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Item Type	Article
Authors	Smith, Tyson
Publisher	UC Berkeley School of Law
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Download date	2026-11-16 16:54:33
Link to Item	http://hdl.handle.net/20.500.12424/175860

Licensing the Rebirth of Nuclear Power: A Primer

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INTRODUCTION

In 2007, the nuclear industry took the first steps toward a second generation of nuclear construction in the United States. Starting with a partial application in July 2007 for a new unit in Maryland, and followed by complete applications for multiple new units in Alabama, Virginia, Texas, and South Carolina in late 2007, new reactor licensing is now underway.[1] These applications are the first received by the U.S. Nuclear Regulatory Commission ("NRC") in nearly 30 years.[2]

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1. *See* U.S. Nuclear Regulatory Comm'n, Combined License Applications and Subsequent Documentation, http://www.nrc.gov/reactors/new-licensing/col.html (last visited Mar. 30, 2008).

2. Dale E. Klein, Chairman, U.S. Nuclear Regulatory Comm'n, Prepared Remarks at the Distinguished Lecturer Series, Department of Mechanical Engineering, The Ohio State University (January 26, 2007), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/speeches/2007/s-07-002.html.

In some ways it may be helpful to discard older methodologies, which contributed to lengthy delays in licensing and construction that plagued the first generation of new plants. But in other ways, that experience and institutional knowledge may yet prove invaluable. The mistakes of the past began with the licensing process, which was cumbersome and unwieldy. Once again, new reactor licensing will set the tone for new nuclear, and success depends on a stable and predictable regulatory process. In light of the significant changes in the framework for licensing nuclear reactors, some background on the structure and roles of participants in the licensing process is critical to understanding the complex regulatory and adjudicatory functions of the NRC.

I. STRUCTURE OF NRC

The NRC is a federal government agency established by the Energy Reorganization Act ("ERA") of 1974.[3] The NRC took over the role of oversight of nuclear regulatory matters from the Atomic Energy Commission ("AEC").[4] Under the Atomic Energy Act of 1954 ("AEA") and the ERA, the NRC regulates source material (*e.g.*, uranium), byproduct material, and special nuclear material (*e.g.*, enriched uranium used as reactor fuel).[5] Like its predecessor, the NRC oversees reactor safety and licensing, material safety and licensing, and waste management through storage and disposal. The other responsibilities of the AEC, including oversight of nuclear weapons and the promotion of nuclear power, were transferred to the Department of Energy ("DOE").[6]

The NRC is headed by five Commissioners appointed by the President and confirmed by the United States Senate for five-year terms. The Commissioners formulate policies and regulations governing reactor safety, issue orders to licensees, and adjudicate legal matters brought before them. One Commissioner is designated by the President to be the Chairman.

The Executive Director of Operations ("EDO") is the chief operating officer responsible for discharging the operational and administrative functions necessary for the day-to-day operations of the NRC. The EDO oversees the NRC staff, which is located at NRC Headquarters in Rockville, Maryland and the agency's four regional offices. These regional offices oversee the operation of 104 power

3. Energy Reorganization Act of 1974, 42 U.S.C. § 5841 (2000).

4. 42 U.S.C. § 5841(f).

5. *See id.*; Atomic Energy Act of 1954, 42 U.S.C. §§ 2011- 2297g-4 (2000).

6. *See* Energy Reorganization Act, §§ 5811, 5814 (establishing the Energy Research and Development Administration (ERDA) and assigning particular functions of the AEC to the newly established ERDA); Department of Energy Organization Act of 1977, 42 U.S.C. § 7131, 7151 (2000) (establishing the Department of Energy and transferring all functions of the ERDA to the Department of Energy).

reactors.[7] The four regional offices conduct inspection, enforcement, and emergency response programs for licensees within their areas of responsibility.

As set forth in the AEA, individuals or entities that are directly affected by any licensing action involving a facility that produces or uses nuclear materials may participate in a hearing. Administrative law judges from the Atomic Safety and Licensing Board ("ASLB") conduct these hearings as individual judges or, more typically, in three-judge panels. The judges are employees of the NRC, but are independent from the NRC Staff, and they have no stake in the outcome of a proceeding. The Commission entertains appeals and petitions for review of the decisions of the ASLB.

