



Carolina Power & Light Company

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JUN 29 1990

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Vice President
Nuclear Services Department

SERIAL: NLS-90-127
TSC 87TSB17

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 & 50-324/LICENSE NOS. DPR-71 & DPR-62
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
EXTENSION OF OPERATING LICENSE
(NRC TAC NOS. 66082 AND 66083)

Gentlemen:

By letter dated February 6, 1990, the Nuclear Regulatory Commission transmitted a request for additional information concerning Carolina Power & Light Company's (CP&L) license amendment request dated August 17, 1987 to extend the expiration dates of the Brunswick Steam Electric Plant, Units 1 and 2 operating licenses. On May 29, 1990, CP&L submitted a response to ten of the Staff's thirteen questions.

Enclosed are responses to two of the three remaining NRC Staff questions. The Company continues to gather information necessary to respond to the remaining question and currently plans to provide the remaining response by July 31, 1990.

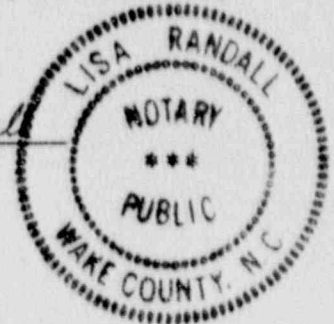
Please relay any questions regarding this submittal to Mr. W. R. Murray at (919) 546-4061.

Yours very truly,

A. B. Cutter

A. B. Cutter, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief; and the sources of his information are officers, employees, contractors, and agents of Carolina Power & Light Company.

Notary (Seal)



My commission expires: 6-7-93

WRM/wrm (\cor\ol-part2)

cc: Mr. S. D. Ebnetter
Mr. N. B. Le
Mr. R. L. Prevatte

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ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
NRC DOCKETS 50-325 & 50-324
OPERATING LICENSES DPR-71 & DPR-62
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
OPERATING LICENSE EXTENSION
(NRC TAC NOS. 66082 AND 66083)

NRC REQUEST NO. 11:

Identify any potential impact that prolonged plant operation may have on properties with historical, architectural, or archaeological significance.

CP&L RESPONSE:

Carolina Power & Light Company has contacted the State of North Carolina Department of Cultural Resources regarding the potential impact that prolonged plant operation may have on properties with historical, architectural, or archaeological significance. Neither CP&L nor the State of North Carolina are aware of any properties of historical, architectural, or archaeological significance that will be impacted by the proposed operating license extensions.

REFERENCES:

1. Letter from Mr. David Brook, Deputy State Historic Preservation Officer, North Carolina Department of Cultural Resources to Ms. Brenda L. Etheridge, Carolina Power & Light Company, dated June 19, 1990.

NRC REQUEST NO. 12:

Assess the impact of the proposed extension on the reactor vessel, mechanical equipment, electrical equipment, and plant structures.

CP&L RESPONSE:

As requested in the NRC's February 6, 1990 letter, Carolina Power & Light Company has considered the impact of the proposed extension of the Brunswick Plant, Unit 1 and Unit 2 operating license on the reactor vessel, mechanical equipment, and plant structures.

The Brunswick Plant was designed for a 40 year operating life. The reactor vessels, which are generally regarded as the limiting item for purposes of plant operating life, were designed for 40 years of normal operation. Programs are in place to monitor fatigue and radiation induced changes to vessel materials. Mechanical equipment is designed for 40 years of operation and is subject to comprehensive surveillance and maintenance programs to assess aging (including Inservice Inspection and Inservice Testing Programs) and ensure that repairs and replacements are made when necessary. Safety-related electrical equipment is also designed for 40 years of operation or is replaced on conservative schedules under the Brunswick Plant Equipment Qualification Program. Other equipment and structures are known to be less susceptible to degradation with age, but nevertheless are designed for 40 years of operation.

