# Efforts Suitable for Civil Defense During Nuclear Disasters

Philipp Sonntag | September 2025

CONTENT



For thousands of years, human civilization has responded to threats with growing experience, and powerful organizations. Accidents affect individuals or small groups, and there is a rich repertoire of medical and organizational assistance available. Disasters are large-scale and endanger large communities of all kinds, and also there is a lot of experience. There are proven concepts for dealing with large damage, with constantly changing boundary conditions of technology, environment and organization.

Radioactivity is a new experience, and a new challenge. Different forms of radiation damaging bodies have been around since the discovery of X-rays by Roentgen in 1895. Meantime there has been a lot of bitter experience. Often risks had been recognized too late. That happened in the context of unfortunate mistakes, aggravated by temporary lack of experience in disaster management. The behavior of authorities can significantly influence the extent of damage. Accordingly this is especially true for nuclear disasters—in peacetime as well as in war.

## Introduction: modern infrastructure must be able to deal with disasters

The BBK (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe / Federal Office for Civil Protection and Disaster Assistance) is responsible for the coordination of Civil Defense (Zivilschutz) in Germany. President Ralph Tiesler of BBK generally emphasizes both the goal of becoming "civil defense capable" in the event of warfare, and the protection of the population in times of peace[1] . This applies in principle to disasters of all kinds.

Nuclear disasters may occur in quite diverse forms, and particularly unexpected. Since 1964, I have been professionally involved in possible responses to this challenge—and the essential subject still strikes me as eerie. We humans cannot

[1] Ralph Tiesler: “Civil protection and disaster relief concern us all”; in: ASB Magazine 02/25, p. 17

sense radioactivity with its damaging radiation. It has a short wavelength that is harmful to the body.

The intensity of the radiation varies enormously. On the one hand, I would only perceive with my eyes just only a slight glow from a dose that is approximately a hundred times lethal at the moment of exposure. On the other hand, experience in Hiroshima shows that people "vaporized" in a flash (without leaving any remains) 500 meters away from the explosion (which occurred at an altitude of about 600 meters above the ground). This was partly caused by a dose that was millions of times lethal, in a fraction of a second.

In 1968, when I asked experts at the KTG (Kerntechnische Gesellschaft, the German Nuclear Technology Association), they were "surprised" that in the event of nuclear explosions on the ground hitting a nuclear power plant, several meters of the concrete shell would "simply disappear" just as quickly. The person who answered at the KTG had internalized the idea that "with our care, a reactor can never be destroyed." The concrete was supposed to be protection "against everything" – and yet its shell is simply pulverized by an atomic bomb, exploding “near by”. There is nothing that can be done about it.

**Basics: in nuclear war there cannot be protection, but a lot of alleviation**

It may and shall come as a surprise, to emphasize that a whole range of civil defense measures are sensible and can usually help a great many people enormously.

This is because there is always a central area of complete destruction caused by the shock wave, in which every building would collapse and survival would be the exception. However, there is always an area around total destruction, that may be is a hundred times larger, where there would be many survivors and it would still be possible to enter homes and possibly repair them.

This is a gross simplification, because radioactive impact effect upon bodies is high near the explosion and decreases towards the outside. The same applies to heat radiation, which for example, sets buildings on fire and can burn unprotected human skin in a terrible way. Thus, at greater distances from the explosion in Hiroshima, even simple clothing provided noticeable protection for the skin in the intense summer heat. All this caught the victims completely unprepared. In 1945, there was no experience whatsoever in the field of civil defense.

This article aims to illustrate examples of experiences, that are crucial for coping with various types of nuclear disasters. What should we pay attention to? Essential decisions shall focus upon clear messages:

- the terrible suffering of the people affected and the enormous damage to their society shall be evident
- nevertheless at the same time it may be helpful in many cases, to provide essential help and welcome relief from terrible suffering and damage, in a pragmatic way
- the prevention and avoidance of nuclear disasters must always be given the highest priority.

Politically, there has always been a fear that our emphasis on "protection" through bunkers in Germany and the teaching of schoolchildren in the US to "duck and cover" (they should throw themselves under tables and onto the floor as quickly as possible in the event of an explosion) could lead to a misleading trivialization of the enormous

destruction, last not least also for the parents. But how to walk a tightrope: children shall not be mentally overwhelmed by fear and horror. This must be dealt with in a targeted manner. For adults, both a realistic information and exercise, including an honest portrayal of the enormous destruction is needed, in order to avoid any trivialization. As society changes along technical progress and new dangers for security, handbooks for pragmatic safety need an ongoing update.

Escalation prone strategic viewpoints of China and USA prepare modernization of their military and civil defense already for many years for conflicts, which might along a war prove both expectations as unrealistic[2]:

> "If deployed against China, the Pentagon's preferred style of conventional warfare would be a potential recipe for nuclear escalation. Since the end of Cold War, the United States' signature approach to war has been simple: punch deep into the enemy territory in order to rapidly knock out the opponent's key military assets at minimal cost. But the Pentagon developed this formula in wars against Afghanistan, Iraq, Libya and Serbia, none of which was a nuclear power.
>
> China by contrast, not only has nuclear weapons; it has also intermingled them with its conventional military forces, making it difficult to attack one without attacking the other. …
>
> This means, that leaders on both sides should dispense with the illusion, that they can easily fight a limited war."

Similarly, the "peacefully prepared efforts during peacetime" of the intrinsically modern and well-networked armed forces in Germany[3], still largely lack a system of possible escalation levels, and different orders of magnitude regarding the impact of radioactivity.

Russia is liable to use a Taliban mentality: With very limited effort it can destroy gigantic values (such as modern scientific research capacities, cultural irreplaceable sites, rich production firms etc.), while in comparison there a only a few valuable targets in Russia. Any way the Russian military forces would focus upon rather defending their own capacities and power. Current planning of civil Defense cannot solve such a problem, that would need an overall encompassing political strategy.

