario 4 · City Centre — 50 kt tactical warhead (surface burst · 15 km downwind)

A tactical-scale surface burst over the centre, seen from 15 km away in a car. Blast and heat are survivable at this range, but a vehicle gives almost no protection from the fallout now drifting your way.

Weapon / yield: 50 kt · **Detonation:** surface burst
Target: City Centre (detonation point)
Worked-example position: 15 km (9.3 mi) from ground zero
Your shelter: Vehicle (car) (protection factor 2×) · **Wind:** 15 mph, you are downwind

SURVIVAL PROGNOSIS AT 15 KM
SEVERE
High probability of serious injury. Immediate shelter critical.

Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	0.55 km (0.34 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	0.70 km (0.43 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	1.07 km (0.66 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	1.66 km (1.03 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	2.28 km (1.42 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	4.42 km (2.75 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	1.90 km (1.18 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	2.64 km (1.64 mi)	Painful blistering burns to exposed skin.
Flash blindness	5.86 km (3.64 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	14.5 km (9.03 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. This surface burst produces heavy local fallout downwind — see the timeline.

What it looks like from where you are — you are 15 km (9.3 mi) downwind of ground zero, sheltering in a vehicle (car):

Time	Event	What happens & what to do
50 μs	DETONATION / FLASH	Light arrives in 50.0 μs. Distant flash from 50 kt at 15 km visible on horizon. Thermal fluence: 0.18 cal/cm² (7.51 kJ/m²). Minimal flash blindness risk. → Note flash direction - blast wave will arrive in approximately 43.7 sec. Move to cover.
50 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 15 km: 525 V/m. Effect: Sensitive equipment may malfunction, most devices survive. EMP effective radius: ~15 km for this 50 kt ground burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-2 seconds	THERMAL PULSE	Minimal thermal effects at 15 km. Fluence: 0.179 cal/cm² over 1.81 sec. Equivalent to brief sun exposure. No injury expected. → No thermal danger. Focus on blast wave arriving in 43.7 sec.
43.7 sec	BLAST WAVE ARRIVES	Blast wave arrives at 15 km after 43.7 sec. MINIMAL: 0.362 psi (2.49 kPa). Wind: 15 mph. Audible boom/rumble. Slight pressure change felt. Window rattling possible. Positive phase: 0.9 sec. → Stay indoors as precaution. Minor structural risk only.
44.6 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase at 44.6 sec. Gentle reverse airflow for 1.4 sec as atmospheric pressure normalizes. Negligible hazard at 15 km. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.

Time	Event	What happens & what to do
46.0 sec - 12 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~11 km (35557 ft) in ~3 min. Cloud continues rising to maximum ~17 km (57394 ft) over 12 min. At 15 km, initial nuclear radiation dose: 0.0 rem (0 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 20 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
1-25 min	SURVIVAL WINDOW	CRITICAL 25-MINUTE WINDOW at 15 km downwind. Fallout not yet arrived. Air contains non-radioactive dust/debris. Visibility may be reduced. This is your only safe time to move. → GET INSIDE solid building IMMEDIATELY. Basement provides PF 40-100. Center room PF 10-20. You have MAXIMUM 25 minutes. GO NOW.
+25 min	FALLOUT ARRIVES	Radioactive particles begin falling - visible as fine gray ash/dust. DO NOT TOUCH. Gamma radiation intensifies rapidly. EXTREME FALLOUT at 15 km downwind: 298 R/hr (2.62M μSv/h) outdoors. In Vehicle (car) (PF 2): 149 R/hr. Radiation sickness onset in ~0.7 hours at current rate. → BE INSIDE with room sealed. Stay in deepest part of shelter. Add any available mass (books, furniture, water containers) for extra shielding. Do NOT go outside.
1-6 hours post-det	PEAK FALLOUT INTENSITY	Maximum radiation deposition period. Outdoors at 15 km: 239 R/hr (2.09M μSv/h). In Vehicle (car): 119.3 R/hr. Estimated 6-hour dose in shelter: ~477 rem. → ABSOLUTE SHELTER - no exceptions. Most fallout deaths occur from premature emergence during this window. Wait it out.
6-24 hours post-det	RADIATION DECAY - PHASE 1	7-10 rule in effect. At 7 hours: ~10% of initial = 29.8 R/hr (261.6k μSv/h) outdoors. In Vehicle (car): 14.92 R/hr. Cumulative dose building but rate dropping. → Continue sheltering. If you have dosimeter, track cumulative exposure. Ration supplies. Begin planning but don't act yet.
24-48 hours post-det	RADIATION DECAY - PHASE 2	Radiation at ~1% of peak: 2.98 R/hr (26.2k μSv/h) outdoors. In Vehicle (car): 1.492 R/hr. Significant improvement from initial levels. → Brief essential outdoor trips possible: MAX 120 minutes with full protection (mask, goggles, covered skin). Decontaminate immediately on return - remove outer clothes outside, wash thoroughly.
48 hours - 7 days	EXTENDED DECAY	Continued decay. Day 2: 1.492 R/hr outdoors. Day 7: ~0.2983 R/hr (2.6k μSv/h). Approaching background-safe levels depending on initial intensity. → Day 2: 240 min outdoor OK. Day 7: Extended activity possible. Always use protection. Monitor with dosimeter if available. Plan evacuation or resupply.
14 days (2 weeks)	TWO-WEEK MILESTONE	Radiation at ~0.01% of peak: 0.02983 R/hr (261.61 μSv/h) outdoors. Status: moderately elevated. Natural background is ~0.00001-0.00003 R/hr (0.1-0.3 μSv/h). Cumulative ground contamination may persist in hot spots. → Extended outdoor activity: Normal activity possible with monitoring. Continue wearing mask in dusty areas. Avoid consuming local food/water without testing. Check for hot spots before occupying new areas. Long-term cleanup may be needed.

