

Three letters to PM Trudeau from U.S. non-proliferation experts

May 25 2021: www.ccnr.org/Open_Letter_to_Trudeau_2021.pdf

July 28 2021: www.ccnr.org/Letter_to_Trudeau_28July2021.pdf

Nov 24 2021: www.ccnr.org/Third_Letter_Trudeau_24_November_2021.pdf

For the convenience of the reader, the three letters are copied below.

Signatories

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Thomas Countryman, Former US Assistant Secretary of State for Nonproliferation (2011-17).

Steve Fetter, Professor of Public Policy, University of Maryland,* former principal assistant director, Office of Science and Technology Policy, The White House (2009-12, 2015-17)

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*For identification only

OPEN LETTER TO PRIME MINISTER JUSTIN TRUDEAU

May 25, 2021

Prime Minister Justin Trudeau
Office of the Prime Minister
80 Wellington Street Ottawa, ON K1A 0A2
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Re: US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime

Dear Prime Minister Trudeau,

We write as US nonproliferation experts and former government officials and advisors with related responsibilities to express our concern about your government's financial support of Moltex – a startup company that proposes to reprocess CANDU spent fuel to recover its contained plutonium for use in molten-salt-cooled reactors.¹

We understand your government's motivation to support nuclear power and to reduce fossil fuel use but *saving the world from climate disaster need not be in conflict with saving it from nuclear weapons*. Also, like other reprocessing efforts, Moltex, even in the R&D stage, would create a costly legacy of contaminated facilities and radioactive waste streams and require substantial additional government funding for cleanup and stabilization prior to disposal.

Our main concern is that, by backing spent-fuel reprocessing and plutonium extraction, the government of Canada will undermine the global nuclear weapons nonproliferation regime that Canada has done so much to strengthen. Canada is a founding member of the Nuclear Suppliers Group, which was established in 1974 in response to India's misuse of a Canada-supplied research reactor and US-supplied reprocessing technology to acquire the plutonium needed for its first nuclear weapons.² Today, Japan is the only non-nuclear-armed state that reprocesses spent nuclear fuel, causing both domestic and international controversy. Other countries could point to Canada's support of the Moltex program to help justify their own reprocessing R&D.

The fuel cycle Moltex proposes appears to be based on pyroprocessing, a technology developed by the US Argonne National Laboratory. Moltex echoes the Argonne developers in calling this technology "proliferation resistant." A 2009 review by nonproliferation experts from six US national laboratories including Argonne concluded, however, that pyroprocessing is about as susceptible to misuse for proliferation as PUREX, the standard reprocessing technology used worldwide in both nuclear-weapon and civilian plutonium programs.³ Pyroprocessing is being used at the US Idaho National Laboratory to process fuel from the shutdown US Experimental Breeder Reactor EBR-2 for disposal but has proved to be extremely costly and unreliable and has not produced stable forms of radioactive waste suitable for deep underground disposal.⁴ In contrast, CANDU spent fuel is a stable waste form suitable for disposal.⁵

Fifty years ago, the US Atomic Energy Commission was promoting reprocessing worldwide as essential to the future of nuclear power, which it saw as requiring a rapid shift to plutonium breeder reactors. In 1974, however, India tested its first nuclear weapon design using plutonium produced with technologies and materials that Canada and the United States had provided exclusively for peaceful use by India's breeder reactor program. The US subsequently discovered that Brazil, Pakistan, South Korea and Taiwan – all under military governments at the time – were going down the same dangerous path. Fortunately, it was possible to derail all those other reprocessing efforts, although Pakistan did acquire nuclear weapons via uranium enrichment.

This experience inspired a White-House-led review of the case for breeder reactors and plutonium fuels that found they were not needed and unlikely to be competitive with reactors operating on a once-through fuel cycle. President Carter announced in 1977 that the US would indefinitely defer reprocessing and breeder commercialization.⁶ This conclusion has been confirmed by the failure to date of all breeder commercialization programs worldwide.

Moltex claims that the removal of plutonium and other long-lived transuranic elements from CANDU spent fuel would reduce the long-term risk from a deep underground radioactive waste repository. That claim has been discredited repeatedly, starting with an in-depth review by the US National Academy of Sciences published in 1996.⁷ Plutonium and other transuranic oxides are relatively insoluble in deep underground anoxic water and poorly absorbed by both plants and animals including humans through the gut wall. As a result, the risk from leakage from underground repositories would likely be dominated by more mobile and absorbable long-lived radioisotopes such as the 17-million-year half-life fission product, iodine-129, which, if not released to the environment during reprocessing, would remain in the radioactive waste.

