

Small modular nuclear reactors and 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.

Small modular nuclear reactors (SMRs or SMNRs) are categorized as nuclear reactors that generate less than 300 megawatts of electricity. More than 100 SMR designs are in various stages of development internationally.

The nuclear industry wants to develop SMRs to keep the industry viable and they have no plans to build more CANDU reactors. CANDUs, the only nuclear power reactors currently operating in Canada, produce multiple times the output of the proposed SMRs.

The Canadian Nuclear Safety Commission currently lists 12 SMR designs in its [vendor design review](#) process. Almost all the designs use "enriched" uranium as fuel.

Two designs involve reprocessing: the ARC-100 and the Moltex Stable Salt Reactor-Wasteburner (SSR-W). The ARC and Moltex SMR projects represent the most significant movement in Canada toward the nuclear industry's reprocessing ambitions. Both projects are planned to be sited in New Brunswick at Point Lepreau on the Bay of Fundy.

The ARC-100 design is for a "breeder" reactor, intended to "breed" plutonium during the fission process. After a nuclear fuel cycle is completed, the used ("irradiated") fuel is reprocessed to provide fuel for the next cycle of fissioning and electricity generation. In contrast, the Moltex SSR-W design proposes to make its own fuel from reprocessed CANDU irradiated fuel.

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The Moltex technology is called "pyroprocessing," different from the PUREX reprocessing used in other countries. PUREX involves dissolving the irradiated fuel in acid whereas pyroprocessing uses molten salt instead of acid. There is no evidence suggesting the Moltex experiment will be successful.

In fact, in 2016, Canadian Nuclear Laboratories released a [report](#) on the feasibility of reprocessing spent CANDU fuel which found that the business case did not exist because of the sizeable challenges: the associated costs and risks make reprocessing "unattractive due to its low fissile content," there are "significant upfront investment and numerous investments over a long timeframe," reprocessing facilities in other countries have yet to achieve commercial success, and reprocessing "would increase proliferation risk."

While the ARC company has been silent about its SMR reprocessing plans, Moltex has been aggressively promoting it as its core innovation, calling it "recycling" and claiming that pyroprocessing can significantly reduce Canada's existing toxic legacy of CANDU spent fuel.

Many nuclear fuel cycle experts in Canada and the US have debunked the Moltex claim, pointing out that plutonium and other fissile materials make up less than 1% of the CANDU used fuel, and only this small portion could possibly be extracted to make new fuel, with the remaining 99% remaining high-level waste. It is not possible to cleanly extract the plutonium and other fissile materials from the CANDU used fuel.

To date, ARC has received no federal funding to develop its SMR design, however the New Brunswick government committed \$5M to the company in 2018 and \$20M in 2021. In 2021, the federal government gave Moltex \$50.5M to develop its SMR and reprocessing technology designs.

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Fact sheet produced November 2022
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