

What would a nuclear war look like?

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These slides will be made available at: <https://www.sgr.org.uk/>

Presentation given at Labour Party conference fringe meeting 'What would a nuclear war look like?', organised by CND, on 25th September, 2022

Nuclear weapons – main impacts

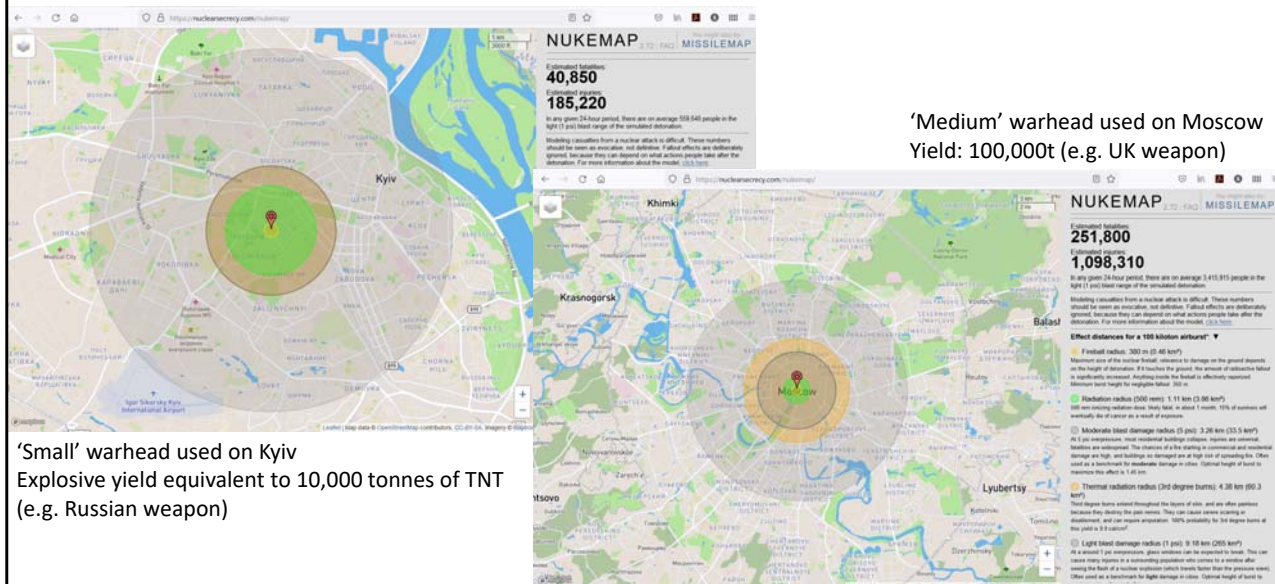
- Direct impacts
 - Heat
 - Blast
 - Radiation
 - Electromagnetic pulse
- Further impacts
 - Severe/ widespread fires
 - Severe damage to infrastructure
 - Catastrophic climate change
 - Ecosystem collapse
 - Social collapse



- Nuclear fireball hotter than surface of Sun
- Blast creates very powerful winds faster than speed of sound
- Intense lethal radiation
- Electromagnetic pulse destroys all electronic circuitry for considerable distance
- Effects over many km – depends on size of weapon and height of explosion
- Wider, cumulative effects dependent on number of weapons used
- For more details, see:
SGR (2021). Nuclear weapons: a beginner's guide to the threats.
<https://www.sgr.org.uk/resources/nuclear-weapons-beginner-s-guide-threats>

[Image credit: Gerd Altmann]

Examples: one nuclear weapon - casualties



- Simulations using ‘Nukemap’ – online application - <https://nuclearsecrecy.com/nukemap/>
- Many variables – significant uncertainty in projected casualty figures
- One current concern is that Russia might use a weapon with a yield of about 10,000t in Ukraine - similar size to Hiroshima bomb
- More detailed scenarios available in academic papers and reports – see, e.g. Article 36/ SGR (2013). <https://www.sgr.org.uk/resources/humanitarian-impacts-single-nuclear-weapon-detonation-manchester>

But use of many nuclear weapons more likely

- World currently has:
 - 12,700 nuclear warheads – 90% owned by Russia/ USA
 - 3,700 deployed
 - **2,000 deployed on 'high alert'** – USA, Russia (+France, UK)
- Many nuclear missiles have multiple warheads
 - Including UK
- Escalation of use could happen very quickly
- Immediate casualty figures for nuclear war could reach **hundreds of millions** depending on scenario



- Warhead figures from: Federation of American Scientists (2022).
<https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/>

