

Today is yesterday's pupil: Reactor licence renewal in the United States

by Kimberly Sexton Nick*

“Over the next 25 years, more than half the nuclear plants in the United States will turn 40, and their operating licenses will expire as they do. With no reactors on order and only two under construction, the nuclear industry’s hope for survival probably rests on continued operation of existing plants.”¹

It has been 27 years since the above statement was made and yet almost the same thing could be said about the state of nuclear power in the United States (US) today: over the next 20 years, half of the nuclear power plants in the United States will turn 60, and their operating licences will expire as they do.² With no reactors on order and only two under construction,³ the US nuclear industry’s hope for survival rests in part on the continued operation of existing plants.

The United States is not alone in this situation. As the enthusiasm for nuclear new build wanes in many western countries, the focus is shifting to reactor licence renewal, lifetime extension and long-term/continued/extended operation of currently operating nuclear reactors.⁴ Currently, well over half of nuclear power

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The first part of the title for this article is a quotation from Benjamin Franklin in his 1751 *Poor Richard Improved*, National Archives (2018), “Founders Online”, <http://founders.archives.gov/documents/Franklin/01-04-02-0029> (accessed: 10 Oct. 2018); original source: Labaree, L.W. (ed.) (1961), *The Papers of Benjamin Franklin*, vol. 4, July 1, 1750, through June 30, 1753, Yale University Press, New Haven, pp. 84-101 (“today is yesterday’s pupil”).

1. Wald, M.L. (1991), “Due Up for License Renewal: The Future of Nuclear Power”, *New York Times*, 24 June, available at: www.nytimes.com/1991/06/24/us/due-up-for-license-renewal-the-future-of-nuclear-power.html.
2. See NEI (2018), “Second License Renewal”, www.nei.org/advocacy/make-regulations-smarter/second-license-renewal (accessed: 28 Sept. 2018).
3. Vogtle Electric Generating Plant, Units 3 and 4, currently under construction in Waynesboro, Georgia, which will be operated by Southern Nuclear Operating Co., Inc.
4. Countries around the world use different terminology to describe the operation of a nuclear power plant beyond its originally designed, licenced or envisaged life or period of operation. For the purposes of simplicity, this article takes the following approaches:
 - Long-term operation (LTO) will be used in to refer all of the following terms: long-term operation, continued operation and extended operation. Often the differences between these terms originate in translations of the same concept. The following IAEA definition, while not the “official” definition of LTO, is the most commonly-used definition when describing the concept: “Operation beyond an established timeframe

reactors around the world have been operating for more than 31 years and almost 20% were put into operation in or before 1977. The five oldest operating nuclear power reactors were connected to the grid in 1969, 49 years ago.⁵ As recently highlighted by the European Commission (EC), “The importance of long-term operations is expected to increase in the coming years, and by 2030 the majority of the fleet [in the European Union (EU)] would be operating beyond its original design life. Long-term operations are expected to represent the majority of nuclear investments in the short to medium term.”⁶ Thus, if new nuclear power plants are less and less likely to come online in Europe and North America, authorising these older plants to continue to safely operate becomes the only viable source of ensuring that nuclear energy continues to contribute to meeting climate change goals.⁷

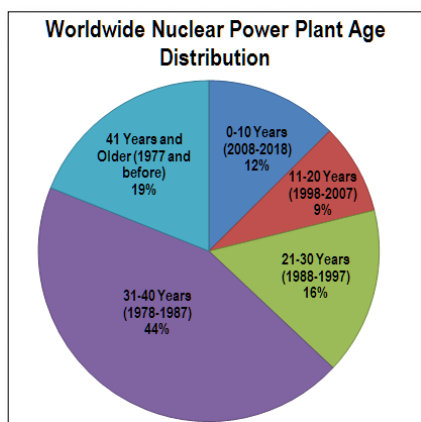


Figure 1.
Chart: K.S. Nick. Data source: IAEA (2018), PRIS,
<https://pris.iaea.org/PRIS/home.aspx> (accessed: 27 Sept. 2018).

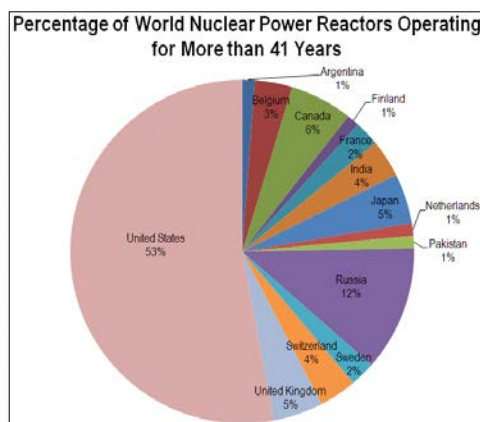


Figure 2.
Chart: K.S. Nick. Data source: IAEA (2018), PRIS,
<https://pris.iaea.org/PRIS/home.aspx> (accessed: 27 Sept. 2018).

set forth by, for example, licence term, design, standards, licence and/or regulations, which has been justified by safety assessment, with consideration given to the life limiting processes and features of SSCs.” IAEA (2009), *Ageing Management for Nuclear Power Plants*, Safety Guide No. NS-G-2.12, IAEA, Vienna, p. 8, para. 2.17.

- There is no commonly accepted definition of the term lifetime extension (LTE). Sometimes LTE is used interchangeably with LTO. In other instances, it is used in reference to a specific “plant life extension” or PLEX programme. In this article, LTO and LTE will be considered as the same concept.
 - Generally speaking, when an operating licence is issued for a defined period of time (often-times 10, 20, 30 or 40 years), the ability to operate past the originally-issued licence term requires a renewed licence. While the operation according to a “renewed licence” does not necessarily indicate that the reactor in question is operating in the period of LTO, it is the case in the United States.
5. Beznau, Unit 1 in Switzerland; Nine-Mile Point, Unit 1 and Ginna in the United States; and Tarapur, Units 1 and 2 in India. International Atomic Energy Agency (IAEA) (2018), “Power Reactor Information System (PRIS)”, <https://pris.iaea.org/PRIS/home.aspx> (accessed: 27 Sept. 2018).
 6. EC (2018), *In-depth Analysis in Support of the Commission Communication COM(2018) 773 “A Clean Planet for all A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy”*.
 7. See e.g. NEA (2012), *The Economics of Long-term Operation of Nuclear Power Plants*, OECD, Paris, p. 108, “LTO of NPPs could be a key element in the decarbonising of electricity generation since they maintain low carbon sources of baseload electricity which cannot easily be replaced by other low-carbon technologies.”; Plumber, B., “How Retiring Nuclear Power Plants May Undercut U.S. Climate Goals”, *New York Times* (13 June 2017), available at: www.nytimes.com/2017/06/13/climate/nuclear-power-retirements-us-climate-goals.html.

The situation is even more pronounced in the United States, which is home to the second oldest operating nuclear power plant (Nine Mile Point, Unit 1); the largest number, as well as greatest percentage, of reactors operating past 40 years of age in the world; and where 11 of the remaining 98 nuclear power plants have already publicly announced closure plans over the next seven years.⁸ This situation makes authorising life beyond 60 years increasingly important.

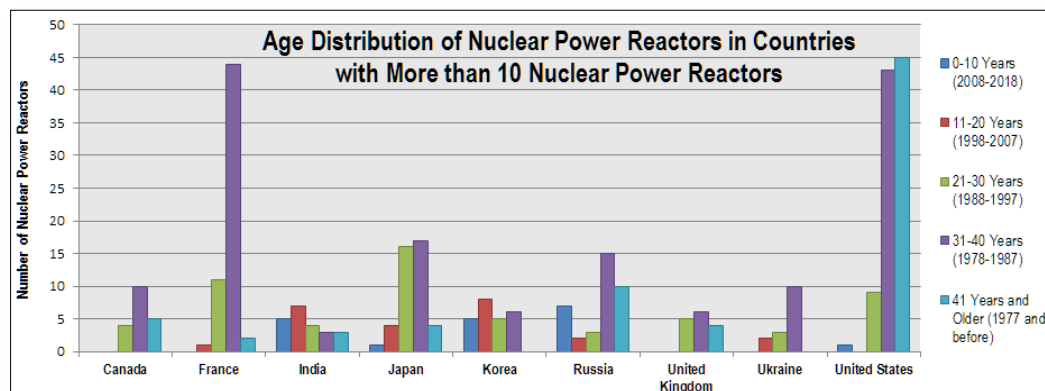


Figure 3.
Chart: K.S. Nick. Data source: IAEA (2018), PRIS, <https://pris.iaea.org/PRIS/home.aspx> (accessed: 27 Sept. 2018).

Although the first renewed operating licence was granted less than 20 years ago,⁹ the United States has decades of knowledge and experience in the licensing and regulation of nuclear power reactors as they enter the period of LTO. And while the NRC determined years ago that renewed licences could be subsequently renewed, it only recently determined that the existing licence renewal regulations were sufficient to cover the period of subsequent renewal, the period of 60-80 years.¹⁰ The NRC is currently reviewing three applications for subsequent licence renewal¹¹ and one additional site has submitted a letter of intent to request subsequent licence

8. Those plants are:

- Pilgrim Nuclear Power Station: by end of May 2019;
- Three Mile Island Nuclear Station, Unit 1: September 2019;
- Davis-Besse Nuclear Power Station, Unit 1: May 2020;
- Perry Nuclear Power Plant, Unit 1: May 2021;
- Indian Point Nuclear Generating, Units 2 and 3: 2020 and 2021, respectively;
- Beaver Valley Power Station, Units 1 and 2: May and October 2021, respectively;
- Palisades Nuclear Plant: by May 2022; and
- Diablo Canyon Power Plant, Units 1 and 2: by August 2025.

NRC (2018), *Information Digest, 2018-2019*, NUREG-1350, Vol. 30, NRC, Washington, DC, p. xii.

9. The final report for the Calvert Cliffs Nuclear Power Plant license renewal application was submitted by Baltimore Gas and Electric to the US NRC in July 1998, and is available at: www.nrc.gov/reactors/operating/licensing/renewal/applications/calvert-cliffs/epri.pdf. The renewed licence was issued by the NRC on 23 March 2000. NRC (2017), "Calvert Cliffs Nuclear Power Plant, Units 1 & 2 – License Renewal Application", www.nrc.gov/reactors/operating/licensing/renewal/applications/calvert-cliffs.html (accessed: 11 Oct. 2018). The licence renewal status of all nuclear power reactors in the United States is provided in an Annex to this article.
10. See e.g. NRC (2017), *Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants: Final Report*, NUREG-2192, NRC, Washington, DC, p. xxix.
11. Turkey Point Nuclear Power Plant, Units 3 and 4; Peach Bottom Atomic Power Station, Units 2 and 3; and Surry Power Station, Units 1 and 2. NRC (2018), "Status of Subsequent License Renewal Applications", www.nrc.gov/reactors/operating/licensing/renewal/subsequent-license-renewal.html (accessed: 11 Dec. 2018).

renewal.¹² Because the unique, highly prescribed nature of the licensing process in the United States is not always well understood in light of the approach taken in many other countries, a detailed understanding of the history and procedure of the legal and regulatory framework is especially beneficial at this time.

With many countries not focusing on nuclear new build, a renewed spotlight has been put on extended plant operation, with international organisations like the NEA looking at the legal, regulatory, economic, technical and policy aspects of LTO and the United Nations Economic Commission for Europe (UNECE)¹³ analysing the role of environmental reviews in the authorisation of LTO. To familiarise an international legal audience, or even new US regulatory attorneys, with the licence renewal approach taken by the United States, this article will first provide in Part 1 a brief background on the licensing process determined by the US government over 60 years ago. It will then detail the regulatory history of the Licence Renewal Rulemaking, explain why certain decisions were made, and look at the issues from a policy perspective, as well as from the standpoint of protecting public health, safety and the environment. Once it is well understood why the NRC made the decisions it did, the next step is putting it into perspective in Part 2 by looking at LTO in an international setting so that the differences in the US regulatory approach can be better understood. Then, the article will take the theory, the policy and the perspectives from Parts 1 and 2 and put it into practice in Part 3, explaining the procedural steps of authorising licence renewal. In the end, the reader will hopefully appreciate that while different from many other countries, the US approach to authorising LTO is fundamentally sound and has worked well for the past 20 years. And more importantly that there is no reason the same approach cannot continue to work for the 60-80-year time period.

