

There Are No Small Nuclear Weapons

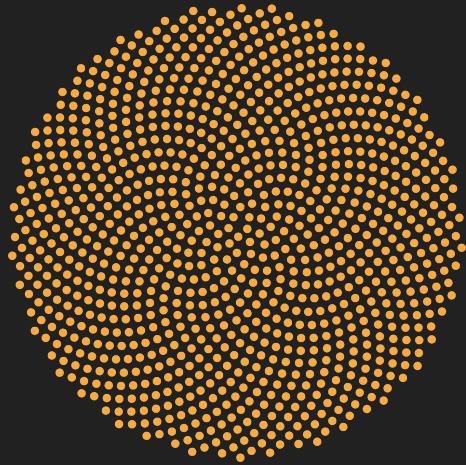
Moritz Kütt | kuett@ifsh.de | www.1kt.at

Institute for Peace Research and Security Policy at the University of Hamburg
Program on Science and Global Security, Princeton University

10th NPT Review Conference
United Nations, New York
August 17, 2022

The explosive power of nuclear weapons

“Yield”, measured in 1000 tons conventional explosive-equivalent (**kT**)



1kT

1 ton
of TNT



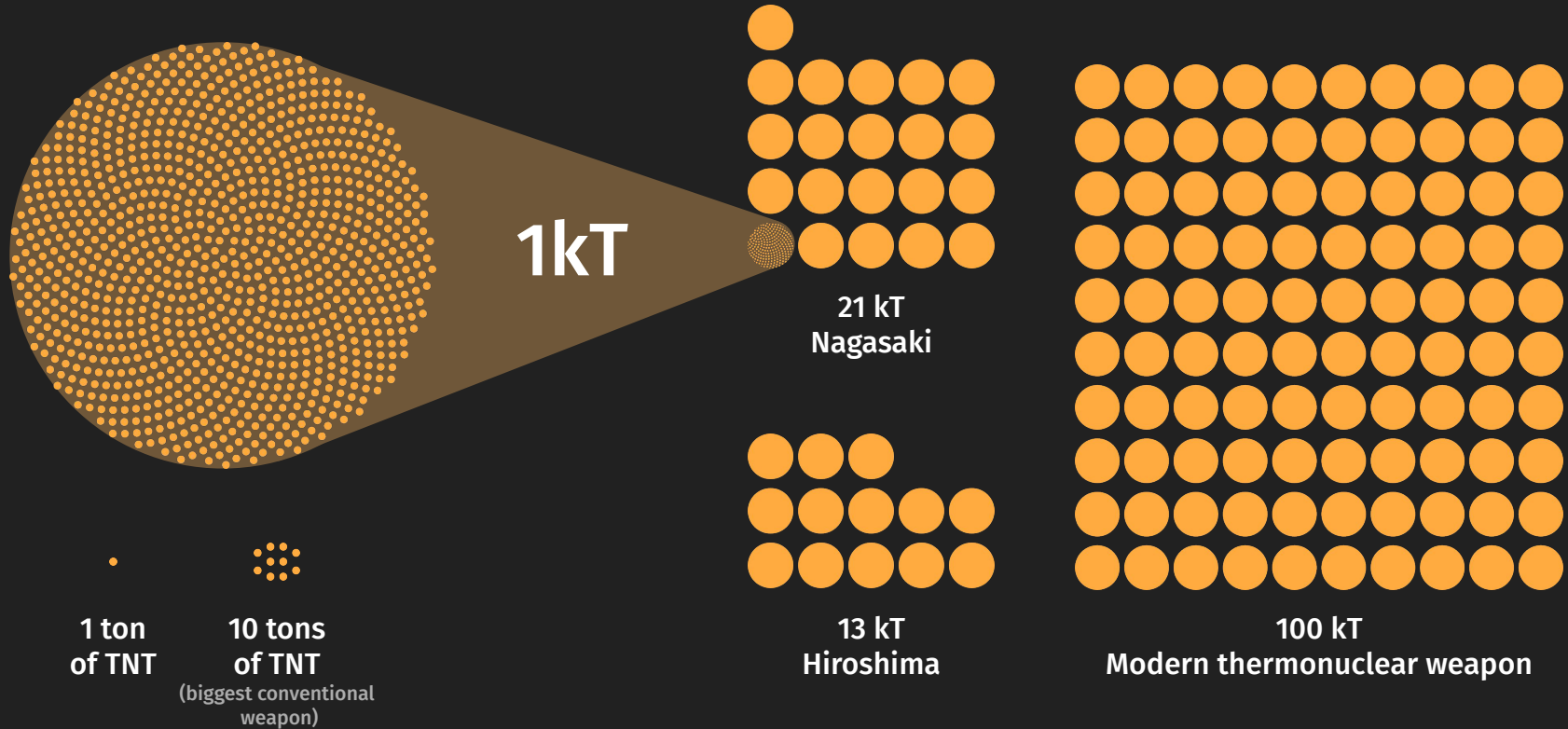
10 tons
of TNT



(biggest conventional
weapon)

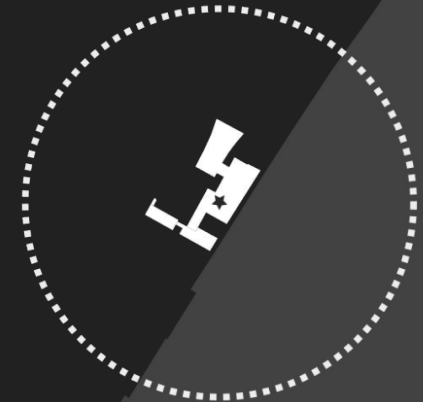
The explosive power of nuclear weapons

“Yield”, measured in 1000 tons conventional explosive-equivalent (**kT**)



Effects of a 1 kT nuclear weapon

United Nations & Grand Central for Scale Comparison