II. LICENSING BASICS

A. Previous Licensing Framework

The current generation of nuclear power plants was constructed under a two-step licensing process. First, an applicant sought a "construction permit" from the NRC. The NRC would review the proposed design and assess its impacts on the environment at the proposed site. If the NRC determined that there was reasonable assurance that the plant could be constructed and operated safely, it would issue the construction permit. Once the applicant had completed (or substantially completed) construction, the NRC performed a second "operating license" review focused on whether the plant had been constructed in accordance with the construction permit. At both stages of the project, the public was permitted to raise issues—that is, intervene in the administrative licensing proceedings—and adjudicate various issues.

The two-step process proved unwieldy. Anti-nuclear groups generally viewed the construction permit and actual construction as creating regulatory momentum that made the operating license a *fait accompli*. Industry generally viewed the process as overly burdensome. In addition to making design changes during construction difficult—even those intended to improve the safety of the plant—the separate operating license review and hearing created the potential for significant delays. These delays meant that a plant could be ready for operation, but would instead sit idle pending completion of the licensing process. This delay led to spiraling interest payments with no ability to recover costs until the plant came on line.

7. U.S. Nuclear Regulatory Comm'n, Find Operating Nuclear Power Reactors by Location or Name, http://www.nrc.gov/info-finder/reactor/ (last visited Mar. 30, 2008).

Among the twenty-five most recently licensed plants, the length of time between filing the application for a construction permit and the issuance of the operating license ranged from 11.5 to 24.7 years.[8] Initial applications for those plants were filed in the early 1970s, yet operating licenses were not issued until the late 1980s or early 1990s. These licensing delays contributed to incredible construction costs. Comanche Peak Units 1 and 2 cost about $11 billion to complete,[9] and Vogtle Units 1 and 2 cost nearly $9 billion.[10] Seabrook Unit 1 alone cost $6.5 billion[11] and Watts Bar Unit 1 cost $6.8 billion.[12] The cancellation of the Shoreham nuclear power plant, which had been completed but never operated after spending $5.5 billion, epitomizes the regulatory gridlock of the era.[13]

B. Current Licensing Framework

After the breakdowns of the two-step licensing process, and in an effort to improve regulatory efficiency and bring greater predictability to the process, the NRC in 1989 created the alternative licensing processes of 10 C.F.R. Part 52. Specifically, the NRC developed several new types of approvals: standard design certifications, early site permits ("ESPs"), and combined licenses ("COLs").[14]

Using the design certification processes, the NRC can certify a reactor *design* through rulemaking. The NRC review of a design assesses the safety of an essentially complete nuclear power plant design, independent of a specific site. A standard design certification contains inspections, tests, analyses, and acceptance criteria. Acceptance criteria are used to verify that a plant is constructed according to the design. The design certification confirms that a reactor design is safe for sites that fall within certain parameters.

The NRC can issue an ESP for a *site* separate from an application for a COL. ESPs are valid for 10 to 20 years and can be renewed for an

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8. Letter from Nils Diaz, Chairman, NRC, to Joe Barton, U.S. Representative (Feb. 20, 2006), *available at* http://www.nrc.gov/reading-rm/doc-collections/congress-docs/correspondence/2006/barton-02-20-2006.pdf.

9. Zack Smith, *Another Shot for Nuclear*, FT. WORTH STAR-TELEGRAM, Dec. 28, 2007, at B13.

10. Jon Gertner, *Atomic Balm?*, NY TIMES, July 16, 2006, § 6 (Magazine), at 36.

11. Matthew L. Wald, *N.R.C. Panel Supports A License for Seabrook*, NY TIMES, Nov. 14, 1989, at D2.

12. U.S. GEN. ACCOUNTING OFFICE, TENNESSEE VALLEY AUTHORITY: FINANCIAL PROBLEMS RAISE QUESTIONS ABOUT LONG-TERM VIABILITY 5 (August 1995), *available at* http://www.gao.gov/archive/1995/ai95134.pdf.

13. CHARLES KOMANOFF & CORA ROELOFS, KOMANOFF ENERGY ASSOCIATES, HISTORICAL COST OF NUCLEAR POWER IN THE UNITED STATES 23 (1992), *available at* http://www.earthtrack.net/earthtrack/library/FiscalFission.pdf.

14. *See* 10 C.F.R. Part 52, Subpart A (Early Site Permits), Subpart B (Standard Design Certifications) and Subpart C (Combined Licenses) (2007).

additional 10 to 20 years. The NRC review of an ESP application addresses site safety issues, environmental protection issues, and plans for coping with emergencies, independent of a specific nuclear plant design. In short, the ESP confirms that a site is suitable for a reactor whose characteristics fall within certain parameters.

