Can NRC Reform Itself?

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This week, I had the privilege of introducing a webinar that Breakthrough hosted with Third Way entitled *Forging Near-term Pathways for Licensing Advanced Reactors* — about the current state of efforts to license advanced nuclear reactors at the Nuclear Regulatory Commission. Presently, there are four advanced reactors that have begun, or will shortly begin, licensing at the Nuclear Regulatory Commission. All are targeting initial commercialization before 2030. Two of them have been selected as part of the Department of Energy's Advanced Reactor Demonstration Program, through which the federal government will share in the costs of building the first commercial reactors.

The focus of the webinar was how prepared is the Nuclear Regulatory Commission to license any of these reactors, or at least, to license them in a manner that anyone would actually want to build on My opening questions to the panel were whether the NRC was on track to modernize licensing, as Congress last year directed? Was it reasonable to expect that the first advanced reactors will be licensed in time to bring the first commercial reactors online before 2030? And will licensing allow for a risk-informed process, as Congress has mandated, that allows developers to commercialize reactors that can compete economically?

The discussion that followed, featuring panels with advanced reactor developers and former NRC commissioners, was elucidating, as much for what was not said as what was. Two key issues stood out.

Irrational Exuberance?

The first issue was how sanguine many of the speakers were about the prospects for licensing advanced reactors. Some of this can be chalked up, at least in the case of the developers, to not wanting to aggravate the regulator they are petitioning to license their technology, or to signal to their investors that the fate of their investment might hang on the whims of a regulator that has, historically, proven less than flexible in response to efforts to innovate.

But I think there is a further factor as well: the optimistic, can-do engineering mindset that dominates the nuclear sector. I personally have now witnessed two cycles of that optimism crushed by the demands of the NRC's byzantine licensing procedures, first with efforts to license the Westinghouse AP1000 reactor, then with the current effort to license the NuScale small modular reactor. In both cases, the entire sector was optimistic that, this time, things would be different.

In neither case has that proven to be the case. It took Westinghouse four years just to get a design certification out of the commission and a further seven years to get a combined operating license allowing full-scale construction to move forward. Caught between an open-ended licensing process that ran over a decade and cost hundreds of millions of dollars and economic pressures from investors and customers to get steel in the ground in an expeditious fashion, Westinghouse receive a limited authorization to move forward with construction of modular components of the AP1000' containment structure. In the middle of that process, NRC issued a long-delayed post-9/11 rule imposing new design requirements, ostensibly to increase resilience to a plane crash. This require Westinghouse to redesign its containment structure, despite the commission explicitly acknowledging that doing so would result in substantial cost and delay, for a change that offered little real safety benefit for a reactor would already be sheathed in three feet of steel-reinforced concrete.

The problem was further exacerbated when Westinghouse's original design needed to be modified due to a design flaw. The design flaw was on Westinghouse, but the need to go back to the commission to review the entire design and license in order to fix the problem was the result of an overly prescriptive licensing framework that is fundamentally broken.

Almost fifteen years after Westinghouse submitted its design, NuScale submitted its design for review and licensing by the NRC in 2016. Five years later, NuScale has still not received a design certification. Even once the design is certified, the company will still need to wait for a combined operating permit before it can begin site preparation, manufacturing, or construction. This for a light water design that, in its basic physics, is no different than reactor designs that NRC has regulated for decades. In a sane regulatory environment, the NuScale reactor's much smaller size and simpler design would make it much easier to license. But instead, the company has been forced to apply for dozens of waivers to existing regulations in order to move forward with appropriate safety measures given its actual physical and design characteristics. For each specific waiver, the company is forced to undertake extensive analysis of the entire reactor performance or provide extensive justification as to why it shouldn't have to do such an analysis.

In the case of both Westinghouse and NuScale, there have been any number of decisions by the companies that can be second-guessed. But it is also worth considering that those decisions were made in the face of a byzantine regulatory framework that completely thwarts innovation. Indeed, if one is going to second guess, the place to start would be the folly of even trying to commercialize new light water reactor designs given the current licensing regime.

If the two Westinghouse AP1000 reactors under construction in Georgia come online in the next couple of years, they will be the first reactors licensed by NRC since its inception in 1975 to actually go into operation, 20 years after Westinghouse initiated licensing and 9 years after it began construction. Perhaps, the advanced reactor experience will prove different, and I hope the optimism expressed by various licensees and former commissioners on our panels proves correct. But I find this recent history with new reactor designs and what I have witnessed thus far relating to the early efforts to license advanced reactors over the last year difficult to square with the optimist takes I heard from many earlier this week.

What does safe mean?

The second and related issue regards the question of safety. The Nuclear Regulatory Commission's mandate, as several panelists emphasized, is safety above all else, including the economic viability of nuclear energy. This mandate differs from virtually all other environmental and public safety regulations, where incremental improvements to public health are balanced against the social and economic benefits that a technology or activity produces and the incremental cost of additional protections.

Functionally, the NRC's interpretation of that mandate has been to attempt to get risk associated with the production of electricity with nuclear energy as close to zero as possible, cost be damned. And perhaps, back in 1975, that made some sense. The risks of exposure to low-level radiation were much more poorly understood. The potential for large radiation releases associated with nuclear accidents were believed to be much greater. The social and economic costs of conventional air pollutants had hardly been assessed or quantified. And the issue of climate change was almost entirely unknown.

But none of those understandings remain today. A large body of research suggests that risks associated with low-level radiation exposures are so low as to be unmeasurable epidemiologically compared with background mortality rates across large populations. Over sixty years of operating over five hundred large reactors, there has been one accident, Chernobyl, resulting in large-scale exposure to radioactive material and the public health consequences of that exposure have turned out to be far less significant than almost everyone at the time had feared. Meanwhile, we know that conventional air pollutants kill hundreds of thousands annually in the United States alone and the range of consequences associated with continuing planetary warming threaten far worse public health impacts.

So how, given these well-established public health realities, should the NRC interpret this mandate when the risks of *not* licensing and operating advanced nuclear reactors are far greater than the risks of building and operating those reactors? The imposition of significant economic costs to avoid minimal additional public health risk will be, on balance, risk augmenting, as doing so reduces the economic viability of reactors and assures continuing operation of fossil-based energy technologies that are responsible for not only far greater public health risk but far greater and well documented public health consequences.

Several panelists suggested that it was long past time that the NRC internalized these public health externalities into its interpretation of its public safety mandate but clearly, those externalities have not been internalized yet. The commission and staff continue to prioritize an extremely narrow interpretation of the commission's public health mandate, to the detriment not only of current license applicants but society as a whole.

What is clear with regard to both of these questions is that business as usual at the NRC will not serve nuclear innovation, public health, or the climate. What remains to be seen is whether the commission and staff are prepared to modernize nuclear licensing, as Congress has directed, in order to do so.