St. Thomas University

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Radioactive Waste Policy Review
Natural Resources Canada
by email: radwastereview-examendechetsradioactifs@nrcan-rncan.gc.ca

April 1, 2022

Re: The federal radioactive waste management policy must ban reprocessing technology

The Environment & Society Program at St. Thomas University (STU) conducts research on, and teaches students about, the social and environmental impacts of our energy choices, including nuclear energy.

We are both faculty members in the STU program and members of the Coalition for Responsible Energy Development in New Brunswick (CRED-NB) which advocates for a nuclear-free renewable energy future. CRED-NB is represented on the Nuclear Waste Watch Radioactive Waste Review Group that produced the Alternative Policy for Canada on Radioactive Waste Management and Decommissioning (March 2022).

Thank you for the opportunity to provide feedback on the federal draft policy on radioactive waste. Our feedback is simple: the new policy must ban reprocessing technology. Reprocessing extracts plutonium and other fissile materials from spent nuclear fuel. A reprocessing unit is planned for development in New Brunswick at the Point Lepreau site on the Bay of Fundy.

We strongly endorse this point in the Alternative Policy:

1.14. Forbid the deployment of reprocessing technology in Canada, noting the considerable evidence that reprocessing spent nuclear fuel creates nuclear weapons proliferation risks and international relations concerns, and based on operating experience to date showing that reprocessing facilities are highly contaminating of the local environment.

This point effectively reverses point 1.5 in the draft NRCan policy that supports reprocessing technology, subject to policy approval.

The rationale for the Alternative Policy point 1.14 and our position is explained in the attached documents:

1. "Troublemaking: more questions about Canada's plutonium funding and nuclear weapons proliferation," by Janice Harvey and Susan O'Donnell, published by *The Hill Times* on April 4, 2022,

2. "Fossil and nuclear energy regimes threaten global security" - by Janice Harvey, published by *The Hill Times* on March 9, 2022.

3. "Will Canada remain a credible nonproliferation partner?" - by Susan O'Donnell and Gordon Edwards, published by the *Bulletin of the Atomic Scientists* on July 26, 2021

4. May 25, 2021: Open Letter to Prime Minister Justin Trudeau - Re: US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime.

5. July 28, 2021: Second Open Letter to Prime Minister Justin Trudeau - Re: US experts concerned that Canadian support for extracting plutonium from spent nuclear fuel is undermining the global nuclear-weapons nonproliferation regime.

6. November 24, 2021: Third letter to Justin Trudeau, signed by Frank N. von Hippel, Professor of Public and International Affairs, emeritus, Program on Science and Global Security, Princeton University

Thank you for considering our feedback. We would welcome follow-up engagement on this important topic.

[redacted]

[redacted]

cc
Johnathan Wilkinson, Minister of Natural Resources Canada
Stephan Guilbeault, Minister of Environment and Climate Change Canada
Jenica Atwin, Member of Parliament for Fredericton
Blaine Higgs, Premier of New Brunswick
Mike Holland, New Brunswick Minister of Natural Resources and Energy Development
David Coon, Member of the Legislative Assembly of New Brunswick for Fredericton South

To be published in The Hill Times • April 4, 2022

Troublemaking: more questions about Canada's plutonium funding and nuclear weapons proliferation

By Janice Harvey and Susan O'Donnell

The threat of nuclear weapons being deployed by Vladimir Putin, and the potential weaponization of nuclear power plants in Ukraine, has reawakened the public to the danger that these technologies pose. Much to the chagrin of the nuclear industry, the connection between military and civilian nuclear industries is now on the public agenda.

It is in the nuclear industry's interest to shut this discourse down. Indeed, the Canadian Nuclear Association has called it "fearmongering" to suggest any connection between civilian nuclear power plants and the military.

We prefer the word "troublemaking." When the nuclear industry and government backers do not want troubling questions asked, it's more important than ever to ask them.

For instance, why is the Government of Canada poised to lift its unofficial ban on extracting plutonium from the radioactive waste stockpiled at nuclear power sites?