PART 1: THE THEORY AND THE POLICY OF REACTOR LICENCE RENEWAL

I. Initial operating licences in the United States

Under the US Atomic Energy Act of 1954, as amended (AEA),¹⁴ licences for the commercial operation of a production or utilisation facility, which include nuclear power reactors, “shall be issued for a specified period, as determined by the Commission, depending on the type of activity to be licensed, but not exceeding forty years from the authorization to commence operations”.¹⁵ There are two general explanations for this 40-year licence term:

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12. North Anna Power Station, Units 1 and 2. NRC (2018), “Status of Subsequent License Renewal Applications”, *ibid*.
 13. Despite its name, the UNECE includes 56 member states across Europe, Asia (Israel, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) and North America (Canada and the United States).
 14. Pub. L. No. 83-703, 68 Stat. 919 (original text of the 1954 Act). The AEA, as amended, is codified at 42 *United States Code* (USC) 2011-2021, 2022-2286i, 2296a-2297h-13. The USC is the consolidated publication of the general and permanent laws of the United States.
 15. AEA, sec. 103(c). It should be noted that the 40-year licence term did not always commence from the start of operations. In the beginning, and for the first 25 years of licensing, the 40-year term actually began at the date of issuance of the licence of the construction permit. 10 CFR 50.51, “Duration of license, renewal” originally stated that “Each license will be issued for a fixed period of time to be specified in the license but in no case to exceed 40 years from the date of issuance.” 21 *Federal Register* (Fed. Reg.) 355, 359 (19 Jan. 1956); see also NRC (1988), *Regulatory Options for Nuclear Power Plant License Renewal: Draft for Comment*, NUREG-1317, NRC, Washington, DC, p. 1-1. In 1982, the NRC issued a policy that determined the 40-year licence period could instead begin at the date of issuance of the operating licence. Memorandum dated 16 Aug. 1982 from W. Dircks,

- The Federal Communications Act of 1934 was a model for the AEA and the drafters of the AEA extracted almost verbatim the licensing provisions of that law for the atomic bill.¹⁶ Under the Federal Communications Act of 1934, “radio stations were licensed to operate for several years and then allowed to renew their licenses as long as they continued to meet their charters”.¹⁷
- In addition, there were antitrust and economic considerations.¹⁸ Although part of the basis for the time limit was “to prohibit open-ended or perpetual licenses”, the specific term was chosen as “a compromise between the efforts of the Justice Department and electric cooperatives, who championed a 20-year limit on the basis of antitrust concerns, and the view of the utility industries that a longer period was necessary to ensure full amortization of a nuclear power plant”.¹⁹ The 40-year amortisation period is based on that of fossil fuel plants.²⁰

While the 40-year decision was not based on a technical rationale or operating experience,²¹ nor was it based on safety or common defence and security concerns,²² certain components of nuclear power reactors may have been designed based on an assumption of a 40-year lifetime.²³ Thus, even if the rule was not based on safety or technical reasons, it informed the design of nuclear power plants.²⁴

Section 103(c) of the AEA goes on to say that the 40-year licence “may be renewed upon the expiration of such period”. The Commission’s regulations at Title 10 of the *Code of Federal Regulations* (CFR)²⁵ Section 50.51(a), “Continuation of license” implemented this by stating that “Each license will be issued for a fixed

Executive Director for Operations, to the Commissioners. By virtue of this policy, reactor operators began to apply for amendments to their operating licences to extend the authorised period of operation to recover the time it took for construction, adding years to their operating licences. See e.g., NRC (1985), Baltimore Gas and Electric Company, Docket No. 50-317, Calvert Cliffs Nuclear Power Plant Unit No. 1, Amendment To Facility Operating License, Amendment No.102, License No. DPR-53; NRC (1985), Baltimore Gas and Electric Company Docket No. 50-318, Calvert Cliffs Nuclear Power Plant Unit No. 2, Amendment to Facility Operating License, Amendment No.84, License No. DPR-69; and (NRC), “Safety Evaluation by the Office of Nuclear Reactor Regulation related to Amendment Nos. 102 and 84 to Facility Operating License Nos. DPR-53 AND DPR-69”.

16. Mazuzan, G.T. and J.S. Walker (1984), *Controlling the Atom: The Beginnings of Nuclear Regulation 1946-1962*, NUREG-1610, University of California Press, Berkeley, California, pp. 26, 71. Hewlett, R.G. and J.M. Holl (1989), *Atoms for Peace and War 1953-1961: Eisenhower and the Atomic Energy Commission*, University of California Press, Berkeley, California, p. 121, fn. 17 (“The portions used almost verbatim are Sections 308(b) and 312(a) of the Communications Act of 1934, P.L.416, 73 Cong., 2 seas.”).
17. NRC (2016), “Additional Information on Orientation”, www.nrc.gov/reactors/operating/licensing/renewal/introduction/orientation/orientation2.html#flow (accessed: 8 Oct. 2018).
18. NRC (2018), “Backgrounder on Reactor License Renewal”, www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-reactor-license-renewal.html (accessed: 28 Sept. 2018).
19. “Final Rule: Nuclear Power Plant License Renewal”, 56 Fed. Reg. 64943, 64962 (13 Dec. 1991).
20. Walker, J.S. and T.R. Wellock (2010), *A Short History of Nuclear Regulation, 1946-2009*, NUREG/BR-0175, Rev. 2, NRC, Washington, DC, p. 68.
21. *Ibid.*
22. 56 Fed. Reg. at 64960.
23. “Final Rule: Nuclear Power Plant License Renewal; Revisions”, 60 Fed. Reg. 22461, 22479 (8 May 1995). See also, Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 7 (2001).
24. “The 40-year license might not have had a technical basis but it had technical implications.” NRC (2014), *No Undue Risk: Regulating the Safety of Operating Nuclear Power Plants*, NUREG/BR-0518, NRC, Washington, DC, p. 9.
25. The CFR is multi-volume publication with 50 subject matter titles codifying the general and permanent rules of the US federal government.

period of time to be specified in the license but in no case to exceed 40 years from date of issuance ... Licenses may be renewed by the Commission upon the expiration of the period.”²⁶ At the time, however, even though licence renewal was allowed in principle, there were no standards and no procedures for this type of licensing action.²⁷

II. Origins of US reactor licence renewal and the 1991 Licence Renewal Rulemaking

Starting in the early 1980s, the NRC began to research the effects of ageing of nuclear power plant systems, structures and components (SSCs).²⁸ These various research activities “concluded that most nuclear plant aging issues are manageable and do not pose technical issues that would prevent them for operating additional years beyond their original 40-year license period.”²⁹ As such, individuals and entities both inside and outside of the NRC urged the agency to analyse the issue and “develop standards and procedures for license renewal so that the utilities would know what will be required to obtain a renewed operating license”.³⁰ The issue was time-sensitive because a number of nuclear power plants had licences that were due to expire and utilities were interested in determining whether it made economic sense to renew those licences – and if not – to build replacement power plants.³¹

As explained by the NRC, the central regulatory question was: “What is an adequate licensing basis for renewing the operating license of a nuclear power plant?”,³² or, more specifically, “What should be the regulatory approach and requirements for renewed licenses in order to have continued assurance of public health and safety?”³³ The NRC considered four alternative regulatory approaches in evaluating the issue:

- continue the existing current licensing basis (CLB)³⁴ of the plant as is, without additional modification;
- supplement the existing CLB with necessary safety modifications based on life after 40 years;
- supplement the existing CLB with necessary safety modifications based on life after 40 years and assess the design of the plant against selected new plant standards; and

26. 56 Fed. Reg. at 64976.

27. *Ibid.*, 64943.

28. *Ibid.*

29. “Backgrounder on Reactor License Renewal”, *supra* note 18 (accessed: 28 Sept. 2018).

30. 56 Fed. Reg. at 64943; Walker, J.S. and T.R. Wellock (2010), *supra* note 20, p. 69.

31. 56 Fed. Reg. at 64943.

32. NUREG-1317, *supra* note 15, p. ix.

33. Sheron, B.W., “Regulatory Options for Nuclear Power Plant License Renewal”, presentation given to US NRC Commissioners during the US NRC public meeting, “Briefing on Policy Paper for Plant Life Extension”, Rockville, Maryland, 12 July 1988, slide 10 (slides included in the in the final transcript of the meeting).

34. At a generic level, the licensing basis can be defined as “the collection of documents or technical criteria that provides the basis upon which the NRC issues a license to construct or operate a nuclear facility”. NRC (2018), “Licensing basis”, www.nrc.gov/reading-rm/basic-ref/glossary/licensing-basis.html (accessed 11 Oct. 2018). Because of the certainty of safety improvements over the life of a nuclear power plant, the licensing basis of a nuclear power plant at the time of a licence renewal is going to be much different than that at its initial licensing. As the licensing basis changes over time, the then-applicable basis on which the NRC regulates that particular plant is known as the CLB. This does not necessarily mean, however, that all currently-applicable safety standards apply. A precise definition of the CLB came out of the 1991 License Renewal Rulemaking. See *infra*.

- treat the plant as a new plant and require compliance with all current safety standards.³⁵

In 1991, the NRC adopted 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants”, which “establishe[d] the procedures, criteria, and standards governing nuclear power plant license renewal”.³⁶ From the technical/safety standpoint, it was determined that the scope of the review for licence renewal would not duplicate that performed at original licensing stage and instead “focus[] upon those potential detrimental effects of aging that are not routinely addressed by ongoing regulatory oversight programs” since “[t]he issues and concerns involved in an extended 20 years of operation are not identical to the issues reviewed when a reactor facility is first built and licensed.”³⁷

The NRC determined that the CLB would carry forward into the renewed licence³⁸ and that the licence renewal review should not be used as an opportunity to assess a plant against current regulatory requirements because:

- (a) its program of oversight is sufficiently broad and rigorous to establish that the added discipline of a formal license renewal review against the full range of current safety requirements would not add significantly to safety, and
- (b) such a review is not needed to ensure that continued operation during the period of extended operation is not inimical to the public health and safety.³⁹

The option to treat the plant as new created strong opinions on both sides. Some argued that “old” plants should not be re-licensed because they did not meet current licensing standards, while others argued that if current licensing standards were used there would probably be no renewed licences⁴⁰ due to the costs of potential plant redesigns. To assuage the safety concerns associated with not performing a wholesale new plant licensing review, the NRC had to clarify the understanding of the CLB, especially as it related to licence renewal. The NRC included a regulatory definition of CLB in the new rule, which explained that the CLB is:

- different for each nuclear power plant;⁴¹

35. 56 Fed. Reg. at 64945.

36. *Ibid.*, 64961.

37. Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 7 (2001).

38. 10 CFR 54.33(d), “Continuation of CLB and conditions of renewed license”, “The licensing basis for the renewed license includes the CLB, as defined in § 54.3(a)”.

39. 56 Fed. Reg. at 64945-6.

40. See e.g. conversation between Commissioner T.M. Roberts and B.W. Sheron, Director, Division of Reactor and Plant Systems, NRC Office of Research, during “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript p. 19.

41. 10 CFR 54.3(a), “Definitions” defines the CLB as:

the set of NRC requirements applicable to a specific plant and a licensee’s written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect. The CLB includes the NRC regulations contained in 10 CFR parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 52, 54, 55, 70, 72, 73, 100 and appendices thereto; orders; license conditions; exemptions; and technical specifications. It also includes the plant-specific design-basis information defined in 10 CFR 50.2 as documented in the most recent final safety analysis report (FSAR) as required by 10 CFR 50.71 and the licensee’s commitments remaining in effect that were made in docketed licensing correspondence such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as licensee commitments documented in NRC safety evaluations or licensee event reports.

