

LICENSING NEW NUCLEAR REACTORS

The NRC's Office of New Reactors (NRO) is responsible for the licensing of all new nuclear reactors in the U.S. The scope of technologies addressed by NRO includes large light water reactors (LWRs), high-temperature gas reactors, integral pressurized water reactors, fast reactors, and other innovative technologies being put forward today. To provide a focused project management function for technologies beyond large LWRs, the Advanced Reactor Program was created within the Office in January 2009. The technical reviews are conducted using a matrix structure, and drawing on the technical expertise within the Office. To the degree the reviews need skills beyond those needed for LWR reviews, additional expertise is recruited to the staff or the staff expertise is supplemented by contractors from the DOE National Laboratories or commercial contractors.

The regulations pertinent to licensing commercial nuclear power reactors in the U.S. are contained in Title 10 of the Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities," and Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Part 52 provides the licensing process requirements that were promulgated by the Commission to address some of the difficulties encountered with the so-called two-step licensing process embodied in Part 50 and used in licensing the currently operating plants in the U.S. While Part 52 provides a one-step licensing process, the technical requirements are provided in Part 50. The regulations addressing environmental reviews are contained in 10 CFR Part 51 "Environmental, Protection Regulations for Domestic Licensing and Related Regulatory Functions," and the regulations addressing plant security are provided in 10 CFR Part 73, "Physical Protection of Plants and Materials."

The technical requirements provided in Part 50, and the associated Standard Review Plan and Regulatory Guides, are based on light-water reactor technology. They are deterministic in nature, and taken as a whole, provide a comprehensive approach to assuring the safety of a nuclear power plant. Over the last several years, the Commission has been making increasing use of probabilistic risk assessments in informing decisions on plant safety, and risk-informed decisions are now a routine part of NRC's regulatory approach. However, the underlying regulations are deterministic in nature and based on LWR technology. The NRC staff is evaluating the need for changes in the review guidance to support reviews of non-LWR technology, specifically high-temperature gas cooled reactors.

As new technologies have been discussed with the NRC, there have been efforts to develop so-called technology neutral regulatory approaches. The most visible of these efforts were described in NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing," published in December 2007. Subsequently, in developing a licensing strategy for the Next Generation Nuclear Plant (NGNP), mandated by the Energy Policy Act of 2005, the NRC and DOE chose a deterministic but risk-informed strategy that is making use of risk-insights and analyses to inform the more traditional deterministic regulatory structure. The Commission has directed the staff to "test" the technology neutral framework from NUREG-1860 in parallel with the licensing strategy for the

NGNP, and to report back to the Commission on the findings. More recently, the Commission has directed the staff to explore the possibility of making risk-informed changes to review guidance. That activity is in the early planning stages.

While there is clear interest in making better use of risk analysis and risk insights in the regulatory process, and in making changes in the regulatory infrastructure to accommodate technologies beyond light-water reactors, it is important to note that the basic regulatory and technical structure in Part 50 and Part 52 can be applied to other technologies. For example, gas-cooled reactors were licensed in the past (Peach Bottom 1 and Fort St. Vrain) and, more recently, the staff reviewed and prepared a safety evaluation of a sodium fast reactor (PRISM).

As noted above, a range of different technologies are being discussed with the NRC staff. The Commission has directed the staff to use a structured approach in preparing for reviewing these various designs. Specifically, the staff is to develop the review guidance and plans to review a high-temperature gas cooled reactor design in accordance with the Energy Policy Act of 2005. Secondly, the staff is to prepare for reviewing integral pressurized water reactor designs. And, finally, the staff is to maintain awareness of other designs and technologies but not to invest appreciable resources in developing review guidance or assessment tools until those technologies and designs are further developed by the industry. This structured approach is consistent with the timelines for the various technologies discussed by Department of Energy representatives.

In summary, the NRC staff is working to develop appropriate review guidance and regulatory infrastructure to support a timely and thorough review of the NGNP design and integral PWR designs. Risk-insights, coupled with a deterministic regulatory structure, will be used in conducting the reviews. Further uses of risk analysis and insights, specifically a technology-neutral licensing framework, will be explored but are not a compelling consideration given the technologies that are expected to be submitted for review in the next few years. Finally, while not optimized for non-LWR technologies, the existing regulatory framework can, and has, been successfully adapted to other technologies, and provides a sound structure for dealing with evolving technologies until other approaches can be developed.