UCS technical rebuttal to the Idaho National Laboratory's opinions on the Versatile (Fast) Test Reactor

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On February 15, I published a blog post entitled "The Versatile Fast Neutron Source: A Misguided Nuclear Reactor Project." The post was critical of the recent Congressional efforts to compel the Department of Energy (DOE) to build a multibillion-dollar fast-neutron nuclear reactor without thorough evaluation of the need for such a project and its cost and benefits. In response, on March 13, the Idaho National Laboratory (INL) released an unsigned "technical rebuttal" responding to what it characterized as "personal opinions that are inaccurate or misleading." It starts by arguing that such a reactor is needed, and then comments on seven statements from my blog post. Given that INL would likely be the site for such a reactor and therefore has a vested interest in the project, the lab's favorable opinions on its merits come as no surprise. However, INL's response contains numerous inaccurate or misleading statements. Below, I list the seven quotes from my blog post, and respond to INL's rebuttal.

1. ***"What may not be clear from the name is that this facility itself would be an experimental fast reactor, likely fueled with weapon-usable plutonium."***

a) "Experimental fast reactor" versus "test reactor"

INL takes issue with my description of the reactor under question as an "experimental fast reactor" and insists it should be called a "test reactor." In fact, other than a legal distinction, calling it a "test reactor" would make no meaningful difference. "Test reactor" is simply a description of the reactor's proposed function and some aspects of its design. There are numerous types of reactor designs, and a test reactor could be any one of these types. The term "test reactor" does not indicate the fundamental nature of the reactor itself.

In fact, the terms "test reactor," "demonstration reactor," "prototype reactor," and "experimental reactor" are not well-defined. The DOE's Nuclear Energy Advisory Committee (NEAC) defines "test reactor" as one that "provides neutrons to study the behavior of fuel and structural materials and components of different technology concepts in a radiation environment." This is distinguished from a "demonstration reactor," which "attempts to duplicate many features in a proposed design but possibly at a reduced power level." In other words, a test reactor is not intended to demonstrate features relevant to its own operation, but only to provide neutrons for studies supporting development of other reactor designs.

One of the primary distinctions between test and demonstration reactors is that, according to NEAC, "the [test] reactor technology, e.g., the driver fuel and coolant, should be based on proven technology. The objective is to reduce the cost, the development time and most importantly, to ensure the reliable operation of the test reactor."

My use of the term "experimental fast reactor" is an accurate description of the proposed facility. Over the past several years, this reactor has variously been called the "Versatile Irradiation Test Reactor," the "Versatile Fast Neutron Source," and now the "Versatile Test Reactor" (VTR). No matter what its name, the proposed machine would be a medium power, metal-fueled fast spectrum reactor that, unlike the vast majority of operating reactors, would not be water cooled. Moreover, this reactor would be sufficiently different in design and operation from previous fast-neutron demonstration reactors that it would require significant development work to achieve a sufficient level of maturity. Thus, it is unlikely to satisfy NEAC's criteria for test reactor reliability.

In fact, the DOE's January 2017 Advanced Demonstration and Test Reactor Options Study (to which INL was a contributor) identifies GE-Hitachi's proposed PRISM Mod-A, a 471 megawatt thermal (MWth) liquid-sodium-cooled fast-neutron reactor, as one of the designs it considered as a potential advanced demonstration reactor. Yet another DOE-INL report released the same month, Preliminary Options Assessment of Versatile Irradiation Test Reactor, includes a section on the very same PRISM reactor (with a slightly smaller power rating of 425 MWth) as an example of a reactor concept that "may aid in designing a versatile test reactor."

The Advanced Demonstration and Test Reactor Options Study points out that the PRISM design uses, "for the most part," technologies demonstrated in the 62 MWth liquid-sodium-cooled EBR-II, a demonstration fast reactor in Idaho that was shut down in 1993. However, it also lists a number of significant issues that would need to be addressed to scale up the power from that of the EBR-II to the 471 MWth PRISM, including qualification of a different and untested system for passive removal of decay heat. This would also hold true for the VTR. INL recently confirmed in an April 25 solicitation that the nominal power rating of the VTR will be 300 MWth, as I stated in my Feb. 15 blog post. One should not underestimate the time and effort needed to address such scale-up issues.