## Historic steps: gradual improvement of societal dealing with nuclear disasters

Experience has shown, how dealing with nuclear disasters can be improved step by step. This has been attempted repeatedly. All along new kinds of failure shall alert. Adequate improvement requires enormous effort. There is always something new to learn. That way a society may gradually (!) achieve a high level of performance with the help of modern tools and infrastructure.

Here are some basic examples:

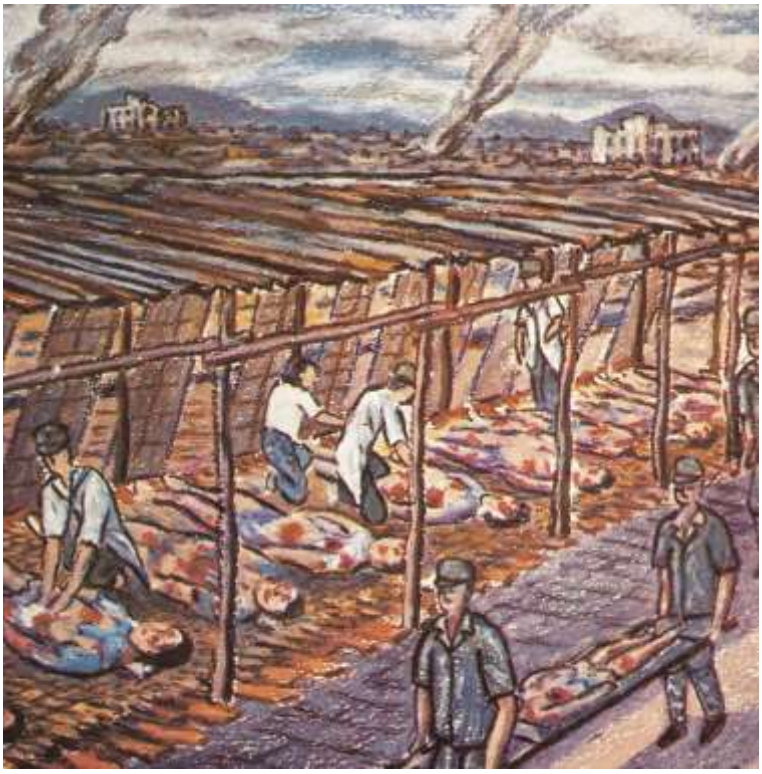
- X-rays were discovered and produced by Wilhelm Conrad Röntgen in 1895. They lie in the electromagnetic spectrum in the energy range above ultraviolet light and, like gamma rays emitted by radioactivity, damage the bodies of living beings. When X-rays penetrate, and go through the body, they can be used to make bones visible – even broken ones. Marie Curie used X-rays during

[2] Caitlin Talmadge: "Beijing's Nuclear Option – Why a U.S.-Chinese War Could spiral out of Control. In FOREIGN AFFAIRS Nov/Dec. 2018; p. 44-50

[3] Behörden Spiegel: "Jahrbuch 2025 / Das Zielbild der Bundeswehr- einsatzfähig und digital"; 67 p.

World War I to examine injured bones. She had investigated the radiation from uranium compounds, as observed by Henri Becquerel in 1896 and coined the term "radioactive" for it.

- The tragedy of the use of X-rays has been, that it took a long time to recognize the damage they caused for bodies, After decades, the officially approved dose of X-rays was finally set at one millionth of the intensity initially dose used. 1896 it had been unknown, that it could subsequently cause radiation sickness. Nobody suspected that a slight redness of the skin could be an alarm signal. But improvements in the production and control of the X-rays were achieved gradually. The damage along medical use could be limited step by step.
- In Hiroshima in 1945, the atomic bomb exposed all the inhabitants of a large city to enormous amounts of radiation, killing over a hundred thousand people and injuring many more. The city was contaminated with radioactive "black rain." As the occupying power, the US prohibited doctors from mentioning anything like "radiation sickness" (which had been unknown in this form before). Doctors gradually learned to diagnose such symptoms, but were not allowed to name them. The Americans forced doctors to report all phenomena. A failure, resulting from lack of experience. Judged from the viewpoint of a later civil defense perspective, failures occurred, such as: already after three days, the city tram service resumed, in the midst of the widespread radioactivity. The hospital was completely destroyed. The few Japanese doctors and civil defense workers who were still able to work, laid the injured on the ground outdoors. There was no concept of evacuation or decontamination. But in the midst of chaos, suffering, and despair, there was a welcome show of compassion to help!



The hospital in Hiroshima was completely destroyed. A makeshift field hospital was set up on the ground, and most of the doctors and medics were themselves seriously injured[4]

- There was a comprehensive report in the US on the experiences in Hiroshima, but it was not made publicly available for many years. Then finally 1957[5], a comprehensive publication revealed the essential issues, as edited by Samuel Glasstone. This book was used from 1964 to 1971 in order to determine the effects of possible nuclear wars on Germany at that time. I was responsible for the model calculations as part of the team at the Association of German Scientists (VDW). The result,[6] was intended to inform German politicians about the issue. At the time, the construction of expensive bunkers was controversial—they could only help in isolated cases. What was true then is still true today: no state can survive against an attack of an enemy determined to destroy it. At the same time, civil defense could significantly (!) alleviate immeasurable suffering among the population. Just “only” even a fraction of the nuclear weapons available to the armed forces in both East and West at that time could cause millions of deaths. Despite somewhat helpful civil defense – which at that time was only vaguely present – nevertheless the damage would be enough to permanently destroy Germany as a viable society, at least for decades. The following capacities would be sufficient to irreparably destroy German as a state, and viable society:
    - 3 percent of the Eastern Bloc's medium-range weapons used against cities, or equally
    - 10 percent of NATO's own (!) tactical nuclear weapons, as soon as they were deployed to defend against advancing tanks.
- Alike today, self-deterrence would be stronger then deterrence of any enemy. Common dramatizations of quite some politicians demanding an “upgrade of nuclear armament” for “more powerful deterrence”, are “fake”, at least contra facts.
- Destroyed nuclear power plants can cause completely different nuclear disasters. Again, the extent of the damage can be significantly influenced by civil defense. An example was in 1979, when the fuel rods melted in the Three Mile Island reactor in Harrisburg: There was a confusing cascade of shrill warnings. The correct response would have been to process the information electronically and issue a few clear warnings, accompanied by clear instructions on how to remain calm and take specific civil defense measures. What made the civil defense even worse, was that the operating company hastily claimed that they had the damage under control. The authorities waited 36 hours before advising the population not to leave their homes. Hours later, they said that pregnant women and small children (a few thousand) should be evacuated – what followed was a chaotic escape of just over 100,000 people fleeing the city and surrounding area.
- In Chernobyl in 1986, several serious mistakes did cause and enlarge an enormous damage. The reactor maintenance, that was due according to regulations, was politically prohibited: the reactor by order “from above” had been forced to continue supplying electricity – i.e. money – during

