AMERICAN BAR ASSOCIATION

December 2009
Special Committee on Nuclear Power
ABA Section of Environment, Energy, and Resources

SMALL MODULAR REACTORS

Charles F. Rysavy, Stephen K. Rhyne, and Roger P. Shaw
K&L Gates LLP

Most of the new generation nuclear plants envisioned by the "nuclear renaissance" are large-scale reactors employing advanced safety features and enhanced reliability. Another sector of the industry, however, is turning away from "bigger is better" toward "smaller is better" reactors, often referred to as small modular reactors (SMRs).

The concept of small modular nuclear reactors is not new, but interest in SMRs exploded in 2009. In October 2009, the Nuclear Regulatory Commission (NRC) hosted a two-day workshop with stakeholders to discuss the generic issues associated with the licensing of SMRs. Public Meetings for Advanced Reactors, http://www.nrc.gov/reactors/advanced/public-meetings.html (last visited Dec. 9, 2009) [hereinafter NRC Public Meeting]. The NRC noted that it will hold additional workshops beginning in early 2010 and will coordinate the formation of an industry group to assist in developing regulations for the licensing of SMRs. Richard Black, Office of Nuclear Energy, U.S. Department of Energy (DOE), emphasized at the conference that the DOE is prepared to devote substantial attention to bolstering the development of such reactors, including cost-sharing of research and development and NRC licensing fees. He also announced that the DOE will hold a workshop in 2010 on funding opportunities for SMRs.

According to the International Atomic Energy Agency (IAEA), SMRs could find a market in some 30-40 countries. One U.S.-based company has stated publicly that there is serious interest in more than 100 units of its small modular reactor (Stevie Smith, *Hyperion hopes mini nuclear reactors will power the world*, Nov. 11, 2008, http://www.thetechherald.com/article.php/200846/2429/Hyperion-hopes-mini-nuclear-reactors-will-power-the-world). Even Congress has demonstrated significant interest in SMRs, as evidenced by three recent Senate bills to amend the Energy Policy Act of 2005: Senate Bill 2052, the Nuclear Energy Research Initiative Improvement Act of 2009, S. 2052, 111th Cong. (2009), would provide funding for research on SMRs; The Nuclear Power 2021 Act S. 2812, 111th Cong. (2009), would establish a program to achieve the goal of designing and certifying two SMR designs by 2018, to be operational by 2021; and Senate Bill 2776, The Clean Energy Act of 2009, S. 2776, 111th Cong. (2009), would mandate a number of nuclear energy policy initiatives, including funding to support license reviews for SMR designs.

SMRs have a number of characteristics that illustrate the unique role that they can play in our energy mix: (1) SMRs are relatively small in power output, on the order of 25 Megawatts electrical (MWe) to 350 MWe, versus large-scale reactors that can have a power output of more

than 1,200 MWe; and (2) several SMR designs are modular. These two characteristics demonstrate the differences between SMRs and traditional large-scale reactors. Unlike traditional reactors, many SMRs would be manufactured and assembled at the factory and shipped to the site as nearly complete units, resulting in much lower capital costs and much shorter construction schedules. SMRs also permit greater flexibility through smaller, incremental additions to baseload electrical generation, and more SMRs can be added and linked together for additional electrical output as needed. SMRs are ideal power sources for discrete locations that require an uninterruptible source of power independent of the electrical grid. These may include remote locations unconnected to the grid or key military installations. The recently passed National Defense Authorization Act, Pub L. No. 111-84,§ 2845 (2009) requires that a study be conducted on the feasibility of building new reactors at military sites, in part because of the "potential energy security advantages" of not being dependant on the grid in times of war or natural disaster. The unique design of SMRs may also provide enhanced safety and reliability and more effective proliferation safeguards. Finally, SMRs can serve as distributed sources of power and as cogeneration sources.

Most SMRs are not merely scaled down versions of large-scale reactors, but rather new in design, siting, construction, operation and decommissioning. Appropriately, the legal and regulatory issues these units will generate will not merely be scaled down versions of the issues faced by their much larger brethren. The NRC's new reactor licensing regulations in 10 C.F.R. Part 52 are designed to provide a more streamlined process for new generation large-scale reactors. Some facets of this new process will be equally advantageous to SMRs, while others will range from awkward to nearly unworkable when applied to the licensing, construction, and operation of SMRs. Creative navigation of the existing regulations by both the NRC and licensees will solve some problems, but others can be solved only by amending the regulations.