There are also many other differences between PRISM and EBR-II. For instance, EBR-II used highly enriched uranium driver fuel, in contrast to plutonium, the preferred fuel for the VTR (see below). Note that the industry's Fast Reactor Working Group has urged that "the driver fuel of the fast test reactor should … be used to expand the fuel performance database of that fuel type as much as possible"—that is, the VTR should be used to *experiment* with its own fuel. There is very little irradiation experience with plutonium-based metal fast reactor fuel.

The INL rebuttal points to the Fast Flux Test Facility (FFTF), a 400 MWth test reactor operated by the DOE at its Hanford, Washington site from 1982-1992, as an example of the demonstration of a large, high power density fast reactor. However, the fuel in the FFTF core was mixed-oxide—which differs significantly from metal fuel in many important respects, including having a higher melting point. Thus, its operating history is of limited applicability to the metal-fueled VTR. And the FFTF power density of 390 watts per cubic centimeter was well below the power density of Argonne National Laboratory's proposed FASTER test reactor (559 watts per cubic centimeter average; 917 watts per cubic centimeter maximum), another VTR candidate.

Another reason that INL is so insistent that the VTR be called a "test reactor" with "no goal to generate electricity" is because of the legal status conferred by such a designation. The 1974 Energy Reorganization Act requires that the NRC license "demonstration nuclear reactors," which are reactors "operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor." However, a "test reactor" whose only purpose is providing neutrons for development of other reactors would not be a "demonstration nuclear reactor" and hence would be exempt from NRC licensing if built at a DOE site. INL has made clear that it does not want the NRC to license the VTR, as discussed below.

b) Fueling options for the VTR

The INL rebuttal states that "the use of plutonium in the fuel is a preferred option but not the only option." This is consistent with my blog post, where I clearly stated that the reactor would "likely" be fueled with plutonium, but that the DOE was also considering high-assay low-enriched uranium (HALEU, slightly less than 20% enriched).

In fact, in INL's April 25 VTR solicitation, the DOE has now confirmed that use of plutonium is not simply its preferred option, but the only option it is currently considering. The solicitation specifies the fuel will be a metal alloy containing 20 weight-percent plutonium and 70 weight-percent 5%-enriched LEU.

The use of plutonium in VTR fuel also raises the question of where the plutonium will come from. This is discussed below.

The solicitation contradicts not just the INL rebuttal but other recent public statements by DOE staff indicating that plutonium will not be used as fuel.

For instance, in testimony before the House of Representatives in February, Principal Deputy Assistant Secretary for Nuclear Energy, Edward McGinnis, stated that the VTR "would need HALEU for fuel development and reactor operation." (His testimony reads: Many advanced reactor concepts and the potential DOE versatile fast test reactor would need high-assay low-enriched uranium (LEU) for fuel development and reactor operation.) Subsequently, in response to a direct question on this point at the Nuclear Regulatory Commission's Regulatory Information Conference in mid-March, Craig Welling from the DOE's Office of Nuclear Energy (NE) stated that HALEU would be used, indicating that other options were off the table.

However, Welling's colleague at NE, John Herczeg, had previously indicated in a March presentation that the "baseline" fuel for the VTR would be a uranium-plutonium-zirconium alloy. This has been incorporated into the April 25 VTR solicitation.

The INL rebuttal also stated that "the fuel compositions under consideration do not include weapons-usable materials." This is incorrect. All plutonium isotopic mixtures, with the exception of nearly pure Pu-238, can be used to make nuclear weapons. Moreover, according to John Herczeg's March presentation, the DOE also evaluated a highly enriched uranium option—a weapon-usable fuel. (More on this is below.)