[4] painted by Fumiko Yamaoka (Hiroshima City 1976: p. 34)
[5] Samuel Glasstone (ed.): "The Effects of Nuclear Weapons," Washington (1957, revised 1962)
[6] Carl Friedrich von Weizsäcker (ed.): Kriegsfolgen und Kriegsverhütung (The Consequences of War and the Prevention of War), Carl Hanser Verlag, Munich (1971)

maintenance. This is basically like requiring a heavy truck traveling at full speed on a highway to undergo maintenance and/or repairs right there while moving, instead of going to a repair shop. What's more, meantime the nuclear power plant there was damaged by a drone in February 2025, and damage control is urgently needed. Officially, it was allegedly stated (it is difficult to distinguish between real and fake) that "there is no money for repairs." This is particularly far from a viable "civil defense-compatible" practice for Europe, because a multitude of simultaneous damage to several reactors is conceivable, whether as a consequence of war, or due to other causes.

- More acute dangers were revealed in a documentary on Arte television about the Russian company Rosatom[7]. Here is a summary based on information from Wikipedia[8] : “This Federal Agency for Atomic Energy of Russia is a federal authority of Russia. It manages the country's civil and military nuclear industry and controls 450 production and research facilities in the nuclear sector with over 350,000 employees. It is based in the capital Moscow. Rosatom reports directly to the Russian government.” And: "Russian nuclear exports amount to around US$3.5 billion per year, according to a representative of the agency in September 2005. A large part of this is generated by the construction of nuclear power plants in Iran, India, and China, as well as the supply of nuclear fuel to Eastern Europe." Added to this is the cheap and politically unproblematic disposal of nuclear waste in Siberia. Risks are treated completely differently in political terms, than they are in Western Europe.
- In Germany, we are used to technically skilled authorities, especially in civil defense, being controlled and monitored by democratically governed political institutions. As the situation is completely different in several other countries, potential damage could certainly affect us, and potentially on a massive scale. This has already been demonstrated by the radioactive fallout from Chernobyl.
- Many professional groups around the world have an influence on mitigating and/or preventing nuclear disasters in a wide variety of contexts, including civil defense. It is noteworthy that among them are thousands of responsible individuals who are unscrupulously willing to take risks and/or who are oppressed by commanders who are willing to take risks and use violence. In 1979, Robert Jungk gave a broad overview of the multitude of politically uncontrollable dangers[9] . In 1981, I wrote: "In the rarest of cases would a ruler be willing to have his physical and mental state examined on an ongoing basis," and I substantiated this primarily with the behavior of a number of US presidents in dealing with serious crises[10] . The sheer number of dangerous individuals in many countries would require a separate article. An example: In the partially destroyed Iran, who gives orders, to whom, regarding the handling of enriched uranium? Alike it is not possible, to foresee “plausible, expectable reactions from North Korean leaders. Even the best espionage can't uncover what neither the enemy's technicians, military personnel, nor politicians

[7] Arte television on July 15, 2025, 8:15–9:45 p.m.: The Nuclear Trap – Putin's Deals with the West. Documentary film, Germany 2024. Directed by William Pieper, Johannes Bünger, Laura Schmitt
[8] https://de.wikipedia.org/wiki/F%C3%B6derale_Agentur_f%C3%BCr_Atomenergie_Russlands (The Nuclear Trap – Putin's Deals with the West); July 2025
[9] Robert Jungk: "The Atomic State – From Progress to Inhumanity," Rowohlt, Reinbeck near Hamburg, (1979), rororo 7288
[10] Philipp Sonntag: "Prevention and Mitigation of Nuclear Catastrophes," Osang Verlag, Bonn, (1981), in particular "Chapter 1.3 The Influence of the Human Factor," pp. 100-146 (quote on p. 104).

themselves know. The enemy might even tell or publish vague assumptions, which might rather mislead an observer.

- When we consider the tasks of nuclear arms control, especially the prevention of escalation, one can get the impression that experts (technical, military, diplomatic) often handle the risks much more cautiously than politicians. Things used to be quite different in the Bundestag, for example, in the disputes between Franz Josef Strauss and Helmut Schmidt. Currently, European coordination for the handling of British and French nuclear weapons in armaments and operational planning is an extremely difficult task.

**Still today: radioactivity poses an unusual and frightening different threat**

Dealing with radioactivity is unusual, and unfamiliar for most people. There are few experts (medicine, civil defense etc.), who have already some experience. Radioactivity cannot be seen or tasted, and by the time its impact is felt, due to incipient illness, it is already too late for important countermeasures. That is especially true for fast, while rather simple precaution (shelter, decontamination, leaving contaminated areas quickly), that could minimize the damage more than all the later treatment in the best clinics.

