

NUCLEAR WEAPONS AND OUR CLIMATE



ICAN 2017
NOBEL
PEACE
PRIZE
AUSTRALIA



icanw.org.au

ICAN Australia Briefing paper | November 2024

Author: Tilman Ruff

Design: Nat Lowrey / ActionSkills.au

Front and back cover photo: King Tide Coming, Eneko, Majuro Atoll, Marshall Islands, 2014. Credit: Jesse Boylan

TABLE OF CONTENTS

SUMMARY	..... 2
1. Introduction	..... 3
2. Nuclear weapons pose the greatest acute danger to Earth’s climate	..... 4
3. A climate-stressed and conflict-ridden world is an even more dangerous place for nuclear weapons	..... 8
4. Nuclear power fuels nuclear proliferation	..... 9
<i>4.1 Nuclear reactors create enormous radiological hazards</i>	..... 11
<i>4.2 Russia’s invasion of Ukraine and weaponisation of nuclear facilities</i>	..... 12
5. Opportunity costs of nuclear weapons for climate action	.....14
CONCLUSION	..... 15
<i>References</i>	..... 16

SUMMARY

Nuclear weapons and climate are deeply interconnected. The hospitable and stable climate required for human and biosphere health needs protecting from both rampant global heating and nuclear war. The smoke from burning cities ignited by even a nuclear war involving 2% of the global nuclear arsenal would suddenly plummet temperatures worldwide to ice age levels, decimate agriculture, disrupt ocean food chains and condemn over two billion people to starve to death.

A climate-stressed world is an even more dangerous place for nuclear weapons. Over the last decade, the number of armed conflicts and their casualties have steadily grown, exacerbated by food and water insecurity, worsening poverty, extreme climate events, displacement and other consequences of global heating. These conflicts and the use of nuclear weapons to assert political and military power with claimed impunity undermine the international cooperation needed to address the climate crisis and other shared challenges. Nuclear arsenals and growing military expenditures not only make conflicts more dangerous and deadly, but have huge opportunity costs, as vast resources are diverted from addressing the real needs of people and planet. Military organisations and activities are also large emitters of greenhouse gases, rarely measured or reported and largely unconstrained.

Apart from being slow, now the most expensive energy source, associated with risks of catastrophic accidents, routine radioactive emissions and intractable waste, nuclear power inseparably creates the capacity to build nuclear weapons. Its promotion as a somewhat low carbon energy source is largely by

vested interests and for political and potential proliferation purposes. Facilities to enrich uranium for nuclear reactors can readily enrich it to weapons grade, and the plutonium inevitably produced from uranium inside a nuclear reactor can be extracted from the spent fuel rods. Both routes have been used for proliferation of nuclear weapons. In most nuclear-armed states, the infrastructure, personnel, expertise, industrial capacity and government investments in nuclear power are also key to their nuclear weapons programs.

Nuclear facilities including reactors, spent fuel storage ponds and reprocessing plants contain vast amounts of long-lived radioactive materials. They are effectively pre-positioned large radiological weapons or 'dirty bombs', vulnerable to direct military attack or disruption to electricity and water supplies essential for continuous cooling. Russia's invasion of Ukraine has starkly highlighted the dangers of a radiological disaster from nuclear facilities in a war zone, particularly with military attacks on, occupation and weaponisation of the Zaporizhzhia Nuclear Power Plant and destruction of the Kakhovka Dam which provided cooling water.

A healthy and sustainable future for all life on Earth requires rapid transition to renewable energy and net zero greenhouse gas emissions, and that we prohibit and eliminate nuclear weapons before they eliminate us. Virtually every species will be harmed in a nuclear war and by global heating; only one species can stop them.

1 INTRODUCTION

Have nuclear weapons and climate change got anything to do with each other? Does climate change increase the risk of nuclear war? What effect would nuclear war have on the climate? How does nuclear power generation - sometimes touted as a climate-friendly energy source - relate to nuclear risks? Could the massive amounts of radioactivity inside nuclear reactors and waste storages cause radioactive contamination akin to nuclear weapons? Could nuclear facilities themselves be turned into weapons? This briefing paper addresses the connections between our climate, nuclear weapons, nuclear power and the stuff that puts the 'nuclear' in nuclear weapons.

THE BOTTOM LINE:

The two paramount human-made existential threats we confront - nuclear weapons and climate change - exacerbate each other and need to be addressed together - with utmost urgency. One harms us and our biosphere every day, the other could deplete it irrevocably and end human civilisation and many species in less than a day.

The "Baker" explosion, part of Operation Crossroads, a nuclear weapon test by the United States military at Bikini Atoll, Micronesia, on 25 July 1946. Credit: United States Department of Defense.



2 NUCLEAR WEAPONS POSE THE GREATEST ACUTE DANGER TO EARTH'S CLIMATE

Global heating is upon us – accelerating and increasingly disrupting our lives, in overwhelming scientific evidence, impossible to ignore. Most of us now understand how crucial to human and planetary health is a stable and hospitable climate, and that securing this is the defining challenge of our age. Human disruptions to climate are frequent topics of conversation, yet too few of us make the connection that the most acute, immediate danger to our lives and climate comes from nuclear weapons.

Nuclear weapons are not some lingering Cold War legacy we can safely ignore, they are a real and present danger, and that danger is as great as it has ever been, and it is growing. Two nuclear armed states, Russia and Israel, are embroiled in hot wars, and they and others are making threats to use nuclear weapons, and changing their military strategies to make that more likely.¹ None of the 9 nuclear-armed states are disarming or involved in any disarmament negotiations. Most of the hard-won treaties that limited nuclear weapons numbers and types have been abrogated. Just one remaining treaty set to expire in Feb 2026 constrains the massive Russian and US arsenals. Nothing is being negotiated to replace it.

Nuclear-armed states are investing massively - US\$91.4 billion in 2023² - in developing new nuclear weapons - faster, stealthier, more accurate, longer-range, more likely to be used. The number of nuclear weapons deployed

“I don’t see a pandemic finishing us off, and climate change itself would (to quote Keating) ‘do us slowly’. The one sure path to extinction is nuclear war.”

