

NUCLEAR WEAPONS AND OUR CLIMATE

WHAT EFFECT WOULD NUCLEAR WAR HAVE ON THE CLIMATE? WHAT HAS NUCLEAR POWER GENERATION GOT TO DO WITH NUCLEAR PROLIFERATION? HOW COULD THE MASSIVE AMOUNTS OF RADIOACTIVITY INSIDE NUCLEAR REACTORS, FUEL AND WASTE STORAGES CAUSE RADIOLOGICAL CONTAMINATION AKIN TO NUCLEAR WEAPONS? COULD NUCLEAR FACILITIES THEMSELVES BE TURNED INTO WEAPONS?

THIS PAPER FROM ASSOCIATE PROFESSOR TILMAN RUFF OF ICAN AUSTRALIA ADDRESSES THE CONNECTIONS BETWEEN OUR CLIMATE, NUCLEAR WEAPONS, NUCLEAR POWER AND THE STUFF THAT PUTS THE 'NUCLEAR' IN NUCLEAR WEAPONS.

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

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

Studies by some of the world's best atmospheric scientists show that less than 0.5% 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 blanket the entire globe within a few weeks, and cool, dry and darken the world beneath for more than two decades. The dark smoke in

the stratosphere and above would be warmed by the sun, heating the upper atmosphere by more than 50°C, and rapidly depleting the ozone which protects us from the Sun's harmful ultraviolet (UV) radiation.¹

100 Hiroshima size bombs – 0.1% of the explosive power of the global nuclear arsenal – for example used in a war between India and Pakistan, would produce over 5 million tons of smoke, cooling average surface temperatures by 1.5°C, with much greater declines of 5-8°C over large land masses. The resulting sustained decline in food production worldwide would put 2 billion people at risk of starving to death.² The combined current arsenals of India and Pakistan - the world's most rapidly growing - now consists of 270-290 nuclear weapons of at least Hiroshima size.³

This abrupt nuclear famine would be exacerbated by chemical and radioactive contamination of large areas; 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. 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.

The burning cities from a nuclear war using only the long-range nuclear weapons that Russia and the US keep on hair-trigger alert, ready to be launched within a few minutes, would put 50 million tons of smoke into the atmosphere. This would produce average ice age conditions, 5°C colder than present. Launch of all Russian and US long-range nuclear weapons would result in global temperatures plummeting 10°C, a severe abrupt ice age that would in all probability end human - and much other - life.⁴

Nuclear weapons and unchecked climate change pose the twin existential threats to our future. They exacerbate each other and both need to be addressed. One diminishes our biosphere every day, the other could deplete it irrevocably and end human civilisation in less than a day. It is imperative for planetary and human health that we prevent both runaway global warming and an abrupt nuclear winter. The only reliable way to prevent nuclear war is to eliminate nuclear weapons before they are otherwise inevitably used again. If we do not succeed in eliminating nuclear weapons in time, achievements and aspirations in every other sphere could become tragically irrelevant in less than an hour.

A CLIMATE-STRESSED WORLD IS AN EVEN MORE DANGEROUS PLACE FOR NUCLEAR WEAPONS

... after nuclear war, human induced global warming is the greatest threat to human life on the planet.

- Admiral Chris Barrie, AC RAN Retired, Chief of the Australian Defence Force 1998-2002.⁵

The world's most senior diplomat, UN Secretary-General Antonio Guterres, has said: "We are living in dangerous times. ... We are on the brink of a new cold war" and described "a resurgence of civil conflict, after more than two decades of decline."⁶

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.⁷

The number of violent conflicts worldwide which are internationalised, involving at least one state outside the area of direct conflict, has increased sharply, from no more than 6 per year in the two decades prior to 2010, to 20 per year by 2017.⁸ Growing food and water insecurity and



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other stresses exacerbated by climate change are helping to drive this upsurge in armed conflict, and contributing to the highest ever number of people forcibly displaced worldwide - reaching 70.8 million at end-2018.⁹

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."¹⁰ Any uranium enrichment plant can be used to produce not only reactor grade uranium, but weapons grade uranium. Currently 14 nations have such plants.¹¹ Laser enrichment technology initially developed in Australia could make enriching uranium more compact and concealable.¹² 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 nuclear reactors as uranium atoms absorb neutrons. Plutonium contained in spent nuclear fuel can then be chemically extracted 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.¹³

Australian 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 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: "... 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 ...".¹⁴

Nuclear weapons, depending on their size and technical sophistication, contain several kg of plutonium, and/or about 3 times as much HEU.

US nuclear weapons on average contain 4 kg of plutonium and 12 kg of HEU.¹⁵ Current global stockpiles of fissile materials – 1340 tons of HEU and 520 tons of separated plutonium¹⁶ – are sufficient to build around 200,000 nuclear weapons. Thus ending production of fissile materials, keeping current stocks extremely securely, 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.”¹⁷

As the costs of nuclear power have risen to become more than twice as expensive as either wind or solar power with storage, the motivation of some governments to maintain civilian nuclear infrastructure and workforce expertise in order to support their nuclear weapons programs has become increasingly obvious, including in France, Russia, UK and US.¹⁸

NUCLEAR REACTORS CREATE ENORMOUS RADIOLOGICAL HAZARDS

Nuclear reactors and their spent fuel pools contain large amounts of radioactivity which is more long-lived than that produced by nuclear weapons. Both require continuous 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*:¹⁹

“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 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 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. 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), the South African ANC attack on the Koeberg nuclear power plant with mines while it was under construction, 1991 US attacks on various Iraqi nuclear facilities and Iraq's firing of Scud missiles at Israel's Dimona nuclear reactor.

Thus each of the 413 operating nuclear power reactors in 31 countries, spent fuel storage facilities, reprocessing plants and other large nuclear facilities are effectively large pre-positioned radiological weapons. 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.



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 crisis 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.²⁰ 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 path that all nations, with and without nuclear weapons, can take to fulfil their binding obligation to eliminate the world’s worst weapons of mass destruction. It is the only internationally defined path towards a world freed from nuclear weapons.

The Treaty builds on the substantial progress made to control biological and chemical weapons, landmines and cluster munitions. A treaty codifying rejection of the 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.



Negotiating conference for the Treaty on the Prohibition of Nuclear Weapons, 2017

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