Within a few days after the explosion of the atomic bomb on Hiroshima, 40.000 people entered the contaminated area, in order to help the victims: Some of those helpers thereafter also suffered from a variety of illnesses over a long time. The long-term effects have been documented in detail; the range is startling. Even 1978 there were still 370 003 officially registered victims in Japan. A list of 62 illnesses (partly in specific medical terms) has been noted. I quote the list to illustrate the disastrous diversity of impacts, which had been observed until 1978, and published[11]:

> "Easily catch cold.
> Cough, sputum and bloody sputum.
> Rhinorrhea, nasal obstruction, sneezing.
> Swollen and sore throat.
> Hoarse voice.
> Wheezing.
> Easily become edematous (face, hand, leg).
> Palpitation of the heart
> Dyspnea by going upstairs.
> Have a pain in the chest.
> Hands, legs, waist easily become cold. End of fingers become white and blue-purple, and benumbed.
> Hands and legs feel hot and become red.
> Upper half-body, especially face, feels hot and fevered. Body becomes frequently and suddenly hot and in a sweat.
> Frequent and strong vertigo.
> Giddy or fainting.
> Headache.
> Heavy feeling of the head.
> Body and legs feel languid.
> Easily fatigued by slight work. (a) recover by lying down; (b) don't recover by rest.

[11] ISDA Proceedings of the International Symposium on the damage and after-effects of the atomic bombing of Hiroshima and Nagasaki. Editorial Committee of Japan National Preparatory Committee, distributed by Pergamon Press 1978

Difficult to get up on awakening in the morning due to severe fatigue.
Eyes easily become fatigued. Dazzling.
Eyes feel pain and dim (lowering of eyesight).
Feel small insects flying in front of eyes.
Double vision.
Difficult to hear. Ringing in the ears.
Feel ears closed. Earache, otorrhea.
Feel pain at back of neck, shoulder, and waist. Stiffness.
Feel pain in bones of hands and legs, joints, muscles and sinews.
Feel dizzy and stagger on walking.
Dysarthria and dysphasia.
Tremor of hand and body.
Muscles of hands and legs become cramped.
Frequency or quantity of urine increase.
Urination not comfortable.
Thirsty. Drink water violently.
Easily bleed (nose, gums, skin, hemorrhoids).
Feel itchy and pain due to infections dermatitis.
Frequent urticaria. Sensitive to sunshine, drugs, bites of insects, etc.
Toothache. Swelling of gingiva.
Frequent stomatitis (painful).
Nausea, belching, heartburn.
Stomachache.
Sense of fullness or pressure in the epigastrium.
Distention of the abdomen.
Have become jaundiced.
Become thin or fat.
Decline of sexual desire.
Become forgetful.
Cannot concentrate attention to one thing. Does not carry on a job. Easily grow weary and attention diverted.
Become irritated.
Easy to become angry.
Worry even about slight things (uneasiness and fear).
Anxiety effects mg gastro-intestinal and cardiac func¬tion.
Lose vigor and feel depressed during morning.
Don't feel reality in anything (indifference).
Anxious about remarks of other persons (reputation concerning self, etc.).
Loss of sound sleep.
Dislike appearing among many people.  Feel life not worth living.
Often feel solitude and sadness.
Painful to remember past.
Others."

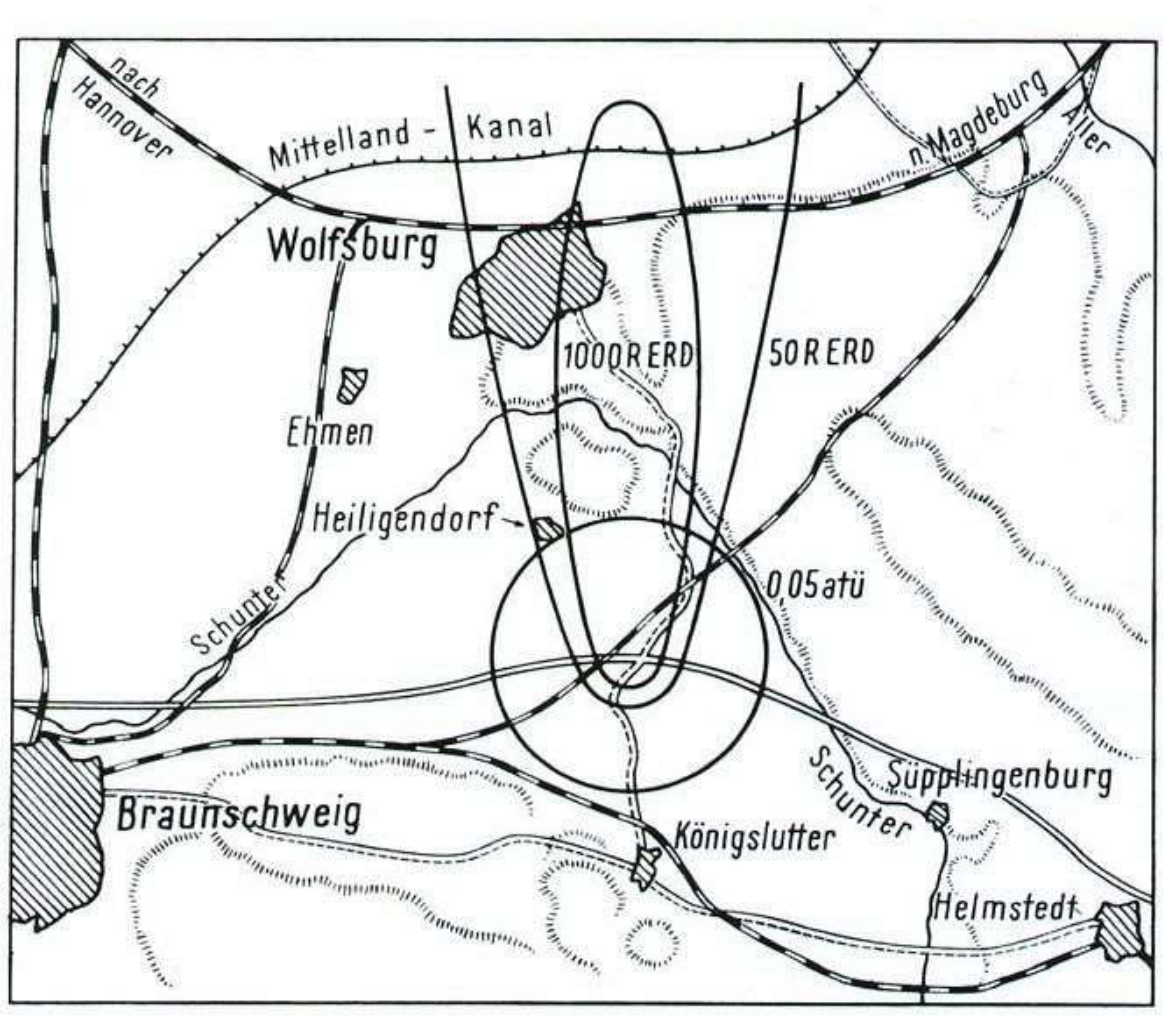
Many people had several of these illnesses at the same time. Medical, psychological- and social factors interact to a large extent, substantiating each other in their effects. Recovery efforts were concentrated on certain public interests. In Hiroshima, the telephone, waterworks, electricity and tramways were operating again within a few days. But many helpers entered the city to help, and many of these got sick. In this special case, with undestroyed surroundings, quick evacuation would have precluded many effects of the radiation. Japan was (and is) an economically and technically well-equipped country. For professional helpers But there is no substitute for basic knowledge about radioactivity and modern civil defense. And despite possible