Scenario 5 · City Centre — 500 kt strategic warhead (surface burst · 80 km downwind)

A large surface burst, 80 km downwind, caught in the open. This is the classic fallout-corridor danger: heavy fallout reaches far downwind, and with no shielding the radiation dose, not the blast, is what threatens you.

Weapon / yield: 500 kt · **Detonation:** surface burst

Target: City Centre (detonation point)

Worked-example position: 80 km (49.7 mi) from ground zero

SURVIVAL PROGNOSIS AT 80 KM

CRITICAL

Survival unlikely without immediate perfect shelter and medical care.

Your shelter: Open ground (no shelter) (protection factor 1×) · **Wind:** 15 mph, you are downwind



Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	1.39 km (0.87 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	1.51 km (0.94 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	2.30 km (1.43 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	3.57 km (2.22 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	4.92 km (3.06 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	9.52 km (5.91 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	4.89 km (3.04 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	6.77 km (4.21 mi)	Painful blistering burns to exposed skin.
Flash blindness	15.1 km (9.35 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	31.1 km (19.3 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. This surface burst produces heavy local fallout downwind — see the timeline.

What it looks like from where you are — you are 80 km (49.7 mi) downwind of ground zero, out in the open with no shelter:

Time	Event	What happens & what to do
267 μs	DETONATION / FLASH	Light arrives in 266.9 μs. Distant flash from 500 kt at 80 km visible on horizon. Thermal fluence: 0.05 cal/cm² (2.18 kJ/m²). Minimal flash blindness risk. → Note flash direction - blast wave will arrive in approximately 4 min. Move to cover.
267 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 80 km: 180 V/m. Effect: Minimal electronics impact at this range. EMP effective radius: ~31 km for this 500 kt ground burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-3 seconds	THERMAL PULSE	Minimal thermal effects at 80 km. Fluence: 0.052 cal/cm² over 2.62 sec. Equivalent to brief sun exposure. No injury expected. → No thermal danger. Focus on blast wave arriving in 4 min.
3 min 53 sec	BLAST WAVE ARRIVES	Blast wave arrives at 80 km after 3 min 53 sec. MINIMAL: 0.102 psi (0.71 kPa). Wind: 5 mph. Audible boom/rumble. Slight pressure change felt. Window rattling possible. Positive phase: 3.2 sec. → Stay indoors as precaution. Minor structural risk only.
3 min 56 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase at 3 min 56 sec. Gentle reverse airflow for 4.8 sec as atmospheric pressure normalizes. Negligible hazard at 80 km. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.