Finally, a COL authorizes construction and operation of the facility in a single step, in contrast to the two-step construction permit and operating license. An application for a COL can incorporate by reference a design certification and/or an ESP. The advantage of this approach is that the issues resolved during the design certification rulemaking and the ESP reviews are not reconsidered at the COL stage. If an ESP or certified design is not referenced in the COL, then the NRC also reviews the technical and/or environmental information associated with the design and site. Most of the recent applications for new reactors have involved COL applications that reference a certified design, but not an ESP.

III. NEW REACTOR LICENSING REVIEWS

A. Safety and Environmental Reviews

All reactor applications undergo a safety review and an environmental review. A COL applicant submits a Safety Analysis Report, which contains the design information and criteria for the proposed reactor and comprehensive data on the proposed site. The application must also contain an assessment of the environmental impact of the proposed unit.

When an application to construct a nuclear plant is received, the NRC Staff determines whether it contains sufficient information to assess compliance with NRC requirements. If the application is accepted, the NRC begins its technical review and initiates the National Environmental Policy Act ("NEPA") process. The NRC also publishes a notice of an opportunity to request a hearing in the *Federal Register*.

The NRC staff reviews the application to determine whether the proposed unit meets all applicable regulations, including those involving site characteristics, nearby population, seismology, meteorology, geology and hydrology; design of the reactor; anticipated response to hypothetical accidents; plant operations; discharges into the environment; and emergency plans.

When the NRC completes its review, it prepares a Safety Evaluation Report summarizing the anticipated effect of the proposed facility on public health and safety. The NRC also issues a Draft Environmental Impact Statement ("DEIS") for comment by the appropriate federal, state, and local agencies as well as by the public. Afterwards, the agency

issues a Final Environmental Impact Statement ("FEIS") that addresses all comments received.

B. Limited Work Authorizations

The NRC may authorize an applicant to perform certain activities, at the applicant's risk, prior to the issuance of a COL. This authorization is known as a Limited Work Authorization ("LWA"). An LWA may be granted only after the presiding officer (one or more members of the ASLB) has made required NEPA findings and has determined that there is reasonable assurance that the proposed site is a suitable location, from a radiological health and safety standpoint, for a reactor of the general size and type proposed.

Recent changes to the NRC's regulations governing LWAs permit a greater range of activities prior to issuance of an LWA or COL.[15] The new rules allow the nuclear industry to take better advantage of modern construction management practices by permitting certain activities that have no nexus to radiological health and safety without prior NRC approval. "Preconstruction" activities include site preparation work, excavation, erection of support buildings (such as warehouse and shop facilities, utilities, concrete mixing plants, unloading facilities, and office buildings) and building of service facilities, including paved roads, railroad spurs, and transmission lines. These regulatory enhancements may produce construction schedule savings of 18 months or more.[16]

IV. NEW REACTOR HEARINGS

The AEA permits "any person whose interest may be affected by the proceeding" to raise issues relating to a license application for an ESP or COL.[17] Following publication of the notice of an opportunity to request a hearing, interested persons may submit proposed "contentions" alleging deficiencies in the application. The contentions may involve questions relating to reactor safety or to environmental issues (*e.g.*, NEPA compliance). The Commission refers these contentions to the ASLB, which decides whether the intervenors have standing and have demonstrated at least one admissible contention. Admissibility turns on whether the contention is specific, adequately supported, and material to the licensing proceeding. If so, a hearing is held.

The NRC's rules of practice in 10 C.F.R. Part 2 specify different types of hearings for different agency actions.[18] For some cases, particularly enforcement actions, the NRC employs a formal, trial-type

15. Limited Work Authorizations for Nuclear Power Plants, 72 Fed. Reg. 57416 (Oct. 9, 2007) (to be codified at 10 C.F.R. pts. 2, 50, 51, 52, and 100).

16. *Id.* at 57417, 57426.

17. Atomic Energy Act of 1954, 42 U.S.C. § 2239 (2000).

18. *See generally* 10 C.F.R. pt. 2 (2007).

process (a.k.a. a "Subpart G" hearing) similar to non-jury federal courts, including pretrial discovery and questioning of witnesses at an evidentiary hearing.[19] For most applications, including initial applications for reactors, the NRC follows a more informal hearing process (a.k.a. a "Subpart L" hearing).[20]

In Subpart L proceedings, the NRC Staff compiles a hearing file consisting of the license application and any amendments; any NRC safety, environmental, or other reports relating to the application; and any relevant correspondence between the NRC and the applicant.[21] The Staff has a continuing duty to keep the hearing file up-to-date.[22] The applicant and the intervenor both have an obligation to make periodic "mandatory disclosures" of documents relevant to the admitted contentions.[23] Beyond the hearing file and mandatory disclosures, however, discovery is prohibited.[24]

Subpart L contemplates that written presentations and (if necessary) follow-up questions posed by the presiding officer, rather than an oral hearing, will be the vehicle by which the parties are heard and the issues resolved. If the presiding officer finds the presentations inadequate to resolve the issues raised, the presiding officer has discretion to allow or require oral presentations. Decisions of licensing boards can be appealed to the Commission, and Commission decisions can be appealed directly to the U.S. Courts of Appeals.