- “not static”⁴² and instead “represents the evolving set of requirements and commitments ... that are modified as necessary over the life of a plant to ensure continuation of an adequate level of safety”;⁴³ and
- not reviewed as part of the licence renewal process, as any issues associated with current plant operation are continually assessed as part of the regular regulatory oversight process.⁴⁴

Therefore, any need to address a current safety issue is handled through traditional operating reactor regulatory oversight process rather than through the licence renewal process.⁴⁵

Many additional regulatory issues had to be addressed, and these were categorised into three main topical areas: (1) technical/safety, (2) environmental and (3) procedural. Each procedural topic contained a subset of regulatory issues that each had to be outlined with alternative approaches, put out for public comment, reviewed and amended as appropriate based on comments, and decided upon:

- Form of licence renewal: Would the request for a renewed licence be treated as a request for a new licence or an amendment to the existing licence or would a new set of regulatory requirements be developed specifically for licence renewal?
- Length of licence renewal term: Would the new, amended or renewed licence be applicable for the statutory maximum of 40 years or some other set time period or would it be decided on a case-by-case basis?
- Latest date for renewal application: The regulation in place at the time provided that an existing licence would continue in place if a renewal application was submitted up to 30 days before licence expiration, but would this be too short?
- Earliest date for renewal application: Because of the need for licensees to plan years in advance to replace power if needed, a decision would be needed well in advance of a licence’s expiration. The question remained regarding how long in advance was an appropriate balance between the needs of the licensee and the regulator’s need for operational experience?
- Effective date of renewal: Would the renewal begin at the expiration of the original licence, a so-called “tack-on” renewal, or would it take effect immediately upon a favourable decision and therefore supersede the original licence, a so-called “supersession” renewal?

42. Nuclear Generation Co. and Entergy Nuclear Operations, Inc. (Pilgrim Nuclear Power Station), CLI-10-14, 71 NRC 449, 454 (2010).

43. 60 Fed. Reg. at 22473.

44. *Ibid.*, 22473 (8 May 1995); see also 10 CFR 54.30, “Matters not subject to a renewal review”; Pilgrim Nuclear Power Station, 71 NRC at 454, *supra* note 42.

45. 10 CFR 54.30, “Matters not subject to a renewal review”:
 (a) If the reviews required by § 54.21 (a) or (c) show that there is not reasonable assurance during the current license term that licensed activities will be conducted in accordance with the CLB, then the licensee shall take measures under its current license, as appropriate, to ensure that the intended function of those systems, structures or components will be maintained in accordance with the CLB throughout the term of its current license.
 (b) The licensee’s compliance with the obligation under Paragraph (a) of this section to take measures under its current license is not within the scope of the license renewal review.

- Use of the Backfit Rule: Two separate questions emerged here, with the first related to backfits in the original licensing term. The second, and more substantial question, was whether and how the Backfit Rule would apply to plant upgrades required for licence renewal?
- Public hearings: Four separate questions had to be addressed in this area: (1) Is there a right to a hearing? (2) When should the hearing be held? Does the hearing have to be held before the decision or can it be held after? (3) Does the hearing have to be formal or can a more informal hearing procedure be developed? (4) What issues can be litigated in a hearing?⁴⁶

The Licence Renewal Rulemaking decided on each of the procedural issues, providing full explanations for each determination.

A. Form of licence renewal

The NRC determined that operation beyond 40 years would be authorised through the issuance of a renewed operating licence.⁴⁷ Simply amending the original licence was not sufficient.⁴⁸ The Commission concluded that this was a necessary determination based on the language in the Atomic Energy Act, the legislative history for the Act and comparable licensing regimes in other federal agencies.⁴⁹ While there was some concern that calling it a “renewed licence” would indicate that it was a “new” licence and therefore subject to current requirements,⁵⁰ these considerations did not impact the final decision.

B. Length of licence renewal term

After determining that extended operation would be authorised in a renewed licence, the next question was for how long. It was determined that a renewed licence could be granted “for more than 20 years beyond the existing license expiration”.⁵¹ Given the language in the AEA, it was legally permissible for the NRC to determine that a renewed licence could be issued for up to 40 years, but the NRC made a policy decision to select 20 years as the term. It should be noted that renewed licences do not have to be issued for exactly 20 years; instead, 20 years is the maximum limit. In practice, renewed licences are generally issued for this amount of time.

The 20-year period was selected based on considerations:

- from an agency perspective, the desire for a longer term due to the significant staff resources needed to review a licence renewal application (LRA);
- from an industry perspective, the desire to provide for long-term planning; and
- from a technical perspective, there is sufficient understanding of age-related degradation to ensure safe operation for a further 20 years.

46. NUREG-1317, *supra* note 15, pp. 5-1 to 5-8. Five additional procedural issues were analysed but are not addressed in this article: material alterations; emergency planning; decommissioning; antitrust review; and Price-Anderson Act coverage.

47. 56 Fed. Reg. at 64945.

48. *Ibid.*, 64945, 69961-2.

49. *Ibid.*, 64961.

50. See e.g. conversation between Commissioner K. Carr and NRC General Counsel W.C. Parler during “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript p. 31.

51. 56 Fed. Reg. at 64945.

Indicating, perhaps, a bit of the uncertainty involved in the selection, the NRC noted that the issue could be revisited in the future with the possibility of granting renewed licences for longer than 20 years.⁵²

C. Earliest and latest dates for renewal application

Given the long planning periods associated with licensing nuclear power reactors, the NRC balanced the needs of the regulator and the operator in determining the earliest and latest dates for the submission of licence renewal applications: the application for a renewed licence can be submitted up to 20 years before the expiration of the current licence⁵³ and if a sufficient LRA is submitted at least 5 years before the expiration of the current operating licence that licence will continue without expiration until the NRC has made a final determination on the LRA.⁵⁴ This five-year provision is known as “timely renewal”.

The timely renewal rule, like the 40-year licence term, did not originate with the NRC. Here, the timely renewal doctrine comes from the US Administrative Procedure Act (APA).⁵⁵ Section 9(b) of the APA states that “[w]hen the licensee has made timely and sufficient application for a renewal or a new license in accordance with agency rules, a license with reference to an activity of a continuing nature does not expire until the application has been finally determined by the agency.”⁵⁶ As explained by the NRC, the purpose of the APA timely renewal provision “is to protect a licensee who is engaged in an ongoing licensed activity and who has complied with agency rules in applying for a renewed or new license from facing license expiration as the result of delays in the administrative process.”⁵⁷

The NRC originally implemented the timely renewal rule in its regulations with a 30-day time period.⁵⁸ This had to change, however, once the possibility of licence renewal came into focus since 30 days was clearly not a reasonable amount of time to review an LRA. Instead, the NRC anticipated that it would take two years to review an LRA, plus an additional year or more if an adjudicatory hearing were to take place.⁵⁹ Although it originally considered three years as an appropriate time frame, the Commission eventually decided on five years, not for any substantive

52. *Ibid.*, 64964. Although not specifically stated, the idea that the 20-year term was slightly arbitrary was danced around in a discussion between Chairman K. Carr, E. Beckjord, Director, NRC Office of Research, Dr T. Murley, Director, NRC Office of Nuclear Reactor Regulation and J. Taylor, NRC Executive Director for Operations during “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript pp. 68-72.

53. 10 CFR 54.17(c), “Filing of application”; 56 Fed. Reg. at 64945.

54. 10 CFR 2.109(b), “Effect of timely renewal application”.

55. Administrative Procedure Act (APA), 5 USC 551 et seq. (1946) as amended.

56. APA, 5 USC 558(c)(2), “Imposition of sanctions; determination of applications for licenses; suspension, revocation, and expiration of licenses”.

57. Letter from Peter S. Tam to Christopher M. Crane (22 Dec. 2004) regarding “Oyster Creek Nuclear Generating Station – Exemption from the Requirements of Section 109(b) of 10 CFR Part 2, Regarding the Effect of Timely License Renewal Application (TAC No. MC3967)”, Enc. 1, p. 3, available at: www.nrc.gov/docs/ML0429/ML042960164.pdf.

58. 56 Fed. Reg. at 64962.

59. Early reviews were conducted on a 22-month schedule from receipt to renewal (without an adjudicatory hearing) while current reviews are conducted on an 18-22-month schedule without an adjudicatory hearing and if a hearing is held, it is anticipated that a decision can be made within 30 months. “Background on Reactor License Renewal”, *supra* note 18 (accessed: 9 Oct. 2018); NRC (2017), “Reactor License Renewal Process”, www.nrc.gov/reactors/operating/licensing/renewal/process.html (accessed: 9 Oct. 2018).

reason but rather for consistency with the five-year requirement for decommissioning planning and financial assurance information.⁶⁰

The idea of timely renewal struck some as odd, questioning why the clear and firm expiration date of a licence could be rendered meaningless simply because the licence renewal review had not yet been completed.⁶¹ It seemed even more peculiar that timely licence renewal could seemingly go on indefinitely.⁶² But, the Commission had little choice in the matter of whether to implement a timely renewal rule; its only option was to determine a reasonable time period. The timely renewal rule did, however, ensure that protracted hearings would not impact reactor operation, nor, on the other side, would a looming deadline impact a full and fair hearing. And, as put succinctly, and bluntly, by former NRC Commissioner Kenneth Rogers in 1988, “if there is any question we think that the plant is unsafe, notwithstanding anything else, we could shut it down.”⁶³ So, again, any need to address a current safety issue is handled through the traditional operating reactor regulatory oversight process rather than through the licence renewal process.

Interestingly, there was more push-back on the 20-year period than the timely renewal doctrine. Many commenters believed that applying 20 years in advance of licence expiration was far too early because it would not provide enough operating experience to support the review and that subsequent operating experience, obtained after the renewed licence was issued, would not be taken into account.⁶⁴ The Commission rejected these arguments, explaining that it proposed the earliest possible date for the application taking into consideration the estimated amount of time for the review process plus the time indicated in industry studies needed to replace a nuclear power plant with a new source of electricity generation (10-12 years for fossil fuel and 12-14 for nuclear or other technologies).⁶⁵

60. 56 Fed. Reg. at 64962. The NRC confirmed that the dates are somewhat arbitrary, declaring early in the rulemaking process “that there is not a strong basis for selecting a particular cutoff time”. “Advance notice of proposed rulemaking; notice of workshop: Nuclear Power Plant License Renewal; Public Workshop on Technical and Policy Consideration”, 54 Fed. Reg. 41980, 41984 (13 Oct. 1989). In fact, the NRC has at least once issued an exemption from the timely renewal doctrine to a nuclear power plant, the Oyster Creek Nuclear Generating Station. On this occasion, the NRC found that allowing an LRA submitted 44 months before the expiration of its original licence, rather than 60, could take advantage of the timely renewal doctrine if necessary based on the fact that 44 months was within the 3-year period originally contemplated for timely renewal.

61. See e.g. conversation between Commissioner K. Rogers and NRC General Counsel W.C. Parler during “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript pp. 47-49.

62. See e.g. *ibid.* Although not indefinite, the LRA for Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3) was a test of the timely renewal doctrine. The LRA for IP2 and IP3 was received on 30 April 2007. The NRC staff completed its safety review approximately 30 months later. Due to an ongoing adjudicatory proceeding, the licence renewal process extended for years and IP2 and IP3 entered into timely renewal on 29 September 2013 and 13 December 2015, respectively. Prior to entering into timely renewal, certain licence renewal commitments for each unit were required to be implemented. The NRC finally issued the renewed operating licences for IP2 and IP3 on 17 September 2018, capping off an 11-year review. NRC (2018), “Indian Point Nuclear Generating Units Nos. 2 and 3 – License Renewal Application”, www.nrc.gov/reactors/operating/licensing/renewal/applications/indian-point.html (accessed: 8 Oct. 2018); NRC (2016), “Indian Point Timely Renewal”, www.nrc.gov/info-finder/reactors/ip/ip-timely-renewal.html (accessed: 8 Oct. 2018).

63. Roger, K. (Commissioner), “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript p. 49.

64. 56 Fed. Reg. at 64963.

65. *Ibid.*

D. Effective date of renewal

Legally speaking, it was perfectly acceptable for the NRC to decide that upon a favourable decision authorising a renewed licence either the “existing license would run its course and be replaced by the renewed license”, i.e. a “tack-on license”, or that the extended period of operation would be added on to the existing period of operation with a new “supersession license”.⁶⁶ There were distinct advantages and disadvantages to each approach – so much so that the industry “requested that the regulations be developed so that the licensee has the flexibility to choose between tack-on and supersession.”⁶⁷

The tack-on approach is cleaner and arguably closer to what was envisioned by Congress given the statement in AEA section 103(c) that the 40-year licence “may be renewed upon the expiration”. But, if a renewed licence can be issued at year 20 with another 20 years to go before its effectiveness, the long intervening period can create regulatory instability regarding the implementation and enforcement of licence conditions in the renewed licence, as well as changes to the CLB.⁶⁸ On the contrary, supersession provides for greater stability in regulatory oversight and allows the licensee to better plan for any necessary changes and modifications, though it does require more work up front.⁶⁹

Weighing both options, the determination was made that a renewed licence that supersedes the original operating licence was required for operation past 40 years. The renewed licence would become effective immediately upon issuance by the NRC,⁷⁰ meaning that the actual term of the renewed licence can be up to 40 years, though this is not likely.⁷¹ If a renewed licence is subsequently set aside upon further administrative or judicial appeal, the operating licence or combined licence previously in effect will be reinstated unless its term has expired and the renewal application was not filed in a timely manner.