Time	Event	What happens & what to do
4 min 1 sec - 14 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~13 km (42802 ft) in ~3 min. Cloud continues rising to maximum ~21 km (67935 ft) over 14 min. At 80 km, initial nuclear radiation dose: 0.0 rem (0 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 101 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
4-106 min	SURVIVAL WINDOW	CRITICAL 106-MINUTE WINDOW at 80 km downwind. Fallout not yet arrived. Air contains non-radioactive dust/debris. Visibility may be reduced. This is your only safe time to move. → GET INSIDE solid building IMMEDIATELY. Basement provides PF 40-100. Center room PF 10-20. You have MAXIMUM 106 minutes. GO NOW.
1-6 hours post-det	PEAK FALLOUT INTENSITY	Maximum radiation deposition period. Outdoors at 80 km: 291 R/hr (2.55M µSv/h). In Open ground (no shelter): 291.3 R/hr. Estimated 6-hour dose in shelter: ~1165 rem. → ABSOLUTE SHELTER - no exceptions. Most fallout deaths occur from premature emergence during this window. Wait it out.
+106 min	FALLOUT ARRIVES	Radioactive particles begin falling - visible as fine gray ash/dust. DO NOT TOUCH. Gamma radiation intensifies rapidly. EXTREME FALLOUT at 80 km downwind: 364 R/hr (3.19M µSv/h) outdoors. In Open ground (no shelter) (PF 1): 364 R/hr. Radiation sickness onset in ~0.3 hours at current rate. → BE INSIDE with room sealed. Stay in deepest part of shelter. Add any available mass (books, furniture, water containers) for extra shielding. Do NOT go outside.
6-24 hours post-det	RADIATION DECAY - PHASE 1	7-10 rule in effect. At 7 hours: ~10% of initial = 36.4 R/hr (319.3k µSv/h) outdoors. In Open ground (no shelter): 36.41 R/hr. Cumulative dose building but rate dropping. → Continue sheltering. If you have dosimeter, track cumulative exposure. Ration supplies. Begin planning but don't act yet.
24-48 hours post-det	RADIATION DECAY - PHASE 2	Radiation at ~1% of peak: 3.64 R/hr (31.9k µSv/h) outdoors. In Open ground (no shelter): 3.641 R/hr. Significant improvement from initial levels. → Brief essential outdoor trips possible: MAX 120 minutes with full protection (mask, goggles, covered skin). Decontaminate immediately on return - remove outer clothes outside, wash thoroughly.
48 hours - 7 days	EXTENDED DECAY	Continued decay. Day 2: 1.820 R/hr outdoors. Day 7: ~0.3641 R/hr (3.2k µSv/h). Approaching background-safe levels depending on initial intensity. → Day 2: 240 min outdoor OK. Day 7: Extended activity possible. Always use protection. Monitor with dosimeter if available. Plan evacuation or resupply.
14 days (2 weeks)	TWO-WEEK MILESTONE	Radiation at ~0.01% of peak: 0.03641 R/hr (319.28 µSv/h) outdoors. Status: moderately elevated. Natural background is ~0.00001-0.00003 R/hr (0.1-0.3 µSv/h). Cumulative ground contamination may persist in hot spots. → Extended outdoor activity: Normal activity possible with monitoring. Continue wearing mask in dusty areas. Avoid consuming local food/water without testing. Check for hot spots before occupying new areas. Long-term cleanup may be needed.

Scenario 6 · City Centre — 500 kt strategic warhead (surface burst · 80 km upwind)

The same surface burst at the same distance, but you are upwind of it. The fallout is carried away from you, showing how much wind direction alone changes your situation. Compare with Scenario 5.

Weapon / yield: 500 kt · **Detonation:** surface burst
Target: City Centre (detonation point)
Worked-example position: 80 km (49.7 mi) from ground zero

SURVIVAL PROGNOSIS AT 80 KM
GOOD
Minimal direct effects expected. Standard fallout precautions advised.

Your shelter: Open ground (no shelter) (protection factor 1×) · **Wind:** 15 mph, you are upwind



Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	1.39 km (0.87 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	1.51 km (0.94 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	2.30 km (1.43 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	3.57 km (2.22 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	4.92 km (3.06 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	9.52 km (5.91 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	4.89 km (3.04 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	6.77 km (4.21 mi)	Painful blistering burns to exposed skin.
Flash blindness	15.1 km (9.35 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	31.1 km (19.3 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. This surface burst produces heavy local fallout downwind — see the timeline.