In addition to hearings on issues raised by intervenors (*i.e.*, "contested" hearings), the AEA requires that a public hearing be held before a COL is issued. At this mandatory or "uncontested" hearing, the licensing board or the Commission reviews the adequacy or sufficiency of the NRC staff's review of the application.

After issuing a COL, the Commission authorizes operation of the facility only after verifying that the licensee completed required inspections, tests, and analyses and that acceptance criteria were met. At periodic intervals during construction, the NRC publishes notices of these completions in the *Federal Register*. Then, not less than 180 days before the date scheduled for initial loading of fuel, the NRC will publish a notice of intended operation in the *Federal Register*. There is another opportunity for a hearing at this time, but only if the petitioner demonstrates that the licensee has not met or will not meet the acceptance criteria. Before a plant can operate, the Commission must determine that the acceptance criteria have been met.

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19. 10 C.F.R. §§ 2.700-2.713.
20. *See* 10 C.F.R. §§ 2.1201-2.1213.
21. 10 C.F.R. § 2.1203.
22. *Id.*
23. *Id.*; § 2.336.
24. § 2.1203.

V. KEYS TO SUCCESSFUL LICENSING

Despite the new licensing process, several obstacles to efficient licensing remain. However, based on the licensing reviews for the three ESPs issued to date, there is some cause for optimism. The NRC completed the reviews in approximately the time expected.[25] (There were some delays associated with processing an unexpectedly large number of comments at the DEIS stage.) In contested hearings, the presiding officers maintained schedule discipline, and in the mandatory hearing, the presiding officers all concluded that the NRC Staff conducted adequate reviews of the applications.[26]

Yet, the COL is a different regulatory creature from the original permitting process. Obtaining a COL is expected to cost nearly $25 million.[27] Placing orders for and purchasing long-lead items (*e.g.*, reactor vessels) raises the actual cost commitment significantly. Ultimately, a new reactor will cost billions of dollars. For these reasons, stability and predictability are key to successful development of new nuclear. While it is, of course, incumbent on applicants to provide complete and high-quality applications, several issues threaten to undermine the predictability and stability of the licensing process in the coming years, particularly given the number of anticipated new reactor applications.

The largest perceived risk with new nuclear plant construction is regulatory uncertainty. The NRC still has not yet resolved issues surrounding the regulatory treatment of potential terrorist attacks. Despite having certified several designs and accepted COL applications, the NRC is considering imposing new requirements for designers of plants to address aircraft impacts.[28] Introducing new requirements at this late date creates considerable uncertainty. Separately, the Ninth Circuit has ruled that the NRC's "categorical refusal to consider the environmental effects of terrorist attack" was unreasonable under NEPA.[29] Although the NRC is applying this decision only in the Ninth Circuit, similar challenges are pending in other courts. Fundamentally,

25. LUIS A. REYES, EXECUTIVE DIRECTOR FOR OPERATIONS, U.S. NUCLEAR REGULATORY COMM'N, SECY-06-0019, 2006 SEMIANNUAL UPDATE OF THE STATUS OF NEW REACTOR LICENSING ACTIVITIES AND FUTURE PLANNING FOR NEW REACTORS, ENCLOSURE 1 (Jan. 31, 2006), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2006/secy2006-0019/enclosure1.pdf.

26. A summary of the licensing and adjudicatory proceedings for the first three ESPs is available at U.S. Nuclear Regulatory Comm'n, Early Site Permits – Licensing Reviews, http://www.nrc.gov/reactors/new-licensing/esp.html (last visited Mar. 30, 2008).

27. *See, e.g.*, Craig Nesbit, *Exelon Nuclear Designates Victoria County, Texas, Site for Combined Construction & Operating License Application*, REUTERS, Dec. 18, 2007, *available at* http://www.reuters.com/article/pressRelease/idUS170663+18-Dec-2007+PRN20071218; Betty Clermont, *Possible New Nuclear Reactor is Threat to Georgia*, ATLANTA PROGRESSIVE NEWS, September 02, 2006, *available at* http://www.atlantaprogressivenews.com/news/0086.html.