5 minute walk from marker

Effects of a 1 kT nuclear weapon

United Nations & Grand Central for Scale Comparison



Blast wave causes building damage,
98% of people will die immediately
(Radius for overpressure of 12psi/0.8 bar)

Effects of a 1 kT nuclear weapon

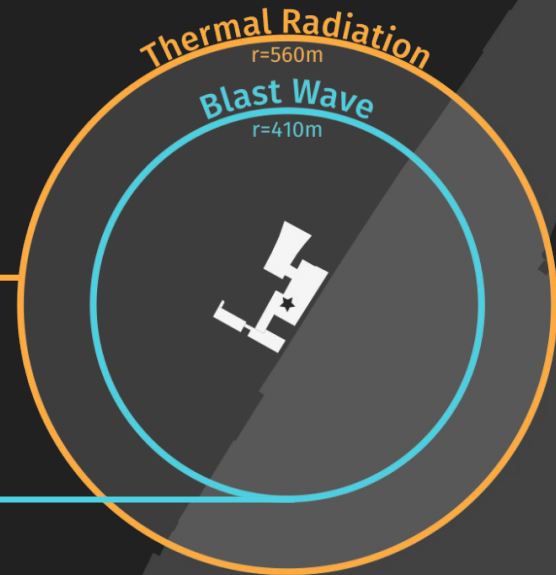
United Nations & Grand Central for Scale Comparison

Ignites material, initiates mass fires.
People receive 3rd degree burns.

(Radius for $7\text{cal}/\text{cm}^2$ radiation)

Blast wave causes building damage,
98% of people will die immediately

(Radius for overpressure of 12psi/0.8 bar)



Effects of a 1 kT nuclear weapon

United Nations & Grand Central for Scale Comparison

Invisible, causes radiation sickness,
50% of people will die within 30 days.