E. Use of the Backfit Rule

Unlike many countries, the NRC does not explicitly regulate on the basis of continuous improvement of safety.⁷² Instead, the NRC regulates on the basis of

66. *Ibid.*, 64964; Parler, W.C., “Briefing on Policy Paper for Plant Life Extension”, *supra* note 33, transcript p. 35.

67. NUREG-1317, *supra* note 15, p. 5-3.

68. *Ibid.*

69. *Ibid.*

70. 10 CFR 54.31(c), “Issuance of a renewed license”.

71. 10 CFR 54.31(b), “Issuance of a renewed license”, “A renewed license will be issued for a fixed period of time, which is the sum of the additional amount of time beyond the expiration of the operating license or combined license (not to exceed 20 years) that is requested in a renewal application plus the remaining number of years on the operating license or combined license currently in effect. The term of any renewed license may not exceed 40 years.”

72. See e.g. Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, *Official Journal of the European Union (OJ) L 219* (25 July 2014) (2014 Amended Safety Directive), Article 1(a), “The objectives of this Directive are to establish a Community framework in order to maintain and promote the continuous improvement of nuclear safety and its regulation” and Article 6(c), “Member States shall ensure that the national framework requires that: licence holders are to regularly assess, verify, and continuously improve, as far as reasonably practicable, the nuclear safety of their nuclear installations in a systematic and verifiable manner.”

ensuring “adequate protection” of public health and safety,⁷³ which is “presumptively assured by compliance with [NRC] regulations and other license requirements”.⁷⁴ This should not be taken, however, to mean that safety is a fixed concept or that regulatory requirements never change. As explained by the NRC in a 1988 rulemaking, “adequate protection is not absolute protection or zero risk[; therefore,] safety improvements beyond the minimum needed for adequate protection are possible. The Commission is empowered under section 161 of the [AEA] to impose additional safety requirements not needed for adequate protection and to consider economic costs in doing so.”⁷⁵

The NRC’s safety improvement process is handled through the “Backfit Rule”.⁷⁶ These so-called “backfits” can include generic backfits imposed through an administrative rulemaking process on all licensees or by administrative orders on a plant-specific basis. Sometimes, new information comes to light that causes the NRC to need to define or redefine what level of protection is regarded as adequate.⁷⁷ In addition, the NRC can require plant upgrades if in light of new technical information it determines that “existing programs or regulations need to be revised to assure an acceptable level of safety.”⁷⁸

Contrary to the wishes of the industry,⁷⁹ the NRC determined that a backfit analysis would not be necessary to impose new requirements through the licence renewal process. The NRC stated that two types of modifications would normally be required as part of the licence renewal process:

- those necessary to ensure adequate protection, whether or not related to plant ageing; and
- those that address age-related degradation unique to licence renewal that are necessary to ensure compliance with the plant’s CLB.

Any changes based on either of these situations would be able to be imposed, regardless of cost, under exemptions already contained in the Backfit Rule: the adequate protection exemption of 10 CFR 50.109(a)(4)(ii) and the compliance exemption of 10 CFR 50.109(a)(4)(i).⁸⁰ To put it simply, because a renewal is “treated

73. AEA, sec. 182a., 42 USC 2232(a). Despite what Winston Churchill once said – “What is adequacy? Adequacy is no standard at all” – adequate protection is the statutory regulatory standard of the US NRC. BBC America (2014), “50 Sir Winston Churchill Quotes to Live By”, www.bbcamerica.com/anglophenia/2015/04/50-churchill-quotes (accessed: 11 Oct. 2018).

74. See e.g. “Final Rule: Revision of Backfitting Process for Power Reactors”, 53 Fed. Reg. 20603, 20606 (6 June 1988); see also, Ostendorff, W.C. and K.A. Sexton (2013), “Adequate protection after the Fukushima Daiichi accident: A constant in a world of change”, *Nuclear Law Bulletin*, No. 91, OECD, Paris, p. 24.

75. 53 Fed. Reg. at 20604.

76. 10 CFR 50.109, “Backfitting”. At the NRC, a “backfit” is defined as “the modification of or addition to systems, structures, components, or design of a facility; or the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct or operate a facility; any of which may result from a new or amended provision in the Commission’s regulations or the imposition of a regulatory staff position interpreting the Commission’s regulations that is either new or different from a previously applicable staff position”.

77. 10 CFR 50.109(a)(4)(iii).

78. NRC (2010), “Integrated Regulatory Review Service Mission to the United States: Module 11a: Periodic Safety Review”, available at: www.nrc.gov/docs/ML1125/ML112510453.pdf, p. 7.

79. SECY-90-0121, “Report on License Renewal Workshop and Proposed Revisions to the Program Plan and Schedule for Rulemaking”, 17 Jan. 1990, Enclosure 3 “Results of the Workshop on Technical and Policy Considerations for Nuclear Power Plant License Renewal”, p. 6.

80. 56 Fed. Reg. at 64966.

as kind of a new licence [y]ou start it off fresh. And the Backfit Rule does not apply [to the application for the renewal].”⁸¹

F. Public hearings

As mentioned, four separate questions needed resolution in relation to public hearings. These questions were intrinsically linked to the question of what form the licence renewal would take. If extended operation was authorised through a renewed licence, very different hearing requirements would attach to this decision than if extended operation was authorised through a licence amendment. For example, whether the public has a right to a hearing on a licence renewal decision under the Atomic Energy Act depends on the type of licensing action undertaken. Section 189a.(1)(A) of the AEA states that “[i]n any proceeding ... for the granting, suspending, revoking, or amending of any license ... the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding.” While it is clear that authorising extended operation through a licence amendment would require an opportunity for a hearing, the question was raised as to whether a licence renewal would as well.⁸² Ultimately it was determined that interested members of the public would be provided an opportunity for a formal public hearing to challenge the licence “renewal applicant’s proposals to address age-related degradation unique to license renewal and compliance with applicable requirements of 10 CFR Part 51”.⁸³ This hearing would occur before the licensing decision is made.

Although specifically requested by industry, the NRC declined to adopt special hearing procedures for licence renewal. The NRC explained that the timely renewal rule coupled with the narrower scope of litigable issues, as well as the then-recent procedural changes to the 10 CFR Part 2, “Agency Rules of Practice and Procedure”, which among other changes raised the threshold for admission of contentions and reduced discovery against the staff, provided a satisfactory process.⁸⁴ As explained by former NRC General Counsel William C. Parler, “Even if it is nothing else, [the hearing] would be much more narrow, much more focused, and much more efficient.”⁸⁵

III. Updating the Licence Renewal Rule in 1995

Within a year of releasing the original Licence Renewal Rule, the NRC began receiving formal recommendations from industry regarding how to improve the licence renewal process.⁸⁶ Following its routine administrative rulemaking process, the NRC obtained comments from the numerous and varied constituencies, including “nuclear utilities, industry organizations, public interest groups, architect and engineering firms, consultants and contractors, and Federal and State governments” as well as private citizens.⁸⁷ In particular, the nuclear industry did not feel that “it received adequate credit for age-related programs already in place, particularly the new maintenance rule”, which dealt with the ageing of active safety

81. See e.g. conversation between Commissioner K. Carr, Dr W. Minners, Deputy Director, US Office of Nuclear Regulatory Research and NRC General Counsel W.C. Parler, during the US NRC “Briefing on Status of Proposed Rule on License Renewal”, Rockville, Maryland, 30 Jan. 1990, pp. 43-45.

82. NUREG-1317, *supra* note 15, p. 5-4.

83. 56 Fed. Reg. at 64945.

84. *Ibid.*, 64966; SECY-90-0121, *supra* note 79, Enclosure 3, pp. 6-7.

85. Parler, W.C., “Briefing on Status of Proposed Rule on License Renewal”, *supra* note 81, p. 55.

86. 60 Fed. Reg. at 22461-2.

87. *Ibid.*, 22462.

components and therefore did not need to be reviewed again during the licence renewal process.⁸⁸

Based on input from the public as well as the NRC's independent review, four years later in 1995, the NRC revised the Licence Renewal Rule to make the process "more efficient, stable and predictable than the previous license renewal rule".⁸⁹ The NRC "determined that the rule could be amended ... while retaining the same degree of safety provided by the previous rule".⁹⁰ Some of the more significant changes were:

- a clear "focus on the adverse effects of aging rather than identification of all aging mechanisms";
- a new section, 10 CFR 54.4 was added to clearly identify the "systems, structures, and components within the scope of the license renewal rule and identify] the important functions (intended functions) that must be maintained"; and
- a narrower subset of structures and components were made subject to an ageing management review for licence renewal, this time with a focus only on passive, long-lived structures.⁹¹

Since that time, although the Rule continues to evolve and change, the substance of licence renewal remains largely the same, as do the principles:

1. With the possible exception of the effects of ageing on certain systems, structures, and components, and a few other issues related to safety only during the period of extended operation, the current regulatory process is adequate to ensure the licensing bases of all operating plants provide and maintain an acceptable level of safety; and
2. Each plant's licensing basis is required to be maintained during the renewal term just as during the original licensing term.⁹²

These two principles of licence renewal, while concise, reflect core regulatory concepts at the NRC.

88. NUREG/BR-0518, *supra* note 23, p. 9.

89. "Backgrounder on Reactor License Renewal", *supra* note 18 (accessed: 28 Sept. 2018).

90. 60 Fed. Reg. at 22485.

91. *Ibid.*, 22463.

92. The current principles are available at "Backgrounder on Reactor License Renewal", *supra* note 18 (accessed: 28 Sept. 2018). As comparison, the text below shows the changes as compared with "Final Rule: Nuclear Power Plant License Renewal; Revisions", 60 Fed. Reg. at 22464:

Principle 1: "with the possible exception of the ~~detrimental~~ effects of aging on ~~the functionality of~~ certain ~~plant~~ systems, structures, and components, ~~in the period of extended operation and possibly~~ a few other issues related to safety only during the period of extended operation, the current regulatory process is adequate to ensure that the licensing bases of all currently operating plants provides and maintains an acceptable level of safety ~~so that operation will not be inimical to public health and safety or common defense and security~~".

Principle 2: "each the plant-specific licensing basis is required to ~~must~~ be maintained during the renewal term ~~in the same manner and to the same extent~~ just as during the original licensing term".

IV. The 1996 update to the Licence Renewal Rule and incorporation of environmental provisions

On 1 January 1970, the National Environmental Policy Act of 1969, or NEPA, was signed into law.⁹³ NEPA is both a policy and a procedure. As a policy, it requires the federal government to use all practicable means and measures to create and maintain conditions under which man and nature can exist in productive harmony.⁹⁴ It does so through providing a procedure by which federal agencies are required to incorporate environmental considerations into both the planning and the decision-making stages, before decisions are made and before actions are taken, through a systematic interdisciplinary approach.⁹⁵ It is then up to the agencies themselves to implement the procedure.⁹⁶

The NRC first implemented NEPA into its regulations at 10 CFR Part 51 in 1974. While not finalised in the original Licence Renewal Rulemaking, note was made of a process underway to address the environmental impacts of licence renewal in a separate rulemaking.⁹⁷ Two main questions were at the core of the NRC's environmental decision making. The first question was what form should NEPA compliance take. Under NEPA, all federal agencies are to prepare detailed statements assessing the environmental impact of, and alternatives to, "major federal actions significantly affecting the quality of the human environment".⁹⁸ It is not always obvious, however, whether a major federal action will have a significant effect on the quality of the human environment. An agency can always, as a matter of policy, determine to prepare an Environmental Impact Statement (EIS) whether or not a determination has been made that the proposed action will have a significant impact. The other alternative is for an agency to prepare an Environmental Assessment (EA) to determine whether the major federal action has the potential to cause significant environmental effects.⁹⁹ Based on the EA, the agency will either determine that there are no significant environmental impacts and therefore issue a "Finding of No Significant Impacts" (FONSI) documenting the rationale for this conclusion, or it will determine that there will be significant impacts and move forward in the preparation of an EIS.¹⁰⁰

The NRC determined by rule in 1984 that certain specific types of licensing actions would require an EIS, and licence renewal was one such action.¹⁰¹ The NRC considered, however, whether as an alternative a site-specific EA, rather than a site-specific EIS, could be performed to comply with NEPA. The NRC originally believed that such an alternative approach would be possible. The Nuclear Energy Institute,

93. National Environmental Policy Act of 1969, as amended (NEPA), Pub. L. 91-190, 42 USC 4321-4347.

94. NEPA, sec. 101, 42 USC 4331.

95. NEPA, sec. 102(2)(A), 42 USC 4332.

96. In addition, federal level regulations were issued in 1978 to implement NEPA and these regulations are binding on all federal agencies. 40 CFR 1500.3, "Mandate".