Plutonium is created when uranium atoms are bombarded by neutrons inside a nuclear reactor. It is one of many dangerous constituents of the high-level nuclear waste (spent fuel) that results. Plutonium is deadly; it is also the primary explosive material in nuclear bombs. It is supplied to the weapons industry through a technology called 'reprocessing' which extracts plutonium from radioactive spent fuel. Plutonium can also be used as fuel for nuclear reactors.

In the 1970s, the US (officially) and Canada (unofficially) banned plutonium reprocessing within the civilian nuclear industry. At the time, reprocessing was part of the nuclear industry's expansion ambitions. This changed in 1974 when India fashioned a nuclear bomb using reprocessing technology to extract plutonium from waste produced by a "peaceful" research reactor given to India by Canada as a gift. US President Jimmy Carter, a nuclear engineer, rightly recognized that access to reprocessing technologies in the civilian nuclear power sector could lead to nuclear weapons proliferation. He banned it. Although no announcements were made, it appears former prime minister Pierre Trudeau followed suit shortly thereafter.

Today, one of the many prospective designs for the next-generation of nuclear reactors being supported by public money requires plutonium reprocessing. In March 2021, Intergovernmental Affairs Minister Dominic LeBlanc, along with the department of Industry, Science and Economic Development (ISED) and the Atlantic Canada Opportunities Agency (ACOA) announced funding in the amount of $50.5 million to Moltex Energy, a UK start-up now based in Saint John. The New Brunswick government had previously given Moltex $5 million.

The company's molten salt reactor design, now moving through the Canadian Nuclear Safety Commission's review process, would use plutonium as its fuel. The plutonium would be extracted from existing nuclear waste using a reprocessing technology called "pyroprocessing."

The Moltex plutonium reprocessing and reactor complex would be located on the site of NB Power's Point Lepreau Nuclear Generating Station, which sits amidst small fishing villages on the Bay of Fundy, 50 kilometres west of Saint John. Point Lepreau's stockpile of high-level nuclear waste would be the feedstock for Moltex's pyroprocessing operation.

In February 2022, Natural Resources Canada (NRCan) released a draft of its long-awaited radioactive waste policy. It includes support in principle for plutonium reprocessing, which implies that the unofficial reprocessing ban in place for several decades is now lifted.

A March 8, 2022 letter from NRCan Assistant Deputy Minister Mollie Johnson to concerned medical doctors states: "... research done to date indicates that this technology represents a potential path forward for recycling used CANDU fuel. If this technology proves viable, it would allow Canada to further extract energy from a used resource, potentially providing Canadians with emissions free energy for years to come while reducing long-lived radioactive waste."

Where is the evidence to back up these claims? Did the government conduct any scientific peer reviews of pyroprocessing technology before funding its development? Why doesn't the government acknowledge that extracting plutonium from spent fuel stockpiles would make only miniscule reductions in overall volumes of waste, if any, while creating whole new classes of long-lived radioactive wastes? The largest experiment with pyroprocessing technology to date, at the US Idaho National Laboratory, has been an economic and technological fiasco.

Did the Government re-examine the proliferation risks that triggered the 1970s reprocessing bans before making this policy change? Why hasn't there been any public or parliamentary debate about the implications of opening this Pandora's box? Might this not be an important matter of public transparency?

Ottawa seems to be avoiding such tough questions. A prestigious group of US nuclear weapons proliferation experts and former senior White House advisors has now sent three letters expressing concerns about Moltex's plutonium reprocessing project. Their first letter sent in May 2021 to Prime Minister Trudeau, copied to Chrystia Freeland and Marc Garneau (then Foreign Affairs Minister), stated that by "backing spent-fuel reprocessing and plutonium extraction, the Government of Canada will undermine the global nuclear weapons non-proliferation regime that Canada has done so much to strengthen." These experts warn that other countries that might want to join the ranks of nuclear weapons states could point to Canada's support for reprocessing to justify their own plutonium acquisition programs.

They sent a second letter in July and a third in November. Receipt of these letters has been acknowledged, but they have not been answered.