Before Canada makes any further commitments in support of reprocessing, we urge you to convene high-level reviews of both the nonproliferation and environmental implications of Moltex's reprocessing proposal including independent international experts. We believe such reviews will find reprocessing to be counterproductive on both fronts.

Signatories to this letter on the following page with affiliations and former US government positions. Contact: Frank N. von Hippel, Princeton University.

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Frank von Hippel, Senior Research Physicist and Professor of Public and International Affairs emeritus, Program on Science and Global Security, Princeton University,* Assistant Director for National Security, Office of Science and Technology Policy, The White House (1993-4).

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¹ Presentations by Moltex's leadership, the Associate Deputy Minister of Canada's Department of Natural Resources, and New Brunswick's Minister of Energy and Natural Resources Development at the 11 May 2021 celebration of a \$50.5 million grant from Natural Resources to Moltex hosted by the Organization of Canadian Nuclear Industries https://www.youtube.com/watch?v=b0Tg_Sh1NFY&t=102s.

² Nuclear Suppliers Group, <https://www.nuclearsuppliersgroup.org/en/>.

³ R. Bari et al, "Proliferation Risk Reduction Study of Alternative Spent Fuel Processing," Brookhaven National Laboratory, 2009, <https://www.bnl.gov/isd/documents/70289.pdf>.

⁴ Ed Lyman, "The pyroprocessing files," 12 August 2017, <https://allthingsnuclear.org/elyman/the-pyroprocessing-files/>

⁵ See also Canadian Nuclear Laboratories, *A Feasibility Study on the Recycling of Used CANDU Fuel*, 2016, https://web.archive.org/web/20180927080537/http://ontarioenergyreport.ca/pdfs/MOE%20-%20Feasibility%20Study_Used%20Fuel%20Recycling%20-%20June%202016.pdf

⁶ "Statement by the President [Carter] on His Decisions Following a Review of U.S. Policy." April 7, 1977, <https://www.nrc.gov/docs/ML1209/ML120960615.pdf>.

⁷ *Nuclear Wastes: Technologies for Separations and Transmutation* (National Academies Press, 1996), <https://www.nap.edu/catalog/4912/nuclear-wastes-technologies-for-separations-and-transmutation>.

SECOND OPEN LETTER TO PRIME MINISTER JUSTIN TRUDEAU

July 28, 2021

Prime Minister Justin Trudeau
justin.trudeau@parl.gc.ca

Re: US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime

Dear Prime Minister Trudeau,

In our [open letter](#) to you, dated 25 May, we urged a nonproliferation review of the decision by Canada's government to fund a proposal by Moltex to separate plutonium from CANDU spent fuel in New Brunswick.

On 23 June, we received an e-mail response from K. Bentsen in your office telling us that our letter had been referred to the Ministers of Foreign Affairs and of Natural Resources.

In the meantime, Moltex published two documents on its website: [a response to our letter](#) and [claims](#) about Moltex's technology by Ian Scott, its chairman and chief scientist.

We write today because of our concern about the misleading claims that Moltex continues to publish.

As we noted in our May letter, Canada's support of Moltex's proposal to chemically separate plutonium by reprocessing spent Candu fuel could undermine the fragile global nuclear-weapon nonproliferation regime. Some of us have written a similar letter of concern to the Biden Administration about the US Department of Energy's invitation of proposals for research and development on reprocessing of spent fuel from "advanced" reactors.

It is as if the nuclear-energy establishments in both countries have forgotten the painful lessons of the 1970s.

We focus on three arguments offered by Moltex:

1. "Civilian reprocessing is up to each country to assess and pursue if they so choose, as long as it is under International Atomic Energy Agency (IAEA) supervision."

Although that is legally true, Canada and the United States have discouraged reprocessing ever since India's first nuclear-weapon test in 1974 used plutonium produced in a Canada-supplied research reactor and separated with US-supplied reprocessing technology. Our two countries immediately co-organized and became founding members of the [Nuclear Suppliers Group](#). There has been no export of reprocessing technology to non-possessors since. It is imperative to uphold this decades-long norm of not reprocessing, lest we find ourselves in a world of many states with latent nuclear-weapon capabilities.

2. "The main output of [Moltex's proposed] WATSS [Waste to Stable Salt] process is an impure extraction of the minor actinides (including plutonium) which is suitable as fuel... If someone wished to use this material for other purposes, a conventional reprocessing facility would be required..."