Reactor Vessel:

The Brunswick Plant reactor vessels were designed and fabricated to meet the requirements of 10 CFR 50.55a and Section III of the ASME Code (1965 Edition including Summer 1967 Addenda). In addition, the vessels meet the intent of the requirements of 10 CFR Part 50, Appendices G and H and the ASME Code, Section XI. This provides assurance that the vessels will retain structural integrity throughout their design life with adequate margin.

With respect to design life, The Brunswick Plant vessels were procured to have a design life of 40 years full power operation with specified design cycles or transients, as shown in the Vessel Purchase Specification 21A1100 with Supplement 21A1100AR. In addition, the surveillance program prescribed in the Technical Specifications monitors the radiation-induced changes in the properties of the vessel materials. Finally, an inservice inspection program is in place to periodically examine the structural integrity of vessel components.

As noted above, the reactor vessels were qualified to the ASME Code, Section III, 1965 Edition with all the Addenda up to and including the Summer 1967 Addenda. The detailed design and analyses were performed by Chicago Bridge and Iron Company and were approved by General Electric. The reactor vessel analyses were performed in three parts: thermal evaluations, stress calculations, and fatigue evaluations. A thermal transient evaluation was performed to calculate the thermal gradients through various critical

sections of the vessels due to each significant transient evaluated. Stresses were calculated from the thermal evaluation as were the stresses due to pressure loads, mechanical loads, seismic loads, and LOCA loads. The resulting stresses were combined in accordance with ASME Code rules and compared with ASME Code, Section III allowables. The 40 year design life was confirmed by a fatigue evaluation. The fatigue analysis evaluates the peak stresses from the thermal transients and combines them in accordance with ASME Code rules with all stresses previously evaluated to calculate a total fatigue usage factor. All the highly stressed areas were evaluated for the 40 year design life and the usage factor compared to the ASME Code allowable. All the areas were qualified with margin for the design life of 40 years. A cyclic monitoring program is being put in place for the Brunswick Plant to compare actual operating cycles to design cycles, both in terms of numbers of cycles and severity of transients.

A surveillance capsule program is in place within the vessels, as required by 10 CFR Part 50, Appendix H. No surveillance capsules have been tested to date, but calculations of adjusted reference temperature, per Regulatory Guide 1.99, Revision 2, have shown that Appendix G criteria will be met with adequate margin for the 40 year life of the plant. The surveillance programs, and associated calculations of pressure-temperature limits, provide assurance that the irradiation effects of power operation on vessel toughness are monitored during operating life, including the proposed extension periods.

Carolina Power & Light Company has an Inservice Inspection (ISI) Program for the Brunswick Plant reactor vessels, based on the requirements of the ASME Code, Section XI and supplementary requirements such as NUREG-0619. The objective of the ISI Program is to observe if any age-related degradation can occur before it can significantly encroach on design margins. Industry experience has shown that the quality of inspections and the extent of vessel regions inspected is constantly increasing. The ISI Program provides an ongoing confirmation of structural integrity of the reactor vessels during their entire operating life, including the proposed extension periods.

Based on the above, Carolina Power & Light Company concludes that the Brunswick Plant reactor vessels are fully qualified for 40 years of plant operation.

Reactor Internals:

The design of the Brunswick Plant reactor internals was in accordance with the applicable portions of Section III of the ASME Boiler and Pressure Vessel Code, 1965 Edition through and including the Summer 1967 Addenda. This evaluation included a fatigue assessment for the 40 year plant operational period in accordance with the ASME Code as referenced above. When the ASME Code did not completely or adequately apply to specific internal components, additional criteria were established and reviewed with the NRC. These criteria appear in the Final Safety Analysis Report.

In addition, where appropriate, the ASME Code was used in the fabrication, assembly, and examination of the reactor vessel internals. Peak strains resulting from thermal shocks postulated from design basis accidents were evaluated at the end of the 40 year life when the material would have been exposed to the highest integrated neutron flux. The evaluation demonstrated the integrity of the reactor vessel internals to perform their intended function during and after a design basis accident even if it were postulated to occur at the end of the 40 year plant life.