What it looks like from where you are — you are 80 km (49.7 mi) upwind of ground zero, out in the open with no shelter:

Time	Event	What happens & what to do
267 μs	DETONATION / FLASH	Light arrives in 266.9 μs. Distant flash from 500 kt at 80 km visible on horizon. Thermal fluence: 0.05 cal/cm² (2.18 kJ/m²). Minimal flash blindness risk. → Note flash direction - blast wave will arrive in approximately 4 min. Move to cover.
267 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 80 km: 180 V/m. Effect: Minimal electronics impact at this range. EMP effective radius: ~31 km for this 500 kt ground burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-3 seconds	THERMAL PULSE	Minimal thermal effects at 80 km. Fluence: 0.052 cal/cm² over 2.62 sec. Equivalent to brief sun exposure. No injury expected. → No thermal danger. Focus on blast wave arriving in 4 min.
3 min 53 sec	BLAST WAVE ARRIVES	Blast wave arrives at 80 km after 3 min 53 sec. MINIMAL: 0.102 psi (0.71 kPa). Wind: 5 mph. Audible boom/rumble. Slight pressure change felt. Window rattling possible. Positive phase: 3.2 sec. → Stay indoors as precaution. Minor structural risk only.
3 min 56 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase at 3 min 56 sec. Gentle reverse airflow for 4.8 sec as atmospheric pressure normalizes. Negligible hazard at 80 km. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.

Time	Event	What happens & what to do
4 min 1 sec - 14 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~13 km (42802 ft) in ~3 min. Cloud continues rising to maximum ~21 km (67935 ft) over 14 min. At 80 km, initial nuclear radiation dose: 0.0 rem (0 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 282 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
4-287 min	SURVIVAL WINDOW	Extended window at 80 km upwind of blast. Fallout carried away from you initially. Wind shift could change this. Current wind: 15 mph from your direction. → Move to shelter within 287 minutes. Don't assume safety - wind patterns can shift unpredictably.
1-6 hours post-det	PEAK FALLOUT INTENSITY	Maximum radiation deposition period. Outdoors at 80 km: 15 R/hr (127.7k µSv/h). In Open ground (no shelter): 14.6 R/hr. Estimated 6-hour dose in shelter: ~58 rem. → ABSOLUTE SHELTER - no exceptions. Most fallout deaths occur from premature emergence during this window. Wait it out.
+287 min	FALLOUT ARRIVES	Radioactive particles begin falling - visible as fine gray ash/dust. DO NOT TOUCH. Gamma radiation intensifies rapidly. MODERATE FALLOUT at 80 km upwind: 18.2 R/hr (159.6k µSv/h) outdoors. Open ground (no shelter) shelter effective: 18.2 R/hr inside. Below acute danger threshold. → BE INSIDE with room sealed. Stay inside. Shelter providing adequate protection. Conserve supplies - plan to stay 48+ hours.
6-24 hours post-det	RADIATION DECAY - PHASE 1	7-10 rule in effect. At 7 hours: ~10% of initial = 1.8 R/hr (16.0k µSv/h) outdoors. In Open ground (no shelter): 1.82 R/hr. Cumulative dose building but rate dropping. → Continue sheltering. If you have dosimeter, track cumulative exposure. Ration supplies. Begin planning but don't act yet.
24-48 hours post-det	RADIATION DECAY - PHASE 2	Radiation at ~1% of peak: 0.18 R/hr (1.6k µSv/h) outdoors. In Open ground (no shelter): 0.182 R/hr. Significant improvement from initial levels. → Brief essential outdoor trips possible: MAX 120 minutes with full protection (mask, goggles, covered skin). Decontaminate immediately on return - remove outer clothes outside, wash thoroughly.
48 hours - 7 days	EXTENDED DECAY	Continued decay. Day 2: 0.091 R/hr outdoors. Day 7: ~0.0182 R/hr (159.6 µSv/h). Approaching background-safe levels depending on initial intensity. → Day 2: 240 min outdoor OK. Day 7: Extended activity possible. Always use protection. Monitor with dosimeter if available. Plan evacuation or resupply.
14 days (2 weeks)	TWO-WEEK MILESTONE	Radiation at ~0.01% of peak: 0.00182 R/hr (15.96 µSv/h) outdoors. Status: slightly elevated above background. Natural background is ~0.00001-0.00003 R/hr (0.1-0.3 µSv/h). Cumulative ground contamination may persist in hot spots. → Extended outdoor activity: Normal activity possible with monitoring. Continue wearing mask in dusty areas. Avoid consuming local food/water without testing. Check for hot spots before occupying new areas. Long-term cleanup may be needed.