This argument is identical to one made twenty years ago by advocates of pyroprocessing at the US Department of Energy's Argonne National Laboratory. They claimed, as Moltex does today, that the minor transuranic elements ("actinides") and lanthanide fission products that remain mixed with plutonium separated out of a molten salt solution would make the plutonium unusable for nuclear weapons and therefore "proliferation resistant." A 2009 [study](#), done by safeguards experts from six US national laboratories including Argonne, found this claim to be incorrect. The [radiation barrier created by the transuranic elements and lanthanide fission products](#) is only one thousandth that provided by the radioactive fission products in spent fuel. As a result, purifying the plutonium would require only the capabilities of a relatively cheap and small laboratory hot cell, not a multi-billion dollar "conventional reprocessing plant" as Moltex asserts.

3. Finally, Ian Scott argues "the 'higher actinides' of plutonium, americium and curium are... both highly radioactive and long lived. Between 300 years and one million years they dominate the radioactivity of the spent fuel and largely create the need for enormously expensive 'deep geological repositories' to keep the fuel safe for millennia... Because it burns these higher actinides, and not just plutonium, the [Stable Salt Reactor – Wasteburner] can radically clean up the nuclear waste left by today's generation of nuclear reactors. This is vitally important to giving nuclear energy the 'social licence' to expand beyond its current limits."

This claim is frequently made by advocates of fast-neutron reactors such as Moltex's SSR. But it too has long been discredited. Although [Scott's graph](#) shows that "actinides," i.e. plutonium and the other reactor-made transuranic elements in spent fuel, dominate its heat output after 300 years, *his implication that they would dominate the hazard to the population living above a radioactive waste repository is not correct*. This is because the transuranics have low solubility and a relatively low uptake by the human food chain and gut.

This was pointed out in 1996 in [a major US National Academy of Sciences study](#) that concluded, "none of the dose reductions [from fissioning plutonium and the other transuranics] seem large enough to warrant the expense and additional operational risk of transmutation" (Executive Summary, p. 3). The "operational risks" discussed were safety and "the proliferation risks that could result from the commercial use of plutonium in recycle fuels" (ES, p. 10).

Subsequently, France's Nuclear Safety Authority also [concluded, as did SKB](#), the company responsible for Sweden's spent fuel repository, that transuranics do not dominate the hazard from buried spent fuel.

Thus, Moltex's proposal would not significantly reduce the risk from radioactive waste but would dramatically increase the risk of nuclear weapons proliferation.

We urge again that Canada's government conduct an expert review of the proliferation and radioactive waste implications of Moltex's proposal, as well as of its economic prospects, about which we also are skeptical. If requested, we are available to provide input for that review.

Signatories to this letter are listed on the following page with affiliations and former US government positions. Contact: Frank von Hippel, Princeton University, fvhippel@princeton.edu

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Signatories

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24 November 2021

Prime Minister Justin Trudeau
justin.trudeau@parl.gc.ca

Re: Request for a proliferation assessment of a Canadian-government-funded proposal to separate plutonium from CANDU spent fuel

Dear Prime Minister Trudeau,

Congratulations on your re-election.

Out of concern that the issue may have been lost during the transition to your new government, I am writing to remind you and to inform relevant members of your new cabinet of the request made on May 25 in an open letter to you and your previous cabinet by a group of senior US nonproliferation experts.¹

We asked for a proliferation assessment of the \$50.5 million funding your government provided to support Moltex, a startup that proposes to reprocess spent fuel from the Point Lepreau CANDU power reactor in New Brunswick to recover plutonium to fuel a molten-salt cooled fast-neutron reactor it proposes to build on the same site. An overlapping group of nonproliferation experts sent a letter to the Biden Administration on June 20 asking for a proliferation assessment of funding the US Department of Energy began to provide for spent fuel reprocessing R&D during the Trump Administration.²

Our letters expressed concern that the Canadian and US governments have forgotten the important lessons both countries learned 50 years ago when their Atoms for Peace assistance facilitated the launch of India's nuclear-weapon program. That experience led the administrations of US President Carter and Canadian Prime Minister P.E. Trudeau to oppose the separation of plutonium from spent fuel.

That policy was reinforced by an assessment by the Carter Administration that exotic fast-neutron reactors such as the one Moltex proposes could not compete with water cooled reactors and that fuel made with reactor-grade but weapon-usable plutonium recovered by the chemical "reprocessing" of power-reactor spent fuel would cost far more than the non-weapon-usable low-enriched uranium fuel that it replaced. That judgement was subsequently confirmed when fast-neutron reactor programs failed in the UK, Germany, France and Japan, and plutonium fuel (mixed oxide fuel, called MOX) recycled in conventional reactors in France and Japan was found to cost ten times more than the low-enriched uranium fuel it replaced. This history suggests strongly that, in addition to undermining the global nonproliferation regime, the Moltex project would be a waste of precious time and funds in the global efforts to combat climate change.