The major components within the reactor vessel were subjected to extensive testing on a prototype plant coupled with a dynamic system analysis of the Brunswick Plant to properly describe any resulting flow induced phenomena incurred from normal plant operation and from anticipated operational transients. Possible contributory sources of vibration were postulated from pump operation, flow induced vibrations caused by cross and/or parallel flow, and turbulent flow. A confirmatory vibration test was performed for the Brunswick Plant and the resultant response compared with analytically determined acceptable values. All flow vibratory induced stresses were well within the fatigue allowables established by the ASME Code.

Based on the above, Carolina Power & Light Company concludes that the Brunswick Plant reactor internals are fully qualified for 40 years of plant operation.

Mechanical Equipment:

At the time of licensing, the NRC concluded that the design of pressure-retaining mechanical fluid systems within the boundaries of Atomic Energy Commission Safety Classification A, B, and C were designed and constructed in accordance with rules consistent with the codes specified in Regulatory Guide 1.26 and in conformance with Sections 50.55a of 10 CFR Part 50. The NRC further concluded that compliance with the above rules provided reasonable assurance that the component quality level was adequate to safely withstand the plant loading conditions and the combination of loadings which the systems may experience over the service lifetime without loss of structural integrity. In addition, the NRC believed that the components satisfied the requirements of AEC General Design Criteria 1, 14, and 30.

All safety-related piping systems including piping supports were analyzed for a 40 year design life using NRC approved methods and computer codes and conformed to the B31.1.0 Power Piping Code, 1967 Edition. The reactor vessel support which is attached and forms an integral part of the vessel is designed in accordance with the same Code rules as the reactor vessel. Fuel related components not covered by the Code were reviewed by the NRC and those items were found acceptable for their normal loads, anticipated transients, seismic events, and postulated accidents without gross loss of structural integrity or impairment of function.

In addition, the mechanical equipment was reviewed relative to the applicable design criteria and standards employed (see Table 1). The enclosed table

lists the criteria and standards employed in the design and fabrication of the mechanical equipment. Not all design criteria or standards are applicable to every component.

As support for the proposed license amendment, CP&L has considered the potential effect of the operating license extension on mechanical equipment and concludes that there will be no impact.

Mechanical equipment for the Brunswick Plant was specified to have a design life of 40 years of operation or is subject to surveillance, testing, and maintenance requirements to detect degradation and ensure corrective action. For example, the NSSS mechanical equipment was designed and procured for a 40 year design life. The fact is reflected in the design documentation of the individual components. See, for example, Design Specification 21A1064 where the design life of 40 years is specified for the recirculation pump casings. Thus, the original design and operation for mechanical equipment encompassed the proposed extension of the operating license because the design life was based on 40 year operation specified and/or a complementary combination of surveillance, inservice inspection, maintenance, and repair/refurbishment. It was, and continues to be, understood that some items of equipment and subcomponents are not expected to last 40 years. Surveillance, maintenance, and testing of mechanical equipment are performed to verify operability of the equipment or detect potential degradation and ensure that when required, equipment is replaced or some other appropriate action taken. In addition, subcomponents such as nonmetallics (gaskets, O-rings) are inspected and periodically replaced, as necessary, as part of routine maintenance in order to ensure that the design life of the equipment will be achieved. Surveillance, inspection, and testing requirements include the following:

ASME Code Section XI: Equipment that is ASME Code Class 1, 2 or 3 is subject to the inservice testing and inservice inspection requirements of ASME Code Section XI and 10 CFR 50.55a. This includes hydrostatic and leakage testing of the reactor coolant pressure boundary, non-destructive volumetric and visual inspections, inservice performance testing of pumps and valves, and inservice testing of supports. These requirements apply throughout the operating life of a facility and ensure that mechanical equipment will be maintained in accordance with the requirements of the ASME Code and the Code of Federal Regulations, regardless of the operating license period.