Scenario 7 · City Centre — 500 kt strategic warhead (air burst · 80 km downwind)

The same yield and distance downwind, but an air burst. Because the fireball never touched the ground, there is little local fallout even directly downwind, in sharp contrast to Scenario 5.

Weapon / yield: 500 kt · **Detonation:** air burst
Target: City Centre (detonation point)
Worked-example position: 80 km (49.7 mi) from ground zero

SURVIVAL PROGNOSIS AT 80 KM
GOOD
Minimal direct effects expected. Standard fallout precautions advised.

Your shelter: Open ground (no shelter) (protection factor 1×) · **Wind:** 15 mph, you are downwind



Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	1.74 km (1.08 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	1.51 km (0.94 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	2.30 km (1.43 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	3.57 km (2.22 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	4.92 km (3.06 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	9.52 km (5.91 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	4.89 km (3.04 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	6.77 km (4.21 mi)	Painful blistering burns to exposed skin.
Flash blindness	15.1 km (9.35 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	116.6 km (72.4 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. As an air burst, local fallout is minimal; the delayed radiation hazard is small compared with a surface burst.

What it looks like from where you are — you are 80 km (49.7 mi) downwind of ground zero, out in the open with no shelter:

Time	Event	What happens & what to do
267 μs	DETONATION / FLASH	Light arrives in 266.9 μs. Distant flash from 500 kt at 80 km visible on horizon. Thermal fluence: 0.06 cal/cm² (2.57 kJ/m²). Minimal flash blindness risk. → Note flash direction - blast wave will arrive in approximately 4 min. Move to cover.
267 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 80 km: 18756 V/m. Effect: Most electronics damaged, vehicles likely disabled, communications down. EMP effective radius: ~117 km for this 500 kt air burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-3 seconds	THERMAL PULSE	Minimal thermal effects at 80 km. Fluence: 0.061 cal/cm² over 2.62 sec. Equivalent to brief sun exposure. No injury expected. → No thermal danger. Focus on blast wave arriving in 4 min.
3 min 53 sec	BLAST WAVE ARRIVES	Blast wave arrives at 80 km after 3 min 53 sec. MINIMAL: 0.079 psi (0.54 kPa). Wind: 5 mph. Audible boom/rumble. Slight pressure change felt. Window rattling possible. Positive phase: 3.2 sec. → Stay indoors as precaution. Minor structural risk only.
3 min 56 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase at 3 min 56 sec. Gentle reverse airflow for 4.8 sec as atmospheric pressure normalizes. Negligible hazard at 80 km. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.

Time	Event	What happens & what to do
4 min 1 sec - 14 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~13 km (42802 ft) in ~3 min. Cloud continues rising to maximum ~21 km (67935 ft) over 14 min. At 80 km, initial nuclear radiation dose: 0.0 rem (0 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 4795 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
4-4800 min	SURVIVAL WINDOW	Air burst at 80 km produces minimal local fallout. Fireball didn't contact ground - no soil/debris irradiated. Primary hazards: fires (possible), structural damage, secondary injuries. → Seek sturdy shelter. Avoid damaged structures and spreading fires. Assist injured if safe. Long-range fallout possible in 24-72 hours.
15+ minutes	MINIMAL LOCAL FALLOUT	Air burst over 80 km away - fireball didn't contact surface. No significant local fallout. Induced radioactivity limited to ~2.6 km of ground zero. Global fallout may arrive in days/weeks via upper atmosphere. → Primary concerns: fires, collapsed structures, injured persons, disrupted infrastructure. Move carefully. Assist others if safe. Monitor for distant fallout warnings.

Scenario 8 · City Centre — 50 kt tactical warhead (air burst · 20 km downwind)

A tactical air burst over the centre, seen from 20 km away in a car. Air burst plus distance means the main hazards are the flash, distant blast and broken glass rather than heavy fallout.

Weapon / yield: 50 kt · **Detonation:** air burst

Target: City Centre (detonation point)

Worked-example position: 20 km (12.4 mi) from ground zero

Your shelter: Vehicle (car) (protection factor 2×) · **Wind:** 15 mph, you are downwind

SURVIVAL PROGNOSIS AT 20 KM

GOOD

Minimal direct effects expected. Standard fallout precautions advised.