PROFESSOR PETER DOHERTY AC,
NOBEL LAUREATE, 9 SEP 2024

ready for use is again growing, as is the number of weapons on high alert, ready to be launched within a few minutes of a decision to do so, highly vulnerable to launch by accident or cyberattack. Cyberwarfare, disinformation and growing armed conflicts in an increasingly climate-stressed world add to the constant danger of equipment and computer failures, accidents, mistakes, bad decisions and other human frailties that have repeatedly brought us to the very brink of nuclear war.³ Use of artificial intelligence in nuclear weapon systems poses new risks. The Doomsday Clock, established in 1947 by the Bulletin of the Atomic Scientists, led by Albert Einstein and Robert Oppenheimer, now stands at 90 seconds to midnight, further forward than ever before.⁴

Studies by some of the world’s best atmospheric scientists show that just 2% of the global nuclear arsenal, targeted on cities in just one region of the world, would ignite massive firestorms that would loft millions of tons of smoke high into the atmosphere, beyond the reach of rain and snow. This smoke would spread, blanketing the entire globe within a few weeks, and cool, dry and darken the world beneath for a decade or more. The dark smoke in the stratosphere and beyond would be warmed by the sun, heating the upper atmosphere by 50-80C, and rapidly depleting the ozone which protects us from the Sun’s harmful ultraviolet (UV) radiation.⁵

250 bombs each of 50 kt (kilotons, 50,000 tonnes of high explosive equivalent, 3 times the

NUMBER OF NUCLEAR WEAPONS ON URBAN TARGETS, YIELDS, DIRECT FATALITIES FROM THE BOMB BLASTS AND RESULTING NUMBER OF PEOPLE IN DANGER OF DEATH DUE TO FAMINE FOR DIFFERENT SCENARIOS OF NUCLEAR WAR

Soot (Tg*)	Number of weapons	Yield (Kt)	Number of direct fatalities	Number of people without food by the end of Year 2
5	100	15	27,000,000	255,000,000
16	250	15	52,000,000	926,000,000
27	250	50	97,000,000	1,426,000,000
37	250	100	127,000,000	2,081,000,000
47	500	100	164,000,000	2,512,000,000
150	4,400	100	360,000,000	5,341,000,000
150	4,400	100	360,000,000	^a 5,081,000,000

*Tg = teragrams = million tons.

The 5 Tg case scenario is for an India-Pakistan war in 2008; the 16-47 Tg cases are for an India-Pakistan war in 2025; and the 150 Tg case assumes attacks on China, France, Germany, Japan, Russia, UK and US. The last column is the number of people who would starve by the end of Year 2 when the rest of the population is provided with the minimum amount of food needed to survive, assumed to be 1911 kilocalories per person per day, allowing for no international trade, assuming that 50% of livestock grain feed is eaten by humans and 50% used to raise livestock, using the latest complete data available for the year 2010, when the total population of the nations studied was 6.7 billion. There are many other scenarios in which these amounts of soot could be produced by a nuclear war; the scenarios used are illustrative examples. The last column is the case without international trade with the fewest number of deaths. Other scenarios and full references are available in the source.

Adapted from: Xia L et al. Nature Food, August 2022. <https://www.nature.com/articles/s43016-022-00573-0>

^aAssuming all household food currently wasted is instead consumed.

size of the Hiroshima bomb but less than a third of the average size of nuclear weapons today) would be less than 1% of the explosive power of the global nuclear arsenal. However, used for example in a war between India and Pakistan, they would produce over 27 million tons of smoke, cooling average surface temperatures by 4C, well within the range of the coldest temperatures during the last ice age 20,000 years ago, 3 to 8°C colder than present.⁶ Much greater declines of 8-15C would occur over the large land masses where most of the world's grain is grown. Rainfall would decline globally by 40%, and sunlight by up to 30%. Food production worldwide would plummet, putting 1.5 billion people at risk of starving to death, and over 2 billion people if the bombs used were 100 kt.⁷

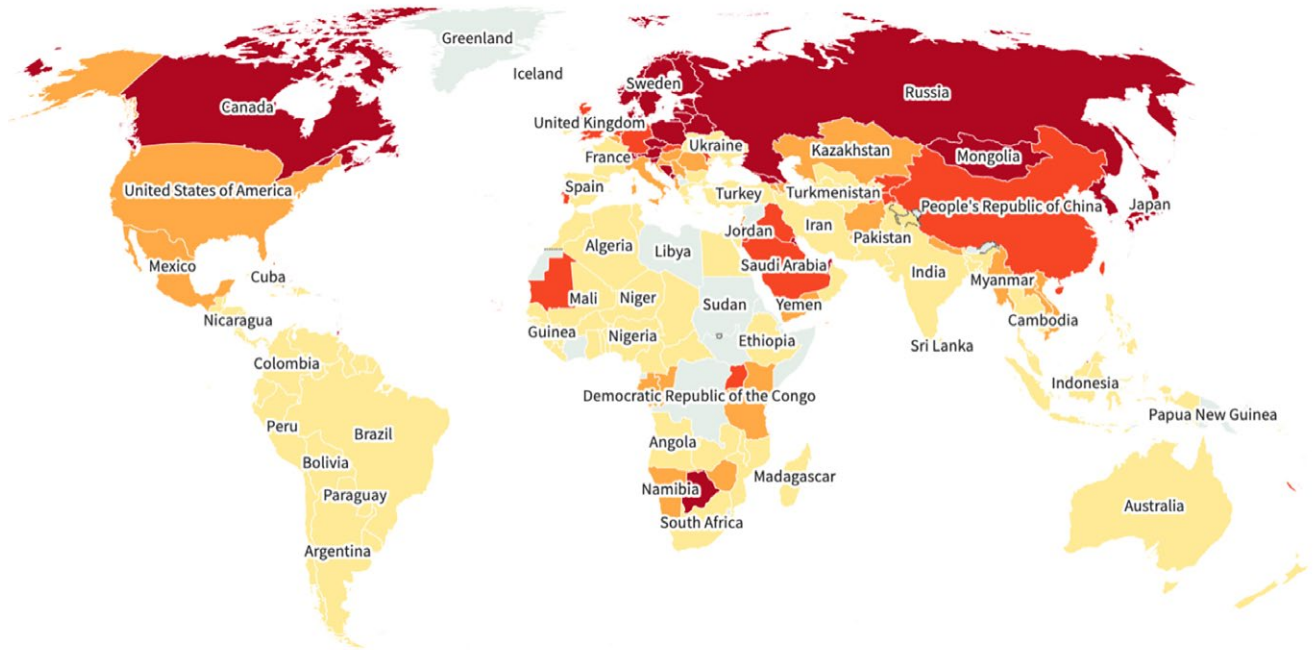
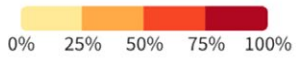
This abrupt nuclear famine would be exacerbated by chemical and radioactive

contamination of large areas, contaminating food; levels of UV radiation harmful to humans as well as plants and animals on land and in the sea; disruption to transport, agricultural trade and distribution of seed, fertiliser, fuel and pesticides; massive numbers of fleeing people, and social chaos. Historically, large-scale famines have inevitably been accompanied by epidemics of infectious diseases, and often by conflict within and sometimes between nations, all of which would magnify the human toll and environmental impact. A global famine on such unprecedented scale would likely trigger widespread conflict over unevenly distributed and dwindling food reserves.

