

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for the Brunswick Steam Electric Plant (BSEP), as filed by Carolina Power & Light Company (CP&L or the applicant). By letter dated October 18, 2004, CP&L submitted its application to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for renewal of the BSEP operating licenses for an additional 20 years. The NRC staff (the staff) prepared this report, which summarizes the results of its safety review of the renewal application for compliance with the requirements of Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." The NRC license renewal project manager for the BSEP license renewal review is S.K. Mitra. Mr. Mitra can be contacted by telephone at 301-415-2783 or by electronic mail at skm1@nrc.gov. Alternatively, written correspondence may be sent to the following address:

License Renewal and Environmental Impacts Program
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: S.K. Mitra, Mail Stop 0-11 F1

In its October 18, 2004, submittal letter, the applicant requested renewal of the operating licenses issued under Section 104b (Operating License Nos. DPR-71 and DPR-62) of the Atomic Energy Act of 1954, as amended, for BSEP Units 1 and 2 for a period of 20 years beyond the current license expiration dates of midnight September 8, 2016, for Unit 1 and midnight December 27, 2014, for Unit 2. The BSEP units are located south of Wilmington, NC, at the mouth of the Cape Fear River in Brunswick County, NC, and two miles north of Southport, NC. The NRC issued the construction permits for Units 1 and 2 on February 7, 1970. The staff issued the operating licenses for Unit 1 on November 12, 1976; and for Unit 2 on December 27, 1974. Units 1 and 2 are boiling water reactors (BWRs) with primary containments of the BWR Mark I design. Each unit has a nuclear steam supply system that is supplied by General Electric Nuclear Energy Company. The balance of the plant was originally designed and constructed by Brown & Root with the assistance of its agent, United Engineers & Constructors. Each unit operates at a licensed power output of 2923 megawatt thermal (Mwt), with a gross electrical output of approximately 1007 megawatt electric (Mwe). The updated final safety analysis report (UFSAR) contains details concerning the plant and the site.

The license renewal process consists of two concurrent reviews - a technical review of safety issues and an environmental review. The NRC regulations found in 10 CFR Parts 54 and 51, respectively, set forth the requirements for these reviews. The safety review for the BSEP license renewal is based on the applicant's LRA and on the responses to the staff's requests for additional information (RAIs). The applicant supplemented and clarified its responses to the LRA and RAIs in audits, meetings, and docketed correspondence. Unless otherwise noted, the staff reviewed and considered information submitted through December 6, 2005. The staff

reviewed the information received after that date on a case-by-case basis, depending on the stage of the safety review and the volume and complexity of the information. The public may view the LRA and all pertinent information and materials, including those mentioned above, at the NRC Public Document Room, located in One White Flint North, 11555 Rockville Pike (first floor), Rockville, MD, 20852-2738 (301-415-4737/800-397-4209), and at the William Madison Randal Library, 601 S. College Road, Wilmington, NC, 28403-3201. In addition, the public may find the BSEP Units 1 and 2 LRA, as well as materials related to the license renewal review, on the NRC website at www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the units' proposed operation for an additional 20 years beyond the term of the current operating licenses. The staff reviewed the LRA in accordance with NRC regulations and the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated July 2001.

SER Sections 2 through 4 address the staff's review and evaluation of license renewal issues that it has considered during the review of the application. SER Section 5 is reserved for the report of the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this report are in SER Section 6.

SER Appendix A is a table that identifies the applicant's commitments associated with the renewal of the operating licenses. SER Appendix B provides a chronology of the principal correspondence between the staff and the applicant related to the review of the application. SER Appendix C is a list of principal contributors to the SER. SER Appendix D is a bibliography of the references used in support of the review.

In accordance with 10 CFR Part 51, the staff prepared a draft plant-specific supplement to the Generic Environmental Impact Statement (GEIS). This supplement discusses the environmental considerations related to renewing the licenses for Units 1 and 2. The NRC staff issued draft Supplement 25 to NUREG-1437 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Brunswick Steam Electric Plant, Units 1 and 2 Final Report," on August 30, 2005.

1.2 License Renewal Background

Pursuant to the Atomic Energy Act of 1954, as amended, and NRC regulations, operating licenses for commercial power reactors are issued for 40 years. These licenses can be renewed for up to 20 additional years. The original 40-year license term was selected on the basis of economic and antitrust considerations, rather than on technical limitations; however, some individual plant and equipment designs may have been engineered on the basis of an expected 40-year service life.

In 1982, the NRC anticipated interest in license renewal and held a workshop on nuclear power plant aging. This workshop led the NRC to establish a comprehensive program plan for nuclear plant aging research. On the basis of the results of that research, a technical review group concluded that many aging phenomena are readily manageable and do not pose technical issues that would preclude life extension for nuclear power plants. In 1986, the NRC published

a request for comment on a policy statement that would address major policy, technical, and procedural issues related to license renewal for nuclear power plants.