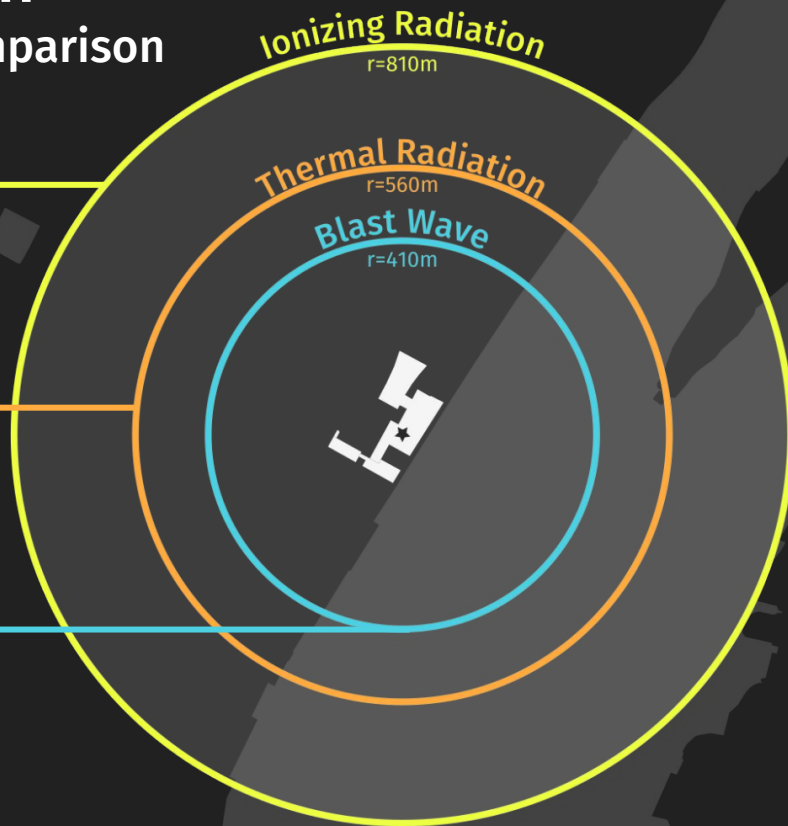
(Radius for direct dose of 500 rem)

Ignites material, initiates mass fires.
People receive 3rd degree burns.

(Radius for $7\text{cal}/\text{cm}^2$ radiation)

Blast wave causes building damage,
98% of people will die immediately

(Radius for overpressure of 12psi/0.8 bar)



Effects of a 1 kT nuclear weapon

United Nations & Grand Central for Scale Comparison

Invisible, causes radiation sickness,
50% of people will die within 30 days.

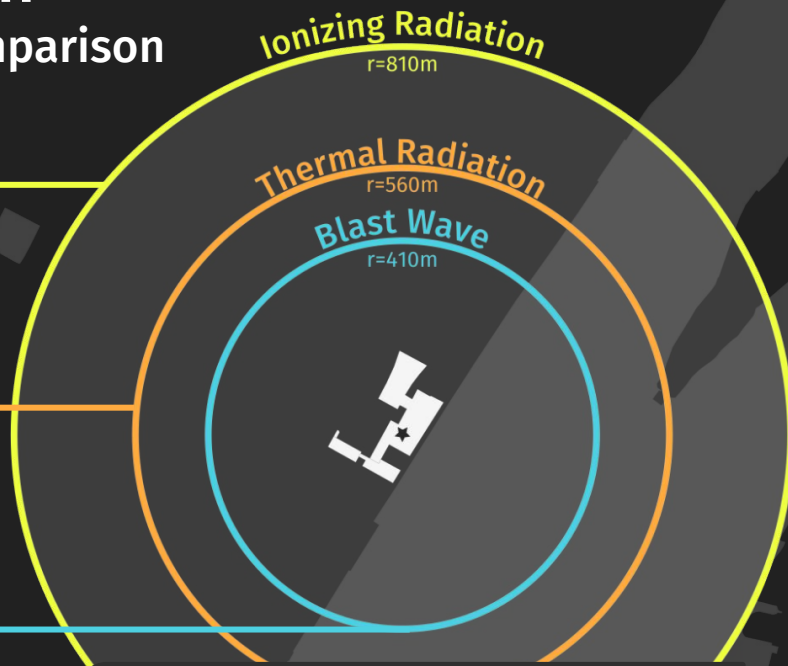
(Radius for direct dose of 500 rem)

Ignites material, initiates mass fires.
People receive 3rd degree burns.

(Radius for 7cal/cm² radiation)