The burning cities from a nuclear war between Russia and the US involving 4400 weapons, equivalent to those they currently deployed plus 20% of those in their military stockpile but

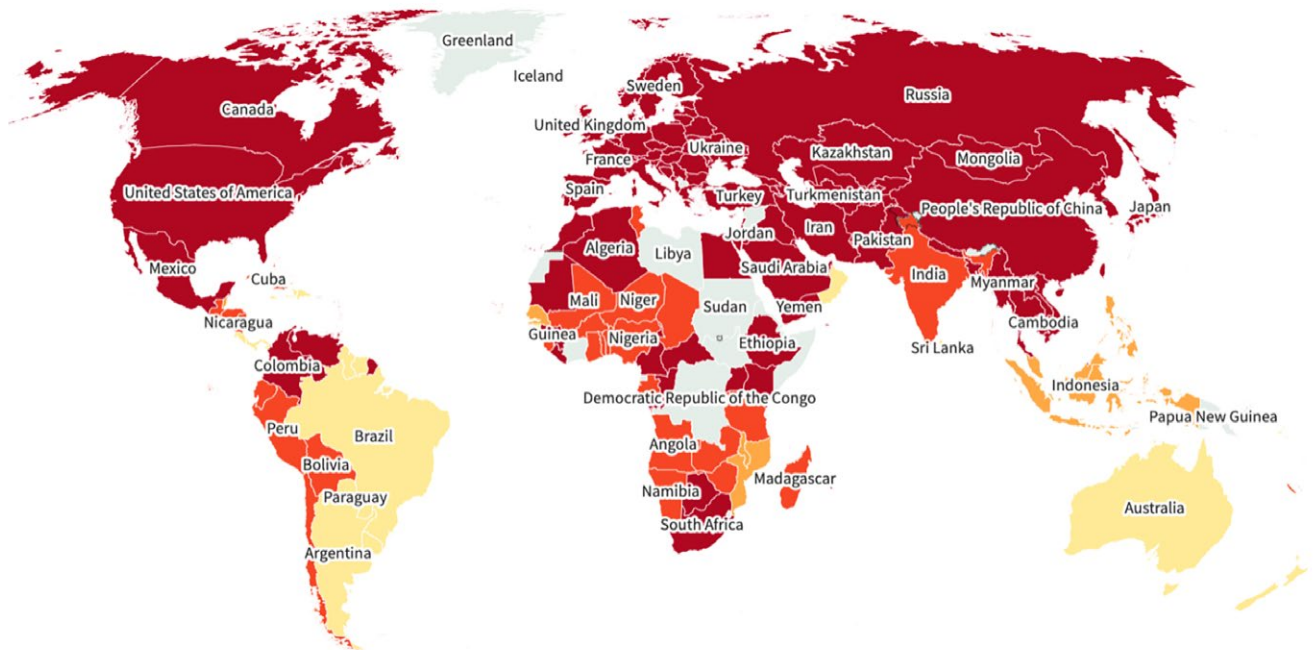
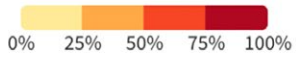
Starvation Caused by Nuclear Winter

Proportion of population starved to death



Maps showing how many people in various nations would die from starvation 2 years after a relatively small-scale (37 million tons of smoke, above image) and large-scale (150 million tons of smoke, below image) nuclear war. Credit: Taylor Jones adapted from original map source: Xia, Lili et al. 'Global food insecurity and famine from reduced crop, marine fishery and livestock production due to climate disruption from nuclear war soot injection'. *Nature Food*, 2022.

Proportion of population starved to death



not currently deployed, would put 150 million tons of smoke into the atmosphere. This would plummet average surface temperatures 10 colder than present, and 20-35C colder in large areas of Eurasia and North America,⁸ a severe abrupt ice age that would result in the large majority of the world's 8 billion people starving to death, along with the starvation and extinction of many other species.⁹ The massive firestorms ignited by nuclear weapons would cause the greatest number of casualties in the first days and weeks after a nuclear war; the climatic effects and famine caused by the smoke from those fires would be the greatest cause of deaths in the longer term.

The more we know about nuclear weapon impacts, the worse it looks. Scientists continue to discover new effects that would exacerbate the harm. Various nuclear war scenarios could induce an El Niño-like pattern of unprecedented magnitude across the Pacific, with associated reductions in equatorial Pacific phytoplankton productivity of about 40%.¹⁰ Large and abrupt exacerbations in global ocean acidification would be a consequence of nuclear war, with potential inability for marine calcifying organisms like shellfish and corals to maintain their shells or skeletons in a corrosive environment.¹¹ Even the smallest nuclear war would devastate ocean systems, leading to sharp declines in fish stocks, expansion of ice sheets into coastal communities and changes in ocean currents that would take decades or longer to reverse.¹² Sea temperature impacts from nuclear war would be particularly extreme in coastal regions, where the majority of fish catch and marine ecosystem services are provided. Massive disruptions in nutrients vital to plankton at the base of food chain would be widespread through the world's oceans, with some changes likely to last hundreds of years or longer.

A recent scientific analysis of the expected extinctions of terrestrial and marine tetrapod (four-limbed vertebrate animals) species over the next 300 years attributable to pollution, deforestation and global warming and those

estimated to follow nuclear war concluded that preventing nuclear war could achieve greater gain in conserving animal species even than reducing deforestation, decreasing pollution and limiting global warming.¹³

Nuclear weapons are a climate issue. The stable and hospitable climate we need for planetary and human survival and flourishing needs to be shielded from both runaway global heating and an abrupt nuclear winter. If we do not succeed in eliminating nuclear weapons in time, all human achievements, labour and aspirations could become tragically irrelevant in an hour or two. Two senior climate scientists recently wrote: "We must solve the problem of nuclear weapons so that we have the luxury of devoting our time to solving the climate crisis".¹⁴

The only reliable way to prevent nuclear war is to eliminate nuclear weapons before they are otherwise inevitably used again. As everyone everywhere, everything we treasure and our living planet is threatened by nuclear weapons, this is everyone's business. Even if the world really steps up in this critical decade for climate action, we will be stuck with adapting to significant impacts of global heating. Nuclear war is entirely preventable if we act in time.



Osirak reactor under construction in Iraq with French and Italian assistance, bombed by Israel in 1981 (attached), Creative Commons from National Security Archive

3 A CLIMATE-STRESSED AND CONFLICT-RIDDEN WORLD IS AN EVEN MORE DANGEROUS PLACE FOR NUCLEAR WEAPONS

Military and security establishments worldwide assess that global warming is a pre-eminent and accelerating threat to security that amplifies other threats. The United States intelligence community annual assessment of worldwide threats provided to the US Congress on 29 January 2019 warned that the effects of climate change and environmental degradation increase stress on communities around the world and intensify global instability and the likelihood of conflict, causing the danger of nuclear war to grow.¹⁵

Over the last decade, the number of armed conflicts and their death toll has steadily grown, particularly the number of “internationalised intrastate” conflicts - within a state but involving at least one nation (disproportionately nuclear-armed nations) outside the state in the conflict.¹⁶ Each such conflict poses a risk of nuclear escalation. To date in 2024, of the 9 nuclear-armed states, Russia and Israel are both prosecuting war and their leaders have made direct threats to use nuclear weapons; the US is involved directly in war in the Middle East; France, UK and the US with other NATO members are less directly involved in the war in Ukraine; and others have been involved in recent cross-border military attacks (Pakistan, with India and Iran; India with China).