97. 56 Fed. Reg. at 64945.

98. NEPA, sec. 102(2)(C), 42 USC 4332; see also 40 CFR Part 1502, "Environmental Impact Statement".

99. 40 CFR 1501.3, "When to prepare an environmental assessment"; 40 CFR 1501.4, "Whether to prepare an environmental impact assessment"; 40 CFR 1508.9, "Environmental assessment".

100. 40 CFR 1501.4(c) and (e), "Whether to prepare an environmental impact assessment"; see also, EPA (2017), "National Environmental Policy Act Review Process", www.epa.gov/nepa/national-environmental-policy-act-review-process (accessed 11 Oct. 2018).

101. 10 CFR 51.20, "Criteria for and identification of licensing and regulatory actions requiring environmental impact statements". "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions and Related Conforming Amendments", 49 FR 9352, 9384 (12 Mar. 1984).

several utilities and the Department of Energy agreed with the NRC's original proposal to undertake site-specific EAs, rather than EISs.¹⁰² But, the NRC ultimately determined that it was not likely that "an assessment of the full set of environmental impacts associated with an additional 20 years of operation would not result in a 'finding of no significant impact'".¹⁰³ Therefore, each licence renewal decision would have to include a site-specific EIS.

The second question was whether a generic (also known as a programmatic) EIS (GEIS) should be prepared to "address potential environmental issues that are common to several or all plants requesting license renewal ... [and] identify major factors that could influence the need for site-specific environmental impact statements in making individual relicensing decisions".¹⁰⁴ Although not legally required, the NRC analysed whether as a policy matter a GEIS would be beneficial to the licence renewal process,¹⁰⁵ since it would reduce the burden on both the staff and the industry in re-analysing the same issues over and over again, and it would also prevent these issues from being challenged in adjudicatory hearings on individual LRAs.¹⁰⁶ Industry supported the generic approach because by programmatically resolving a significant number of environmental issues, these issues were all essentially shielded from litigation in individual licence renewal proceedings.¹⁰⁷

There was much discussion, however, about even what form this generic approach would take: a generic EA or a GEIS. Ultimately, the NRC determined that a GEIS was best and began developing a document that would "address, in generic fashion, the impacts associated with continued operation of a nuclear plant beyond its original license, including the impacts of activities to counter the effects of aging, the impacts of high-level and low-level waste, and the effects of radioactive discharges".¹⁰⁸ The generic environmental findings in the GEIS could then be incorporated into a site-specific supplemental EIS.

Five years after the 1991 Licence Renewal Rule, the NRC published the environmental provisions for licence renewal. In 1996, the NRC published revisions to the environmental regulations in Part 51 to define the scope of the agency's environmental review and require the preparation of a site-specific Supplement to the Generic Environmental Impact Statement (SEIS) by the NRC in support of each licence renewal decision.¹⁰⁹ In addition, the NRC also published the *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS)*.¹¹⁰ Since the publication of the GEIS, 59 site-specific supplements have been

102. "Final Rule: Environmental Review for Renewal of Nuclear Power Plant Operating Licenses", 61 Fed. Reg. 28465, 28471 (5 June 1996).

103. *Ibid.*, 28471.

104. NUREG-1317, *supra* note 15, p. xii. The NEPA implementing regulations encourage using the "tiering" method, whereby a programmatic or policy level broad EIS is prepared to cover issues that could come up across a large number of separate programmes or policies. 40 CFR 1502.20, "Tiering". Site-specific EISs are then prepared that summarise and incorporate by reference the information in the programmatic EIS and then concentrate the analysis on the site-specific environmental issues. 40 CFR 1502.20, "Tiering".

105. Parler, W.C., "Briefing on Policy Paper for Plant Life Extension", *supra* note 33, transcript p. 28.

106. 54 Fed. Reg. at 41984.

107. Minners, W., "Briefing on Status of Proposed Rule on License Renewal", *supra* note 81, p. 11.

108. 60 Fed. Reg. at 22489.

109. NRC (2006), *Frequently Asked Questions on License Renewal of Nuclear Power Reactors*, NUREG-1850, NRC Washington, DC, p. 4-8.

110. NRC (1996), *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)*, NUREG-1437, NRC, Washington, DC.

published¹¹¹ and a lessons learnt process undertaken to review, re-evaluate and revise the GEIS with a revision published in 2013.¹¹²

PART II: INTERNATIONAL PERSPECTIVES ON LTO

V. Safety reviews

According to the NEA Committee on Nuclear Regulatory Activities (CNRA), the fundamental principle “underpinning of any programme on extended operation” is that “[t]he safe operation of the nuclear power plant needs to be ensured during the period considered for long-term operation.”¹¹³ Broadly speaking, there are two main approaches to approving LTO: licence renewal and periodic safety reviews (PSRs). Regardless of the approach that a country takes in approving LTO, safe operation “is achieved through maintaining the current licensing basis of the plant and effectively managing ageing of systems, structures and components within the scope of licence renewal.”¹¹⁴

In comparison to the United States, many countries, especially European,¹¹⁵ but also others such as Canada and Korea, provide for a PSR. A PSR “is a comprehensive safety review of all important aspects of safety, carried out at regular intervals, typically every ten years.”¹¹⁶ The “safety review” is also called a “reassessment” because it looks at a number of factors including “the cumulative effects of ageing, modifications, operating experience, technical developments and siting aspects”,¹¹⁷ with an assumption that following the regulatory review of the operator’s PSR a number of safety improvements will be proposed.¹¹⁸ This follows the IAEA approach of continuous safety improvement.¹¹⁹

The PSR is not necessarily the only factor in a decision to allow LTO.¹²⁰ As stated by the IAEA, “a PSR may be used in support of the decision making process for licence renewal or long term operation”.¹²¹ Thus, PSRs can be combined with other approaches, like licence renewal and refurbishment. The NRC, however, does not make use of PSRs because its regulatory structure was already well established by

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111. A link to each of the supplements is available at NRC (2018), Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437), www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/.
 112. NRC (2013), *Generic Environmental Impact Statement for License Renewal of Nuclear Plants – Final Report (GEIS)*, NUREG-1437, Revision 1, NRC, Washington, DC.
 113. 2012 (NEA), *Challenges in Long-term Operation of Nuclear Power Plants: Implications for Regulatory Bodies*, OECD, Paris, p. 9.
 114. *Ibid.*, p. 11.
 115. See e.g., 2014 Amended Safety Directive, *supra* note 72, Article 8(c).
 116. IAEA (2013), *Periodic Safety Review for Nuclear Power Plants*, Specific Safety Guide No. SSG-25, IAEA, Vienna, p. 1.
 117. IAEA (2007), *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection*, IAEA Doc. STI/PUB/1290, IAEA, Vienna, p. 141.
 118. IAEA (2013), *supra* note 116, p. 55.
 119. See e.g., IAEA (2016), *Governmental, Legal and Regulatory Framework for Safety*, IAEA Safety Standards Series, General Safety Requirements, No. GSR Part 1 (Rev. 1), IAEA, Vienna, p. 24, para. 4.27, “The regulatory body shall emphasize the continuous enhancement of safety as a general objective”.
 120. It should be noted that a specific decision or authorisation does not necessarily result from a PSR. In some instances, following a regulatory review of the PSR documentation by the operator, there may be an implicit decision to allow continued operation but there is no explicit regulatory decision or authorisation. This lack of a clear licensing decision factors in during considerations related to environmental reviews, as discussed below.
 121. IAEA (2013), *supra* note 116, pp. 1, 8-10; see also IAEA (2016), *Safety of Nuclear Power Plants: Commissioning and Operation*, Specific Safety Requirements No. SSR-2/2 (Rev. 1), p. 19; IAEA (2009), *supra* note 4, pp. 32-33.

the time the PSR approach was developed.¹²² And the NRC felt that no change was necessary because its regulatory process was already robust enough to encompass the goals of the PSR and that its daily, yearly and as-needed inspection and assessment processes met the PSR objectives on a more frequent basis.¹²³ Through daily on-site monitoring, periodic inspections, evaluations of operating experience, resolution of generic issues, updates of the licensing basis, and imposition of new requirements, the NRC ensures adequate protection of public health and safety.¹²⁴

VI. Environmental reviews

The licence renewal process in the United States follows two tracks: a safety and an environmental track. While there have been some adjustments over time, the two-track review process has remained since the beginning. The clear requirement for a licence renewal environmental review is different from the situation in many countries where an environmental review is not required as part of the LTO authorisation process. There are several explanations for this, many having to do with the form of authorisation. Where licences are open-ended, no changes are made to the licence, and no major works are foreseen to continue operation, there is not necessarily a trigger to perform such an environmental review under the existing laws.

A. Espoo Convention

The Espoo Convention is mainly a European convention, with the exception of Canada, and while Russia and the United States, among other UNECE member countries, are signatories, they are not parties.¹²⁵ Of the 30 countries that have operating nuclear power reactors, over half (18) are parties to the Espoo Convention.¹²⁶ Like NEPA, the Espoo Convention sets out the obligations of parties “to give explicit consideration to environmental factors at an early stage in the decision-making process”.¹²⁷ The difference, however, is that NEPA’s focus is internal, while the Espoo Convention’s focus is external. As stated in Article 2(1) of the Espoo Convention, “The Parties shall, either individually or jointly, take all appropriate and effective measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities.”¹²⁸ The operative word in that sentence is “transboundary”. In many ways, the Espoo Convention can be viewed as an extension of national environmental impact assessment (EIA) laws.¹²⁹ Regional EIA agreements like Espoo ensure “that states

122. NRC (2010), *supra* note 78, p. 1.

123. *Ibid.*, pp. 1, 12-13.

124. *Ibid.*, p. 4.

125. The Convention was amended for the first time in 2001 to allow all United Nations member states to accede to the Convention. Although in force since 2014, that amendment is not yet effective, pending seven missing ratifications.

126. The contracting parties to the Espoo Convention with operating nuclear power reactors are: Armenia, Belgium, Bulgaria, Canada, Czech Republic, Finland, France, Germany, Hungary, Netherlands, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom. The countries that have operating nuclear power reactors that are not parties to the Espoo Convention are: Argentina, Brazil, China, India, Iran, Japan, Korea, Mexico, Pakistan, Russia, South Africa and the United States.

127. Convention on Environmental Impact Assessment in a Transboundary Context (1991), 1989 UNTS 310, entered into force 10 Sept. 1997 (Espoo Convention).

128. As noted in UNECE (2006), “Guidance on the Practical Application of the Espoo Convention”, ECE/MP.EIA/8, p. 8, “Environmental impact assessment existed in the national legislation of most Parties and thus it was technically possible to extend the assessment across the border under the Convention.”

129. UNECE (2006), “Guidance on the Practical Application of the Espoo Convention”, ECE/MP.EIA/8, p. 8.

apply EIA without extraterritorial discrimination – that they take extraterritorial effects into account just as they take domestic effects into account, and that they enable foreign residents to have access to the domestic EIA procedures to the same extent as local residents.”¹³⁰

Although the Convention does apply to some nuclear energy-related activities, it does not apply to *all* nuclear energy-related activities. Herein lies the challenge. At the screening stage, countries normally have to apply the provisions of the Convention when two requirements are met: (1) the proposed activity is listed in the Convention and (2) the proposed activity is likely to cause a significant adverse transboundary impact. Pursuant to Article 1 of the Espoo Convention, any major change to an activity listed under Appendix I of the Convention also falls within its scope of application. Although there is currently no doubt that new reactor construction requires a transboundary EIA, as explicitly required under Appendix I,¹³¹ the question remains whether the same applies to LTO. It should be noted that most nuclear power reactors in the contracting parties’ territory were built before the Espoo Convention entered into force in 1997 and “their construction was rarely subject to” a transboundary EIA and furthermore “not always to domestic EIA”.¹³²

Currently, only a handful of Espoo contracting parties perform a full scope transboundary EIA as part of the authorisation process for LTO.¹³³ In a 2011 note by the Espoo Secretariat on the application of the Convention to nuclear energy-related activities, it was stated that:

The renewal of an NPP [nuclear power plant] licence is generally subject to EIA, though the location, technology and operating procedures may remain unchanged (see appendix III to the Convention). However, in many UNECE countries, NPPs are licensed without any lifetime limitation. Questions remain as to whether an extension of the designed operation period of an NPP is subject to the Convention if no licence renewal process is needed. The unlimited licence is normally coupled with the obligation to perform periodic safety reviews, usually every 10 years. Such a review could lead to a modification of the NPP and its operating licence; though national legislation does not always require EIA in such cases.¹³⁴

130. Knox, J.H. (2002), “The Myth and Reality of Transboundary Environmental Impact Assessment”, *American Journal of International Law*, Vol. 96, Issue 2, p. 291.