2. ***"Compared to conventional light-water reactors, fast reactors are less safe, more expensive, and more difficult to operate and repair. But the biggest problem with this technology is that it typically requires the use of such weapon-usable fuels as plutonium, increasing the risk of nuclear terrorism."***

a) Weapon-usability of plutonium fuel

INL objects to the statement that plutonium, a fuel typically used in fast reactors and (as we now know) a component of the intended fuel for the VTR, is nuclear weapon-usable.

Their main objection, however, is a straw man. INL states that the proposed fuel for the VTR, an alloy of plutonium, uranium, and zirconium, "CANNOT be used for weapons" (emphasis theirs). But nowhere does my blog post state that this mixture is directly weapon-usable. My fundamental—and indisputable—point is that the plutonium itself is a nuclear weapon-usable material, unlike the low-enriched uranium used to fuel conventional light-water reactors. Concern about the proliferation risks of plutonium and the closed fuel cycle led the U.S. to terminate its reprocessing and fast-neutron breeder reactor programs in the 1970s.

But what about the direct weapon-usability of the proposed fuel for the VTR? The fuel composition specified by INL in its April 25 solicitation would be 20 weight-percent, and it would be even higher for other potential candidate VTR designs, such as PRISM, which would have 26 weight-percent plutonium. The INL solicitation does not include further details about the reactor and fuel design, but information about PRISM is available. Each PRISM driver fuel assembly would contain 30 kilograms of plutonium, or enough for about five nuclear weapons. According to the DOE material control and accountability standard STD-1194-2011, a driver fuel assembly with these characteristics would be designated a Category I, Attractiveness Level C item with regard to nuclear-weapon use. According to the standard, Attractiveness Level C materials "generally require relatively little processing time or effort to obtain Level B material." And Attractiveness Level B material "can be used in its existing form" or can be used after simple mechanical processing "to produce a weapon/improvised nuclear device." (DOE guidance reduces the attractiveness level one grade—to D—for plutonium concentrations between 0.1 and 10 weight-percent.)

Thus, the material is clearly very attractive for potential nuclear proliferators or terrorists, and DOE standards require it to be protected as rigorously as an equivalent quantity of pure plutonium in the form of oxide. As to whether the fuel alloy may be used directly (without processing) in a low-efficiency but still devastating nuclear explosive, I note that a 2015 INL report on fueling options for a test or demonstration reactor states that "for plutonium, the concentration [required for weapons production] will be somewhat less [than 20%]." This contradicts the claim that mixtures with 20 weight-percent plutonium or greater "CANNOT" be used. (In fact, for mixtures of U-238 and Pu-239, the plutonium concentration requirement is about 12%.)

The INL rebuttal also says, misleadingly, that "it is true that plutonium is weapon usable within a certain isotopic vector" and "once that fuel is irradiated in the test reactor, some of the plutonium is destroyed and the isotopic plutonium vector becomes even less weapon usable." First, as INL experts surely know, reactor-grade plutonium is weapon usable. Therefore, irradiating weapons-grade plutonium would not render the plutonium significantly less weapon-usable by changing its isotopic content in the direction of reactor-grade plutonium. This statement is in direct contradiction to the DOE's own definitive statement confirming the weapon usability of reactor-grade plutonium. It is completely irresponsible for INL to be peddling such misinformation, which undermines efforts to strengthen security over plutonium and other weapon-usable fissile materials worldwide.

But even if changing plutonium isotopics away from weapons-grade was seen as a worthwhile objective, irradiation in a fast reactor is a poor option for doing that. According to the 2014 DOE weapon plutonium disposition working group report, it would take 27 months of irradiation of weapons-grade plutonium in a fast reactor simply to increase the Pu-240/Pu-239 ratio to above

0.1—the standard in the U.S.-Russia Plutonium Management and Disposition Agreement. And even then, the isotopic content is still far closer to weapons-grade plutonium than it is to reactor-grade plutonium, which has a Pu-240/Pu-239 ratio around 0.35.

b) Safety of fast reactors

INL disputes the statement that "fast reactors are less safe, more expensive, and more difficult to operate and repair" than conventional light-water reactors. There is a vast amount of literature supporting every aspect of this statement—far more than can be fairly summarized here. Suffice it to say that INL is vastly overselling the so-called "passive safety" features of fast reactors. In fact, unlike light-water reactors, most fast reactor designs have inherent prompt power instabilities, such as a positive coolant void coefficient, that render them passively unsafe. And with regard to the operational challenges of fast reactors, I was only paraphrasing Admiral Hyman Rickover's famous statement in 1956 on such reactors: they are "expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair." His assessment has been borne out by the poor performance of fast reactors worldwide.