On June 23, we received a response to our letter from your office informing us that the matter had been referred to the offices of then Foreign Minister Marc Garneau and Minister of Natural Resources O'Regan. But we did not receive any communications from those Ministers prior to their departures from your cabinet.

In the meantime, Moltex responded to our public letter by posting an article on the internet claiming that, since the process it was proposing to use to separate plutonium from CANDU spent fuel would produce impure plutonium, a multi-billion dollar "conventional

reprocessing facility” would be required to further purify it for weapons use. We therefore sent you, Mr. Prime Minister, a follow-on letter on July 27 explaining that a conventional reprocessing facility would not be required by a potential proliferator, as the radiation level would be quite low from the impure product produced by pyroprocessing CANDU fuel and pure plutonium could be extracted from the product in a low-cost "hot cell" – the same type of facility that Moltex would require to fabricate the material into fuel.³ Terrorists willing to accept a small increase in their lifetime cancer risk would not require a hot cell.

Since we sent those letters, you have appointed a new Minister of Foreign Affairs, Mélanie Joly, and a new Minister of Natural Resources, Jonathan Wilkinson. I am therefore copying them in this letter.

I am also copying your new Minister of Environment and Climate Change, Steven Guilbeault, because of refuted environmental claims by Moltex for its reprocessing technology that should also be considered in your government’s expert review. As detailed in our letter to you of 27 July, the claim repeated by Moltex that the radioactive waste from its reprocessing of CANDU fuel would pose a hazard of significantly lesser longevity than that of the original CANDU fuel has been refuted by comprehensive studies by the US National Academies and SKB the company responsible for Sweden’s spent fuel repository. We note also that the Idaho National Laboratory, which developed the pyroprocessing technology that Moltex proposes to use, has, after decades of effort, yet to demonstrate the conversion of the radioactive salt waste into a stable form suitable for disposal.⁴

I hope to hear from your government on this matter. If requested, our group can provide additional relevant background information. For example, I co-authored a proliferation assessment of pyroprocessing in 2005.⁵ Its conclusion was confirmed in 2009 by a joint assessment by experts from six US national laboratories.⁶ It have also recently co-authored an overview book on the issues involved in plutonium recycle.⁷ Some of my co-signatories have also done significant work on the subject. Two are no longer available as independent analysts because one has joined the State Department and another a national nuclear laboratory.

Given the gravity of the issues involved, this is a public letter, as were the 25 May and 27 July letters to you from our group. I will share this follow-up with my co-signatories on those previous letters as well as any responses received from your government.

Sincerely,



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¹ “US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime,” 25 May 2021, <https://sgs.princeton.edu/sites/default/files/2021-06/Open-Letter-to-Prime-Minister-Letter-Trudeau-May-2021.pdf>.

² “13 US Nonproliferation Experts Request a Review of the Department of Energy’s Promotion of Civilian Plutonium Separation,” 20 June 2021, <https://sgs.princeton.edu/sites/default/files/2021-11/letter-to-biden.pdf>.

³ “Re: US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime,” 27 July 2021, <https://sgs.princeton.edu/sites/default/files/2021-11/second-letter-to-trudeau.pdf>.

⁴ Michael Patterson, “Update on EBR-II Used Fuel Treatment,” presentation to the National Academy of Sciences Committee on Merits and Viability of Different Nuclear Fuel Cycles and Technology Options and the Waste Aspects of Advanced Nuclear Reactors, 29 Sept 2021, slides 14 and 17, <https://www.nationalacademies.org/event/09-28-2021/merits-and-viability-of-different-nuclear-fuel-cycles-and-technology-options-and-the-waste-aspects-of-advanced-nuclear-reactors-meeting-10-september-28-29-2021-public-sessions>.

⁵ Jungmin Kang and Frank von Hippel, “Limited Proliferation-Resistance Benefits from Recycling Unseparated Transuranics and Lanthanides from Light-Water Reactor Spent Fuel,” *Science & Global Security*, Vol. 13:169–181, 2005, <https://scienceandglobalsecurity.org/archive/sgs13kang.pdf>.

⁶ R. Bari et al, “Proliferation Risk Reduction Study of Alternative Spent Fuel Processing,” Brookhaven National Laboratory, BNL-90264-2009-CP, 2009, <https://www.bnl.gov/isd/documents/70289.pdf>.

⁷ Frank von Hippel, Masafumi Takubo and Jungmin Kang, *Plutonium: How Nuclear Power’s Dream Fuel Became a Nightmare* (Springer, 2019) <https://link.springer.com/book/10.1007/978-981-13-9901-5>.