Indirectly, the Government has given lip-service to Canada's obligations in regard to nuclear proliferation. In her letter referenced above, NRCan ADM Mollie Johnson stated, "Canada remains committed to the Treaty on the Non-Proliferation of Nuclear Weapons, including the full implementation of safeguards set by the International Atomic Energy Agency to provide assurances that nuclear materials are used solely for peaceful purposes in Canada."

Therein lies the problem. Johnson refers to using nuclear materials for peaceful purposes *in Canada.* Last year, in signing an MOU with the Port of Belledune, Moltex CEO Rory O'Sullivan was explicit in their intent to sell its reactors "around the world." Canadian-subsidized plutonium reprocessing technology is fully intended to be deployed far beyond Canadian borders.

Any export of Moltex technology would require prior approval by the Government of Canada. However, how serious is Canada about meeting its responsibility for ensuring that publicly funded plutonium technologies in Canada do not increase the risk of nuclear proliferation abroad?

In his February 2022 presentation to a committee of the US National Academies of Sciences studying new and advanced nuclear reactors, Moltex's CEO O'Sullivan acknowledged that his company was developing a very controversial technology. To allay concerns, O'Sullivan said, Moltex has an obligation to "ensure we've got the risk of weapons proliferation managed and sufficiently low" by directly engaging independent experts.

What a bizarre proposition! What, do we suppose, might be a "sufficiently low" risk of weapons proliferation? Is Ottawa leaving this to Moltex to figure out, after filling its pockets with millions of dollars? Is it not the obligation of the Government of Canada, a signatory to the nuclear non-proliferation treaty, to prevent any such risk? Why would Canadians fund any nuclear weapons proliferation-vulnerable technologies at all?

This is a matter of grave concern. Canadians should be alarmed – outraged, even – by Ottawa's seemingly cavalier attitude to the security dangers inherent in its embrace and subsidization of private companies hawking promises of nuclear techno-fixes to our climate change obligations.

Ottawa needs to answer these troubling questions now, before one more tax dollar is spent paving this road that ultimately leads to a global plutonium economy.

Janice Harvey, PhD, is assistant professor of environment and society at St. Thomas University, Fredericton, N.B. Before entering academia, Dr. Harvey worked for 25 years on environmental and energy policy at the Conservation Council of New Brunswick.

Susan O'Donnell, PhD, a social scientist and adjunct professor at both the University of New Brunswick and St. Thomas University, is an expert in technology adoption. In 2017, she retired as Senior Research Officer from the National Research Council of Canada.

OPINION

Fossil and nuclear energy regimes threaten global security

By JANICE HARVEY (/AUTHOR/JANICE-HARVEY) MARCH 9, 2022

Equally perverse is the opportunistic clamouring of transnational oil interests invested in Canada and their political backers to quickly expand Canada's oil and gas reach to Western Europe. Climate science couldn't be more clear: the fossil fuel industry needs to wind down fast, not expand. What part of climate catastrophe do politicians not understand?

Vladimir Putin’s terror campaign against Ukraine has pulled back the curtain on the tightly integrated, brittle, and destructive energy regime that fuels the industrialized world. *Image courtesy of Wikimedia Commons*

FREDERICTON, N.B.–Vladimir Putin's terror campaign against Ukraine has pulled back the curtain on the tightly integrated, brittle, and destructive energy regime that fuels the industrialized world. This regime poses an immediate threat to the survival of the people of Ukraine, and the longer-term survival of civilization itself. The deadly power of the troika of oil, gas, and nuclear energy is unfolding before our eyes as Ukraine pays the price for a path all our countries have forged.

Energy is a source of two kinds of power—the kind that turns on lights, heats homes, and turns engines and the kind that drives politics. While there are many options for providing the energy services we all need, only some create authoritarian petrostates, transnational corporations with budgets larger than many nations, and billionaire oligarchs. Only some finance wars and inflict gross injustices on those in the paths of rigs and pipelines. Only some emit pollutants that kill millions every year. Only some create deadly wastes that will persist longer into the future than humans have walked on this Earth. Only some turn a conventional missile into a nuclear bomb. Only some destroy the climate that makes Earth liveable.

