

# Environmental Costs of Nuclear Weapons

Peace Education Scotland  
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## Introduction

The two most immediate threats to human survival are climate change and nuclear weapons.

This booklet will demonstrate that these two existential threats are closely linked.

Climate change will increase conflicts over resources, and even a limited use of nuclear weapons could trigger a 'nuclear winter'. Nuclear weapons testing has already caused lasting environmental damage around the world, while present day military installations also leave us a legacy of radioactive and toxic waste.

Nuclear weapons are not legitimate under international law, and don't protect us against serious threats to human security, such as climate disruption, terrorist attacks and pandemics. Meanwhile they divert money and skills away from solving these problems.

However, for many people, these weapons of mass destruction have been present all their lives, so the issue is seen as not urgent or relevant while climate change effects become ever more apparent.

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## 1. Climate Change and Conflict

Climate change will create conflict over resources, and migration – increasing the risk of war between nuclear-armed states. Even a regional exchange of nuclear weapons would itself cause catastrophic climate change.



People living in poverty, in under-developed and unstable states are hardest hit by climate change. The physical consequences - such as more frequent extreme weather, rising sea-levels, and shorter growing seasons - add to existing pressures meaning that these communities are less able to adapt to climate change while facing a higher risk of violent conflict.

Several nuclear-armed powers are vulnerable to social stress as a result of climate change. They have large populations but a smaller share of the world's freshwater supplies, which climate change will reduce further.

Food insecurity and drought may make it impossible to live in a particular region, and the resulting large-scale migrations risk destabilising the internal politics of neighbouring countries.

## 2. Nuclear Winter

Climate scientists have found that even a 'limited' regional nuclear war would result in tens of millions of deaths and unprecedented global climate disruption.

Smoke from urban firestorms caused by multiple nuclear explosions would rise into the upper atmosphere. The



soot cloud could block 10% of sunlight leading to significant cooling and reductions in rain for more than a decade. In the first year a 10% decline in global rainfall and a reduction in the Asian monsoon would have a significant impact on agricultural production. These effects would persist over many years – shortening the growing season in many grain producing areas of the world and destroying crops.

It is sometimes suggested that 'nuclear winter' could stop 'global warming', however this is not true.

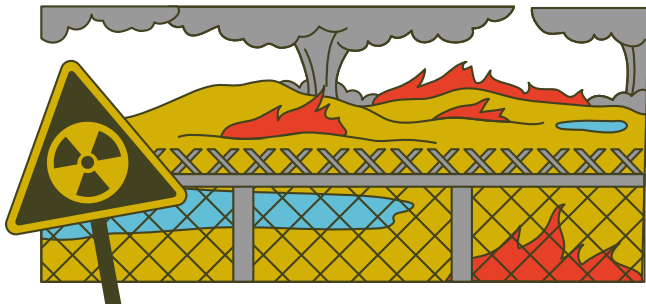
Apart from the effects on human health of radioactive fallout,

the blocking of sunlight by the soot clouds would cause plants to die, releasing more carbon (CO<sub>2</sub> and methane) into the atmosphere. The cooling effect would therefore be temporary, and once the dust particles had settled the Earth would get even hotter due to the extra CO<sub>2</sub> and methane in the atmosphere.

### 3. Nuclear Tests

Nuclear weapons tests were used to determine the explosive capability of nuclear weapons, and how personnel, structures, and equipment would be affected by nuclear explosions. Atmospheric tests mainly took place from 1945 until the Limited Test Ban Treaty in 1963. The USA, UK and the former USSR complied with the treaty, but France and China did not sign, continuing with atmospheric testing until 1974 and 1980 respectively. Underground tests continue to this day.

Nuclear weapons testing raised the worldwide 'background radiation' level, increasing risks of cancer and leaving a



traceable signature of radionuclides in food and livestock.

Nuclear tests historically exposed poor and indigenous people to great harm. Britain tested weapons at Maralinga in Australia, leaving large regions contaminated with radioactive waste. The Aboriginal people suffered illnesses and death when they attempted to return to their contaminated homelands.

In the 1950s there were even proposals to carry out British nuclear test explosions near Wick in the north of Scotland – however the proposal was later scrapped as it was decided that Wick was “not a suitable site”. The experiment was instead moved to Emu Field in Australia.

The UK’s nuclear tests also involved over 20,000 military personnel, the ‘British Nuclear Test Veterans’, many of whom believed they suffered ill health due to their exposure to radiation in Australia and the South Pacific – and received some compensation from the UK Government.

