

Environmental contamination from nuclear fuel reprocessing

The nuclear industry refers to extracting plutonium or other specific isotopes from nuclear fuel waste as “reprocessing” or “recycling.” It is highly contaminating, practiced in only a few countries, and linked to nuclear proliferation and nuclear weapons.

There has never been commercial reprocessing in Canada. The limited reprocessing done at the federal government's Chalk River Nuclear Laboratory has left a legacy of nuclear contamination. Canada is currently reviewing its radioactive waste policy. The revised policy must include a formal prohibition on nuclear fuel waste reprocessing in Canada.

In a nuclear reactor, some uranium atoms hit by neutrons split into fission products, releasing more neutrons that sustain a chain reaction. Other uranium atoms absorb neutrons and transform into heavier elements such as neptunium and plutonium.

Reprocessing involves separating uranium and plutonium from the fission products that emit most of the dangerous penetrating gamma radiation. The remaining plutonium can then more easily be made into fuel rods or weapons. However, this leaves behind highly radioactive liquid waste.

All commercial and military reprocessing is done at present using the “PUREX” (plutonium uranium extraction) process. The first step in PUREX reprocessing is dissolving radioactive fuel in concentrated nitric acid. In December 1950, an accident occurred at a pilot plant for plutonium reprocessing at Canada’s Chalk River Laboratories. The evaporator used to concentrate fission product wastes from a nitric acid-ammonium nitrate solution exploded, killing one worker.

Another liquid reprocessing waste facility at Chalk River was shut down in 1954 following [several leak events](#). Much of the equipment was buried on site, resulting in a plume of fission products that currently discharges into a tributary of the Ottawa River.

REPROCESSING = PLUTONIUM FACT SHEET #4

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Dissolution of the fuel in nitric acid is followed by a solvent extraction involving tributyl phosphate (TBP) and kerosene. A TBP-kerosene solution forms an explosive substance known as “red oil” when it comes in contact with nitric acid. The 1993 [Radiological Accident in the Reprocessing Plant at Tomsk](#) (a city in Siberia) was caused by a red oil explosion that destroyed the plant and dispersed radiation in the local area.

Reprocessing is associated with worker deaths, unplanned criticality events, excessive worker radiation exposures, fires, chemical explosions, and radioactive contamination of lands and waters. A 1996 International Atomic Energy Agency [document](#) reviewed 58 accidents, 37 of which occurred in reprocessing plants.

The worst-ever reprocessing [accident](#) occurred in 1957 at Russia’s secret [Mayak](#) weapons production facility. A large tank of liquid reprocessing waste exploded, spreading radioactive fallout over hundreds of square kilometers, forcing the evacuation of thousands of people, and leaving a large area uninhabitable. The Russian government was able to cover up this accident until the 1980s. Reprocessing wastes were being dumped in local lakes and rivers before the tanks were built.

[Leaking tanks](#) of reprocessing wastes at the Hanford site in Washington are contaminating groundwater and the nearby Columbia River. Hanford housed the world’s first reactor for the production of plutonium, used in the first nuclear bomb ever tested and in the Fat Man bomb that destroyed Nagasaki, Japan.

A commercial reprocessing facility operated from 1966 to 1972 in West Valley, New York, about 50 kilometers south of Buffalo. It produced over two million liters of liquid high level waste. It continues to be the site of expensive clean-up efforts, with annual expenditures of around \$100 million and no estimated date for closure. Former workers are [plagued by cancers](#) and have been paid over \$200 million in compensation.

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Nuclear Waste Watch
www.nuclearwastewatch.ca
nuclearwastewatch@gmail.com