All these existential threats are associated with the global networks of political and economic power built by transnational energy corporations. Energy policy has long been dominated by "iron triangles" of energy business interests, "client"-oriented energy bureaucrats, and captured politicians. Whether it is Putin's transnational petrodollars, Western Europe's energy tap line to Russia, or nuclear plants dotting the European landscape, governments and whole countries have become entangled in a dangerous, brittle system that now threatens global security.

The inevitable outcome is the world on a knife-edge.

In the midst of Russia's oil-financed terror campaign, the international climate science body issued its latest report documenting our collective descent into climate hell. UN Secretary-General António Guterres called the report "an atlas of human suffering and a damning indictment of failed climate leadership." (https://news.un.org/en/story/2022/02/1112852)

In the midst of Russia's oil-financed terror campaign, the international climate science body issued its latest report documenting our collective descent into climate hell. UN Secretary-General António Guterres, pictured, called the report 'an atlas of human suffering and a damning indictment of failed climate leadership.' *Photograph courtesy of the UN*

Enter the nuclear industry. After languishing for decades in Western countries due to intractable liabilities, and a legitimacy crisis following narrow escapes and full-blown disasters at Three Mile Island, Chernobyl, and Fukushima, opportunistic nuclear interests have seized on the climate emergency to promote itself as the "clean" energy solution. This falsehood has now been exposed in Ukraine. Every nuclear reactor and nuclear waste storage site is a potential nuclear bomb, minus the blast and fireball. All Putin has to do to wreak radioactive havoc across Europe is target a nuclear facility or two with conventional missiles. Uncontrolled nuclear reactions and wind currents will do the rest.

Yet, the Liberal government's climate action plan includes pouring hundreds of millions into an industry that would build modular nukes to export around the world, each one a target for a despot or a terrorist. This is all laid out in the federal "SMR Action Plan" (https://smractionplan.ca/) that the nuclear industry helped to write, with funding disguised within the $8-billion "Net Zero Accelerator. (https://www.ic.gc.ca/eic/site/125.nsf/eng/00039.html)"

New Brunswick (https://smractionplan.ca/content/new-brunswick) is vying to become the hub for producing this deadly commodity. Nuclear experts from the United States have exposed the security threat inherent in the plutonium feedstock— (https://www.hilltimes.com/2021/06/10/a-nuclear-start-up-company-could-undermine-canadas-global-non-proliferation-policy-experts/300756)the stuff of nuclear bombs—that one of the New Brunswick models requires (https://www2.gnb.ca/content/gnb/en/departments/erd/news/news_release.2018.07.0930.html). But even without diverting that fuel into a nuclear weapons program, the plant only needs to exist to be a nuclear target.

The Ukraine catastrophe should be enough to halt nuclear expansion in its tracks. Trading one existential threat (fossil fuel dependency) for another (an even wider network of nuclear targets) is a callous, willful betrayal of the public trust by those politicians enabling it.

Equally perverse is the opportunistic clamouring of transnational oil interests invested in Canada and their political backers to quickly expand Canada's oil and gas reach to Western Europe. Climate science couldn't be more clear: the fossil fuel industry needs to wind down fast, not expand. What part of climate catastrophe do politicians not understand?

In June 1988, the Canadian government hosted the first international conference on climate change called, The Changing Atmosphere: Implications for Global Security (https://wedocs.unep.org/handle/20.500.11822/29980). Prophetically, the final report of the conference opened with this statement: "Humanity is conducting an unintended, uncontrolled,

globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war." Today, the world is simultaneously facing climate breakdown and the threat of nuclear catastrophe.

Fortunately, we have the means to deescalate on both fronts if we choose to do so. Every country can, without delay, embark on a rapid transition to a resilient, efficient, locally-controlled renewable energy system. This option exists now, is the cheapest source of new power, is available to all, and can be built out quickly.

Political leaders in Canada and abroad have two choices before them. They can deepen domestic and global energy and security vulnerabilities and hasten climate breakdown by building more pipelines, escalating oil and gas production, and enabling the expansion of the nuclear industry. Or they can work towards the elimination of energy as a geopolitical weapon and an existential threat to the civilization. It is up to us citizens to hold them accountable for the choice they make.