In 1991, the NRC published the license renewal rule in 10 CFR Part 54 (the Rule). The NRC participated in an industry-sponsored demonstration program to apply the Rule to a pilot plant and to gain experience necessary to develop implementation guidance. To establish a scope of review for license renewal, the Rule defined age-related degradation unique to license renewal; however, during the demonstration program, the NRC found that many aging mechanisms occur and are managed during the period of initial license. In addition, the NRC found that the scope of the review did not allow sufficient credit for existing programs, particularly the implementation of the Maintenance Rule, which may also manage plant-aging phenomena. As a result, the NRC amended the license renewal rule in 1995. The amended 10 CFR Part 54 established a regulatory process that is simpler, more stable, and more predictable than the previous license renewal rule. In particular, the NRC amended 10 CFR Part 54 to focus on managing the adverse effects of aging rather than on identifying age-related degradation unique to license renewal. The NRC initiated these rule changes to ensure that important systems, structures, and components (SSCs) will continue to perform their intended functions during the period of extended operation. In addition, the revised Rule clarified and simplified the integrated plant assessment (IPA) process to be consistent with the revised focus on passive, long-lived structures and components (SCs).

In parallel with these efforts, the NRC pursued a separate rulemaking effort and developed an amendment to 10 CFR Part 51 to focus the scope of the review on environmental impacts of license renewal and fulfill the NRC's responsibilities under the National Environmental Policy Act of 1969 (NEPA).

1.2.1 Safety Review

License renewal requirements for power reactors are based on two key principles:

- (1) The regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety, with the possible exception of the detrimental effects of aging on the functionality of certain SSCs, as well as a few other safety-related (SR) issues, during the period of extended operation.
- (2) The plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

In implementing these two principles, 10 CFR 54.4 defines the scope of license renewal as including those SSCs (1) that are safety-related (SR), (2) whose failure could affect SR functions, and (3) that are relied on to demonstrate compliance with the NRC's regulations for fire protection (FP), environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transient without scram (ATWS), and station blackout (SBO).

Pursuant to 10 CFR 54.21(a), an applicant for a renewed license must review all SSCs that are within the scope of the Rule to identify SCs that are subject to an aging management review (AMR). Those SCs that are subject to an AMR perform an intended function without moving parts or without a change in configuration or properties, and are not subject to replacement based on qualified life or specified time period. As required by 10 CFR 54.21(a), an applicant

for a renewed license must demonstrate that the effects of aging will be managed in such a way that the intended function(s) of those SCs will be maintained, consistent with the current licensing basis (CLB), for the period of extended operation; however, active equipment is considered to be adequately monitored and maintained by existing programs. In other words, the detrimental effects of aging that may affect active equipment are more readily detectable and can be identified and corrected through routine surveillance, performance monitoring, and maintenance activities. The surveillance and maintenance activities programs for active equipment, as well as other aspects of maintaining the plants' design and licensing basis, are required throughout the period of extended operation.

Pursuant to 10 CFR 54.21(d), each LRA is required to include a supplement to the UFSAR. This supplement must contain a summary description of the applicant's programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses (TLAAs) for the period of extended operation.

License renewal also requires the identification and updating of the TLAAs. During the design phase for a plant, certain assumptions are made about the length of time the plant can operate. These assumptions are incorporated into design calculations for several of the plant's SSCs. In accordance with 10 CFR 54.21(c)(1), the applicant must either show that these calculations will remain valid for the period of extended operation, project the analyses to the end of the period of extended operation, or demonstrate that the effects of aging on these SSCs can be adequately managed for the period of extended operation.

In 2001, the NRC developed and issued Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses." This RG endorses the Nuclear Energy Institute (NEI), "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 3, March 2001 (NEI 95-10). NEI 95-10 details an acceptable method of implementing the license renewal rule. The NRC also used the SRP-LR to review this application.

In the LRA, BSEP fully utilizes the process defined in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," issued in July 2001. The GALL Report provides the staff with a summary of staff-approved aging management programs (AMPs) for the aging of many SCs that are subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources used to review an applicant's LRA can be greatly reduced, thereby improving the efficiency and effectiveness of the license renewal review process. The GALL Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used throughout the industry. The report also serves as a reference for both applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined can provide adequate aging management during the period of extended operation.