mitigation of damage, survivors still fear radiation sickness, and pregnant women in particular fear deformities. In the midst of despair, it can at least be helpful and welcome to know what to do and what not to do - for example, when dealing with radioactive clothing.

Politicians should know at least a few basics, such as: the explosion had been several hundred meters above ground. A ground surface burst would have caused a crater, and thereby much more radioactivity, lasting for a longer time. The radius of the crater would have been about 50 meters, and the depths about 20 meters.

**Flexibility needed: how to cope with unpredictability**

I would like to use an example to illustrate that even with optimal preparations for civil defense efforts, a high degree of flexibility and prudence is important in order to be able to respond to unpredictability. Here is my sketch of my model calculation, as a result in a project 1964-1971)[12] about the use of a nuclear weapon on a highway bridge near Helmstedt (a scenario based on the idea of stopping advancing Russian tanks with tactical nuclear weapons).




Use of a nuclear bomb to destroy a highway bridge near the border with GDR (computation and design by Philipp Sonntag)

[12] Carl Friedrich von Weizsäcker (ed.): Kriegsfolgen und Kriegsverhütung (The Consequences of War and the Prevention of War), Carl Hanser Verlag, Munich (1971), p. 189.

Conclusion: a small change in the current wind direction can determine whether large cities (for instance Wolfsburg, including the VW plant) or "only" small villages are affected. That concerns, what civil defense measures might help, for instance first by shielding in buildings, then by fast decontamination etc. A dose of 1000 R ERD in the drawing (Roentgen Equivalent Residual Dose, a former designation, about 5 Sieverts (Sv)) is lethal. More than Above 50 ERD (about 0,25 Sv) would cause radiation illness. But for the amount of the impact of course further conditions would be essential, such as wounds, heat, support etc.

Another example of the unpredictability was the behavior of animals after the explosion in Hiroshima. Privately owned samurai swords were helpful for" effective civil defense, in this specific situation. This is an example of how either foresight and/or spontaneous flexibility can have an impact on effectivity of civil defense under special circumstances.

At night, hordes of hungry wild dogs came and attacked the weakened people living in makeshift tents[13].

[13] Picture painted by Hisao Nishitani (Hiroshima City 1976: 18)

**Human preparedness: to prevent and/or survive nuclear atomic catastrophes**

Civil defense measures can influence both the probability of the occurrence of atomic catastrophes and the amount of their consequences. A political decision must take both aspects into account. The potential catastrophes connected with nuclear power are a subject of growing awareness and anxiety. At the same time, nuclear armament seemed to be accelerating on the level of the superpowers, and proliferation is increasingly regarded as uncontrollable[14] How can the government exercise responsibility in this situation? Should it display confidence (atomic catastrophes appear so unlikely that people need not worry, much less be prepared for them) or should it take measures to Improve preparedness? Might people even become careless, thinking they could survive a disaster anyway?

The facts are: good and undisguised preparation would confront people with a clearer realization that the impact of an atomic catastrophe would be very severe, regardless of whatever they might do. They cannot alter the social and political fact of a catastrophe. But at the same time, they would understand that a good preparation can mean a general alleviation and a reduction of suffering in the case of an eventual catastrophe. This latter point can be proven technically[15].

In the American and German societies, there were and are notable similarities in the debate about, and implementation of civil defense. In both societies emphasis has shifted back and forth between peacetime and wartime catastrophes, between assigning a larger fiscal and legal role to central government or to regional and communal authorities. Whoever is in charge puts great verbal and little financial emphasis on the subject, as Sidney Drell[16] documents for a number of American governments.