Upon close reading, INL's rebuttal does not actually state that fast reactors are as safe or safer than light-water reactors. It says that "the inherent/passive safety features of fast reactors … have been studied extensively by the international community." But it doesn't say what those studies have concluded. The statement points to the recently completed IAEA Coordinated Research Project (CRP) that "specifically evaluated the safety characteristics of the EBR-II reactor." But the CRP's purpose was not to analyze the safety claims of the reactor but only to use the data collected from two safety tests to "benchmark," or validate, codes used to model fast reactors. The actual safety implications of those two tests, which were highly scripted and performed on a small uranium-fueled reactor with a negative sodium void coefficient and relatively low decay heat load, are of little relevance to the VTR or most commercial fast reactors.

And light-water reactors also have been designed with passive safety features, such as the AP1000 units now under construction in Georgia. The French nuclear safety research organization IRSN concluded in its 2014 review of Generation IV technologies that it "cannot issue an opinion on the possibility of SFRs [Sodium-cooled Fast-neutron Reactors] reaching a safety level significantly higher than that aimed [for] by the Generation III (e.g. light-water reactors) under construction."

3. ***"Based on what little public information there is available about the plans for this facility, it would be a fast reactor of at least 300 thermal megawatts (or about 120 MW of electricity if it is also used for power generation). This power level is the minimum necessary to achieve the desired rate of neutron production. This would make the reactor about five times larger than the last experimental fast reactor operated in the United States, the EBR-II, which shut down in 1994. One proposed design, called FASTER, would have a peak power density three times higher than the EBR-II, making it much more challenging to remove heat from the core."***

I address INL's comments on this statement in Section 1 above.

4. ***"It's also important to keep in mind that the estimated cost … does not include a facility to fabricate the plutonium fuel, which could add billions to the final price tag."***

INL has been vague about how it intends to fabricate fresh plutonium-based fuel for the VTR. The April 25 solicitation does not explicitly mention fuel fabrication as part of the new "fast neutron irradiation capability." (The document does not make clear whether prospective bidders would obtain the fuel from the DOE—and at what cost—or if they would need to fabricate it themselves.)

For fuel fabrication, INL states that "the considered option is to use the existing facilities (with modifications as necessary) at the DOE sites … for the size range that is being considered, it is believed that existing facilities may be adequate."

However, even if existing facilities could be used for VTR fuel fabrication, significant questions remain about the DOE's readiness for carrying out the task. A 2015 INL paper states that "fabrication of fast reactor metallic fuel was last accomplished at INL to fuel EBR-II and a partial fuel loading of FFTF" – that is, more than two decades ago – and that "fabrication capability for fast reactor fuels no longer exists in the United States."

The paper also points out that fabrication of plutonium fuels would be significantly more expensive than uranium fuels and would "necessarily be glovebox operations with a significant escalation of cost and schedule, as experienced with the construction of the MOX plant at Savannah River National Laboratory [sic]." (The MOX plant is at the Savannah River Site, but not at the Savannah River National Laboratory.)

Moreover, the 2015 INL paper points out additional problems with plutonium-based fuel and states that "for a test/demonstration fast reactor, plutonium-bearing fuels should be viewed as the startup-driver fuel options with a more arduous path to success." These include the need for an aqueous processing capability to remove gallium from plutonium feedstock from excess nuclear-warhead "pits" (the most likely source of the fuel) and the fact that "no plutonium-bearing metallic fuel has ever been used as driver fuel for a fast reactor." (This underscores my earlier point that the VTR itself is an experimental reactor.) The 2015 INL paper makes a strong argument for using only uranium-based fuels for the test reactor. It is therefore unclear why INL is pursuing plutonium fuel.