1.2.2 Environmental Review

In December 1996, the staff revised the environmental protection regulations to facilitate the environmental review for license renewal. The staff prepared a "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (NUREG-1437, Revision 1) to document its evaluation of the possible environmental impacts associated with renewing

licenses of nuclear power plants. For certain types of environmental impacts, the GEIS establishes generic findings that are applicable to all nuclear power plants. These generic findings are codified in 10 CFR Part 51, Appendix B to Subpart A. Pursuant to 10 CFR 51.53(c)(3)(i), an applicant for license renewal may incorporate these generic findings in its environmental report. In accordance with 10 CFR 51.53(c)(3)(ii), an environmental report must also include analyses of those environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with NEPA and the requirements of 10 CFR Part 51, the staff performed a plant-specific review of the environmental impacts of license renewal, including whether new and significant information existed that the GEIS did not consider. As part of its scoping process, the NRC held a public meeting on January 27, 2005, in Southport, NC, to identify environmental issues specific to the plant. The staff's draft plant-specific Supplement 25 to the GEIS, which was issued on August 30, 2005, documents the results of the environmental review and includes a preliminary recommendation with respect to the license renewal action. The staff held another public meeting on October 18, 2005, in Southport, North Carolina, to discuss the draft plant-specific Supplement 25 to the GEIS. After considering comments on the draft, the staff will prepare and publish a final, plant-specific supplement to the GEIS separately from this report.

1.3 Principal Review Matters

The requirements for renewing operating licenses for nuclear power plants are described in Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54). The staff performed its technical review of the BSEP LRA in accordance with NRC guidance and the requirements of 10 CFR Part 54. The standards for renewing a license are set forth in 10 CFR 54.29. This SER describes the results of the staff's safety review.

In 10 CFR 54.19(a), the NRC requires a license renewal applicant to submit general information. The applicant provided this general information in LRA Section 1 for BSEP, Units 1 and 2, which it submitted to the staff by letter, dated October 18, 2004. The staff reviewed LRA Section 1 and found that the applicant had submitted the information required by 10 CFR 54.19(a).

In 10 CFR 54.19(b), the NRC requires that each LRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The applicant stated the following in the LRA regarding this issue:

The current indemnity agreement for BSEP 1 and 2 states in Article VII that the agreement shall terminate at the time of expiration of that license specified in Item 3 of the Attachment to the agreement, which is the last to expire. Item 3 of the Attachment to the indemnity agreement, as amended, lists BSEP 1 and 2 Operating Licenses DPR-71 and DPR-62. The Company requests that conforming changes be made to the indemnity agreement, and/or the Attachment to the agreement, as required, to specify the extension of the agreement until the expiration date of the renewed BSEP 1 and 2 operating licenses as sought in this application.

The staff intends to maintain the original license numbers upon issuance of the renewed licenses, if approved. Therefore, conforming changes to the indemnity agreement do not need to be made, and the requirements of 10 CFR 54.19(b) have been met.

In 10 CFR 54.21, the NRC requires that each LRA must contain: (a) an integrated plant assessment (IPA), (b) a description of any CLB changes that occurred during the staff review of the LRA, (c) an evaluation of TLAAs, and (d) a UFSAR supplement. LRA Sections 1, 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). LRA Appendix A contains the license renewal requirements of 10 CFR 54.21(d).

In 10 CFR 54.21(b), the NRC requires that each year following submission of the LRA, and at least three months before the scheduled completion of the staff's review, the applicant must submit an amendment to the renewal application that identifies any changes to the CLB of the facility that materially affect the contents of the LRA, including the UFSAR supplement. The applicant submitted an update to the LRA by letter dated September 29, 2005, which summarized the changes to the CLB that have occurred at BSEP, Units 1 and 2, during the staff's review of the LRA. This submission satisfies the requirements of 10 CFR 54.21(b) and is still under staff review.

In accordance with 10 CFR 54.22, an applicant's LRA must include changes or additions to the technical specifications that are necessary to manage the effects of aging during the period of extended operation. In Appendix D to the LRA, the applicant stated that it had not identified any technical specification changes necessary to support issuance of the renewed operating licenses for Units 1 and 2. This adequately addresses the requirement specified in 10 CFR 54.22.

The staff evaluated the technical information required by 10 CFR 54.21 and 10 CFR 54.22 in accordance with NRC regulations and the guidance provided by the SRP-LR. SER Sections 2, 3, and 4 document the staff's evaluation of the technical information contained in the LRA.

As required by 10 CFR 54.25, the ACRS will issue a report to document its evaluation of the staff's LRA review and associated SER. SER Section 5 will incorporate the ACRS report once it is issued. SER Section 6 will document the findings required by 10 CFR 54.29.

The final plant-specific supplement to the GEIS will document the staff's evaluation of the environmental information required by 10 CFR 54.23 and will specify the considerations related to renewing the licenses for Units 1 and 2. The staff will prepare this supplement separately from this SER.

1.4 Interim Staff Guidance

The license renewal program is a living program. The NRC staff, industry, and other interested stakeholders gain experience and develop lessons learned with each renewed license. The lessons learned address the NRC's performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. Interim staff guidance (ISG) is documented for use by the NRC staff, industry, and other interested stakeholders until it is incorporated into the license renewal guidance documents such as the SRP-LR and the GALL Report.