Blast wave causes building damage,
98% of people will die immediately

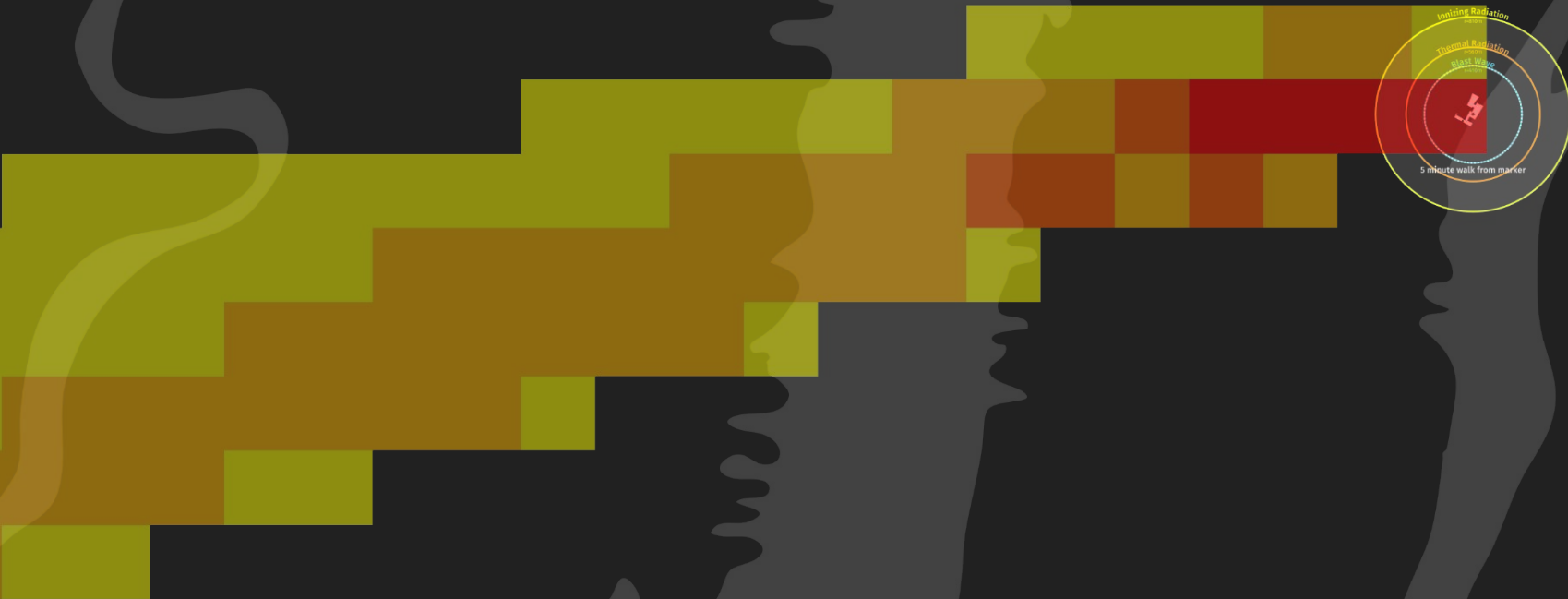
(Radius for overpressure of 12psi/0.8 bar)



Additional health effects
after months & years.

Fallout

Regional contamination for “ground bursts”



Fallout

Regional contamination for “ground bursts”

Radioactive particle dispersal depends on wind and rain conditions.

Increased cancer rates
(10 rem)

50% of people die within 30 days
(500 rem)

~40km

Outside of population centers, fallout affects agricultural production and water supplies.

Social & Psychological Effects after the use of a single nuclear weapon



Mental health is considered biggest problem of reactor accidents Three Mile Island (1979) and Chernobyl (1986).

Technological progress **increases the number** of people exposed to disasters.

News and social media exposure will have overwhelming negative **mental health consequences** (cf. 9/11, Fukushima).

Neria. and Sullivan (2011) 'Understanding the Mental Health Effects of Indirect Exposure to Mass Trauma Through the Media', *JAMA*, 306(12), pp. 1374-1375.

Niitsu et al. (2014) 'A Pilot Study of the Psychological Impact of the Great East Japan Earthquake and Tsunami', *Journal of the American Psychiatric Nurses Association*, 20(3), pp. 194-202.

Lee et al. (2021) 'Exploring the factors associated with indirect trauma caused by a human-made disaster on the general population: A community study five years after the Sewol ferry incident', *International Journal of Disaster Risk Reduction*, 60, p. 102262.

Bromet, E.J. (2014) 'Emotional consequences of nuclear power plant disasters', *Health physics*, 106(2), pp. 206-210.

Mushroom cloud size and artwork from Alex Wellerstein's Nukemap: <https://nuclearsecrecy.com/nukemap/>. Images from Google Earth Pro.

Escalation

Single nuclear weapon use is likely not the last step

From U.S. wargames:

“So we played a big exercise [...] how do you think it ends?”

It ends the same way every time.

