

LEARN ABOUT NUCLEAR WEAPONS

Uranium mining

Uranium is the principle fuel for nuclear reactors and the main raw material for fission nuclear weapons. Uranium ore taken from the ground needs to go through several processes - conversion and enrichment - in order to concentrate the levels of U-235 to the 2-3% required for nuclear reactor grade fuel, and to the 80% or more required for weapons grade fuel. Though more than 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, and Brazil.

Ecologically, uranium mining is a very 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 uncontained. 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, with a half-life of 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.



Radioactive tailings waste at Olympic Dam mine, near Roxby Downs, South Australia. (photo: Adam Dempsey, ICAN)

The world's largest and most concentrated known uranium deposits are in Northern Saskatchewan, Canada. Here, contaminated water from uranium mining and milling has routinely -- sometimes mistakenly -- been left in the open. Large fishing industries have been polluted and the health and livelihood of native people living off what nature offers are severely threatened.

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

In the US, waste products from the uranium mines have also been left on the lands of native people and have 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 river in New Mexico in the 1980s.

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. Poisonous and radioactive tailings are also left behind from uranium milling.

Uranium mining and milling require 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.

Uranium enrichment

To be used in nuclear power reactors or nuclear weapons, uranium needs to be enriched. Separating the lighter isotope U-235 from the heavier U-238 does this. In the end, both isotopes can be used in nuclear weapons: highly enriched uranium (HEU) is enriched U-235, while U-238 can be turned into plutonium.

Uranium used in nuclear power reactors is usually enriched to 3-4 percent U-235, while nuclear weapons usually require enrichment to around 80 percent or more.



Uranium enrichment requires large-scale industrial processes that are both costly and demand large amounts of energy. The cheapest and most widely used method of enrichment involves centrifuges that spin very fast to separate and concentrate certain isotopes. Uranium enrichment, regardless of the method used, requires large facilities that are difficult to hide by states wishing to keep their uranium enrichment programmes secret. The same types of centrifuges are used to enrich nuclear power reactor uranium and weapons grade uranium.

Reprocessing



The next step is transferring the material to a nuclear reactor. The waste products from energy production in a nuclear reactor can be used to obtain weapons-grade plutonium through reprocessing. Reprocessing, therefore, is a nuclear weapons proliferation concern. France, India, Japan, Russia, the UK, and the US have commercial reprocessing plants. A larger number of states have military facilities for the reprocessing of plutonium: China, France, India, Israel, North Korea, Russia, the UK, and the US.

Nuclear power – nuclear weapons

In 2007, the International Atomic Energy Agency (IAEA) reported that 435 nuclear power reactors were operating in 31 countries. There are also 44 states that either have nuclear power or nuclear research reactors, thereby assumed to have the capacity of producing nuclear weapons. A number of states have used their civilian nuclear facilities for clandestine development of nuclear weapons, e.g. India, Pakistan and North Korea.¹ As noted above, the material and the technology are the same, whether enriching uranium for nuclear power or nuclear weapons.



1 <http://www.icanw.org/nuclear-chain>