The following table provides the current set of ISGs issued by the staff, as well as the SER sections in which the staff addresses ISG issues.

ISG Issue (Approved ISG No.)	Purpose	SER Section
GALL Report presents one acceptable way to manage aging effects (ISG-1)	This ISG clarifies that the GALL Report contains one acceptable way, but not the only way, to manage aging for license renewal.	N/A
SBO Scoping (ISG-2)	<p>The license renewal rule 10 CFR 54.4(a)(3) includes 10 CFR 50.63(a)(1)—SBO.</p> <p>The SBO rule requires that a plant must withstand and recover from an SBO event. The recovery time for offsite power is much faster than that of EDGs.</p> <p>The offsite power system should be included within the scope of license renewal.</p>	2.1.3.1.1 2.5.1 3.6.2.3
Concrete AMP (ISG-3)	Lessons learned from the GALL demonstration project indicated that GALL is not clear on whether concrete requires an AMP.	3.5.2.2 3.5.2.3

ISG Issue (Approved ISG No.)	Purpose	SER Section
<p>FP System Piping (ISG-4)</p>	<p>This ISG clarifies the staff position for wall-thinning of the FP piping system in GALL AMPs XI.M26 and XI.M27.</p> <p>The staff's new position is that there is no need to disassemble FP piping, as disassembly can introduce oxygen to FP piping, which can accelerate corrosion. Instead, use a non-intrusive method, such as volumetric inspection.</p> <p>Testing of sprinkler heads should be performed at year 50 of sprinkler system service life, and every 10 years thereafter.</p> <p>This ISG eliminates the Halon/carbon dioxide system inspections for charging pressure, valve line-ups, and the automatic mode of operation test from GALL; the staff considers these test verifications to be operational activities.</p>	<p>2.3.3.15 3.0.3.2.7 3.0.3.2.8</p>

ISG Issue (Approved ISG No.)	Purpose	SER Section
<p>Identification and Treatment of Electrical Fuse Holders (ISG-5)</p>	<p>This ISG includes electrical fuse holders AMR and AMP (i.e., same as terminal blocks and other electrical connections).</p> <p>The position includes only fuse holders that are not inside the enclosure of active components (e.g., inside of switchgears and inverters).</p> <p>Operating experience finds that metallic clamps (spring-loaded clips) have a history of age-related failures from aging stressors such as vibration, thermal cycling, mechanical stress, corrosion, and chemical contamination.</p> <p>The staff finds that visual inspection of fuse clips is not sufficient to detect the aging effects from fatigue, mechanical stress, and vibration.</p>	<p>2.1.3.2.3 2.5.1.1 3.6</p>
<p>The ISG Process (ISG-8)</p>	<p>This ISG provides clarification and update to the ISG process on Improved License Renewal Guidance Documents.</p>	<p>N/A</p>
<p>Standardized Format for License Renewal Applications (ISG-10)</p>	<p>The purpose of this ISG is to provide a standardized license renewal application format for applicants.</p>	<p>N/A</p>

1.5 Summary of Open Items

An open item (OI) is an issue that, in the staff's judgment, has not been resolved in a manner that meets all applicable regulatory requirements. After completing a review of the LRA for

Units 1 and 2, including all additional information and clarifications submitted to the staff as of September 29, 2005, the staff has identified no OIs.

1.6 Summary of Confirmatory Items

A confirmatory item (CI) is an issue that the applicant and the staff have resolved, but for which the applicant has not yet formally submitted the resolution. After completing a review of the LRA for Units 1 and 2, including all additional information and clarifications submitted to the staff as of September 29, 2005, the staff has identified no CIs.

1.7 Summary of Proposed License Conditions

As a result of the staff's review of the LRA for Units 1 and 2, including subsequent information and clarifications provided by the applicant, the staff identified three proposed license conditions.

The first license condition requires the applicant to include the UFSAR supplement required by 10 CFR 54.21(d) in the next UFSAR update, as required by 10 CFR 50.71(e), following the issuance of the renewed licenses.

The second license condition requires that the activities identified in SER Appendix A be completed in accordance with the schedule in Appendix A.

The third license condition requires the implementation of the most recent staff-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as the method to demonstrate compliance with the requirements of 10 CFR Part 50, Appendix H. Any changes to the BWRVIP ISP capsule withdrawal schedule must be submitted for NRC staff review and approval. Any changes to the BWRVIP ISP capsule withdrawal schedule which affects the time of withdrawal of any surveillance capsules must be incorporated into the licensing basis. If any surveillance capsules are removed without the intent to test them, these capsules must be stored in manner which maintains them in a condition which would support re-insertion into the reactor pressure vessel, if necessary.