131. Appendix I lists the proposed activities that fall within its scope of application, one of which “nuclear power stations and other nuclear reactors (except research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load)”.

132. UNECE (2011), “Background note on the application of the Convention to nuclear energy-related activities: Note by the secretariat”, CE/MP.EIA/2011/5, para. 2.

133. Transboundary EIAs have been performed for the lifetime extensions of the Paks NPP in Hungary and transboundary consultations are underway for the lifetime extension of Unit 3 of the Rivne NPP in Ukraine. The transboundary EIA procedures currently underway in Ukraine are a result of an Espoo Implementation Committee decision that found “that the extension of the lifetime of reactors 1 and 2 of the Rivne NPP after the initial licence has expired, even in absence of any works, is to be considered as a proposed activity under article 1, paragraph (v), and is consequently subject to the provisions of the Convention”. UNECE (2014), “Report of the Implementation Committee on its thirtieth session”, ECE/MP.EIA/IC/2014/2, Annex, p. 22, para. 59.

134. UNECE (2011), *supra* note 132, para. 9.

This statement aside, the note goes on to say that lifetime extension *might* be considered a “major change[] to nuclear-energy related activities, subject to the provisions of the Convention”.¹³⁵ Other nuclear power reactor related activities such as decommissioning and power uprates could also potentially be considered a major change.¹³⁶ But, there is no explicit definition in the Convention of what constitutes a “major change”. Therefore, many Espoo Convention contracting parties have adopted the belief that while a lifetime extension in the absence of licensing activity may be a change to an existing activity, it does not amount to a major change.¹³⁷

At the moment there remains “considerable legal uncertainty as to whether and in what circumstances lifetime extensions of nuclear power plants require a

135. *Ibid.*, para. 10.

136. *Ibid.*

137. At the risk of losing the reader with what may seem like a digression, the author notes that the philosophical underpinnings of this issue crystallised while listening to an episode of the “Revisionist History” podcast by Mr Malcolm Gladwell, available at: <http://revisionisthistory.com/episodes/11-a-good-walk-spoiled>. Although this episode focused on an unrelated matter, it raised a critical philosophical question: how do time and extent factor in to the determination that a change has occurred? In analysing the issue, Mr Gladwell referenced the philosophical conundrum associated with the “ship of Theseus”, a 2 000 year old puzzle where a ship at sea has all of its old planks replaced with new planks one at a time until every piece of the ship is new. The question arises: when it arrives at port, is it the same ship or is it a new ship?

The answer depends on how one views change. As explained by Mr Gladwell, some believe it is a new ship because identity “is the sum of its component parts; change the parts, you change the thing”. Others believe it is the same because “an object can maintain its identity so long as the change is gradual and the form or shape of the object is preserved to the changes of its component materials”. These two approaches correspond to the mereological theory of identity and the spatiotemporal continuity theory, respectively. (A transcript of the podcast can be found at Simon Says Transcription (2017), “A Good Walk Spoiled with Malcolm Gladwell | S2/E1: Revisionist History podcast (Transcript)”, <https://blog.simonsays.ai/a-good-walk-spoiled-with-malcolm-gladwell-bf204294a1e8>.)

For our purposes, instead of the ship of Theseus consider a nuclear power reactor. As explained by the NEA, “lifetime extension can imply replacement of some large components of the nuclear island ... as well as major refurbishments or replacements on the conventional islands”. NEA (2012), *The Economics of Long-term Operation of Nuclear Power Plants*, OECD, Paris, p. 19. The NEA goes on to note that “[i]ndependent of LTO, equipment in NPPs is regularly upgraded”. *Id.* at 21. Additionally, ongoing oversight and maintenance programmes result in components being replaced throughout the initial operating life of a reactor. These factors ensure that while there are significant changes to a nuclear power reactor over the course of its life, not all changes occur at one specific point in time. So this leads to the question: at the time LTO is authorised, is the reactor the same as when it was originally authorised? And of course, the answer depends on how you view the meaning of change.

Under the current interpretation of the Espoo Convention, spatiotemporal continuity theory applies; no “major change” has occurred because the changes are gradual. But, there is another perspective. If viewed through the mereological theory of identity, because the reactor is the sum of its parts and those parts have largely changed over time, the reactor has in fact undergone a change – and in fact a major change – regardless of the time period under which the changes occurred. Therefore, a transboundary EIA would be a necessary step in every LTO authorisation, regardless of whether the approval is implicit or explicit.

transboundary environmental impact assessment under the Espoo Convention”.¹³⁸ Work is currently being done to address this issue, but draft guidance is not anticipated before September 2020.¹³⁹

B. European Union EIA Directive

The 2014 EU EIA Directive¹⁴⁰ largely mirrors the text of the Espoo Convention and thus contains the same ambiguities. While nuclear power reactors are a project specifically listed in Annex I(2)(b), thus automatically subject to the EIA requirements, the Directive is silent as to LTO and therefore a determination would have to be made that there is a “change to or extension of projects listed in this Annex where such a change or extension in itself meets the thresholds, if any, set out in this Annex”.¹⁴¹ Using this methodology, any implicit or explicit action to allow LTO would normally be screened out of the scope of the EIA Directive. Therefore, unlike the mandatory EIS requirement in the United States, the determination of whether to perform a domestic EIA prior to LTO is left to the discretion of EU member states, for now.

PART III: THE PROCEDURE OF REACTOR LICENCE RENEWAL

VII. Licence renewal review process

A. Overview

In the United States, a renewed license may be issued by the Commission if three criteria are met. First, from a safety perspective, the NRC must determine that:

[a]ctions have been identified and have been or will be taken with respect to [managing the effects of ageing and time-limited ageing analyses (TLAA)] such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant’s CLB in order to comply with this paragraph are in accord with the Act and the Commission’s regulations.¹⁴²

138. UNECE (2018), “Draft terms of reference for possible guidance on the applicability of the Convention to the lifetime extension of nuclear power plants: Proposal by the ad hoc working group”, ECE/MP.EIA/WG.2/2018/4, p. 3. In fact, there are currently four pending matters before the Espoo Implementation Committee related to the lifetime extension of the Borssele NPP in the Netherlands (EIA/IC/INFO/15); Units 1 and 2 of Doel NPP and Unit 1 of the Tihange NPP in Belgium (EIA/IC/INFO/18); the Dukovany NPP in the Czech Republic (EIA/IC/INFO/19); and Unit 3 of the Rivne NPP, the South Ukraine NPP, five reactors at the Zaporizhzhya NPP and the Khmelnytsky NPP in Ukraine (EIA/IC/INFO/20). UNECE (n.d.), “Information from other sources”, www.unece.org/environmental-policy/conventions/environmental-assessment/areas-of-work/review-of-compliance/information-from-other-sources.html (accessed 27 Nov. 2018). It is assumed that more cases will be coming in the future. UNECE (2018), “Progress report on the development of guidance on the application of the Convention to the lifetime extension of nuclear power plants: Report by the ad hoc working group”, ECE/MP.EIA/2019/10, Advance Copy, p. 2, para. 4.

139. UNECE (2018), “Progress report on the development of guidance on the application of the Convention to the lifetime extension of nuclear power plants: Report by the ad hoc working group”, ECE/MP.EIA/2019/10, Advance Copy, p. 6, para. 28.

140. Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, OJ L 124 (25 Apr. 2014) (EIA Directive).

141. *Ibid.*, Annex I(24).

142. 10 CFR 54.29(a), “Standards for issuance of a renewed license”.

Second, all environmental regulations contained in Subpart A of Part 51 must be satisfied.¹⁴³ And finally, any adjudicatory hearing must be fully concluded.¹⁴⁴ The review follows this same process. Visually, the licence renewal process can be organised in the following chart, outlining the dual safety and environmental review tracks. All required documents are shown in bold, while all opportunities for public involvement are noted in red.

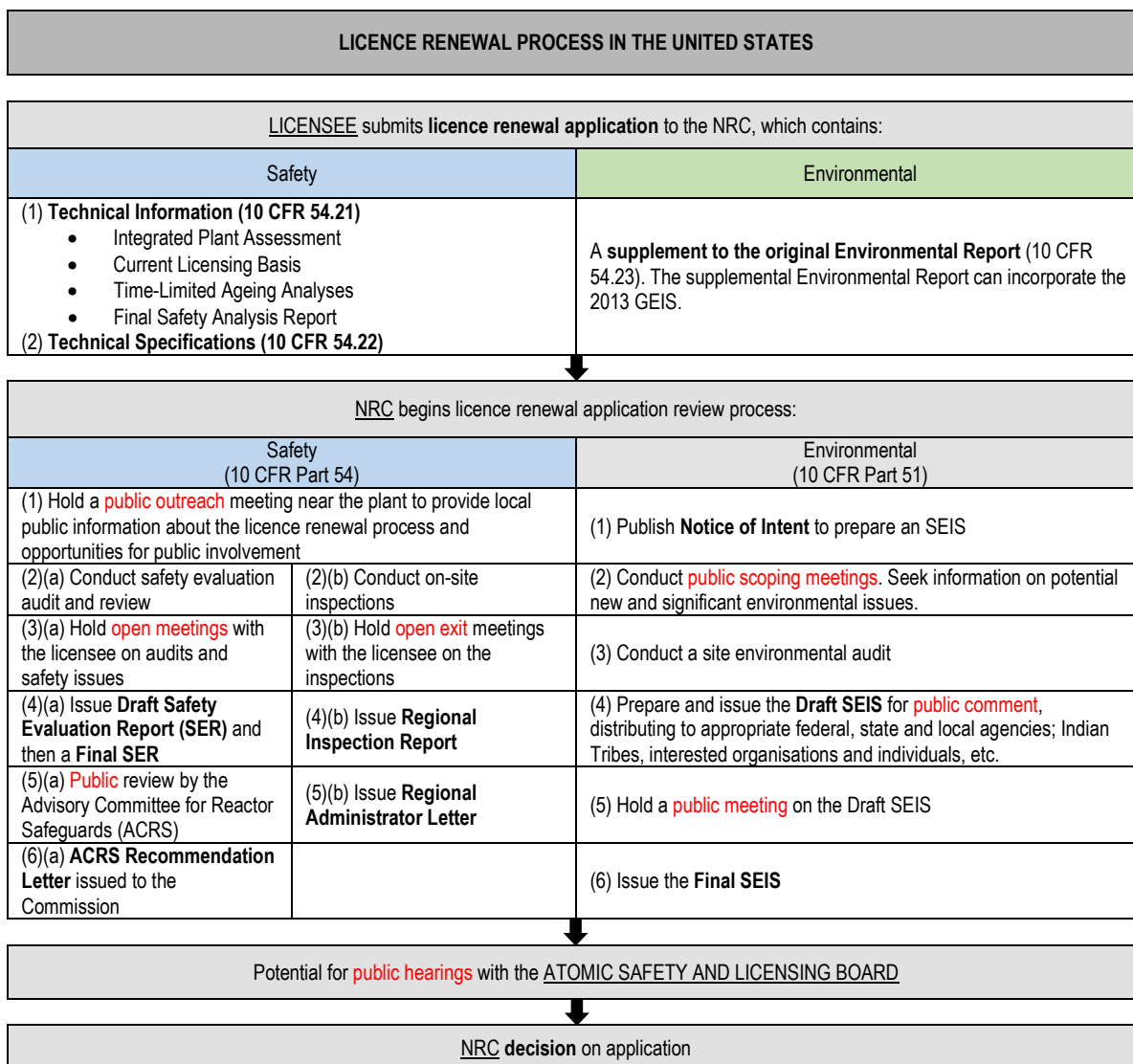


Figure 4.