Although the INL rebuttal does not identify existing facilities that could be used to fabricate VTR fuel, previous studies have identified the Fuel Manufacturing Facility (FMF) at INL as the only option for plutonium. However, a 2008 INL report states that "if a reactor size greater than 250 MWth is selected, then … multiple facilities or a new large capacity fuel fabrication facility will be needed." Moreover, another study points out that "the previous equipment used for metallic fuel fabrication has been discarded" and that the FMF has a new mission and "may not be available," so that a new facility would need to be constructed in any case. Previous studies from 2007 estimated the construction cost of such a facility would be $116 million, or over $140 million in 2018 dollars.

How long would it take to build and startup a new facility? In 2008, INL assumed, optimistically, 3-5 years for construction and 2 years for startup activities. Given that it would likely take 2-3 years to fabricate the initial reactor core, the VTR would not likely be able to begin operation until about a decade after construction begins on a fuel fabrication facility, even if the reactor itself could be built more quickly. This calls into question the feasibility of the DOE's 2026 target for VTR availability.

Moreover, INL has not identified the source of the plutonium for the VTR fuel. John Herczeg's March 2018 presentation states that the annual plutonium requirement for the baseline fuel would be 330 kilograms of plutonium (with a typical reactor-grade isotopic composition) per year. Assuming the annual requirement is one-third of a core, the initial core and thirty years of operation would require 11 metric tons of reactor-grade plutonium. But the U.S. possesses virtually no separated reactor-grade plutonium. The U.S. has a significant stockpile (around 50 tons) of excess weapons-grade plutonium, but only 7.4 metric tons of separated non-weapons-grade plutonium (predominantly "fuel-grade" with a Pu-240 content of 12% or below). Most of the non-weapons-grade plutonium, however, is in the form of fabricated fuel for defunct reactors and would have to be chemically extracted before it could be used to make VTR fuel, at additional cost and risk.

Therefore, unless the U.S. is prepared to import reactor-grade plutonium from other countries, such as France or Japan, the VTR will have to use weapons-grade plutonium. But the DOE is currently obligated to dispose of 34 metric tons of excess weapons-grade plutonium as mixed-oxide (MOX) fuel in light-water reactors and has stated its intention to change that plan to directly dispose of that material in a geologic repository without using it as fuel. The DOE has 7.1 metric tons of excess weapons-grade plutonium that is currently unobligated, but it has not formally evaluated the option of using that material in a fast test reactor. Thus, the DOE would need to amend the current Environmental Impact Statement in accordance with the National Environmental Policy Act. Moreover, the DOE does not have sufficient capacity to convert weapon pits to a suitable feedstock for reactor fuel fabrication at the necessary rate. All of these uncertainties significantly increase the programmatic risk of the VTR project and could greatly increase cost.

If INL cannot provide a credible and concrete plan for addressing these and other fuel supply-related issues up front, then there is very good reason, based on the DOE's past performance with large nuclear projects, to be skeptical of the viability of the VTR. INL says that "DOE fully intends to include the estimated cost for fuel fabrication needs in the total project cost estimate," as well it should. But the point I made in my blog is that H.R. 4378, which passed the House of Representatives, authorizes a sum of money for the entire project without having at hand an accurate estimate of the total project cost, including fuel fabrication. INL says that until a reliable cost estimate is available, it is not prudent to comment on the project cost. Yet, as my blog points out, INL already has specified a project cost estimate of around $3.4 billion, which exceeds H.R. 4378's total authorization.

5. ***"…the DOE's Idaho National Laboratory has been unable to deal effectively with the spent fuel legacy of the defunct EBR-II…"***

Effective and credible plans for management and disposal of its spent fuel should be key components of the VTR project. Yet there is no indication that INL has given serious thought to these issues.