Among the highly inequitably distributed effects of climate change are water and food insecurity, exacerbation of poverty and displacement. World Bank data show the entwining nexus between fragility, conflict, violence and climate change.¹⁷ It notes that:

“Violent conflict has spiked dramatically since 2010 in several regions, and the fragility landscape is becoming more complex. Since the start of the COVID-19 pandemic, the world has seen a series of massive setbacks to stability in regions across the world: from Asia

and Africa to Latin America and the Caribbean, and more recently in Eastern Europe and the MENA region.”

The World Bank estimates that a total of 324 million extremely poor people reside in 33 countries classified as fragile and conflict affected, and that by 2030, nearly 60% of the world’s extremely poor people will live in countries affected by fragility, conflict and violence (FCV). Severe food insecurity, which is estimated to affect over 956 million people by 2028, is twice as prevalent in FCV-affected countries. Conflict is the biggest driver of hunger, with 70% of the world’s hungry people living in areas afflicted by war and violence. Fifteen of the top 25 countries most vulnerable to climate-related impacts (*Notre Dame Global Adaptation Initiative index*) are fragile and conflict-affected.¹⁸

The Bank recognises forced displacement as a developing world crisis. At the end of 2023, an unprecedented 117.3 million people were forcibly displaced as a result of persecution, conflict, violence or human rights violations.¹⁹ 52% of refugees worldwide originate from just three countries—Afghanistan, Syria and Ukraine - all of them at war presently or recently.

The United Nations 2023 *A New Agenda for Peace*²⁰ notes in relation to the climate emergency:

Where record temperatures, erratic precipitation and rising sea levels reduce harvests, destroy critical infrastructure and displace communities, they exacerbate the risks of instability, in particular in situations already affected by conflict. ... Failure to tackle head-on the challenges posed by climate change, and the inequalities it creates, through ambitious mitigation, adaptation and implementation of the loss and damage agenda, bolstered by adequate climate

finance, will have devastating effects, for the planet as well as development, human rights and our shared peacebuilding objectives.

The first priority for international peace and security in the UN Agenda is the elimination of nuclear weapons. The UN Agenda recommendations also reinforce the need to “recognize climate, peace and security as a political priority” and ensure “that climate action and peacebuilding reinforce each other”. The formation of a dedicated expert group under the Intergovernmental Panel on Climate Change is urged “to develop recommendations on integrated approaches to climate, peace and security”.

The third revision draft of the UN Pact for the Future (Rev.3) included as Action 21:

“We will address adverse climate and environmental impacts that could contribute to the onset or escalation of conflict.”²¹

It explained:

“The adverse effects of climate change, environmental degradation, loss of biodiversity, desertification, water scarcity and water risks can exacerbate social tensions, instability and economic insecurity, increase humanitarian and socio-economic needs,

and, in some cases, contribute to the onset or escalation of conflict.”

Regrettably, this action to “address adverse climate and environmental impacts that could contribute to the onset or escalation of conflict” was removed from the final Pact for the Future document adopted by consensus at the UN on 22 September 2024.

The draft Pact (Rev.3) also noted that:

“Countries affected by armed conflict often lack the capacity, resources and resilience to respond to the adverse effects of climate change and other environmental challenges.”

Australia’s 2023 National Defence Strategic Defence Review recognised the increased risk of war associated with climate change:

“Climate change is now a national security issue. Climate change will increase the challenges for Australia and Defence, including increased humanitarian assistance and disaster relief tasks at home and abroad. If climate change accelerates over the coming decades it has the potential to significantly increase risk in our region. It could lead to mass migration, increased demands for peacekeeping and peace enforcement, and intrastate and interstate conflict.”²²

4 NUCLEAR POWER FUELS NUCLEAR PROLIFERATION

It was recognised by the Ranger Uranium Environmental Inquiry in 1977, which preceded the expansion of commercial uranium mining in Australia, that nuclear power contributes to an increased risk of nuclear war, and that “this is the most serious hazard associated with the industry.”²³ Any uranium enrichment plant can

“One does not go without the other. Without civil nuclear, no military nuclear, without military nuclear, no civil nuclear.”²⁴

PRESIDENT EMMANUEL MACRON,
FRAMATOME FACILITY, LE CREUSOT, 8 DEC 2020

be used to produce not only reactor grade uranium, but weapons grade uranium. Currently 14 nations have such plants.²⁵ Laser enrichment technology initially developed in Australia could make enriching uranium more compact and concealable.²⁶ Highly enriched uranium (HEU, containing >20% U-235) is one of the two fissile

materials used to build nuclear weapons. The other is plutonium, inevitably produced inside all nuclear reactors as uranium atoms absorb neutrons. Plutonium contained in spent nuclear fuel can then be chemically extracted (through ‘reprocessing’) at some future time.

South Africa, Pakistan and North Korea primarily used the HEU route to build nuclear weapons; India and Israel primarily used a plutonium route. All used facilities and fuel that were ostensibly for peaceful purposes. Both France and the UK have used reactors which also produced electricity to produce plutonium and tritium for nuclear weapons.²⁷ Tritium is used to ‘boost’ the explosive yield of the fission explosion in modern nuclear weapons about ten-fold. The half-life of tritium is 12.3 years, so it must be regularly replaced to maximise the destructiveness of nuclear weapons. Since 2003, the US has been producing tritium for its own and the UK’s weapons at the two Watts Bar civil nuclear power plants in Tennessee. The French government announced in March 2024 that it will also in future produce tritium for its nuclear weapons in a civilian nuclear plant.²⁸

Australia’s own history underscores the inseparable ‘Trojan horse’ connections. The government of PM John Gorton commenced construction of Australia’s first nuclear power reactor at Jervis Bay in NSW in the late 1960s, largely to accelerate Australia’s capacity to build its own nuclear weapons. Australian Atomic Energy Commission chair JP Baxter spoke of “the indissoluble connection between the peaceful and military uses of nuclear materials”.

A briefing to the Minister for the Interior in 1969 stated:

“From discussions with the AAEC [Australian Atomic Energy Commission] officers it is understood that in establishing the Australian nuclear power industry it is desired to provide for the possibility of producing nuclear weapons ...”.

The same year Gorton ally minister WC Wentworth MP wrote to then Defence Minister Malcom Fraser:

“It would be so easy for us to produce nuclear warheads – we have plutonium at nuclear power plants in Japan, enough to make several thousand such warheads.”²⁹

ICHIRO OZAWA, WHILE PRESIDENT OF THE LIBERAL PARTY IN JAPAN, LECTURE IN FUKUOKA, APRIL 2002

***“... everything we do must be capable of presentation as a normal move in peaceful atomic industry. In this way we can hope to get a ‘short-term nuclear option’ without giving open offence, and then, at some future date, if events require it, take up the option without giving this offence time to accumulate ...”.*³⁰**

Nuclear weapons, depending on their size and technical sophistication, contain several kg of plutonium, and/or about 3 times as much HEU. 4 kg of plutonium or 12 kg of HEU are enough to make a modern fission weapon.³¹ A two-stage modern weapon using 3-4 kg of plutonium and 4-7 kg of HEU could have an explosive yield up to 160 kg - 10 times that of the Hiroshima bomb. Global stockpiles of fissile materials at the start of 2023 – 1245 tons of HEU and 560 tons of separated plutonium³² – were sufficient to build over 200,000 nuclear weapons.³³ Thus ending production of fissile materials, keeping current stocks extremely secure, preferably under international control, and eliminating these materials wherever possible will be crucial to achieving and sustaining a world free of nuclear weapons.

