

The Honorable Jennifer M. Granholm  
Secretary of Energy  
US Department of Energy  
1000 Independence Avenue, S.W.  
Washington, DC 20585-1000

November 29, 2021

Re: Advanced reactors, fast reactors, nuclear proliferation

Madam Secretary:

Among the Energy Department's "advanced reactors" that are being supported for commercialization and export are some — sodium-cooled fast reactors — that shouldn't be for international security reasons. The natural fuel of such reactors is plutonium. In this mode they are called "breeder" reactors. If they are successful in becoming an export product—which the Department of Energy and the companies designing them advertise as a desirable goal—they will provide easy access around the world to nuclear weapons-grade plutonium. As far back as 1976, President Gerald Ford said we should not rely on plutonium fuel until the world can cope with the proliferation consequences. This determination was subsequently backed by President Jimmy Carter. Does anyone think we are anywhere near meeting this test and that we should now reverse that policy? The short answer is no.

Certainly, the Energy Department's current enthusiasm to develop and export fast reactors is in direct conflict with the Pentagon's trepidation about these reactors' utility as nuclear weapons material production plants. In specific, Pentagon's latest China military power report, released earlier this month, spotlighted two Chinese fast reactors and their associated reprocessing plants under construction and their role in helping to supply China with the weapons plutonium Beijing needs to acquire more than 1,000 nuclear weapons by 2030.

The head of the Strategic Command, Admiral Charles Richard, amplified this point earlier this year before the Senate Armed Services Committee. "With a fast breeder reactor," he noted, "you now have a very large source of weapons grade plutonium available to you, that will change the upper bounds of what China could choose to do if they wanted to, in terms of further expansion of their nuclear capabilities." In speaking of "a large source of weapons-grade plutonium," Admiral Richard is referring not only to copious plutonium production, but to the "super weapons-grade" quality of about half of plutonium produced in fast reactors, a circumstance that simplifies weapon design and production. Imagine if such facilities spread globally, including to dangerous regions in Asia and the Middle East. We certainly cannot exclude the possibility that some future owners of such reactors may be interested in using these plants to make bombs.

With light water reactors, there is no need to extract plutonium. Also, as noted previously in letter to you with multiple signatures sent June 20<sup>th</sup>, there's a major economic penalty for recycling plutonium in light water reactors versus using fresh uranium. As a result, international inspections to afford timely warning of military diversions are feasible. In contrast, with the copious quantities of "super-grade" plutonium that fast reactors produce, no such warning is yet practicable. Nor is there some technical modification of reprocessing technology that promises to make it substantially harder to access the plutonium to make bombs. Exporting "smaller" advanced nuclear plants also won't help: Nuclear facilities, which are small in commercial terms, can, nonetheless pose very large military threats. A "small" 300 megawatt (electrical) fast reactor, for example, can produce upwards of 300 kilograms of plutonium annually, about half of which is "super-grade." Contrast that with the requirement for a warhead, which can be as little three kilograms.

Unfortunately, nuclear enthusiasts intrigued with the breeding potential of fast reactors, especially the sodium-cooled category, have largely ignored these international security issues. Instead, they've lobbied for "advanced" fast reactors and reprocessing for decades. Yet, their "advanced" design dates back to the mid 1940s and so predates the light water reactor. In the 1970s, a fast reactor demonstration plant, the

Clinch River Breeder Reactor, then the largest US energy project ever, was the Atomic Energy Commission's main focus. Congress canceled it in the early 1980s because it made no economic sense. The Department of Energy, then, tried to revive the fast reactor concept during the George W. Bush administration on grounds that it would help in nuclear waste management, but that got nowhere.

The current Department of Energy flagship fast reactor commercialization demonstration project, TerraPower's Sodium reactor, is based on an earlier General Electric-Hitachi design for a Prism reactor which is classified as a plutonium-fueled fast breeder reactor. TerraPower executives say they intend to fuel Sodium not with plutonium, but with uranium enriched to below 20 percent and that it would not require reprocessing of spent fuel. They also plan on exporting the reactor.

But fast reactors are very flexible regarding fuel use, and its customers, especially its foreign customers, will view the reactor as a potential "breeder" reactor, indeed it is the main attraction of such machines, and we expect the exporters will accommodate the customers. Consider that while TerraPower is taking advantage of the "small modular reactor" label's cachet, TerraPower's CEO expects customers to want the larger 1000 megawatt (electrical) size and expects to accommodate them. It is apparently still true—despite the enthusiasm over small modular reactors—that the larger sizes are more economic. I believe that once the design is established the fuel choice will revert the same way.

The Biden administration and Congress have decided to support nuclear energy as part of the effort to combat climate change. You have said that you are "very bullish on advanced nuclear reactors." But our government's support for advanced reactors should not be extended to fast reactors, much less their export, which would make it much easier for those so inclined to manufacture nuclear weapons. At a minimum, our government should not push their export unless and until it can certify that it can technically assure timely warning of possible nuclear military diversions. This was the requirement that Presidents Ford and Carter demanded be met before the United States ever commercialized plutonium-based fuels. If we are still serious about preventing nuclear proliferation, our government should demand no less today.

Sincerely,



Henry Sokolski  
Executive Director  
The Nonproliferation Policy Education Center

CC: Secretary of State Antony Blinken  
Administrator of the National Nuclear Security Administration Jill Hruby  
Chairman, Nuclear Regulatory Commission Christopher Hansen