Technical Specifications: Equipment covered by Technical Specifications is subject to the surveillance and testing requirements of the applicable Technical Specification, with specified testing and surveillance intervals. These surveillance requirements include calibration and inspection of systems and components to ensure that operation of the plant will remain in accordance with Limiting Conditions for Operation, as well as requirements for maintaining the structural integrity of reactor coolant system components (see Technical Specification 3/4.4.8). Examples include safety/relief valve operability testing (see Technical Specification 3/4.4.2), pressure testing of the reactor building air lock (see Technical

Specification 3/4.6.1.3), and stroke time testing of main steam line isolation valves (see Technical Specification 3/4.4.7).

10 CFR 50, Appendix J: Equipment and components associated with containment penetrations, including containment isolation valves, are subject to leak rate testing under 10 CFR 50, Appendix J. This includes local leak rate testing (Type B and C) of penetrations as well as integrated leak rate tests (Type A) to verify overall containment integrity (see Technical Specification 3/4.6.1).

Performance Testing: Although there are no NRC equipment qualification requirements *per se* for mechanical equipment, such equipment is subject to performance testing by CP&L.

In addition to these programs, the Company has initiated and will continue to initiate programs to address any identified concerns with items of mechanical equipment as they arise. For example, CP&L was active in establishing a program to address erosion/corrosion in carbon steel piping. This program is a long-term erosion/corrosion monitoring program to assure the structural integrity of piping systems is maintained. Similarly, CP&L has implemented a crack arrest verification program (CAVS) to monitor the stress corrosion potential in material representative of the pressure boundary as well as other mechanical equipment. As another example of the continued ongoing effort to assure the performance adequacy of mechanical components, CP&L is engaged in a program of performance testing and monitoring of key mechanical components. In addition to the ISI Pump and Valve Testing Program, other key mechanical rotating equipment such as the HPCI and RCIC turbines and the Reactor Recirculation MG Sets are included in a vibration monitoring program. Other activities which aid in providing an ongoing program for proper maintenance of mechanical components for the 40 year operating life of the plant are the reliability data system and repetitive failure detection systems.

The above described activities provide the necessary assurance that mechanical equipment will be maintained properly throughout the operating life of the plant, including the proposed license extension period.

Electrical Equipment:

Safety-related electrical equipment installed in the Brunswick Plant was designed for a full 40 year operating life. Exceptions include those cases where the equipment has some "consumable" quantity (e.g., neutron monitoring detectors, batteries, etc.).

Equipment maintenance (where required/anticipated for both preventive and corrective purposes) has been considered within applicable plant maintenance procedures. For those cases where a less than 40 year design service life applies, maintenance activities will include equipment/component replacement. Additionally, required maintenance surveillance testing practices have been implemented to maintain plant operating conditions within plant Technical Specification limits. These plant maintenance procedures have been

established after review of vendor recommendations and required operating system parameters.

Carolina Power & Light Company acknowledges that there will be cases where equipment/component obsolescence will occur. These cases can potentially occur during the current licensing period, and will be dealt with by CP&L on a case by case basis, regardless of plant license extension.

The above-noted existing design considerations and ongoing maintenance practices provide assurance that the Brunswick Plant safety-related electrical equipment will remain operable through the full 40 year plant operating life (i.e., through September 8, 2016 for Unit 1 and through December 27, 2014 for Unit 2).

Two particular areas that deserve further detail have been summarized within the following discussions.

1. Brunswick Plant EQ Program:

The Brunswick Plant has in place a program for the environmental qualification of safety-related electrical equipment/cables (EQ Program) located in the potential harsh environments of the primary and secondary containments, to comply with the requirements of 10 CFR 50.49. This program was found acceptable by the NRC, based upon a March 5, 1985 Safety Evaluation Report as well as NRC (audit) inspections of the EQ Program during August 1985 and August 1989.

The Brunswick Plant EQ Program includes the considerations for a "qualified life" to each item of electrical equipment/cable within its scope. This qualified life for each equipment/cable has been established based upon available test data and engineering analyses, comparable to industry-accepted practices. These qualified life determinations apply to normal plant operating service conditions, to ensure equipment/cable operability in the event an accident occurred on the last day of its determined qualified life.