Effect zone	Reaches out to	What it means at the edge of this zone
Fireball	0.69 km (0.43 mi)	Everything within is vaporised instantly.
Total destruction — 20 psi	0.70 km (0.43 mi)	Even reinforced buildings are flattened; no realistic survival in the open or in ordinary structures.
Severe blast — 10 psi	1.07 km (0.66 mi)	Most buildings collapse; most people here are killed.
Heavy blast — 5 psi	1.66 km (1.03 mi)	Houses destroyed; widespread fatalities and serious injuries.
Moderate blast — 3 psi	2.28 km (1.42 mi)	Walls and roofs fail; serious injuries common.
Light blast — 1 psi	4.42 km (2.75 mi)	Windows shatter out to here; flying glass is the main injury.
3rd-degree burns	1.90 km (1.18 mi)	Full-thickness burns to exposed skin facing the flash.
2nd-degree burns	2.64 km (1.64 mi)	Painful blistering burns to exposed skin.
Flash blindness	5.86 km (3.64 mi)	Temporary loss of vision (worse at night) — dangerous if you are moving or driving.
EMP reach (approx.)	54.5 km (33.9 mi)	Unprotected electronics and some vehicles may fail within roughly this radius.

Thermal ranges assume clear air and an unobstructed line to the fireball; smoke, cloud, walls and terrain shorten them. As an air burst, local fallout is minimal; the delayed radiation hazard is small compared with a surface burst.

What it looks like from where you are — you are 20 km (12.4 mi) downwind of ground zero, sheltering in a vehicle (car):

Time	Event	What happens & what to do
67 μs	DETONATION / FLASH	Light arrives in 66.7 μs. Distant flash from 50 kt at 20 km visible on horizon. Thermal fluence: 0.12 cal/cm ² (4.88 kJ/m ²). Minimal flash blindness risk. → Note flash direction - blast wave will arrive in approximately 58.3 sec. Move to cover.
67 μs	EMP PULSE	Electromagnetic pulse arrives with light flash. Field strength at 20 km: 18604 V/m. Effect: Most electronics damaged, vehicles likely disabled, communications down. EMP effective radius: ~55 km for this 50 kt air burst. → Electronics may have failed. Vehicles with electronic ignition may not start. Don't rely on phones, radios, or GPS. Use manual/mechanical backups. Battery devices inside metal containers may survive.
0-2 seconds	THERMAL PULSE	Minimal thermal effects at 20 km. Fluence: 0.117 cal/cm ² over 1.81 sec. Equivalent to brief sun exposure. No injury expected. → No thermal danger. Focus on blast wave arriving in 58.3 sec.
58.3 sec	BLAST WAVE ARRIVES	Blast wave arrives at 20 km after 58.3 sec. MINIMAL: 0.197 psi (1.36 kPa). Wind: 10 mph. Audible boom/rumble. Slight pressure change felt. Window rattling possible. Positive phase: 1.0 sec. → Stay indoors as precaution. Minor structural risk only.
59.3 sec	NEGATIVE PRESSURE / RETURN WIND	Negative phase at 59.3 sec. Gentle reverse airflow for 1.5 sec as atmospheric pressure normalizes. Negligible hazard at 20 km. → Remain in protected position until all wind stops completely. Weakened buildings may collapse during this phase.
1 min 1 sec - 12 min	MUSHROOM CLOUD FORMATION	Fireball rises and cools, forming mushroom cloud. Initial stabilization at ~11 km (35557 ft) in ~3 min. Cloud continues rising to maximum ~17 km (57394 ft) over 12 min. At 20 km, initial nuclear radiation dose: 0.0 rem (0 mSv) if exposed outdoors. → CRITICAL WINDOW BEGINS: You have approximately 1195 minutes before fallout arrives. Move to best available shelter NOW. Every minute counts.
1-1200 min	SURVIVAL WINDOW	Air burst at 20 km produces minimal local fallout. Fireball didn't contact ground - no soil/debris irradiated. Primary hazards: fires (possible), structural damage, secondary injuries. → Seek sturdy shelter. Avoid damaged structures and spreading fires. Assist injured if safe. Long-range fallout possible in 24-72 hours.
15+ minutes	MINIMAL LOCAL FALLOUT	Air burst over 20 km away - fireball didn't contact surface. No significant local fallout. Induced radioactivity limited to ~1.0 km of ground zero. Global fallout may arrive in days/weeks via upper atmosphere. → Primary concerns: fires, collapsed structures, injured persons, disrupted infrastructure. Move carefully. Assist others if safe. Monitor for distant fallout warnings.

 Nuclear Event Survival Master Guide - Complete Edition v4.0