Janice Harvey, PhD, is assistant professor of environment and society at St. Thomas University, Fredericton, N.B. Before entering academia, Dr. Harvey worked for 25 years on environmental and energy policy at the Conservation Council of New Brunswick. For 12 years, she penned an op-ed column for Brunswick News under the banner, A Civil Society.

The Hill Times

Read our breaking Ukraine coverage

Will Canada remain a credible nonproliferation partner?

By Susan O'Donnell, Gordon Edwards | July 26, 2021

AMBER WAVES OF GRAIN. This field of ceramic nose-cones represents, in miniature, all the warheads in the US nuclear arsenal at the height of the Cold War, along with the nuclear submarines, bombers, and ballistic missiles designed to deliver them. Estimates put the warhead count at around 25,000. Denver sculptress Barbara Donachy created this installation to show what such a concentration of nuclear weaponry would look like all in one place. Her display contains 33,561 pieces representing 31,000 warheads, 1,799 ballistic missiles, 324 intercontinental bombers, and 37 nuclear submarines. Amber Waves of Grain installation by Barbara Donachy, Boston Science Museum, Boston, Massachusetts. February 13, 1985. Photograph copyright by Robert Del Tredici, The Atomic Photographers Guild. Used with permission.

The recent effort to persuade Canada to sign the Treaty on the Prohibition of Nuclear Weapons has stimulated a lively debate in the public sphere. At the same time, out of the spotlight, the start-up company Moltex Energy received a federal grant to develop a nuclear project in New Brunswick that experts say will undermine Canada's credibility as a nonproliferation partner.

Moltex wants to extract plutonium from the thousands of used nuclear fuel bundles currently stored as "high-level radioactive waste" at the Point Lepreau reactor site on the Bay of Fundy. The idea is to use the plutonium as fuel for a new nuclear reactor, still in the design stage. If the project is successful, the entire package could be replicated and sold to other countries if the Government of Canada approves the sale.

On May 25, nine US nonproliferation experts sent an open letter to Prime Minister Justin Trudeau expressing concern that by “backing spent-fuel reprocessing and plutonium extraction, the Government of Canada will undermine the global nuclear weapons non-proliferation regime that Canada has done so much to strengthen.”

The nine signatories to the letter include senior White House appointees and other US government advisers who worked under six US presidents: John F. Kennedy, Lyndon B. Johnson, Richard Nixon, George H.W. Bush, Bill Clinton, and Barack Obama; and who hold professorships at the Harvard Kennedy School, University of Maryland, Georgetown University, University of Texas at Austin, George Washington University, and Princeton University.

Plutonium is a human-made element created as a byproduct in every nuclear reactor. It’s a “Jekyll and Hyde” kind of material: on the one hand, it is the stuff that nuclear weapons are made from. On the other hand, it can be used as a nuclear fuel. The crucial question is, can you have one without the other?

India exploded its first nuclear weapon in 1974 using plutonium extracted from a “peaceful” Canadian nuclear reactor given as a gift many years earlier. In the months afterwards, it was discovered that South Korea, Pakistan, Taiwan, and Argentina—all of them customers of Canadian nuclear technology—were well on the way to replicating India’s achievement. Swift action by the US and its allies prevented these countries from acquiring the necessary plutonium extraction facilities (called “reprocessing plants”). To this day, South Korea is not allowed to extract plutonium from used nuclear fuel on its own territory—a long-lasting political legacy of the 1974 Indian explosion and its aftermath—due to proliferation concerns.

Several years after the Indian explosion, the US Carter administration ended federal support for civil reprocessing of spent nuclear fuel in the US out of concern that it would contribute to the proliferation of nuclear weapons by making plutonium more available. At that time, Canada’s policy on reprocessing also changed to accord with the US policy—although no similar high-level announcement was made by the Canadian government.

Preventing an accidental nuclear crisis in Iran and beyond

Moltex is proposing to use a type of plutonium extraction technology called "pyroprocessing," in which the solid used reactor fuel is converted to a liquid form, dissolved in a very hot bath of molten salt. What happens next is described by Moltex chairman and chief scientist Ian Scott in a recent article in *Energy Intelligence*. "We then—in a very, very simple process—extract the plutonium selectively from that molten metal. It's literally a pot. You put the metal in, put salt in the top, mix them up, and the plutonium moves into the salt, and the salt's our fuel. That's it. … You tip the crucible and out pours the fuel for our reactor."