In many cases, equipment/cable qualified lives have been determined to be greater than forty years (from the date of initial plant operation). For those remaining cases where the qualified life has been determined to be less than 40 years, an EQ-related replacement/refurbishment process has been established (based upon EQ Program documentation) and is being implemented (as part of ongoing plant maintenance activities).

It should be noted that additional assurance of Brunswick Plant EQ equipment integrity is based upon the fact that a significant amount of equipment was replaced to assure initial compliance to 10 CFR 50.49. In addition, EQ-related cable replacements in upper drywell elevations have been or will be performed for each Brunswick unit, based upon higher ambient temperatures experienced to date (relative to operating conditions at lower drywell elevations).

2. Batteries:

Technical Specification 3/4.8.2.3 includes operability and surveillance requirements which have been incorporated into plant maintenance surveillance test procedures. These maintenance surveillance test procedures verify the existence of an (minimum) 80 percent battery capacity and require annual testing or battery replacement (at 85 percent of service life [17 years]), consistent with criterion established per IEEE Standard 450-1980, versus their rated 20 year service life.

Current plans are to replace the batteries after 17 years of service to eliminate the annual testing requirements (over the final 3 years of battery life). Based on these plans, the batteries in service as of February 6, 2010 will be only 5 to 7 years old. Otherwise, if annual testing is performed, the second set of replacement batteries would be at or near their expected end-of-life on February 6, 2010, and battery replacement would be completed to support continued operation beyond February 6, 2010 (consistent with existing plant maintenance test procedures).

The above additional discussions identify specific examples of programmatic activities which are being performed irrespective of the proposed plant operating expiration date. However, these activities do serve to further promote the extension of the Brunswick Plant operating license to its full 40 year term, i.e. through September 8, 2016 (for Unit 1) and December 27, 2014 (for Unit 2).

Plant Structures:

All Seismic Category I structures for the Brunswick Steam Electric Plant, Units 1 and 2, including the containment, the concrete and structural steel internal structures, and foundations, were reviewed and found acceptable by the NRC at the time of licensing (see Safety Evaluation Report Section 3.8). The structures were designed for dead loads, live loads, missiles, LOCA, small break LOCA, seismic events, hurricane loads, and tornado loads in accordance with applicable codes. The pre-stressed post-tensioned concrete girders which support the fuel pool, steam separator and dryer pool, and reactor well were designed in accordance with ASME Code Section III and American Concrete Institute Standard ACI 318. The NRC found the design, materials, construction methods and quality assurance utilized for the containment to be acceptable for satisfying relevant requirements of General Design Criteria 2, 4, 16, and 50 (see Safety Evaluation Report Section 3.8.1).

The containment was subjected to a pre-operational acceptance test in accordance with Regulatory Guide 1.18 (AEC Guide 18) utilizing an internal pressure of 1.15 times the containment design pressure. In addition, a pre-operational Integrated Leak Rate Test (ILRT) was performed in accordance with 10 CFR 50, Appendix J.

The reinforced concrete containment is generally known not to be susceptible to significant degradation with time. Specific evaluation in regards to high temperature effects on drywell concrete will support extension of the operating license. Nevertheless, measures are in place to ensure that any deterioration is detected and repaired. Throughout the service life of the unit, the containment structure is subject to the inspection and testing program of Appendix J. The Appendix J program requires three Type A ILRTs during every 10 year cycle. This program includes visual examination of both interior and exterior surfaces of the containment for any indications of degradation affecting structural integrity.

The Appendix J leak rate testing program is well documented and provides reasonable assurance that containment structural integrity remains adequate throughout the service life of the facility, including the proposed extension period.

The plant's concrete and structural steel internal structures, including walls, compartments and floors, its other Seismic Category I structures (slabs, walls, beams and columns), and its foundations were found adequate to meet General Design Criteria 2 and 4 (see Safety Evaluation Report Sections 3.8.2, 3.8.3, and 3.8.4). Again, these structures were designed to resist various combinations of loadings. These structures are generally known not to be susceptible to significant age-related degradation. Nevertheless, surveillance and maintenance requirements set forth in Technical Specifications provide assurance of structural integrity and ensure that any degradation will be detected and repaired.