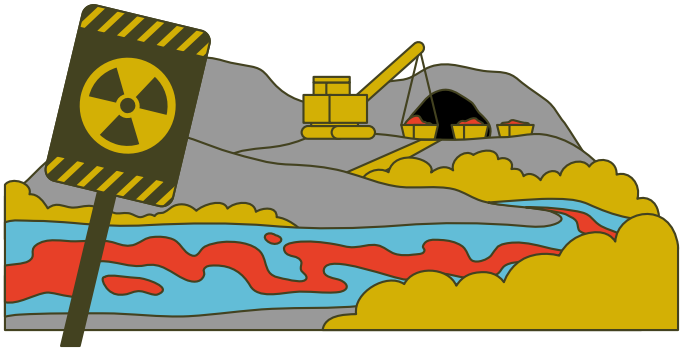
The Soviets tested many nuclear weapons at Semipalatinsk, a remote area of Kazakhstan - once home to nearly a quarter of the world’s nuclear testing. The long-term health impact on its inhabitants has been devastating.

The USA tested nuclear weapons in various locations including the Marshall Islands. A legacy of these tests is a concrete dome containing nuclear debris, which islanders call “the Tomb”. The dome is now at risk of collapsing from rising seas and other effects of climate change.

## 4. Pollution from Mining

Nuclear weapons contain radioactive isotopes - either highly enriched uranium or plutonium. The extraction and production of these elements is a very energy intensive and polluting process.

Contamination from uranium mining pollutes the air and the water - disproportionately affecting economically disadvantaged communities living near the mines.



Native Americans in the northern Great Plains have the highest cancer rates in the United States, particularly lung cancer. The cancer rates started increasing drastically a few decades after uranium mining began on their territory.

Uranium mined in Australia was used to produce Britain's first nuclear weapon, and is still mined in Australia today - leaving a legacy of toxic waste and contaminated groundwater. The



incidence of cancer in Aboriginal people in one mining area is 90% greater than in other parts of Australia.

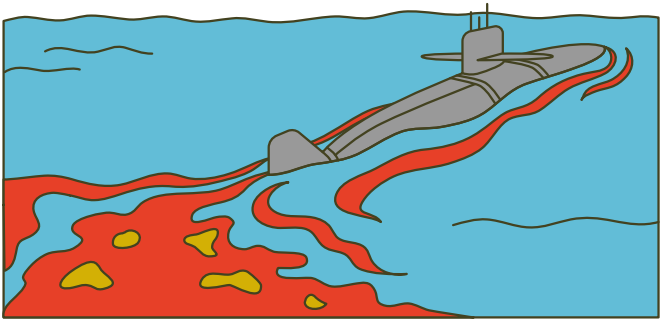
Mining not only exposes uranium to the atmosphere, where it becomes reactive, but releases other radioactive elements such as thorium and radium and toxic heavy metals including arsenic, selenium, mercury and cadmium. Exposure to these radioactive elements can cause lung cancer, skin cancer, bone cancer, leukaemia, kidney damage and birth defects.

## 5. Pollution from Military Sites

Large amounts of radioactive waste are generated by the production and maintenance of nuclear warheads.

The UK Atomic Weapons Establishment (AWE) at Aldermaston stores about 4 million litres of waste, some of which is held in old, degraded containers. The site was placed under “special measures” in 2013 due to a leak of tritium gas, and will remain under these measures until at least 2022.

The Faslane Naval Base in Argyll and Bute, Scotland, handles liquid nuclear waste from the reactors used by the UK’s nuclear submarines, as well as solid waste from the nuclear weapons depot at Coulport. Liquid waste (including highly dangerous tritium) is discharged into the Gare Loch, a sea loch that is popular for fishing, sailing and water sports. The base also discharges high levels of toxic chlorine which it regularly uses to clean its waste discharge pipes.



The UK's nuclear submarines present an environmental hazard long after they are taken out of service, as they contain spent nuclear fuel and large quantities of radioactive waste. The UK has failed to fully decommission any of the 20 nuclear submarines that have been taken out of service since 1980. It is a complex and costly process and a permanent disposal site has not been found for the nuclear waste.

It is estimated that the vessels – which are stored at Devonport dockyards, Plymouth, and Rosyth in Fife – still contain 4,500 tonnes of hazardous material. Storage has so far cost taxpayers more than half a billion pounds.