INL calls misleading my blog's observation that it has been "unable to deal effectively with the spent fuel legacy of the defunct EBR-II…" and states that "the work is progressing well based on the availability of annual funding." It is disappointing that INL still refuses to take responsibility for the failure of the sodium-bonded spent fuel pyroprocessing project, which I documented in detail in August 2017. More recent data reveals that, as of October 2017, after 21 years of operation, INL was only able to successfully pyroprocess 5.04 metric tons, or 19.5%, of the 26 metric tons of sodium-bonded metallic spent fast reactor fuel that the DOE authorized for treatment in 2000. The average throughput achieved is approximately a factor of ten smaller than the rate that the DOE projected in 2000, at an average cost of around $50,000 per kilogram of spent fuel. As a result of the low throughput, INL now projects that it will not be able to complete the processing until many years after the 2035 deadline specified by the Idaho Settlement Agreement.

Although my February blog post referenced our longer analysis, which is supported by many years' worth of internal INL documents that UCS obtained through a Freedom of Information Act (FOIA) request, INL apparently did not review it. We urge INL to review the material and provide a substantive response to explain its poor performance. As we explain in our analysis, the funding constraints are only one part of the story. And INL has never explained why the DOE never provided a level of funding to support operations at the level that was originally intended. One plausible explanation is that the DOE understands that throwing more money at a failed program will not solve its problems.

In addition to missing its throughput goal, the program has also failed to achieve its original objective of converting sodium-bonded spent fuel to stable, well-characterized waste forms for geologic disposal. According to the 2000 Final Environmental Impact Statement, the DOE decided to proceed with pyroprocessing the EBR-II and FFTF spent fuel to "reduce the uncertainties associated with qualifying sodium-bonded spent nuclear fuel for disposal." The process was intended to produce stable ceramic and metallic waste forms. In addition, a "spent fuel treatment product" primarily containing the leftover uranium would be produced for storage. However, today INL has apparently given up on the attempt to stabilize the electrorefiner salt waste in a ceramic and is planning to directly dispose of the salt waste—a heterogeneous and poorly characterized material—in the Waste Isolation Pilot Plant (WIPP). The metallic waste form was intended to stabilize both cladding hulls and noble metal fission products. However, today INL is reconsidering whether to stabilize the cladding hulls at all or to reclassify them from high-level waste to transuranic waste or even low-level waste. Finally, long-term storage of the residual uranium waste at INL, which is contaminated with fission products and plutonium, has become a significant liability. INL is now considering sending some of that material to the Savannah River Site for aqueous purification in the H-Canyon reprocessing plant. In other words, none of the waste streams generated by pyroprocessing has turned out to be simpler to manage and dispose of than the original sodium-bonded spent fuel. Pyroprocessing has made it harder, not easier, to deal with this nuclear waste.

6. ***"The primary purpose of the facility would be to assist private companies that want to develop and sell fast reactors, but most of those companies aren't sold on the idea. According to a report last year by the DOE's Nuclear Energy Advisory Committee, "some of the industry representatives (e.g., AREVA, GE-Hitachi, TerraPower, Westinghouse, and***

Terrestrial Energy) who have an interest in pursuing advanced reactors … [are] of the view … that a test facility was not essential for the commercial advancement of their technology."

INL claims that this quote was taken out of context and that the VTR is very important to fast reactor developers.

However, INL does not make a compelling case that there is sufficient demonstrated demand for a VTR to justify its multibillion-dollar cost and its security and safety risks. It points to the membership of the Nuclear Energy Institute (NEI) Fast Reactor Working Group as an indication that there is great demand for the VTR. However, it is not clear how many of these members have serious and credible plans for commercialization of fast reactors. Excluding utility members, there are only six reactor designers in the Working Group, of which one, Westinghouse, is bankrupt.

Also, INL points out that "some commercial companies are proceeding with developing the first prototype in parallel to the test reactor development." In a December 2016 letter to the DOE's Nuclear Energy Advisory Committee, the Fast Reactor Working Group states that "some developers are pursuing deployment schedules that would occur before a fast test reactor would be operational," but that "these designers agree that a fast test reactor would enable performance improvements for these technologies." If true, do these designers really need a government-owned test reactor that will not be available for a decade or longer? Surely it might be nice for them to have. But given other demands for scarce government R&D dollars, it hardly seems like a priority. And other alternatives exist. For example, why couldn't one of the prototype reactors, if actually deployed on the aggressive schedule that its developer predicts, be used as a test reactor to support other vendors?