The twin concurrent existential threats that confront us, climate disruption and nuclear war, demand win-win solutions. Promotion of nuclear power as a claimed climate friendly energy source is a lose-lose proposition. As noted in 2010 by the Board of the Bulletin of the Atomic Scientists in setting the hands of the Doomsday Clock – an authoritative indicator of our global proximity to existential peril, “Nuclear war is a terrible trade for slowing the pace of climate change.”³⁴

As the costs of nuclear power have continued to rise to become substantially higher than renewables plus storage, and scale-up of nuclear power to play a significant part in reaching net zero greenhouse gas emissions by 2050 has proven unfeasible^{35,36} the motivation of some governments to maintain civilian nuclear infrastructure and workforce expertise in order to support their nuclear weapons programs has become increasingly overt, including in France, Russia, UK and US.³⁷

The authoritative World Nuclear Industry Status Report 2024 assesses:

“that across all major nuclear-armed states, ‘civil’ nuclear policies are increasingly driven by pressures to maintain military nuclear infrastructures. ... What civil activities help provide for military interests, is a way to subsidize distinctive national nuclear skills, supply chains, design capabilities, manufacturing capacities, educational provision, research facilities, regulatory infrastructures, and career incentives, which would not otherwise be affordable under the supposedly responsible budgets.”³⁸

A recent detailed study of revenue flows in the UK civil-military nuclear complex conservatively estimates the overall undeclared excess costs to the UK economy of keeping the UK civil and military nuclear complex in operation at US\$6.3 billion per year, of which the presently concealed de facto flow of value from civil allocations to military purposes is at least US\$2.5 billion per year.³⁹

4.1 Nuclear reactors create enormous radiological hazards

Nuclear reactors and their spent fuel pools contain massive amounts of radioactivity which is more long-lived than that produced by nuclear weapons. Both require continuous water cooling. Unlike the several layers of engineered containment around nuclear reactors, spent fuel pools have no containment other than a simple roof over them. At the

Fukushima Daiichi plant severely damaged in the 2011 nuclear disaster, 70% of the total radioactivity at the site was in the spent fuel pools.

Nuclear physicist and Nobel Peace Laureate Joseph Rotblat wrote in 1981 about nuclear reactors with remarkable prescience in his book *Nuclear radiation in warfare*.⁴⁰

“But despite this heavy protection, modern precision-guided bombardment with conventional weapons could succeed in rupturing the containment vessel as well as the pressure vessel. Alternatively, the task might be achieved in a commando raid, as was carried out on a heavy water plant during World War II. ... In a pressurised water reactor, the melt-down of the core could occur within less than one minute after the loss of coolant; with other types of reactor it might take a few minutes. ... If a group took over a reactor they would not need to blow up the heavy biological shield of the pressure vessel; all they would have to do would be to cut off the supply of cooling water to bring about core melt-down.”

What happened in Fukushima because of poor design and a large earthquake and tsunami could equally happen not only through an attack by a national military force, but because of commandos or terrorists disrupting the power or cooling water supply for reactors and/or spent fuel pools for long enough to cause meltdown and/or explosions. Such an event could also occur because of cyberattack; or as a result of electricity supply and electronic equipment failure caused by the electromagnetic pulse (EMP) generated by a single high altitude nuclear explosion, which could simultaneously disrupt nuclear reactors across a whole continent.

Rotblat further showed that nuclear attack on nuclear reactors or spent fuel storages would massively increase the resulting radioactive fallout. A 1 megaton (Mt) nuclear detonation would typically blanket an area of 2000 km² with a (sizable) radiation dose of 1 Gray between



ABOVE: A broken bridge from shelling and air attacks near the Zaporizhzhya Nuclear Power Plant. 15 June 2023. Credit: IAEA

BELOW: IAEA team observes damage caused by shelling on the roof of the special building at the ZNPP that houses the fresh nuclear fuel and the solid radioactive waste storage facility. Credit: IAEA



1 month and 1 year afterwards. The area so contaminated following a 1 Mt nuclear explosion on a typical 1 GW power reactor would be 34,000 km², and 61,000 km² were a spent fuel storage tank targeted. While radioactive releases from nuclear reactors subject to attack have not been documented, this is largely fortuitous, and a number of attacks on nuclear reactors have taken place.⁴¹ These include multiple attacks between Iran and Iraq during their 1980-8 war, Israel's destruction through airstrikes of nuclear reactors under construction in Iraq (1981) and Syria (2007), a South African ANC attack on the Koeberg nuclear power plant with mines while it was under construction, 1991 and 1993 US attacks on various Iraqi nuclear facilities, Iraq's firing of Scud missiles at Israel's Dimona nuclear reactor in Jan-Feb 1991, and Hamas' 2014 unsuccessful rocket attacks against Israel's Dimona nuclear reactor and nuclear weapons site.

4.2 Russia's invasion of Ukraine and weaponisation of nuclear facilities

The war between Ukraine and Russia following Russia's 2022 invasion is the first time that nuclear power plants have been directly involved - 'weaponised' - in war. All Ukraine's 5 nuclear power plant sites and several other nuclear facilities have been affected by various combinations of military occupation, damage to power lines, interruptions to electricity supply, shelling, missile strikes, damage due to fighting, fires and disruption of staffing.⁴² The most hazardous situation has been at the Zaporizhzhia Nuclear Power Plant (ZNPP), Europe's largest, with 6 reactors. An unprecedented attack on an operating civil nuclear plant by Russian forces on 4 March 2022, was followed by military takeover and continued occupation and use as a military base. Power lines have been severely compromised, with loss of power on 8 occasions to mid 2024, sharply escalating the risk of reactor fuel meltdown. It has been subject to drone strikes and damaging fires. Landmines have been laid, conditions for reduced numbers of remaining staff made extremely difficult and insecure, maintenance compromised.

Systematic detention, mistreatment and torture of civilians associated with the plant have been documented.⁴³ The Kakhovka Dam which provides the ultimate source for essential cooling water for the plant was breached by an explosion in June 2023.

According to the Feb 2023 IAEA (International Atomic Energy Agency) report:⁴⁴

“Every single one of the IAEA’s crucial seven indispensable pillars for ensuring nuclear safety and security in an armed conflict has been compromised, including the physical integrity of nuclear facilities; the operation of safety and security systems; the working conditions of staff; supply chains, communication channels, radiation monitoring and emergency arrangements; and the crucial off-site power supply.”

The report further states:

“Shelling, air attacks, reduced staffing levels, difficult working conditions, frequent losses of off-site power, disruption to the supply chain and the unavailability of spare parts, as well as deviations from planned activities and normal operations, have impacted each nuclear facility and many activities involving radioactive sources in Ukraine.”