28. Consideration of Aircraft Impacts for New Nuclear Power Reactor Designs, 72 Fed. Reg. 56287 (Oct. 3, 2007) (to be codified at 10 C.F.R. pt. 52).

29. San Luis Obispo Mothers for Peace v. NRC, 449 F.3d 1016, 1028 (9th Cir. 2006).

the nuclear industry is capable of addressing these issues, but the uncertainty and lack of clear standards undermines the stability of the licensing process.

Administratively, the NRC has not yet demonstrated that it can handle the number of expected applications. Currently, there are letters of intent for up to thirty-three new units.[30] But in the past 20 years, the NRC has only conducted seven reviews under the new Part 52 provisions.[31] At the same time, a significant percentage of the agency's workforce is set to retire over the next few years.[32] The agency simply may not have the human capital necessary to review all the expected applications. Congress's failure to pass budgets in a timely manner also disrupts the agency's hiring programs and forces it to continually reevaluate its review capacity.

Substantively, the COL licensing process is still an untested process, and there are bound to be unanticipated consequences. The one-step process is not simply a matter of adding up and combining the requirements for a construction permit with the requirements for an operating license. The NRC's expectations with regard to information and level of detail in the application may not correspond with the available information. If the NRC insists on detail that simply is not available, the process may grind to a halt.

Finally, the hearing process is perhaps the biggest wild card. While Licensing Boards generally have the legal and technical expertise needed to resolve contested issues, they are not as well equipped to handle issues of policy that arise during the course of a licensing review. In short, these questions are better left to the Commission, which has the authority to balance competing considerations and decide matters of policy once and for all. However, the Commission may not be willing or able to resolve these issues in a timely manner.

CONCLUSION

Over the past several decades, the nuclear power industry has matured. The number of significant events (*e.g.*, equipment malfunctions or operational anomalies) is 30 times lower than it was at the end of the 1980s, and the operating reactor fleet continues to operate at high levels

30. U.S. Nuclear Regulatory Comm'n, Expected New Nuclear Power Plant Applications (Updated March 19, 2008), http://www.nrc.gov/reactors/new-licensing/new-licensing-files/expected-new-rx-applications.pdf (last visited Mar. 20, 2008).

31. In addition to the three ESPs, the NRC has reviewed four design certification applications. *See* 10 C.F.R. Part 52, Appendix A to D (2007).

32. One-third of the NRC workforce will be eligible to retire in FY2010. U.S. GEN. ACCOUNTING OFFICE, HUMAN CAPITAL: RETIREMENTS AND ANTICIPATED NEW REACTOR APPLICATIONS WILL CHALLENGE NRC'S WORKFORCE 48 (January 2007), *available at* http://www.gao.gov/new.items/d07105.pdf.

of safety and efficiency.[33] Nuclear power is the most affordable baseload source of electricity, supplying nearly 20 percent of electricity in the United States, and is also our largest source of carbon-free electricity.[34] The excellent safety record, low (though capital intensive) costs, and environmental benefits of nuclear power plants are the key reasons that business and political leaders are advocating new nuclear construction.

The fate of the second generation of nuclear construction will be known in the next few years. If history is any guide, the regulatory processes governing the licensing of a nuclear power plant must be both stable and predictable. While the NRC has made fundamental changes to its licensing processes to address past problems, there remains uncertainly surrounding the regulations with which an applicant must comply, the availability of adequate agency resources, and discipline in the hearing process. Any instability will damage the availability of financing for new nuclear plants. Yet, with the right management tools, focused and effective hearings, and adequate Congressional support, new nuclear may not be that far away.

33. *Oversight on the Nuclear Regulatory Commission: Hearing Before the Subcomm. on Clean Air, Climate Change, and Nuclear Safety of the S. Comm. on Environmental and Public Works*, 108th Cong. 209 (2004) (statement of Marvin S. Fertel, Senior Vice President of Nuclear Generation, Nuclear Energy Institute), *available at* http://epw.senate.gov/hearing_statements.cfm?id=221804.

34. Energy Information Administration, U.S. Nuclear Generation of Electricity, http://www.eia.doe.gov/cneaf/nuclear/page/nuc_generation/gensum.html (last visited Mar. 30, 2008); Energy Information Administration, Nuclear Power: 12 percent of America's Generating Capacity, 20 percent of the Electricity, http://www.eia.doe.gov/cneaf/nuclear/page/analysis/nuclearpower.html (last visited Mar. 30, 2008).