In 2025, there is a huge increase in civil defense spending in Germany. Such drastic changes have happened often historically. Within a few years, political attitudes, including the willingness to invest in civil protection, did change dramatically, as documented[17]:

> “From "Total Defense" to "All Hazards," 1962–1978
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> At the beginning of the 1960s, the first signs of a shift in the direction of West German civil defense emerged. On the one hand, NATO's strategic shift from "Massive Retaliation" to "Flexible Response" fueled hopes that doomsday scenarios, such as those envisioned by "Fallex 62," (a NATO staff exercise in the autumn of 1962, which transitioned from the phase of tension to that of defense) could be avoided even in the event of war. The announcement that the organization would now respond "flexibly" to enemy provocations without immediately threatening nuclear annihilation tended to lend greater plausibility to the promise of protection offered by civil defense efforts.
>
> At the same time, the organizations succeeded in effectively demonstrating their commitment to civil disaster protection, which had been used rather rhetorically during the 1950s. The Federal Agency for Technical Relief (THW, Technisches Hilfswerk) in particular. …” The ongoing stalemate between civil

[14] Wohlstetter, A., T. Brown, D. Jones, D. McGarvey, H. Rowen, V. Taylor and R. Wohlstetter: Swords from Plowshares. The military potential of civilian nuclear energy, Chicago-London 1979
[15] Sonntag, Ph.: Verhinderung und Linderung atomarer Katastrophen, Osang, Bonn 1980
[16] Drell S.: In: Civil defense, Hearing before the Committee on Banking, Housing and Urban Affairs, United States, 95th Congress, Jan. 8, 1979. US Government Printing Office, Washington 1979
[17] https://www.bpb.de/shop/zeitschriften/apuz/bevoelkerungsschutz-2021/327987/zwischen-apokalypse-und-alltagsunfall/

> protection experts demanding shelters and political decision-makers had gradually increased the willingness to reform on all sides. In addition to the generally easing global political situation, events such as the storm surge disaster finally paved the way for fundamental changes that, from the mid-1960s onward, transformed West German civil defense into a civil protection system that addressed both civilian and military scenarios. The result of these developments was the 1968 Act to Expand Disaster Protection (Katastrophenschutzgesetz: KatSG-68).

A rich society could afford to invest billions of dollars. Von Weizsäcker[18] explained the political background of a decision to cancel even limited shelter programs:

> "I regret it. The cause of the abandonment is not the cost, but I would say rather the unvarying instinct of chancellors to let sleeping dogs lie."

No government would like to admit that under its guidance and maybe as a consequence of its politics, a potential catastrophe might become an actual threat. To be fair: civil defense expenditures could also be much lower both in Germany and in the United States. How efficient would the actual emergency preparedness of these modern industrial societies be in the face of the impact of a catastrophe? Is the civil and military administration, is the general public prepared for a limited, not to mention a large-scale nuclear disaster?

Emphasis upon dangers can cause positive results, such as controllable accidents, as long as a limited area near nuclear facilities is damaged. The German safety preparedness had been well-developed for such accidents already 45 years ago, an example[19]:

> “A large fire broke out in a research institute on May 12, 1979. The distance to the nuclear research reactor of Garching near Munich was 100 meters. The fire brigades arrived within a few minutes. The technicians with special equipment for atomic, biological and chemical accidents (ABC Zug = ABC group), the police, the THW (Technisches Hilfswerk = multipurpose technical aid group), the Red Cross and fire brigades arrived within a very short time. Radioactive material and other dangerous substances were stored in the burning building; nevertheless, the fire was brought under control and extinguished without violation of security measures.”

**Order of magnitude: basic distinction between nuclear accidents and disasters**

Despite a number of uncertainties and special conditions, civil defense efforts in the event of either nuclear accidents, or disasters, are possible in a targeted manner.

A clear distinction is made between

- "radiation accidents," are organizationally manageable. Damage can be largely avoided, because of limited radiation and/or just a few victims. Examples are use of radiation for medical purposes, or industrial measurements, or research.
- and large-scale radiation disasters, concerning a great number of people, and a dose causing radiation illness or -death, as in the context of nuclear warfare, or major destruction concerning reactors.

[18] von Weizsäcker, C. F.: Rückblende I: Die Probleme sehen lernen. In: VDW Intern, Dec. 1978
[19] Kirchhoff R., und H. J. Linde: Reaktorunfälle und nukleare Katastrophen, perimed, Erlangen 1979

And yet the following applies to both cases: Hard radiation is frightening for the population and must be explained realistically. Clear panic control is possible in the event of accidents, but not easy[20]:

> "Accidents involving ionizing radiation often cause apocalyptic fears among emergency responders."
>
> For helpers: "Don't panic! Radiation accidents are very rare."
>
> For organization: "With a little preparation, (almost) any radiation accident can be safely handled by emergency medical services."

This results in a challenge for the management of civil defense: It is clear that emergency doctors and other rescue workers need in-depth knowledge of how to deal with accidents. Usually information is readily available in civil defense in an easy-to-understand form.

The book correctly emphasizes the special nature and risks of disasters[21]:

> "Recourse to empirical knowledge is only possible to a limited extent in a disaster"; every disaster is different and behavior cannot therefore be planned for a specific reality (p. 27). Another conclusion (chapter 1.5, p. 28): "Disasters threaten the long-term survival of society."

Precisely because of the terrible stress and despair of those affected by a nuclear disaster, the ability to improvise in civil defense must be prepared as well as possible, both practically and psychologically. It is difficult to predict in advance how nuclear disasters arise and develop. Depending on the situation, effective measures to ensure the survival of society as a whole can take very different forms. There are unspeakably bitter experiences that are at the same time valuable for civil defense.

The extent of potential damage encompasses a wide range of eventualities. The more extensive the damage, the more difficult it is for government organizations to provide assistance to the individual affected.

In times of greatest desperation, victims are most dependent on self-help. Therefore, it is always a central task of civil defense to inform the population about self-help options well in advance of disasters. Even with just a few victims, it's important to know how to limit the impact of radioactivity. It's about magnitude: what to do with a thousand victims, a million, what to do with virtually unlimited damage, for example, after East and West have deployed and used their approximately 5,000 nuclear weapons, which have been deployed 2025.