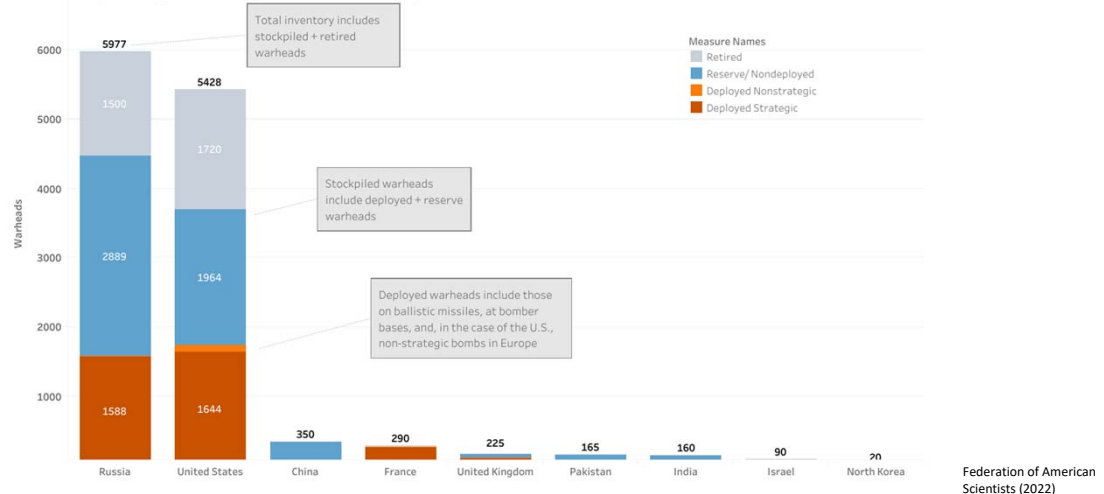
[Image credit: MOD]

Where are the nuclear weapons?

Estimated Global Nuclear Warhead Inventories, 2022

Hans M. Kristensen, Matt Korda, and Robert Norris, Federation of American Scientists, 2022

Last updated: 23 February 2022



- Federation of American Scientists (2022). <https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/>

UK Trident system

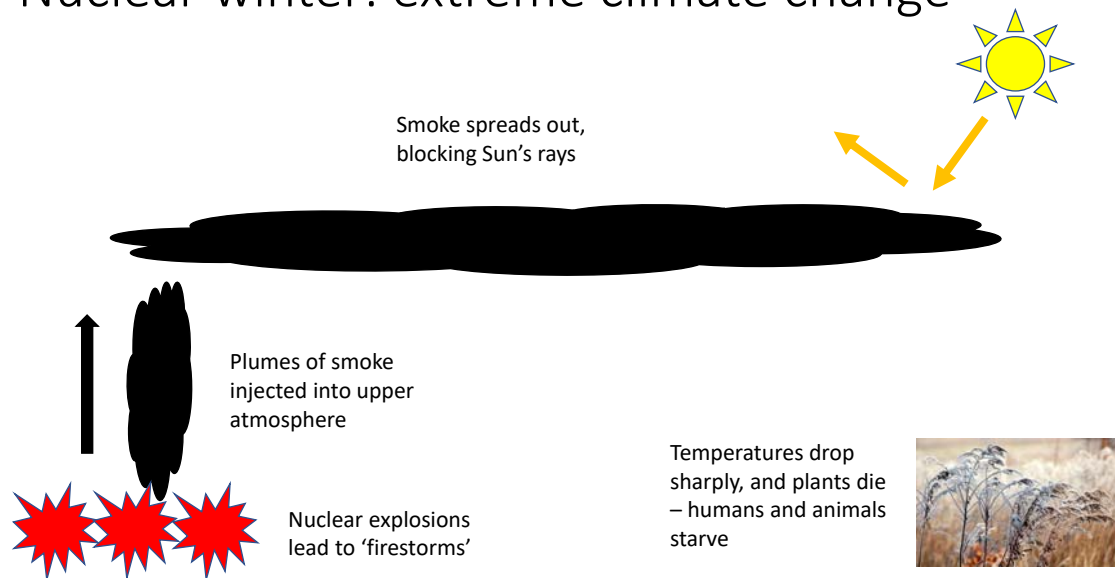


- Warheads
 - Current stockpile: 225 warheads – rising to 260
 - Yield of each warhead is 100,000 tonnes – which may be increased
- Submarines
 - 4 Vanguard class due to be replaced by Dreadnought class from early 2030s
 - One always on patrol
- Each submarine carries 40 warheads
 - Total explosive power greater than **all bombs** dropped in **World War II**
 - Total explosive power large enough to **trigger nuclear winter** (regional war scenario)

- Data from:
 - Federation of American Scientists (2022). <https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/>
 - Nuclear Information Service (2022). <https://www.nuclearinfo.org/reports/2022/extreme-circumstances-the-uks-new-nuclear-warhead-in-context/>
 - SGR (2013). <https://www.sgr.org.uk/publications/climatic-impacts-and-humanitarian-problems-use-uk-s-nuclear-weapons>
- Total explosive power of all bombs dropped in World War II: estimated by US and Russian physicists to be about 3,000,000 tonnes of TNT.
From: p19 of: Schlosser E (2013), Command and Control. Penguin.

