

LEARN ABOUT NUCLEAR WEAPONS

Uranium and plutonium – the nuclear fuel chain

The two most commonly used materials for nuclear weapons are uranium (U) and Plutonium (Pu). While Uranium exists as a natural element, plutonium in its natural form is virtually non-existent and is thus created synthetically in nuclear reactors from U-238. Natural Uranium consists of two isotopes: U-235 and U-238. Both have extremely long half-lives, that is the time it takes for the radioactivity to reduce by half. U-235 has a half-life of 0,7 billion years, while U-238 has a half-life of 4,5 billion years. The Uranium found in nature has a very low level of U-235 (0,7 %). Fuel for nuclear reactors must contain at least 3-4 % U-235 and to reach weapons grade material, 90 % U-235 is preferred. This is why the uranium has to be enriched, to obtain the desired level of the necessary isotope U-235.

Plutonium from nuclear reactors for energy production can be used to build a nuclear weapon, even though the process is difficult. Plutonium is highly radioactive and, when found in a reactor, mixed with other isotopes not wanted in a nuclear weapon. However, with the right technical knowledge and equipment, plutonium can be reprocessed into weapons grade material.

Uranium mining

Uranium is the principle fuel for nuclear reactors and the main raw material for fission nuclear weapons. Uranium is already radioactive when it is dug out of the ground, although weakly. Uranium ore needs to go through several processes - conversion and enrichment - in order to concentrate the radioactivity by 2-3% to become nuclear reactor grade fuel, and by 80% to become weapons grade, although lower levels of enrichment will suffice.

Over half of the world's uranium is in Canada and Australia. Uranium is mined in 18 countries: Canada, Australia, Kazakhstan, Russia, Namibia, Niger, Uzbekistan, USA, Ukraine, China, South Africa, Czech Republic, India, Romania, Germany, Pakistan, France, Brazil.

Uranium mining is a very ecologically damaging link in the nuclear chain. For every tonne of uranium oxide produced, hundreds of thousands of tonnes of wastes, or tailings, are left behind. Often the tailings are simply dumped on the land near the

mine and left to the effects of the elements. Mine tailings (waste) contain around 80% of the radioactivity of the original ore. One of the major isotopes produced from uranium mine tailings is thorium-230 whose half-life is 75,000 years. Uranium-238, the most prevalent isotope in uranium ore, has a half-life of about 4.5 billion years; that is, only half the atoms will decay in that amount of time.

Wind carries radon gas and radioactive dust from these tailings for many miles. Uranium miners are exposed to radioactive radon gas, and consistently suffer increased rates of lung cancer. Indigenous peoples' lands have also been used to mine uranium, dump radioactive wastes and to test (explode) nuclear bombs both above-ground and below-ground, resulting in massive radioactive contamination.



*Picture: Uranium mines in Priargujanski, Krasnomensk, Russia.
Source: Greenpeace*

In Northern Saskatchewan, Canada, lies the world's largest and most concentrated uranium findings known. Here, contaminated water from uranium mining and milling has routinely or by mistake been left in the open. Large fishing industries have been polluted and the health and livelihood of native people living of what nature offers is severely threatened.

In Niger and Namibia, Africa, by-products from the uranium mines have been left in the desert sand. It contaminates the air, food and drinking water for the nomadic people moving in the area.

Also in the US, waste products from the uranium mines have been left on the lands of native people and there destroyed the health of whole populations. It is not well-known that the second largest nuclear accident in American history was the spilling of by products from uranium mining into the Rio Puerco in New Mexico in the 1980's.

Uranium milling - Yellow cake

Uranium ore is crushed and made into a fine powder and then chemically leached to remove other elements to make yellow cake. Yellow cake consists of 80 percent uranium oxide, and can be used in nuclear power plants or nuclear weapons. While milling uranium, just as when mining it, large amounts of waste products, tailings, are left behind. These tailings are poisonous and radioactive. Uranium-238, the most prevalent isotope in uranium ore, has a half-life of about 4.5 billion years; that is, only half the atoms will decay in that amount of time.



Uranium mining and milling requires a great deal of water. BHP Billiton's Olympic Dam mine in South Australia, the driest state in the world's driest continent, uses 33 million litres of water per day. A proposed expansion of the mine would increase this to up to 162 million litres per day. This water becomes radioactive waste, which is

placed into evaporation ponds that are not always adequately secured from leaking and flooding. Contaminated rainwater can and does enter the soil and eventually, the food chain, endangering health.

Picture: Radioactive tailings at Olympic Dam, near Roxby Downs, South Australia.

Source: Adam Dempsey, ICAN