Before, the United States and the Soviet Union had achieved the highest levels of nuclear weapons in history during the Cold War. In the 1980s, the two superpowers together possessed an estimated 60,000 to 70,000 nuclear warheads. 1986, the US Single Integrated Operational Plan (SIOP) identified a total of 16,000 targets in the Soviet Union as potential targets. Detailed nuclear strikes, including a coordinated

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[20] W. Kirchinger: "Management von Strahlenunfällen und Strahlenkatastrophen – Schutz der (Klinik-) Mitarbeiter. (= Management of Radiation Accidents and Radiation Disasters – Protection of (Hospital) Employees). In: Schutzkommision beim Bundesministerium des Innern / RedaktionJohann Wilhelm Weidringer: Katastrophenmedizin / Leitfaden für ärztliche Versorgung im Katastrophenfall, 2013 Federal Office for Medical Care in Catastrophe Situations (ed.), Bonn, 6th edition 2013 / Editor Johann Wilhelm Weidringer, Chairman of the Protection Commission at the Federal Ministry of the Interior: "Disaster Medicine – Guidelines for Medical Care in Catastrophe Situations"; Chapter 12, pp. 203-233.
[21] Ibid. A. Müller Cyran: "Ethical aspects of disaster medicine," chapter 1.4, pp. 23-29

deployment of approximately 2,500 nuclear weapons, were developed and provided for use. Hell unlimited!

With the end of the Cold War, a fundamental shift occurred in the search for a nuclear adversary. Accordingly, massive American preemptive strikes against "rogue states" were developed. Exercises such as "Desert Breeze" and "Eagle Resolve" tested the use of ABC weapons by potential adversaries in the Middle East. Hundreds of targets in emerging economies had already been identified before 9/11. And together with an expert from Lebanon I had published had published the significance of such threats for those potentially affected in Middle East[22]. I had not expected, and did never receive any response from decision-makers in Middle-East.

How to achieve some impact. From 1980 to 1986, I was at the WZB (Science Center in Berlin), and interested parties from the Russian Embassy came to visit our research team in order to obtain "important documents" of our research. I gave them long-published papers by Horst Afheldt and myself on escalation and the consequences of nuclear war – in the hope of awakening a bit more sense of the risks in the Soviet Union. Similarly, years earlier, Horst Afheldt's and my escalation models had been openly discussed at Pugwash conferences – and indeed, Russian participants in these conferences later told me that there were "dissertations" in the Soviet Union based on our mathematics – and I was firmly promised that I would receive copies – which, however, never arrived. At a congress of the Society for Radiation Protection (GSS) in 2011 with Russian participants, I deliberately explained the dangers posed by radioactivity, which continue to pose an existential threat to everyone[23]. I emphasized how societies, including authorities (in the East, the West, everywhere), mostly negligently deal with the dangers posed by radioactivity.

Discussion was about the risk of a major a change toward a much colder climate, along the armament of tens of thousands of nukes as provided with SIOP. For such damage, asking google, KI responded (August 2025):

> ”Surviving nuclear winter is a significant challenge, but not impossible. It requires good preparation, robust shelter, and the ability to cope with the extreme conditions and consequences of nuclear war.”

That may work for a few rich billionaires for a short time, while it might occur that billions of other people would die or be very sick.

There are many intermediate stages of possible Nuclear Disaster, such as for example in France, there was almost a particularly severe GAU (Utmost Conceivable Accident) at a breeder nuclear power plant, where plutonium could have rendered large parts of the country uninhabitable. The last serious accident involving a fast breeder reactor occurred in 1996 at the Creys-Malville nuclear power plant (Superphénix) when a furnace exploded. However, there have been several similar other incidents – but so far no GAU.

Various kinds of political failure might cause a lack of coordination between military and civilian defense, with different, often unforeseen consequences. Normally, the military defends, among other things on a valid infrastructure – not least because it relies on it. This requires the establishment of logistics even before the outbreak of

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[22] Abu Samn; Sonntag, Ph.: Zivilverteidigung im Nahen Osten**.** In: Zivilverteidigung 1978, 1, S. 17-18

[23] Philipp Sonntag: How Society Deals with Radioactivity. Presentation at the conference of the German Society for Radiation Protection (GSS): 25 Years of Consequences of the Chernobyl Disaster: Taking Stock of 25 Years of Ecological and Health Damage / 28th International Congress, Berlin, April 6–8, 2011, page 28 of the conference report (in German and Russan)

war. The challenges are inevitably most dramatic in the case of a nuclear war. But whatever the challenge may be, the best civil defense cannot succeed, when a society fails to care for essentials of “normal life”.

One can prepare many things materially and accumulate large reserves. However, in every disaster, the decisive factor will always be the behavior of the people. This is emphasized by a recent article that denounces blatant failures[24]:

> “... the threat of war with China looms large. China continues to rapidly expand its Navy and build capabilities that would enable it to seize Taiwan if it so chooses.
>
> Regardless, the United States still must be prepared to wage a Major conflict. … And while there is no doubt that the Military remains the most capable and powerful Fighting force in the world, it is suffering from systemic challenges in a critical component of warfighting success: personnel readiness. …
>
> In March, a military health care expert testifying before Congress warned that without major interventions to fix deficiencies in the system, the M.H.S. would slide into "medical obsolescence." Jeremy Cannon, a retired Air Force trauma surgeon and medical professor, estimated that in a war with a high volume of casualties "many of these patients will have survivable injuries, yet one in four will die in the Hands of an unprepared System". Military Housing is also in disarray."

That certainly is a special failure. The challenge is, to be alert to immediately notice and cope with any kind of surprise, whatever the special situation may be.

**Update: Civil Defense In Germany 2025**

A healthy infrastructure is part of life's resilience. Current changes in Germany would have an enormous impact on chances of survival. Update of civil protection can have an enormous impact on the survival of a society, on the survival as a society, in the event of very different nuclear disasters.

Our government is in the process of drastically changing our gross domestic product (GDP). This includes everything we produce, provide services, and waste in a year. Accidents, for example, are unavoidably part of waste: these, too, inevitably increase GDP measurably, with every manual operation in the repair shop, with every bandage in the hospital.

Politicians in democracies are responsible for limiting any waste as skillfully as possible. Germany has indeed succeeded in significantly reducing the number of accidents, especially in road traffic, over the decades. At the same time, there have been failures in protecting bridges. Such measures are generally manageable and can be decided on in a socially effective manner.