Note that the DOE's 2017 Advanced Demonstration and Test Reactor Options study, to which INL was a contributor, estimated that a sodium fast test reactor would cost about $2.8 billion to construct, and would require approximately 15 years from start of conceptual design to full operation. Generously assuming that there has already been one year of preconceptual design, one would not expect the test reactor to begin operating before 2032. H.R. 4378's mandate that the reactor be operational by the end of 2025, or even the DOE's target date of 2026, therefore seem utterly unrealistic. The facility could be obsolete before it ever operated. And how many of the current fast reactor designer companies will even still be in existence at that time? It is hard to see the value of this speculative future facility to any serious private sector entity today.

Overall, INL seems to be confused about the main point of my blog post, which is a criticism of H.R. 4378's approach. Although we are skeptical that there is a need for the VTR, we support the DOE's completion of a user need assessment, as well as preliminary design and cost information to support a fair evaluation of the risks and benefits of the project. But H.R. 4378 does not do this. Instead, it directs the DOE to proceed with construction of the facility before completing an assessment of user need or even a detailed design and cost estimate. INL points out that the DOE has only "begun to undertake" pre-conceptual planning activities, a statement confirmed recently by Mr. Herczeg of the DOE, who said that a three-year R&D effort had begun only in April and that the DOE had not determined yet whether a VTR should be built. Also, we note that the DOE's FY 2019 budget justification requested only $15 million "for the early-stage R&D and related pre-conceptual design activities in the Versatile Advanced Test Reactor R&D subprogram … as a prerequisite for future decisions on test reactor infrastructure." (Congress, however, has already given the program $35 million in the FY 2018 omnibus spending bill.)

7. ***"Finally, what agency will oversee the safety and security of this risky project? The DOE. By designating this reactor as a neutron source, and building it at a DOE site, it will be exempt from licensing and oversight by the Nuclear Regulatory Commission. While NRC licensing is far from perfect, it would be far superior to DOE self-regulation."***

INL takes issue with this statement and says that "it would be perfectly adequate for DOE to license and operate this reactor under DOE's legislative authority" because the VTR is a test reactor (see 1a above). However, the issue raised here is not whether the DOE has the authority to regulate the VTR, but whether that authority should be delegated to the NRC. As pointed out before, despite its name, the VTR would be a relatively large, experimental reactor that could have a significant impact on public health, safety, security, and the environment. In the Advanced Demonstration and Test Reactor study, the DOE points out that "once any of the [test] reactors get larger than 10-20 MWth, NRC could be expected to apply the same level of technical review … as to a similarly sized power reactor, due to the potential public risk from the larger source term."

The DOE has not had experience in authorizing a new nuclear reactor facility in decades, and it is not clear that it even wants the licensing responsibility or has the necessary expertise to execute it. The Advanced Demonstration and Test Reactor study also points out that "advanced reactor attributes that are critical to the technology's safety basis will ultimately need to be reviewed by the NRC technical staff prior to the demonstration and commercial deployment of that technology. Deferring formal NRC review of those attributes under DOE authority causes the NRC's review to be deferred, perpetuating the underlying regulatory uncertainty related to the technology, thus doing nothing to mitigate the subsequent commercial license applicant's business risk due to regulation."

We agree. NRC licensing of the VTR or any other test or demonstration reactor at a DOE site would have clear benefits not only for public health and safety but also for the viability of the technology. In addition to serving as an independent check on the DOE's activities, NRC licensing is a more transparent process and has well-defined mechanisms for public input, including opportunities for public hearings. NRC licensing would provide greater public confidence in the safety and security of the VTR than DOE self-regulation.

INL's desire to build fast reactors has not diminished since the days of EBR-II, and the VTR is only the latest incarnation of that ambition. But INL has still not seriously addressed the fundamental safety, security, and cost issues associated with such a project.