[image credit: MOD]

Nuclear winter: extreme climate change



- Extreme cooling (rather than heating from carbon emissions)
- Change would be faster and larger than that due to carbon emissions
- Robust evidence for impacts – derived using modern climate models – published in academic journals

Image credit: Alicja via Pixabay

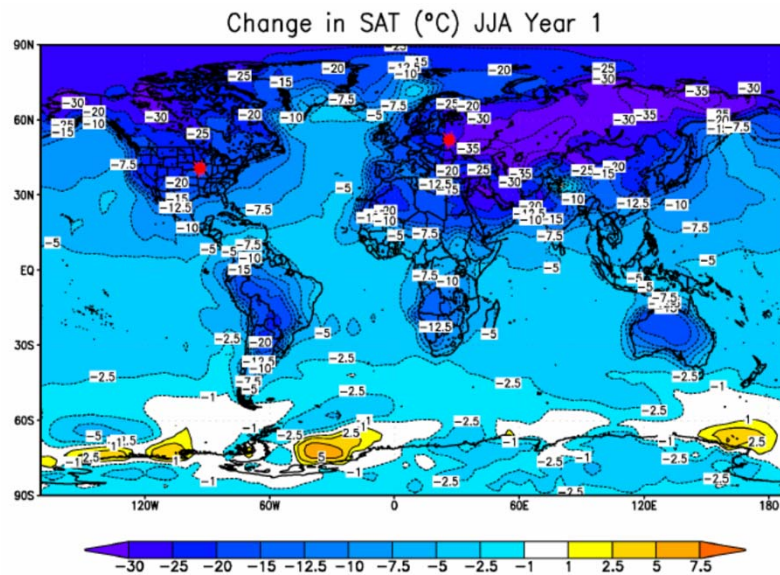
Key impacts of regional nuclear war scenario

- Regional war scenario: about 100 'Hiroshima bombs'
- Large areas of 'severe fire zone', injecting 5m tonnes of soot into stratosphere
- Sudden major drop in surface temperatures lasting over 7y
- Coldest global temperature for at least 1,000 years
- Severe frosts/ drought lead to much shorter growing season/ reduction in crop yields for years
- Major loss of ozone layer
- Major impact on global ecosystems
- **Global famine affecting about 2,000,000,000 people**
- (In addition to 10-21 million direct deaths from explosions)



- Key findings from two academic papers:
Robock A, Oman L, Stenchikov G, Toon O, Bardeen C, Turco R (2007b). Climatic consequences of regional nuclear conflicts. *Atmospheric Chemistry and Physics*, 7, 2003–2012; DOI:10.5194/acp-7-2003-2007
Toon O, Turco R, Robock A, Bardeen C, Oman L, Stenchikov G (2007). Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism. *Atmospheric Chemistry and Physics*, 7, 1973–2002, DOI:10.5194/acp-7-1973-2007
Several other studies over past 15y give comparable results
- Early research published in 1980s/90s
- Global famine affecting 2 billion – IPPNW (2013).
<https://www.ippnw.org/programs/nuclear-weapons-abolition/nuclear-famine-climate-effects-of-regional-nuclear-war>
- *Image credit: Alicja via Pixabay*

Nuclear winter scenario: USA-Russia war



- Graph of 'Global-high' scenario: Surface air temperature changes (degrees Celsius) for the '150 Tg case' – i.e. a major nuclear war between USA and Russia using arsenals available in mid-2000s leading to emissions of 150 million tonnes of black carbon into the upper atmosphere, mainly in the form of smoke – averaged for June, July, and August of the year of smoke injection and the next year. Effects are largest over land, but there is substantial cooling over oceans, too. The warming over Antarctica in Year 0 is for a small area, is part of normal winter interannual variability, and is not significant. Also shown as red bursts are two example locations for nuclear weapon explosions.
- 'Global-low' war scenario – reductions in temperature are about half the magnitude, but follow a similar geographical distribution
- Reference:
Robock A, Oman L, Stenchikov G (2007a). Nuclear winter revisited with a modern climate model and current nuclear arsenals: still catastrophic consequences. *Journal of Geophysical Research: Atmospheres*, 112:D13; DOI:10.1029/2006JD008235