There are controversial priorities for investments in comprehensive safety.

As part of a broad NATO arms buildup, the US had demanded that 5% of GDP be spent on "war-readiness." For #d, this is a massive arms buildup. 3.5% is to be invested directly in the military, and 1.5% in civil defense – unavoidably including including disaster relief.

[24] Dan Caldwell and Darin Selnick: "War is still a people Business", NYTI july 30th 2025, p. 1 and 10

Measures for wars and disasters are far more difficult to evaluate, than for accidents. With 3.5% of GDP, you can try to build a considerable amount of combat capability. Does this prevent or provoke war, a common form of waste? This has been controversial since the beginning of evolution. Can 1.5% of GDP be used to limit damage for attempts at "protection" of all kinds? Absolutely! However, it depends heavily on the scenario, preparation, and behavior. Preparations for civil-military cooperation can be valuable, but they also might be misleading. also disastrous.

In Hiroshima, far fewer than a quarter of the seriously injured could be saved. A key problem was, that even after some “First Aid” improvisation succeeded, nevertheless only few victims survived: Cause was the widespread lack of "Second Aid." This term was coined by Horst Afheldt in our research team 1964 - 1971: “For a few hours, for example, tying off an artery may perhaps help—but if the chaos of a disaster means that no doctors or skilled, well-equipped paramedics are available, there can be a great many deaths." Civil-military cooperation at the national level has many facets (according to Google's AI) – from the Bundeswehr's administrative assistance in the context of relief operations in the event of disasters or accidents to cooperation between civilian and military agencies in the context of national and alliance defense.

Civil protection and disaster control are two closely related, yet distinct, areas of civil protection in Germany. Civil protection is primarily responsible for protecting the population from the consequences of war, while disaster control encompasses the defense against natural disasters and other major disasters in peacetime.

**Conclusion and outlook: dealing with mental and pragmatic challenges**

There are countless reports about – potential as well as real – nuclear disasters. Specific situations afford according special reactions. One conclusion may sound too simplistic, but it serves to explain the special nature of "nuclear" for civil defense:[25] :

> "Radiation sickness exacerbated the suffering of the seriously wounded. Their various injuries from burns, contusions, and radiation sickness reinforced each other and delayed or prevented healing."

This experience highlights the fact that radiation damage in survivors can have both immediate and long-term effects, exacerbating suffering for decades. In this book, as in many others, the reality was only comprehensible through the almost poetic language used in the accounts of those who suffered.

From 1964 onwards, it took me years to mentally come to terms with such reports and apply them to my research into a possible nuclear war in Germany. My personal conclusion: Mitigating the effects of nuclear disasters can be valuable and welcome in the midst of chaos. Special attention should be paid to prevention. This goes hand in hand with honest, realistic, pragmatic civil defense preparations, which can also be particularly valuable in preventing disasters.

It is especially hard to determine own capability in interdisciplinary fields. An according to the “Kruger Dunning” effect, human beings tend to over-estimate own knowledge in those fields, where the in fact know less[26]. A rude, while popular interpretation was: “If you are stupid, then you cannot notice, that and how stupid you are". David Dunning insisted meantime, that the effect should remind us, “to never

[25] Elke Tashiro and Jannes K. Tashiro: "Hiroshima – Menschen nach dem Atomkrieg" (Hiroshima – People after the Atomic War), dtv 10098, Munich (1982), p. 43
[26] Journal of Personality and Social Psychology. 10.1037/0022-3514.776.6.1121, 1999

feel perfect, but rather keep improving all along the own life", and "you will control and command a science not before you are aware, that you will always remain a remain a beginner"[27]. A conclusion shall be: missing knowledge about issues of military and civil defense can be especially dangerous. Almost "naturally" knowledge in the field of radioactivity is missing, that might cause failures in the entire field of security.

All along during decades with modernization of civil defense, experts as well as laymen over and again got surprised by unexpected damage events. Partly adequate information could and should have been known, and professional training, should have been prepared and continuously exercised. Both were mentally repressed. Thus also prevention did and does not get the emphasis, also essential for survival. With gigantic 1,5% of the BIP for civil defense, upcoming decisions in Germany will be vital. The current official journal of the German Civil Defense[28] promotes efforts such as a Virtual Operations Support (VOST)[29], as a tool has excellent technology (including tools such as Location mapping) in order to evaluate a local situation and integrate different local helpers.

But the BBK doesn't even begin to address the various scenarios, such as those addressed in the areas of "military readiness for war" and the political handling of escalation (and as this article at least tentatively addresses). Large-scale contamination by radioactivity would overwhelm all the authorities listed by the BBK—and perhaps also the citizens who are supposed to be "protected from panic," and the reality could then hit them all the harder. Nevertheless, what the BBK prepares and describes can prove helpful and mitigating in almost all scenarios. Infrastructure is considered, but only in the area of currently manageable environmental damage—not in the context of looming major climate catastrophes, for which one should actually prepare.

Globally both democracy and autocracy are confronted with a basic challenge.

Regarding the impact of radioactivity, we have a lot of experience with nuclear disasters. But most people were surprised with a kind of normalcy bias. And next time? Will we be better prepared? Yes we can – while the challenge is a broad interdisciplinary approach. As during the last hundred years, most important is the professional, and socially supported, prevention of nuclear disasters. In addition, realistic civil defense can help both prevent disasters and, if necessary, mitigate them.

[27](Selbstüberschätzung ist unvermeidlich (overestimation of oneself is unavoidable); An interview of David Dunning, in Gehirn&Geist 10/2025, p. 16-17

[28] BBK: Bevölkerungsschutz / Bürgernaher Bevölkerungsschutz, 3/2025; see also www.bbk.bund.de

[29] Volker Tondorf, Tabea Klör, und Alena Biegert: Die digitale Welt im Blick. In: BBK: Bevölkerungsschutz / 3/2025, p. 10 - 13;