The federal government recently supported the Moltex project with a $50.5-million grant, announced on March 18 by Intergovernmental Affairs Minister Dominic LeBlanc in Saint John. At the event, LeBlanc and New Brunswick Premier Blaine Higgs described the Moltex project as "recycling" nuclear waste, although in fact barely one-half of one per cent of the used nuclear fuel is potentially available for use as new reactor fuel. That leaves a lot of radioactive waste left over.

From an international perspective, the government grant to Moltex can be seen as Canada sending a signal—giving a green light to plutonium extraction and the reprocessing of used nuclear fuel.

The US experts' primary concern is that other countries could point to Canada's support of the Moltex program to help justify its own plutonium acquisition programs. That could undo years of efforts to keep nuclear weapons out of the hands of countries that might want to join the ranks of unofficial nuclear weapons states such as Israel, India, Pakistan, and North Korea. The Moltex project is especially irksome since its proposed pyroprocessing technology is very similar to the one that South Korea has been trying to deploy for almost 10 years.

In their letter, the American experts point out that Japan is currently the only nonnuclear-armed state that reprocesses spent nuclear fuel, a fact that is provoking both domestic and international controversy.

In a follow-up exchange, signatory Frank von Hippel of Princeton University explained that the international controversy is threefold: (1) The United States sees both a nuclear weapons proliferation danger from Japan's plutonium stockpile and also a nuclear terrorism threat from the possible theft of separated plutonium; (2) China and South Korea see Japan's plutonium stocks as a basis for a rapid nuclear weaponization; and

(3) South Korea's nuclear-energy R&D community is demanding that the US grant them the same right to separate plutonium as Japan enjoys.

Despite the alarm raised by the nine authors in their letter to Trudeau, they have received no reply from the government. The only response has come from the Moltex CEO Rory O'Sullivan. His reply to a *Globe and Mail* reporter is similar to his earlier rebuttal in *The Hill Times* published in his letter to the editor on April 5: the plutonium extracted in the Moltex facility would be "completely unsuitable for use in weapons."

Putin reminds everyone that Ukraine joining NATO could lead to nuclear war

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But the International Atomic Energy Agency (IAEA) has stated that "Nuclear weapons can be fabricated using plutonium containing virtually any combination of plutonium isotopes." All plutonium is of equal "sensitivity" for purposes of IAEA safeguards in nonnuclear weapon states.

Similarly, a 2009 report by nonproliferation experts from six US national laboratories concluded that pyroprocessing is about as susceptible to misuse for nuclear weapons as the original reprocessing technology used by the military, called PUREX.

In 2011, a US State Department official responsible for US nuclear cooperation agreements with other countries went further by stating that pyroprocessing is just as dangerous from a proliferation point of view as any other kind of plutonium extraction technology, saying: "frankly and positively that pyro-processing is reprocessing. Period. Full stop."

And, despite years of effort, the IAEA has not yet developed an approach to effectively safeguard pyroprocessing to prevent diversion of plutonium for illicit uses.

Given that history has shown the dangers of promoting the greater availability of plutonium, why is the federal government supporting pyroprocessing?

It is clear the nuclear lobby wants it. In the industry's report, "Feasibility of Small Modular Reactor Development and Deployment in Canada," released in March, the reprocessing (which they call "recycling") of spent nuclear fuel is presented as a key element of the industry's future plans.

Important national and international issues are at stake, and conscientious Canadians should sit up and take notice. Parliamentarians of all parties owe it to their constituents to demand more accountability. To date however, there has been no democratic open debate or public consultation over the path Canada is charting with nuclear energy.

Countless Canadians have urged Canada to sign the UN Treaty on the Prohibition of Nuclear Weapons that came into force at the end of January this year. Ironically, the government has rebuffed these efforts, claiming that it does not want to "undermine" Canada's long-standing effort to achieve a Fissile Materials Cut-off Treaty. Such a treaty would, if it ever saw the light of day (which seems increasingly unlikely), stop the production of weapons usable materials such as highly enriched uranium and (you guessed it) plutonium.