A Long-Term Program (LTP), based on the Brunswick Plant Unique Analysis Report for Mark I containment structures was initiated. Modifications required due to the LTP have been identified and installation of the modifications was scheduled to begin in March 1980. During the review of the CP&L operating license for the Brunswick Plant, several areas involving equipment design and systems design were required to be modified for the NRC Staff to conclude that these areas were acceptable and in conformance with the Commission's General Design Criteria, quality assurance criteria, and Regulatory Guides. Eleven of these areas which the Staff required design modifications are listed in the Safety Evaluation Report (see Safety Evaluation Report Section 1.7). All of the Commission's concerns were resolved or indicated to be resolved following completion of the necessary modifications.

On the basis of the above considerations, CP&L concludes that the plant structures will not be adversely affected by the proposed extension of the operating license.

REFERENCES:

1. NRC Inspection Report 50-325/85-26 and 50-324/85-26 dated November 12, 1985.

2. NRC Inspection Report 50-325/89-24 and 50-324/89-24 dated September 26, 1989.
3. NRC Safety Evaluation Report dated March 5, 1985.
4. Brunswick Plant Updated Final Safety Analysis Report.
5. Brunswick Plant Final Environmental Statement.

Table 1

Design Codes and Standards
Used for Brunswick Plant Mechanical Components

1. ANSI B31.1.0
2. ANSI B31.7
3. USAS B16.5
4. USAS B31.1.0 (1967 Edition plus Code Cases N7, N9, N10)
5. ANSI B96.1
6. ASME Boiler and Pressure Vessel Code
(Sections II, III, VIII, IX, XI, and Code Case N-411)
7. ASME Nuclear Pump and Valve Code
8. Regulatory Guide 1.92
9. IE Bulletins 79-02, 79-07, 79-14, and 80-17
10. Manufacturer's Standards MSS-SP66
11. ASTM Part 31
12. API 620 and 650
13. TEMA Standards
14. AWWA D-100

NRC REQUEST NO. 13:

Provide a listing of all FES or FSAR sections in which less than 40 years of operation was assumed; provide an assessment of the impact of the extensions on conclusions found in the sections identified.

CP&L RESPONSE

Listed below are the Updated FSAR sections which reference time of operation of less than 40 years:

(a) Updated FSAR Section 2.1.3

This section addresses population projections through the year 2010. Updated population projections based on 40 years of plant operation are provided as responses to NRC Requests Nos. 1 and 2.

(b) Updated FSAR Section 3.5.1, pages 3.5.1-13 and 3.5.1-15

This section discusses turbine failure probabilities provided by General Electric (GE). Carolina Power & Light Company has requested the assistance of General Electric in assessing the impact of the proposed extension periods regarding turbine failure probabilities. A supplemental response will be provided when CP&L receives additional information from GE.

Listed below are the Final Environmental Statement (FES) sections which reference time of operation of less than 40 years:

(a) FES Section IX, page IX-1

This section of the FES addresses irreversible and irretrievable commitment of resources due to the operation of the Brunswick Plant. The FES identified two major resources that would be irreversibly and irretrievably committed due to operation of the Brunswick Plant: the land (during the life of the plant) and the uranium consumed by the reactor. The FES conclusions concerning the irreversible and irretrievable commitment of resources remain unchanged as a result of the proposed operating license extension.

(b) FES Section XI.B, page XI-16

This section of the FES discusses the cost-benefit analyses for the plant with respect to alternatives. The analysis assumes a 30 year effective plant life relative to monetized costs and/or benefits. The extension of the operating licenses produces significant additional benefit for the customers of Carolina Power & Light Company and the Eastern Municipal Power Agency, while deferring the cost of replacement power. Therefore, the FES conclusion that the environmental impact of plant operation will be greatly outweighed by the availability of

electrical power produced by the plant remains valid for the period of the requested operating license extensions.