Chart: K.S. Nick. Sources for information presented: NRC (2018), "Backgrounder on Reactor License Renewal", www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-reactor-license-renewal.html (accessed: 9 Oct. 2018); NRC (2017), "Reactor License Renewal Process", www.nrc.gov/reactors/operating/licensing/renewal/process.html (accessed: 9 Oct. 2018); NRC (2006), *Frequently Asked Questions on License Renewal of Nuclear Power Reactors*, NUREG-1850, NRC, Washington, DC, p. 1-9.

143. 10 CFR 54.29(b), "Standards for issuance of a renewed license".

144. 10 CFR 54.29(c), "Standards for issuance of a renewed license".

B. Licence renewal application

The required contents of an LRA are spelled out in NRC regulations in Title 10 of the CFR. The contents of the safety portion of the LRA are specified according to “general information” (section 54.19), “technical information” (section 54.21) and “technical specifications” (section 54.22). Section 54.23 requires that each LRA must also contain a supplemental Environmental Report in compliance with Subpart A of 10 CFR Part 51, which contains the NRC’s regulations implementing section 102(2) of NEPA.

On the safety side, each application must contain:

- an integrated plant assessment (IPA) that lists those structures and components subject to an ageing management review (AMR);
- an evaluation of TLAAAs that considers the effects of ageing on the structures, systems and components within the scope of the rule based on current operating assumptions;
- a supplement to the FSAR that describes the programmes and activities for managing the effects of ageing; and
- yearly updated amendments to the application indicating any material changes to the CLB during the time of the NRC review of the LRA.¹⁴⁵

In addition, the LRA must include any changes or additions to the current technical specifications of the plant that are necessary to manage the effects of ageing during the period of extended operation.¹⁴⁶

On the environmental side, the LRA must contain an environmental document entitled “Applicant’s Environmental Report – Operating License Renewal Stage” that includes the following:¹⁴⁷

- a statement on the purpose of and need for the proposed action (renewing the operating licence);
- a description of the proposed action, which includes: general plant information; any refurbishment activities related to licence renewal; any new programmes or activities for managing the effects of ageing that could impact the environment; changes to employment; and replacement power alternatives;
- information on the affected environment describing the plant’s environmental setting as well as the environmental consequences of the proposed action and mitigating actions in the following areas: land use and visual resources, meteorology and air quality, noise, geology and soils, water resources, ecological resources, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management;
- an assessment of new and significant information regarding the environmental impacts of licence renewal identified by the licensee prior to beginning the LRA environmental review process, as well as any new and

145. 10 CFR 54.21, “Contents of application – technical information”.

146. 10 CFR 54.22, “Contents of applications – technical specifications”.

147. 10 CFR 51.53(c), “Postconstruction environmental reports”; NRC (2013), “Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications”, Regulatory Guide 4.2, Supplement 1, NRC, Washington, DC.

significant information identified during the scoping process, site visits and comments from the public on the draft SEIS.¹⁴⁸

The licensee's ER must be made available to the public for inspection.¹⁴⁹

C. NRC review

Once the licensee submits their LRA, the NRC performs a sufficiency review, which entails the NRC making an explicit determination that the LRA is essentially complete with enough information that the agency can begin its review.¹⁵⁰ If the NRC concludes that the application is "sufficient", the application is "docketed".

Once the LRA has been formally docketed, the NRC will publish a "notice of intent" that it will prepare an EIS and send the notice to appropriate federal, state and local agencies; Indian Tribes; and to interested persons upon request, among others.¹⁵¹ The notice should describe the proposed environmental scoping process to the public, which would then begin as soon as practicable after publication of the notice.¹⁵²

▪ 1. Environmental review

As part of the scoping process, very soon after the LRA is docketed, the NRC holds a public meeting near the plant in question. Although multiple public meetings will be held throughout the LRA review process the first meeting is important as it launches the review process, informing the public about what to expect and how to be involved, and begins to formally gather information as part of environmental scoping. Interested members of the public can provide comments both during the course of public meetings and in writing; regardless of the format, the NRC treats all comments equally. During the scoping process, the NRC focuses on identifying new and significant information on the environmental impacts of licence renewal, which it will get from the public scoping process as well as on-site environmental audits of the plant to gather first-hand knowledge of the plant and the surrounding environment.

Once the NRC has gathered together all the information from the licensee's ER, the public comments and its own assessments, it will prepare a draft SEIS and issue it for public comment.¹⁵³ Following a similar format as the ER, the NRC's draft SEIS will evaluate, verify and validate all the information gathered. The NRC will seek to gather comments on the draft SEIS from the US Environmental Protection Agency, any other federal agency with expertise or legal jurisdiction, the licensee and appropriate state and local agencies, as well as Indian Tribes, among others.¹⁵⁴ In addition, the NRC will hold another public meeting to discuss its findings and seek further comment.¹⁵⁵

The NRC must consider all information gathered during this public comment period, respond accordingly and determine whether there is a need to modify the

148. 10 CFR 51.53(c)(3)(iv); Regulatory Guide 4.2, *supra* note 147, p. 49.

149. 10 CFR 51.120, "Availability of environmental documents for public inspection".

150. 56 Fed. Reg. at 64962.

151. 10 CFR 51.27, "Notice of intent".

152. *Ibid.*; 10 CFR 51.29, "Scoping – environmental impact statement and supplement to environmental impact statement".

153. 10 CFR 51.70, "Draft Environmental Impact Statement – General"; 10 CFR 51.71, "Draft Environmental Impact Statement – Contents"; 10 CFR 51.95(c), "Postconstruction Environmental Impact Statements"; 10 CFR 51.73, "Request for Comments on Draft Environmental Impact Statement".

154. 10 CFR 51.74, "Distribution of Draft Environmental Impact Statement and Supplement to Draft Environmental Impact Statement; News Releases".

155. "Reactor License Renewal Process", *supra* note 59 (accessed: 10 Oct. 2018).

draft SEIS. In issuing the final SEIS, the NRC must make the ultimate determination as to “whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.”¹⁵⁶

- 2. Safety review

The NRC’s safety review proceeds in dual-track manner, with one track focussed on a safety review and audit of the LRA and the other track focussed on on-site inspections to determine whether the licensee “has implemented and complied” with the licence renewal regulations.¹⁵⁷ The NRC staff’s SER provides the technical and legal basis for the NRC’s conclusions on whether or not the LRA satisfies the 10 CFR 54.29(a), “Standards for issuance of a renewed license”. All the documentation – the LRA and the staff’s review, including the draft and final SER and inspection reports – are made publicly available, and the NRC’s meetings with the licensee are open to the public. While the public is welcome to comment at the end of the meeting, “the highly technical nature of the staff’s safety review does not lend itself to [the same type of] public involvement process such as that used for the environmental review.”¹⁵⁸

In addition to the staff’s review, another body, the Advisory Committee for Reactor Safeguards reviews the LRA.¹⁵⁹ The ACRS is a statutorily-mandated federal advisory committee that is independent of the NRC staff and reports directly to the NRC Commission.¹⁶⁰ As part of the ACRS review, it will hold an open meeting where interested members of the public can provide oral statements that will be considered by the ACRS during its review.¹⁶¹ The ACRS documents the results of its review of the safety aspects of the LRA as well as the staff’s SER and provides a recommendation letter to the Commission.¹⁶²

D. Administrative adjudicatory hearings

Separate and apart from the safety and environmental review process is the potential for an administrative adjudicatory hearing. While it is not mandatory to hold an administrative adjudicatory hearing as part of the licence renewal process, the NRC must offer the public an opportunity to request one. After the LRA is docketed, the NRC will publish a notice of opportunity for a hearing in the *Federal Register*.¹⁶³

Interested members of the public that seek to participate as a party in an adjudicatory hearing must meet two conditions: first they must establish that they have standing to participate and second they must submit an admissible contention. Members of the public have two ways to demonstrate standing: they can either prove that they live within 50-miles of the plant in question, thus satisfying the “proximity presumption”,¹⁶⁴ or they can satisfy traditional judicial concepts of standing as provided in 10 CFR 2.309(d)(1). If a state, local governmental body, or federally-recognised Indian Tribe seek to participate as a party, unlike general

156. 10 CFR 51.95(c)(4), “Postconstruction environmental impact statements”.

157. NUREG-1850, *supra* note 109, p. 3-2.

158. *Ibid.*, p. 3-6.

159. 10 CFR 54.25, “Report of the Advisory Committee on Reactor Safeguards”.

160. AEA, sec. 29, 42 USC 2039, “Advisory Committee on Reactor Safeguards”.

161. NUREG-1850, *supra* note 109, p. 3-7.

162. *Ibid.*, p. 3-5.

163. 10 CFR 54.27, “Hearings”. The *Federal Register* is the daily journal of the Federal government that contains agency regulations, proposed rules, notices of interest to the public and assorted Presidential documents.

164. See e.g. Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-01-6, 53 NRC 138, 150.

members of the public, these entities do not have to demonstrate standing and must only provide an admissible contention, as provided in 10 CFR 2.309(f).

In addition to demonstrating standing to intervene, the prospective party must also submit at least one admissible contention. As described earlier, the scope of the safety and environmental review is more limited than at the operating licence stage; the same carries over to any potential adjudicatory hearing where the scope of litigable issues is also more limited. This is not intended to remove the public's ability to challenge an agency decision but rather to focus the scope of the hearing on issues uniquely associated with the period of extended operation. This is due in part to the fact that the agency already offered the public an opportunity to participate in other decision-making processes (like the Licence Renewal Rulemaking and the GEIS) and also to the fact that the public still has an opportunity to raise challenges on issues outside the scope of an adjudicatory hearing through other processes like petitions for rulemakings (under 10 CFR 2.802) and requests for enforcement action (under 10 CFR 2.206).

The flow of Figure 4 might indicate that there is a sequential nature to the staff's review and the administrative adjudicatory hearing process. But, rulings on contention admissibility and standing to intervene often occur while the staff is performing its safety and environmental review. This is because "The purpose and scope of a licensing proceeding is to allow interested persons the right to challenge the sufficiency of the application. The NRC has not, and will not, litigate claims about the adequacy of the Staff's safety review in licensing adjudications."¹⁶⁵ This, however, only applies to the safety review. A distinction is made for environmental contentions because in that case, "NEPA places legal duties on the NRC, not on license applicants" and therefore the staff's review is the subject of the contention.¹⁶⁶ This being said, the hearing itself generally does not occur until the staff's final SER and SEIS are issued.

The presiding officer in an LRA adjudicatory hearing is a three-member panel of the Atomic Safety and Licensing Board (ASLB or ASLBP if it is the three-member panel).¹⁶⁷ The ASLB is statutorily-mandated and independent of the NRC, even though they are technically employees of the NRC.¹⁶⁸ The ASLBP for licence renewal proceedings is made up of two technical judges and one legal judge.¹⁶⁹

Generally speaking, the simplified hearing procedures of 10 CFR Part 2, Subpart L are used in licence renewal adjudications. This Subpart L procedure emphasises mandatory and continuous openness in document disclosures and written statements, testimony, questions and responses in advance of an oral hearing.¹⁷⁰ Questioning is done by the judges of the ASLBP based on proposed questions provided by the parties.¹⁷¹ Following the hearing, each party is responsible for filing their own "findings of fact and conclusions of law", which will then be considered by the ASLBP in rendering their initial decision.¹⁷²

165. AmerGen Energy Co., LLC (Oyster Creek Nuclear Generating Station) et al., CLI-08-23, 68 NRC 476 (2008).

166. *Ibid.* at 476-477, fn. 64.

167. 10 CFR 2.313, "Designation of presiding officer, disqualification, unavailability, and substitution".

168. AEA, sec. 191, "Atomic Safety and Licensing Board", 42 USC 2241.

169. *Ibid.*

170. 10 CFR 2.1207, "Process and schedule for submissions and presentations in an oral hearing".

171. *Ibid.*

172. 10 CFR 2.1209, "Findings of fact and conclusions of law"; 10 CFR 2.1210, "Initial decision and its effect".