The situation has not improved since, and IAEA efforts to ensure respect for the conditions needed for the safety and security of the plant and prevent a severe nuclear accident have been thwarted. IAEA inspectors have been repeatedly blocked from certain areas of the plant. The extent of dysfunction and need at Ukraine’s nuclear facilities is underscored by the IAEA in August 2024 shipping mattresses to Chernobyl to improve living conditions for staff.⁴⁵ The IAEA Director General stated to the Board of Governors on 9 Sept 2024:⁴⁶

“The situation at the Zaporizhzhya Nuclear Power Plant (ZNPP) remains precarious. Regular explosions, drone attacks, gunfire; repeated interruptions of external power supply, among other challenges, increase the risk of a nuclear accident. On August 11, a fire ignited inside one of the plant’s cooling towers,

... The damage may require the cooling tower to be demolished.”

In August 2024, military activity was reported in the vicinity of the Kursk Nuclear Power Plant in Russia, close to Ukraine, including involving drones. One of Russia’s largest nuclear facilities, the Kursk plant contains 4 reactors of the same RBMK-1000 type as those at the Chernobyl nuclear plant, which lack a containment structure. The IAEA Director General’s 9 Sep 24 statement referred to the situation at Kursk NPP as “serious”. Whether hit deliberately or accidentally by heavy weapons, through detonation of stored weapons, disruption of vital water and power for continuous cooling, or loss of staff able to ensure safe operation, the risk of meltdown of reactor fuel or core explosions as a result of cooling failure or direct damage to spent fuel pools or reactors with potentially catastrophic release of radioactivity from these weaponised plants in a war zone adds an alarming danger for the whole European continent to the already catastrophic humanitarian impacts of Russia’s invasion.

Thus, each of the 407 operating nuclear power reactors in 32 countries, spent fuel storage facilities, reprocessing plants and other large nuclear facilities are effectively large pre-positioned radiological weapons (‘dirty bombs’). Many are located in or near large population centres. While attacks on or other disruption of these would not produce nuclear explosions, they could cause severe and extensive radioactive contamination requiring the long-term evacuation of large areas.

While international humanitarian law (the laws of war) requires belligerents to avoid to an absolute minimum any military activities at or near nuclear power plants, and be guided by the imperative to prevent a nuclear accident,⁴⁷ it is disturbing that even with the weaponisation of nuclear plants in the Russia-Ukraine war, the most recent (2022) Review Conference of the nuclear Non-proliferation Treaty was unable to agree anything at all, including any measures to prevent military attacks on or from nuclear power plants.

5 OPPORTUNITY COSTS OF NUCLEAR WEAPONS FOR CLIMATE ACTION

Profligate and growing military expenditures have substantial opportunity costs for climate action and other needs to protect people and planet. Current estimates of global spending on development and production of nuclear weapons reached US\$91.4 billion in 2023, a 34% increase from 2019, despite the economic costs and constraints of the COVID-19 pandemic.⁴⁸ The total cost of nuclear weapons programs, including environmental clean-up and legacy costs, is far greater. The US spends the most on its military and nuclear weapons: in financial year 2024 nuclear weapons-related costs reached US\$94.49 billion.⁴⁹ US military spending, 37% of the global total in 2023, consumes half of all discretionary US government spending. In the US, nuclear warhead spending is currently at an all-time record high, with projected expenditures over the next three decades of over US\$2 trillion to comprehensively refurbish the nuclear arsenal and the facilities that produce it.⁵⁰

In a wider context, annual military expenditures reached a record high of US\$2,443 billion in 2023 - 6.8% higher than the previous year.⁵¹ This amounts to US\$306 per person alive in the world. That increase occurred despite the COVID-19 pandemic and the associated severe economic downturn, increase in poverty and food insecurity. Even the previous 3.7% increase in 2022, of US\$127 billion, was greater than the entire UN annual climate finance goal.⁵² The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report of 2022 stated that moderate reductions in military spending could free up considerable resources to tackle the climate crisis.⁵³

Nuclear weapons exacerbate international tensions. They are used by nuclear-armed states to provide cover and impunity for

aggressive and illegal actions such as invasions. The role of Russia's nuclear weapons in assisting and enabling its invasion of Ukraine and claiming impunity for its illegal actions is but a current example of a playbook also used by other nuclear-armed states. The head of US Strategic Command has argued: *"We must acknowledge the foundational nature of our nation's strategic nuclear forces, as they create the "maneuver space" for us to project conventional military power strategically."*⁵⁴

Nuclear weapons and threats impede the international cooperation needed to effectively implement urgent climate action worldwide, and other complex shared challenges. Weapons and war only make addressing the climate crisis harder.

War and military activities, including but not limited to nuclear weapons, are large emitters - the best available estimate suggests militaries are responsible for 5.5% of global greenhouse gas emissions, greater than the emissions of all countries except three - China, the US and India.⁵⁵ The US Dept of Defence is the world's largest institutional user of petroleum and thus the largest institutional emitter of greenhouse gases in the world.⁵⁶ The military carbon footprint of NATO states, which accounted for 55% of global military spending in 2023, increased from 196 million tonnes of CO2 equivalent in 2021 to 226 million tonnes in 2023, and is projected to rise further as military expenditures are planned to rise.⁵⁷ After pressure from the US, military emissions reporting was excluded from the 1997 Kyoto Protocol. The Paris Agreement of 2015 made reporting of military emissions voluntary. In most countries, military emissions are not measured or reported.⁵⁸ Regular reporting of national emissions is an obligation for only 43 Annex 1 countries plus the EU. This excludes many countries with large militaries, such as China, India, Saudi Arabia and Israel. Much military equipment will outlast the diminishing window for climate action in this critical decade. Thus large but largely unaccounted for and unconstrained military emissions are excluded from overall calculation of each state's emissions and undermine climate action and our collective security.⁵⁹

CONCLUSION

The web of links between nuclear weapons, nuclear reactors, and the materials that power both are deep and inextricable. Nuclear power cannot solve our climate crisis, and aggravates the existential danger posed by nuclear weapons. Out of the climate crisis frying pan and into the fire of radioactive incineration, nuclear ice age and famine is a lose-lose dance with extinction. Our understanding of our climate emergency and challenge needs to broaden to include the jeopardy of abrupt nuclear winter. A healthy and sustainable future for all life on Earth requires that we act to rapidly transition to renewable energy systems and net zero carbon emissions, and that we prohibit and eliminate nuclear weapons, with the utmost urgency demanded of us.

The most effective way for Australia and all nations to lift the nuclear threat and build security for their own and all people is to join and implement the historic UN Treaty on the Prohibition of Nuclear Weapons.⁶⁰ The Treaty recognises the incontrovertible evidence:

“that the catastrophic consequences of nuclear weapons cannot be adequately addressed, transcend national borders, pose grave implications for human survival, the environment, socioeconomic development, the global economy, food security and the health of current and future generations, and have a disproportionate impact on women and girls, including as a result of ionizing radiation,”

The Treaty provides a categorical and comprehensive prohibition of nuclear weapons. It further provides a framework that all nations, with and without nuclear weapons, can use to fulfil their binding obligation to eliminate the world’s worst weapons of mass destruction. It

is the only internationally agreed path towards a world freed from nuclear weapons which is codified in a treaty.