*It does. **It ends bad.** And the bad meaning it ends with **global nuclear war.**”*

Gen. Hyten,

Head of U.S. Strategic Command, 2018

<https://www.stratcom.mil/Media/Speeches/Article/1577239/the-mitchell-institute-triad-conference/>



Princeton Simulation “Plan A”

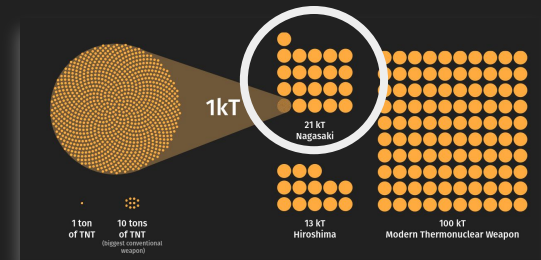
<https://youtu.be/2jv3JU-ORpo>

Arsenals for a Global Nuclear War

Ordered by explosive power

Nagasaki yield or less
(≤ 21 kT)

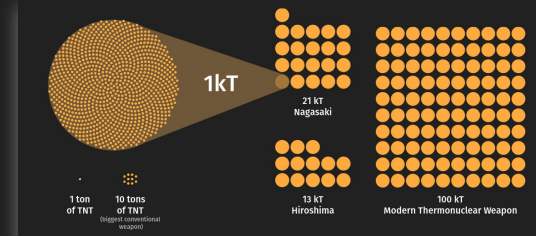
750



Based on
Sutyagin (2012) Atomic Accounting: A New Estimate of Russia's Non-Strategic Nuclear Forces. Occasional Paper. Royal United Services Institute (RUSI).
Kristensen and Korda (2022) 'United States nuclear weapons, 2022', Bulletin of the Atomic Scientists, 78(3), pp. 162–184.
Kristensen and Korda (2022) 'Russian nuclear weapons, 2022', Bulletin of the Atomic Scientists, pp. 1–24.
Kristensen and Korda (2021) 'United Kingdom nuclear weapons, 2021', Bulletin of the Atomic Scientists, 77(3), pp. 153–158.
Kristensen and Korda (2021) 'Pakistani nuclear weapons, 2021', Bulletin of the Atomic Scientists, 77(5), pp. 265–278.
Kristensen and Korda (2021) 'Chinese nuclear weapons, 2021', Bulletin of the Atomic Scientists, 77(6), pp. 318–336.
Kristensen and Korda (2020) 'Indian nuclear forces, 2020', Bulletin of the Atomic Scientists, 76(4), pp. 217–225.
Kristensen and Korda (2019) 'French nuclear forces, 2019', Bulletin of the Atomic Scientists, 75(1), pp. 51–55.
<https://missilethreat.csis.org/>

Arsenals for a Global Nuclear War

Ordered by explosive power



Nagasaki yield or less
(≤ 21 kT)

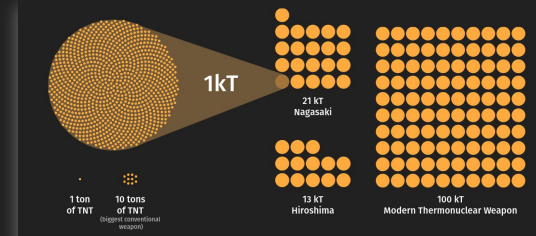
750

Yield up to 5 times larger
(≤ 100 kT)

3700

Arsenals for a Global Nuclear War

Ordered by explosive power



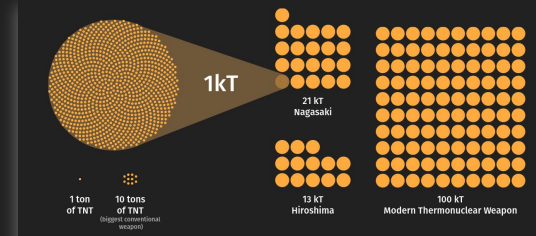
Nagasaki yield or less
(≤ 21 kT) **750**

Yield up to 5 times larger
(≤ 100 kT) **3700**

Even bigger
(150 kT - 5000 kT) **4050**

Arsenals for a Global Nuclear War

Ordered by explosive power



Nagasaki yield or less
(≤ 21 kT) **750**

Yield up to 5 times larger
(≤ 100 kT) **3700**

Even bigger
(150 kT - 5000 kT) **4050**

Unknown **950**

Takeaways

There are no small nuclear weapons because

- 1) ... direct effects are catastrophic
- 2) ... of unknown global social and psychological effects
- 3) ... any use likely triggers escalation