The Ministry of Defence (MoD) dumped radioactive waste from its weapons systems at sea, until 1983, and in 1989 they drew up plans to dump 22 nuclear submarines off the picturesque west coast of Scotland.

# ATOMIC SCOTLAND

**A legacy of radioactive waste, chemicals and heavy metal contamination in sites around Scotland - and regular convoys of nuclear warheads by road through the Central Belt.**



## DOUNREAY

Nuclear facility with civilian reactors 1955-92 and 1963 Vulcan submarine reactor. Poor reputation for lax attitude to waste disposal, including 1977 shaft explosion. Quantities and types of waste released may never be known. Decommissioning to last until at least 2032.

## HMNB CLYDE

Faslane submarine base (Polaris 1964, Trident 1996) and Coulport nuclear warhead store. History of accidents and safety failures. Liquid radioactive waste discharged into Gare Loch; sea loch popular for fishing, sailing and water sports - high levels of toxic chlorine used to clean waste discharge pipes.

## HOLY LOCH

US Polaris submarines were based here 1961-92, during the Cold War. It was later admitted that radioactive waste coolant and heavy metals were released into the loch.

## DUNCANSBY

In 1953, scientists from the AWE secretly proposed testing a nuclear weapon on the Stacks of Duncansby but the wet weather was too much for the device's electronics.

## TRIDENT CONVOYS

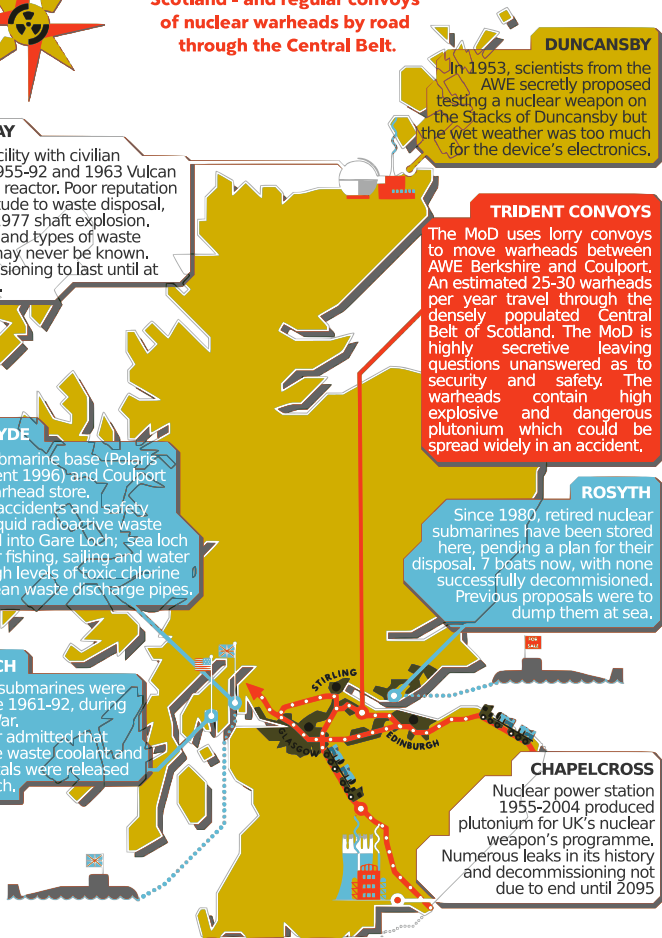
The MoD uses lorry convoys to move warheads between AWE Berkshire and Coulport. An estimated 25-30 warheads per year travel through the densely populated Central Belt of Scotland. The MoD is highly secretive leaving questions unanswered as to security and safety. The warheads contain high explosive and dangerous plutonium which could be spread widely in an accident.

## ROSYTH

Since 1980, retired nuclear submarines have been stored here, pending a plan for their disposal. 7 boats now, with none successfully decommissioned. Previous proposals were to dump them at sea.

## CHAPELCROSS

Nuclear power station 1955-2004 produced plutonium for UK's nuclear weapon's programme. Numerous leaks in its history and decommissioning not due to end until 2095



## 6. Nuclear Power

From the beginning the UK's civil nuclear power programme has been closely linked with nuclear weapons production.

The UK's first nuclear power station, Calder Hall at Sellafield, Cumbria, was built to produce plutonium for military purposes. Most of the electricity it generated was used to power the site itself with a small amount going to the grid. It wasn't until 1960 that the public were told of the reactor's military purpose.