For example, the NRC's annual fee to operate each licensed nuclear reactor is $4.5M under 10 C.F.R. Part 171, which would likely pose problems for the operation of many SMRs. In March 2009, the NRC published an advanced notice of proposed rulemaking that contemplates a variable fee structure based on thermal limits for each power reactor. 74 Fed. Reg. 12,735 (March 25, 2009). This or a similar change will be necessary to make SMRs financially viable. Likewise, the size of the decommissioning fund, insurance, and other liability issues could make SMRs uneconomical if not tailored to the smaller units. Moreover, the form of the combined operating and construction license (COL) must take into consideration that certain sites are likely to start out with a single SMR but later add multiple small reactors as needs evolve. Flexibility is one of the SMR's primary benefits, and the governing regulatory structure most allow (and preferably embrace) that flexibility, while simultaneously ensuring the safety of these reactors. Another issue to consider is that the current Emergency Planning Programs require a 10-mile Emergency Planning Zone (EPZ) for all reactors, based on the size of existing large-scale reactors. Emergency Plans, 10 C.F.R. § 50.47 (2009). This requirement is almost certainly unjustifiable for a SMR. These smaller reactors are much less powerful, and in many cases the actual containment/reactor system will be placed underground.

Another aspect of SMRs that will require new, or substantially revised, regulations is the likely combination of SMR power generation capabilities with process heat applications in cogeneration facilities (NRC Public Meeting, Meeting Slides–NRC). Such facilities could

include the production of steam for desalination, hydrogen production, chemical production, and petroleum refining. Regulations will need proper consideration to ensure that potential accidents at the facility using the steam cannot adversely affect the safe operation of the SMR.
Other characteristics of the proposed SMRs will create unique legal and regulatory challenges, including: import/export requirements for technology, materials and equipment; design certification; operating license restrictions; accident consequence analysis; maintenance programs; environmental programs; safeguards and security; non-proliferation; foreign country regulations; foreign ownership; IAEA standards; Price Anderson Act; insurance and liability; financial qualifications; decommissioning funding; license duration; inspection programs; and staffing, especially for passive operation plants.

Regulatory resources present one of the greatest challenges to a robust SMR program in the U.S. The NRC Office of New Reactors, which is already working on the licensing of a number of large-scale reactors, is already over-burdened and will need to make resource adjustments to handle SMR applications. See, NRC Public Meeting, Meeting Slides–NRC (discussing the resource priorities of the Office of New Reactors). The NRC has already begun pre-application discussions with a number of SMR companies, but it is likely that SMRs will take a back seat to large-scale plants for the time being. *Id.* The Department of Energy has a unique and possibly essential role in overcoming this challenge. Encouragingly, DOE has stated that it intends to support the industry's efforts to bring SMRs to domestic markets (NRC Public Meeting, Meeting Slides–DOE). Included among DOE's proposed programs is a cost-share partnership for first-of-a-kind SMR design and licensing that may be initiated as early as 2011 (NRC Public Meeting, Meeting Slides–DOE). DOE also intends to work with NRC and the industry to evaluate unique licensing issues for SMRs, and to work on enhancing the regulatory framework and licensing process with the NRC (NRC Public Meeting, Meeting Slides–DOE).

Charles F. Rysavy *is a partner with the law firm of K&L Gates LLP, has practiced law for more than 20 years, and has over 15 years of legal experience with the nuclear industry.* **Stephen K. Rhyne** *is a partner with the law firm of K&L Gates LLP, has practiced law for more than 30 years, and has been involved with the nuclear industry for over 5 years.* **Roger P. Shaw** *is a scientist with the law firm of K&L Gates LLP, has over 30 years of experience with the nuclear industry, and is the former Director of Radiation Protection for the Three Mile Island and Oyster Creek Nuclear Plants.*

© 2009. American Bar Association. All rights reserved. The views expressed herein have not been approved by the ABA House of Delegates or the Board of Governors and, accordingly should not be construed as representing the policy of the ABA.

This is a product of the ABA Section of Environment, Energy, and Resources. All persons interested in joining the Section or one of its committees should contact the Section of Environment, Energy, and Resources, American Bar Association, 321 N. Clark St., Chicago, IL 60654, www.abanet.org/environ/