The nuclear weapons ban treaty builds on the substantial progress made to control biological and chemical weapons, landmines and cluster munitions. A treaty codifying evidence-based rejection of an unacceptable weapon and providing one standard for all nations has been key to progress for every indiscriminate and inhumane weapon. Indeed no unacceptable weapon has been controlled without a treaty proscribing it. Australia needs to get on the right side of history and join this treaty, soon, before it is too late.

“Anyone concerned about the climate crisis, about environmental degradation and biodiversity loss, needs to take up the cause of disarmament with equal passion, as these are interconnected issues. ... Delegates, every species will be harmed in a nuclear war; only one species can stop it.”⁶¹

MELISSA PARKE, ICAN EXECUTIVE DIRECTOR,
ICAN HIGH LEVEL STATEMENT TO THE OPENING
OF THE SECOND MEETING OF STATES PARTIES OF
THE TREATY ON THE PROHIBITION OF NUCLEAR
WEAPONS, UNITED NATIONS, NEW YORK,
27 NOV 2023.

REFERENCES

1. Vyas H. *Russia revisits nuclear doctrine to allow attacks on non-nuclear states in response to Western weapons in Ukraine*. Australian Broadcasting Commission/Reuters 26 Sep 2024. <https://www.abc.net.au/news/2024-09-26/russia-revises-nuclear-weapons-laws-warning-united-states/104398414>
2. International Campaign to Abolish Nuclear Weapons (ICAN). *Surge: 2023 global nuclear weapons spending*. Geneva, ICAN, 2024. https://www.icanw.org/surge_2023_global_nuclear_weapons_spending
3. Lewis P, Williams H, Pelopidas B, Aghlani S. *Too close for comfort. Cases of near nuclear use and options for policy*. Chatham House Report. April 2014. Royal Institute for International Affairs; Witmer S. *Nuclear close calls*. 31 Aug 2017. Nuclear Age Peace Foundation. <https://www.wagingpeace.org/nuclear-close-calls/>; Union of Concerned Scientists. *Close calls with nuclear weapons*. Factsheet. April 2015. <https://www.ucsusa.org/resources/close-calls-nuclear-weapons>
4. Science and Security Board. *A moment of historic danger: It is still 90 seconds to midnight*. 2024 Doomsday Clock Statement. Bulletin of the Atomic Scientists 23 Jan 2024. <https://thebulletin.org/doomsday-clock/current-time/>
5. Bardeen CG, Kinnison DE, Toon OB, Mills MJ, Vitt F, et al. Extreme ozone loss following nuclear war results in enhanced surface UV radiation. *Journal of Geophysical Research: Atmospheres* 2021;126:e2021JD035079.
6. Toon OB, Bardeen CG, Robock A, Xia L, Kristensen H, et al. Rapidly expanding nuclear arsenals in Pakistan and India portend regional and global catastrophe. *Science Advances* 2019;5:eaay5478.
7. Xia L, Robock A, Scherrer K, Harrison CS, Bodirsky BL, et al. Global food insecurity and famine from reduced crop, marine fishery and livestock production due to climate disruption from nuclear war soot injection. *Nature Food* 2022;3:586–596.
8. Coupe J, Bardeen, CG, Robock A, Toon OB. Nuclear winter responses to global nuclear war in the whole atmosphere community climate model version 4 and the Goddard Institute for Space Studies modelE. *Journal of Geophysical Research: Atmospheres* 2019;124:8522–8543.
9. Xia L, Robock A, Scherrer K, Harrison CS, Bodirsky BL, et al. Global food insecurity and famine from reduced crop, marine fishery and livestock production due to climate disruption from nuclear war soot injection. *Nature Food* 2022;3:586–596.
10. Coupe J, Stevenson S, Lovenduski NS, Rohr T, Harrison CS, et al. Nuclear niño response observed in simulations of nuclear war scenarios. *Communications Earth and Environment* 2012;2:18.
11. Lovenduski NS, Harrison CS, Olivarez H, Bardeen CG, Toon OB, et al. The potential impact of nuclear conflict on ocean acidification. *Geophysical Research Letters* 2020;47:e2019GL086246.
12. Harrison CS, Rohr T, DuVivier A, Maroon EA, Bachman S, Bardeen CG, et al. A new ocean state after nuclear war. *AGU Advances* 2022;3:e2021AV000610.
13. Kaiho K. An animal crisis caused by pollution, deforestation, and warming in the late 21st century and exacerbation by nuclear war. *Heliyon* 2023;9:e15221.
14. Robock A, Prager SC. Geoscientists can help reduce the threat of nuclear weapons. *Eos* 2021;102: 27–29.
15. US Congress. *McGovern-Blumenauer House Resolution 302. Embracing the goals and provisions of the Treaty on the Prohibition of Nuclear Weapons*. 8 April 2019, https://mcgovern.house.gov/uploadedfiles/mcgo_010_xml.pdf.
16. Uppsala Conflict Data Program. *State-based: Armed conflict by type and year (1946-2023)*. Uppsala: Uppsala Universitet. 2024. Based on UCDP 24.1 data. <https://ucdp.uu.se/downloads/charts/>
17. World Bank. *Fragility, Conflict and Violence*. Overview - updated 24 May 2024. <https://www.worldbank.org/en/topic/fragilityconflictviolence/overview>
18. University of Notre Dame. *Notre Dame Global Adaptation Initiative*. <https://gain.nd.edu/our-work/country-index/rankings/> (scores for 2022, accessed 15 Oct 2024).
19. UNHCR *Global Trends* 2023. 13 June 2024. <https://www.unhcr.org/au/>
20. United Nations. *Our Common Agenda, Policy Brief 9 - A New Agenda for Peace*. July 2023. New York, United Nations. <https://www.un.org/sites/un2.un.org/files/our-common-agenda-policy-brief-new-agenda-for-peace-en.pdf>
21. United Nations. *Pact for the Future Rev.3*. 27 August 2024. <https://www.un.org/en/summit-of-the-future/pact-for-the-future-revisions>
22. Australian Government. *National Defence. Defence Strategic Review*. 2023. Commonwealth of Australia:47.
23. Commonwealth of Australia. *Ranger Uranium Environmental Inquiry*. First Report. AGPS, Canberra, 1977:185.
24. Elysee. *Our energy and ecological future depends on nuclear power*. Visit by President Emmanuel Macron to the Framatome industrial site. 8 Dec 2020. <https://www.elysee.fr/emmanuel-macron/2020/12/08/deplacement-du-president-emmanuel-macron-sur-le-site-industriel-de-framatome>
25. International Panel on Fissile Materials. *Facilities: Enrichment facilities, as of 2023*. http://fissilematerials.org/facilities/enrichment_plants.html
26. Snyder, R. "A proliferation assessment of third generation laser enrichment technology", *Science & Global Security*, 2016;24(2):68-91, <http://www.silex.com.au/SILEX-Laser-Uranium-Enrichment-Technology>
27. Feiveson H, Glaser A, Mian Z, von Hippel F. *Unmaking the bomb*. MIT Press, 2014.
28. Schneider M, Froggatt A, Hazeman et al. *The World Nuclear Industry Status Report 2024*. Paris, Mycle Schneider Consulting, Sep 2024:337.
29. Barnaby F, Burnie S. *Thinking the unthinkable. Japanese nuclear power and proliferation in East Asia*. Oxford Research Group and Citizen's Nuclear Information Centre. Aug 2005. <https://cnic.jp/english/publications/pdffiles/ThinkingTheUnthinkable.pdf>
30. Clohesy L, Deery P. "The prime minister and the bomb: John Gorton, W.C. Wentworth and the quest for an atomic Australia", *Aust J Politics and History*, 2015, 61(2):217-32.
31. International Panel on Fissile Materials, "Fissile materials and nuclear weapons", in *Global fissile material report 2022*. https://fissilematerials.org/publications/2022/07/global_fissile_material_r.html
32. International Panel on Fissile Materials. *Fissile material stock*. [beginning 2023] 13 April 2024. <http://fissilematerials.org>
33. Norwegian People's Aid. *Nuclear Weapons Ban Monitor 2020*. Jan 2021. <https://banmonitor.org/about/our-publications>
34. Bulletin of the Atomic Scientists. *It is 6 minutes to midnight*, 14 Jan 2010.
35. Graham P, Hayward J, Foster J. 2024, *GenCost 2023-24: Final report*, CSIRO.
36. Schneider M, Froggatt A, Hazeman et al. *The World Nuclear Industry Status Report 2024*. Paris, Mycle Schneider Consulting, Sep 2024.
37. Schneider M, Froggatt A, et al. *The World Nuclear Industry Status Report 2018*. Paris, London September 2018.
38. Schneider M, Froggatt A, Hazeman et al. *The World Nuclear Industry Status Report 2024*. Paris, Mycle Schneider Consulting, Sep 2024:332.
39. Stirling A, Johnstone P. *Illuminating the 'UK Nuclear Complex': Implications of hidden links between Military and Civil Nuclear Activities for Replacing Negative with Positive Irreversibilities around Nuclear Technologies*. University of York York, IND Research Report #2, March 2024.
40. Rotblat, J. *Nuclear radiation in warfare*. SIPRI, Taylor & Francis London, 1981:125-130.
41. Castelli L, Samuel O. *Justifying attacks on nuclear facilities*. The Nonproliferation Review 7 Feb 2024. <https://doi.org/10.1080/10736700.2024.2301883>
42. Fedchenko V. *Nuclear security during armed conflict: lessons from Ukraine*. SIPRI Research Policy Paper, March 2023. Stockholm International Peace Research Institute.
43. Schneider M, Froggatt A, Hazemann J et al. *The World Nuclear Industry Status Report 2024*. Paris, Mycle Schneider Consulting, Sept 2024: 229.
44. IAEA. *Nuclear safety, security and safeguards in Ukraine*. February 2022 - February 2023. Vienna, International Atomic Energy Agency.