So, the Emperor not only has no clothes, but his right hand doesn't know what his left hand is doing.

Editor's note: This article, which was reprinted with permission from the authors, was originally published in The Hill Times on June 10, 2021.

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
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,

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.

cc. Chrystia Freeland, Deputy Prime Minister and Minister of Finance, House of Commons, Ottawa, ON, Canada K1A 0A6. Chrystia.Freeland@parl.gc.ca

Marc Garneau, Minister of Foreign Affairs, House of Commons, Ottawa, ON, Canada K1A 0A6. Marc.Garneau@parl.gc.ca

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Annamie Paul, leader of the Green Party of Canada, PO Box 997, Station B, Ottawa, ON K1P 5R1, <leader@greenparty.ca>

Signatories

Matthew Bunn, James R. Schlesinger Professor of the Practice of Energy, National Security, and Foreign Policy, Co-Principal Investigator, Project on Managing the Atom, Harvard Kennedy School.*

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)

Robert L. Gallucci, Distinguished Professor in the Practice of Diplomacy, Georgetown University,* Former Ambassador at Large and Assistant Secretary of State for Political-Military Affairs (1992-2001).

Richard L. Garwin, IBM Fellow Emeritus, IBM Thomas J. Watson Research Center,* member U.S. President's Science Advisory Committee from 1962–65, 1969–72.

Alan J. Kuperman, Associate Professor, LBJ School of Public Affairs, Coordinator, Nuclear Proliferation Prevention Project (www.NPPP.org), University of Texas at Austin,* former Congressional staff (1989-93).

Henry Sokolski, Executive Director, Nonproliferation Policy Education Center,* Deputy for Nonproliferation Policy, Office of the Secretary of Defense (1989-93)

Sharon Squassoni, Research Professor, Elliott School of International Affairs, George Washington University,* former nonproliferation specialist with the US State Department and Congressional Research Service.

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).

*For identification only

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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/

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[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

cc. Marc Garneau, Minister of Foreign Affairs, Marc.Garneau@parl.gc.ca
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Rumina Velshi, President, Canadian Nuclear Safety Commission, Rumina.Velshi@canada.ca

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Signatories

Peter Bradford, former chair of New York and Maine utility regulatory commissions and former U.S. Nuclear Regulatory Commissioner (1977-82)

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)

Robert L. Gallucci, Distinguished Professor in the Practice of Diplomacy, Georgetown University,* Former Ambassador at Large and Assistant Secretary of State for Political-Military Affairs (1992-2001)

Richard L. Garwin, IBM Fellow Emeritus, IBM Thomas J. Watson Research Center;* member U.S. President's Science Advisory Committee (1962–65, 1969–72)

Victor Gilinsky, Nonproliferation Policy Education Center; Nuclear Regulatory Commissioner (1975-79)

Alan J. Kuperman, Associate Professor, LBJ School of Public Affairs and Coordinator, Nuclear Proliferation Prevention Project (www.NPPP.org), University of Texas at Austin;* Congressional staff (1989-93)

Henry Sokolski, Executive Director, Nonproliferation Policy Education Center; Deputy for Nonproliferation Policy, Office of the Secretary of Defense (1989-93)

Sharon Squassoni, Research Professor, Elliott School of International Affairs, George Washington University,* former nonproliferation specialist with the US State Department and Congressional Research Service

William Tobey, Director, US-Russia Initiative to Prevent Nuclear Terrorism, Harvard Kennedy School;* Deputy Administrator for Defense Nuclear Nonproliferation, National Nuclear Security Administration, 2006-2009

Frank N. 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)

*For identification only

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.

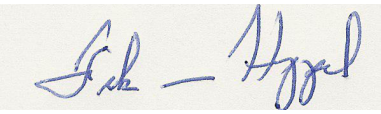
Since we sent those letters, you have appointed a new Minister of Foreign Affairs, Mélanie Joly, and a new Minister of Natural Resources, Jonathan Wilkinson. I am therefore copying them in this letter.

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.
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[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.