Appeals and petitions for review from ASLBP initial decisions can be made to the five-member Commission of the NRC.¹⁷³ Although some Commissioners have legal training, not all do and therefore a separate office of lawyers (the Office of Commission Appellate Adjudication or OCAA) works to analyse appeals and petitions for review, propose options to address the appeals, and write the Commission adjudicatory decision. Appeals from Commission decisions can be brought before the US Court of Appeals. Appeals for further review can be made by petitioning the US Supreme Court for a writ of certiorari.

VIII. Conclusions

This article addressed in detail the regulatory history of the licence renewal regulations to shed light on the reasons behind the policy, safety and environmental decisions because, apart from inspection-related activity, subsequent licence renewal in the United States will follow essentially the same process. This decision was not made lightly, with years of work and study involved.¹⁷⁴ After re-analysing the initial bases for the Licence Renewal Rulemaking, as well as studying lessons learnt, operating experience, insights from international PSRs and safety improvements made over time, the NRC was able to determine that the current approach was adequate.¹⁷⁵ This long look back demonstrates that the process is fundamentally sound and that the United States can move forward with reviewing applications subsequent renewal.¹⁷⁶

The current and upcoming applications for subsequent renewal are critical for maintaining nuclear's contribution to the world's climate change goals.¹⁷⁷ Each year, despite grid connections in China and Russia, the average age of operating nuclear power plants in the world has been steadily increasing, as has the number of reactors operating past the 40-year mark.¹⁷⁸ If sufficient numbers of reactors are not going to be connected to the grid,¹⁷⁹ regulators and operators have to be committed to ensuring safe continued operation.

173. 10 CFR 2.1212, "Petitions for Commission review of initial decision"; 10 CFR 2.341 "Review of decisions and actions of a presiding officer".

174. See e.g. SECY-14-0016, "Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal", 31 Jan. 2014.

175. It should be noted, however, that although the process will remain largely the same, the technical review will differ as there are unique aspects of ageing and material degradation that apply to the post-60-year period.

176. The concept of looking back to move forward was taken from an article by then-NRC Deputy General Counsel Stephen G. Burns from 2008 entitled "Looking Backward, Moving Forward: Licensing New Reactors in the United States", *Nuclear Law Bulletin*, No. 81, OECD, Paris, pp. 7-29.

177. See e.g. IEA/NEA (2015), *Technology Roadmap: Nuclear Energy*, OECD, Paris, p. 52 ("[The] 2D Scenario highlight[s] the significant role that nuclear energy has to play in the decarbonisation of the world's energy system."); NEA (2015), *Nuclear Energy: Combating Climate Change*, OECD, Paris, p. 8 ("Thus, if the present nuclear energy capacity were to be phased out and replaced by remaining technologies in the world's current energy mix, including fossil fuels as well as low-carbon sources such as hydro and other renewables, ... global annual CO2 emissions from electricity supply would rise by 12%").

178. Schneider, M. and A. Froggatt (2018), *The World Nuclear Industry Status Report 2018*, A Mycle Schneider Consulting Project, Paris, available at: www.worldnuclearreport.org/IMG/pdf/20180902wnisr2018-hr.pdf, pp. 41-42.

179. NEA (2015), *supra* note 177, p. 10 ("In the absence of strong carbon pricing policies, with the current rate of construction of nuclear power plants, and the economics of long-term operation of the existing fleet challenged in many countries, by either low wholesale prices driven by subsidised renewables or by cheap fossil fuel alternatives, nuclear power is not on track to fulfil its potential as one of the main decarbonising technologies.").

Annex

Status of reactor licence renewal in the United States

Reactor	Application Received	Renewed License Issued	Date Entering Extended Operation
Calvert Cliffs 1	10 April 1998	23 March 2000	31 July 2014
Calvert Cliffs 2	10 April 1998	23 March 2000	13 August 2016
Oconee 1	7 July 1998	23 March 2000	6 February 2013
Oconee 2	7 July 1998	23 March 2000	6 October 2013
Oconee 3	7 July 1998	23 March 2000	19 July 2014
Arkansas Nuclear One 1	1 February 2000	20 June 2001	20 May 2014
Turkey Point 3	11 September 2000	6 June 2002	19 July 2012
Turkey Point 4	11 September 2000	6 June 2002	10 April 2013
Edwin I. Hatch 1	1 March 2000	15 June 2002	6 August 2014
Edwin I. Hatch 2	1 March 2000	15 June 2002	13 June 2018
Surry 1	29 May 2001	20 March 2003	25 May 2012
Surry 2	29 May 2001	20 March 2003	29 January 2013
North Anna 1	29 May 2001	20 March 2003	1 April 2018
North Anna 2	29 May 2001	20 March 2003	21 August 2020
Peach Bottom 2	2 July 2001	7 May 2003	8 August 2013
Peach Bottom 3	2 July 2001	7 May 2003	2 July 2014
St. Lucie 1	30 November 2001	2 October 2003	1 March 2016
St. Lucie 2	30 November 2001	2 October 2003	6 April 2023
Fort Calhoun ◊	11 January 2002	4 November 2003	9 August 2013
McGuire 1	14 June 2001	5 December 2003	12 June 2021
McGuire 2	14 June 2001	5 December 2003	3 March 2023
Catawba 1	14 June 2001	5 December 2003	5 December 2023
Catawba 2	14 June 2001	5 December 2003	5 December 2023
HB Robinson 2	17 June 2002	19 April 2004	31 July 2010
VC Summer	6 August 2002	23 April 2004	6 August 2022
RE Ginna	1 August 2002	19 May 2004	18 September 2009
Dresden 2	3 January 2003	28 October 2004	22 December 2009
Dresden 3	3 January 2003	28 October 2004	12 January 2011
Quad Cities 1	3 March 2003	28 October 2004	14 December 2012
Quad Cities 2	3 March 2003	28 October 2004	14 December 2012
Joseph M. Farley 1	15 September 2003	12 May 2005	25 June 2017
Joseph M. Farley 2	15 September 2003	12 May 2005	31 March 2021
Arkansas Nuclear One 2	15 October 2003	30 June 2005	17 July 2018
DC Cook 1	31 October 2003	30 August 2005	25 October 2014
DC Cook 2	31 October 2003	30 August 2005	23 December 2017
Millstone 2	22 January 2004	28 November 2005	31 July 2015
Millstone 3	22 January 2004	28 November 2005	25 November 2025
Point Beach 1	26 February 2004	22 December 2005	5 October 2010

Reactor	Application Received	Renewed License Issued	Date Entering Extended Operation
Point Beach 2	26 February 2004	22 December 2005	8 March 2013
Browns Ferry 1	2 January 2004	4 May 2006	20 December 2013
Browns Ferry 2	2 January 2004	4 May 2006	28 June 2014
Browns Ferry 3	2 January 2004	4 May 2006	2 July 2016
Brunswick 1	18 October 2004	26 June 2006	8 September 2016
Brunswick 2	18 October 2004	26 June 2006	27 December 2014
Nine Mile Point 1	27 May 2004	31 October 2006	22 August 2009
Nine Mile Point 2	27 May 2004	31 October 2006	31 October 2026
Monticello	24 March 2005	8 November 2006	8 September 2010
Palisades	31 March 2005	17 January 2007	24 March 2011
FitzPatrick	1 July 2006	8 September 2008	17 October 2014
Wolf Creek 1	4 October 2006	20 November 2008	11 March 2025
Harris 1	16 November 2006	17 December 2008	24 October 2026
Oyster Creek ☞	22 July 2005	8 April 2009	9 April 2009
Vogtle 1	29 June 2007	3 June 2009	16 January 2027
Vogtle 2	29 June 2007	3 June 2009	9 February 2029
Three Mile Island 1	8 January 2008	22 October 2009	19 April 2014
Beaver Valley 1	28 August 2007	5 November 2009	29 January 2016
Beaver Valley 2	28 August 2007	5 November 2009	27 May 2027
Susquehanna 1	13 September 2006	17 November 2009	17 July 2022
Susquehanna 2	13 September 2006	17 November 2009	23 March 2024
Cooper	30 September 2008	29 November 2010	18 January 2014
Duane Arnold	1 October 2008	16 December 2010	21 February 2014
Kewaunee ✦	14 August 2008	24 February 2011	✦
Vermont Yankee ❖	27 January 2006	21 March 2011	21 March 2012
Palo Verde 1	15 December 2008	22 April 2011	1 June 2025
Palo Verde 2	15 December 2008	22 April 2011	24 April 2026
Palo Verde 3	15 December 2008	22 April 2011	25 November 2027
Prairie Island 1	15 April 2008	27 June 2011	9 August 2013
Prairie Island 2	15 April 2008	27 June 2011	29 October 2014
Salem 1	18 August 2009	30 June 2011	13 August 2016
Salem 2	18 August 2009	30 June 2011	18 April 2020
Hope Creek 1	18 August 2009	20 July 2011	11 April 2026
Columbia Generating Station	20 January 2010	22 May 2012	20 December 2023
Pilgrim 1	27 January 2006	29 May 2012	8 June 2012
Limerick 2	22 June 2011	20 October 2014	22 June 2029
Limerick 1	22 June 2011	20 October 2014	26 October 2024
Callaway 1	19 December 2011	6 March 2015	18 October 2024
Sequoyah 1	15 January 2013	24 September 2015	17 September 2020
Sequoyah 2	15 January 2013	24 September 2015	15 September 2021
Byron 1	29 May 2013	19 November 2015	31 October 2024

Reactor	Application Received	Renewed License Issued	Date Entering Extended Operation
Byron 2	29 May 2013	19 November 2015	6 November 2026
Davis-Besse 1	30 August 2010	8 December 2015	22 April 2017
Braidwood 1	29 May 2013	27 January 2016	17 October 2026
Braidwood 2	29 May 2013	27 January 2016	18 December 2027
LaSalle 1	9 December 2014	19 October 2016	17 April 2022
LaSalle 2	9 December 2014	19 October 2016	16 December 2023
Grand Gulf 1	1 November 2011	1 December 2016	2 November 2024
Fermi, Unit 2	30 April 2014	15 December 2016	21 March 2025
South Texas Project 1	28 October 2010	28 September 2017	21 August 2027
South Texas Project 2	28 October 2010	28 September 2017	16 December 2028
Indian Point 2	30 April 2007	17 September 2018	17 September 2018
Indian Point 3	30 April 2007	17 September 2018	17 September 2018
River Bend	31 May 2017	20 December 2018	30 August 2025
Waterford 3	23 March 2016	27 December 2018	19 December 2024
Crystal River 3 ‡	18 December 2008	‡	‡
Diablo Canyon 1 Δ	24 November 2009	Δ	Δ
Diablo Canyon 2 Δ	24 November 2009	Δ	Δ
Seabrook 1 □	1 June 2010	<i>under review</i>	<i>under review</i>
Perry 1 ◆	<i>[October – December 2020]</i>	<i>awaiting application</i>	<i>awaiting application</i>
Clinton 1 ◆	<i>[January – March 2021]</i>	<i>awaiting application</i>	<i>awaiting application</i>
Comanche Peak 1 ◆	<i>[April – June 2022]</i>	<i>awaiting application</i>	<i>awaiting application</i>
Comanche Peak 2 ◆	<i>[April – June 2022]</i>	<i>awaiting application</i>	<i>awaiting application</i>
Chart created and slightly adapted from information and chart on the website NRC (2019), "Status of Initial License Renewal Applications and Industry Initiatives", www.nrc.gov/reactors/operating/licensing/renewal/applications.html (accessed 28 Jan. 2019) and supplemented by NRC (2019), "Waterford Steam Electric Station, Unit 3 – License Renewal Application", www.nrc.gov/reactors/operating/licensing/renewal/applications/waterford.html .			
NOTES			
<ul style="list-style-type: none"> ■ Reactor permanently shut down ▒ Withdrawn application with planned reactor shut down date ◇ Fort Calhoun Station was permanently shut down on 24 October 2016. ⌘ Oyster Creek was permanently shut down on 17 September 2018. ✦ Kewaunee was permanently shut down on 7 May 2013. ❖ Vermont Yankee was permanently shut down on 29 December 2014. ‡ The Crystal River 3 application was withdrawn by the licensee on 6 February 2013. The facility was permanently shut down on 20 February 2013. Δ The Diablo Canyon 1 & 2 application was withdrawn by the licensee on 7 March 2018. The two units will continue operating until their current operating licenses expire (2 November 2024 for Unit 1 and 20 August 2025 for Unit 2.) □ Application received and under NRC review ◆ Licensee has submitted a letter of intent to pursue licence renewal with a planned submission date. 			