Plutonium is commonly used in nuclear weapons because it is more efficient than uranium – it has a higher probability for fission and a smaller critical mass. Nuclear reactors convert uranium atoms into plutonium atoms. Weapons-grade plutonium is generally produced in military reactors, but some countries, including France and the UK, have used civil nuclear reactors to produce plutonium for weapons in the past.

'Reprocessing' is when the plutonium is separated from the reactor's spent nuclear fuel rods using strong acids. These processes release dangerous radioactive particles into the air and create vast quantities of high-level liquid nuclear waste. The end product, plutonium-239, has a half-life of 24,100 years and will be dangerous for 10 to 20 times that length of time - meaning that plutonium produced today could be toxic for the next half a million years.

Nuclear fuel reprocessing has been carried out at Sellafield since operations began, creating a stockpile of around 126 tonnes of plutonium. Reprocessing is set to end at the site by 2021, but this stockpile will continue to pose a proliferation risk, as it contains enough plutonium to make tens of thousands of nuclear weapons. Large quantities of nuclear waste are stored at Sellafield too, including the used fuel from the nuclear reactors in the UK's nuclear-armed submarines.

In 1957, a fire at Sellafield burned for three days. Radioactive contamination spread across Europe and caused at least 240 reported cases of cancer. In 2016, a whistleblower warned that serious safety issues persisted at Sellafield.



In June 2021 a report from Dr Paul Dorfman of University College London warned that nuclear power could become a significant casualty of climate change. The report points out that while 40% of reactors around the globe are on the coast -

sea levels globally will rise further and faster than earlier predictions suggested, and storm surges could threaten such coastal installations. Nuclear power stations require large quantities of water to keep cool and avert meltdowns so reactors inland face threats from drought and wildfires. Over half a billion people live within 50 miles of an operating reactor.

There has been a decline in the use of nuclear power worldwide, partly due to high-profile disasters such as Chernobyl and Fukushima. The nuclear industry and their backers have attempted to portray nuclear energy as a 'green' technology, essential for fighting climate change. However these claims are often not based in fact.

In recent years, thorium has been touted as a new 'miracle' nuclear fuel, but many of the claims about it have been debunked. For example, conspiracy theories arose suggesting that governments suppressed thorium research as uranium was preferred due to its potential for use in nuclear weapons. In fact thorium can also be weaponised, although by a more complicated and expensive process than uranium.

Small Modular Reactors (SMRs) involve high development costs, and technical uncertainties. They have the same unresolved issues of radioactive waste disposal, along with new safety issues, transport of radioactive substances to numerous smaller sites and unique proliferation risks.

## 7. Carbon Footprint

Both civil nuclear power sites and military nuclear installations have carbon footprints larger than they first appear.

Claims that nuclear power is a low carbon energy source fall apart under scrutiny.

Nuclear power stations rely on uranium to operate, and considerable amounts of carbon are released in the mining, milling and separation of the uranium from the ore and then it has to be transported. Current estimates for uranium say reserves will last 50 - 70 years. As demand increases, more poor quality ores will have to be processed, leading to a CO<sub>2</sub> balance for atomic power, which gets worse over time

According to the UK Government's Climate Change Committee (CCC) if we are to avoid the worst effects of climate change, by 2030 all electricity should be generated with less than 50 grams of carbon dioxide emitted for each kilowatt-hour. The committee believed that the latest nuclear power station 'Hinkley C' would produce six grams of CO<sub>2</sub> per unit of electricity - however multiple studies have shown that the true figure is likely to be well above 50 grams - breaching the CCC's recommended limit for new sources of power generation beyond 2030.

An independent report in 2020 estimated the total carbon footprint, or 'bootprint' of the British military as approximately 11 million tonnes of carbon dioxide.

This is more than 11 times the figure the MoD usually claims, and is similar to the emissions produced by over six million UK cars in a year – producing more carbon emissions than 60 individual countries combined.



Globally, military carbon emissions are thought to be a major contributor to the climate emergency – but research on them is hampered by a lack of transparency.

The carbon ‘bootprint’ of nuclear weapons is still shrouded in secrecy, while their toxic legacy of radioactive and chemical waste has become more obvious.



## 8. About Us

Peace Education Scotland aim to increase knowledge of the environmental impact of nuclear weapons, nuclear accidents, nuclear waste and radiation.

Our underlying principle is that people should be encouraged to have informed debates and opinions about nuclear weapons.



[peaceeducationscotland.org](http://peaceeducationscotland.org)

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Dr Ian Fairlie

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Scan code for full references & resources

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