45. IAEA. *Update 247 - IAEA Director General Statement on situation in Ukraine*. 29 Aug 2024. Vienna, IAEA.
46. IAEA Director General's Introductory Statement to the Board of Governors. Vienna, IAEA, 9 Sep 2024. <https://www.iaea.org/newscenter/statements/iaea-director-generals-introductory-statement-to-the-board-of-governors-9-september-2024>
47. Zeith A, Giorgou E. *Dangerous forces: the protection of nuclear power plants in armed conflict*. International Committee of the Red Cross. 18 Oct 2022. <https://blogs.icrc.org/law-and-policy/2022/10/18/protection-nuclear-power-plants-armed-conflict/>
48. International Campaign to Abolish Nuclear Weapons (ICAN). *Surge: 2023 global nuclear weapons spending*. Geneva, ICAN, 2024. https://www.icanw.org/surge_2023_global_nuclear_weapons_spending
49. Dodge R. *How much do you pay for nuclear weapons?* 2024. <https://www.psr-la.org/nuclear-costs>
50. Pytlak A, Acheson R. *Assuring Destruction Forever: 2022 edition*. New York: Women's International League for Peace and Freedom, 2022. <https://www.reachingcriticalwill.org/resources/publications-and-research/publications/15669-assuring-destruction-forever-2022-edition>
51. Stockholm International Peace Research Institute (SIPRI). *Trends in world military expenditure, 2023*. SIPRI Fact Sheet. April 2024. Solna: SIPRI. https://www.sipri.org/sites/default/files/2024-04/2404_fs_milex_2023.pdf
52. Stockholm International Peace Research Institute (SIPRI). *Trends in world military expenditure, 2022*. SIPRI Fact Sheet. April 2023. Solna, SIPRI. <https://www.sipri.org/publications/2023/sipri-fact-sheets/trends-world-military-expenditure-2022>
53. IPCC. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. [PR Shukla, J Skea, R Slade, A Al Khourdajie, R van Diemen, D McCollum, M Pathak, S Some, P Vyas, R Fradera, M Belkacemi, A Hasija, G Lisboa, S Luz, J Malley (eds.)] Cambridge University Press, 2022.
54. Richard CA. Forging 21st-century strategic deterrence. U.S. Naval Institute. *Proceedings* 2021;147:1416. <https://www.usni.org/magazines/proceedings/2021/february/forging-21st-century-strategic-deterrence>
55. Medical Association for Prevention of War. *Defence emissions: briefing paper*. Nov 2022. https://www.mapw.org.au/wp-content/uploads/2023/01/ADF-EMISSIONS_BRIEF_NOV-2022.pdf More detail can be found here: Parkinson S, Cottrell L. Estimating the military's global greenhouse gas emissions. *Scientists for Global Responsibility and the Conflict and Environment Observatory*, Nov 2022. https://ceobs.org/wp-content/uploads/2022/11/SGRCEOBS-Estimating_Global_Military_GHG_Emissions_Nov22_rev.pdf
56. Crawford NC. *Pentagon fuel use, climate change, and the costs of war*. Updated and revised 13 Nov 2019. *Costs of War*, Watson Institute, Brown University.
57. Lin HC, Buxton N, Akkerman M, Burton D, de Vries W. *Climate crossfire: how NATO's 2% military spending targets contribute to climate breakdown*. October 2023. Transnational Institute. <http://www.tni.org/climatecrossfire>
58. <https://militaryemissions.org/>
59. Weir D. The climate costs of war and militaries can no longer be ignored. *The Guardian*, 9 Jan 2024.
60. ICAN Australia. *Choosing humanity: Why Australia must join the Treaty on the Prohibition of Nuclear Weapons*. July 2019: <https://icanw.org.au/choosinghumanity>; ICAN Australia. *History is calling*. March 2024. <https://icanw.org.au/history-is-calling-report>
61. https://www.icanw.org/ican_high_level_statement_tpnw_second_meeting_of_states_parties
-



ICAN 2017
NOBEL
PEACE
PRIZE
AUSTRALIA



@icanw.au



@ican_australia



@ican_australia



@icanaustralia8113

icanw.org.au