



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING AMENDMENT NO. 82 TO FACILITY OPERATING LICENSE NO. NPF-12

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated August 2, 1985, as supplemented March 30, 1988, June 15, 1989, and September 1, 1989, South Carolina Electric & Gas Company (the licensee) requested an amendment to the Facility Operating License (OL) for the Virgil C. Summer Nuclear Station, Unit No. 1, (Summer). The proposed amendment would change the expiration date for the license from March 21, 2013 to August 6, 2022, an extension of nine years and four months. The supplemental letters provided clarifying information that did not change the requested amendment or alter the initial determination; therefore, this application was not renoticed.

2.0 DISCUSSION AND EVALUATION

Section 103.c of the Atomic Energy Act (Act) of 1954 provides that a license is to be issued for a specified period not exceeding 40 years. 10 CFR 50.51 specifies that each license will be issued for a fixed period of time, to be specified in the license, not to exceed 40 years from date of issuance. 10 CFR 50.57 allows the issuance of an operating license pursuant to 10 CFR 50.56 for the full term specified in 10 CFR 50.51 in conformity with the construction permit (CP) and when other provisions specified in 10 CFR 50.57 are met. The current term of the license for Summer is 40 years commencing with the issuance of the CP. This represents an effective operating term of 30 years and 8 months, not 40 years. Consistent with the Act and the Commission's regulations, as noted above, the licensee seeks an extension of the OL term for Summer such that the fixed period of the license would be 40 years from the date of issuance of the OL.

Current NRC policy is to issue operating licenses for a 40-year term, commencing with the date of issuance of the OL. For Summer, this date was August 6, 1982. Thus a 40 year term would change the expiration date from March 2, 2013 to August 6, 2022 for an extension of nine years and four months, the interval between issuance of the CP and OL.

The licensee's request for extension of the operating license is based, in part, on the fact that a 40-year service life was considered during the design and construction of the plant. Although this does not mean that some components will not wear out during the plant lifetime, design features were incorporated which maximize the inspectability of structures, systems and equipment. Surveillance, inspectability and maintenance practices which were implemented in accordance with the ASME Code for Inservice Inspection and Inservice Testing of Pumps and Valves and the facility Technical Specifications provide assurance that any unexpected degradation in plant equipment will be identified and corrected. The specific provisions and requirements for ASME Code testing are set forth in 10 CFR 50.55a.

Reactor Pressure Vessel

The Summer reactor pressure vessel has been designed and fabricated to meet the requirements of 10 CFR 50.55a and Section III of the ASME Code (1971 Edition). In addition, the vessel meets the requirements of 10 CFR Part 50, Appendices G and H. This was noted in the NRC Safety Evaluation Report (SER), dated February 1981, (NUREG-0717) and Supplement 1 thereto dated April 1981.

The licensee stated that the Summer vessel was procured to have a design life of 40 years full power operation with specified design cycles or transients. A cycle monitoring program is in place to determine when design limits are approached. In addition, the Summer surveillance program prescribed in Technical Specification (TS) 4.4.9.1.2 monitors the radiation-induced changes in the properties of the vessel materials. The licensee indicated, in a September 16, 1989 letter to the NRC, that surveillance tests on capsules, as required by 10 CFR Part 50, Appendix H, have shown that Appendix G criteria will be met with adequate margin for the life of the plant. The surveillance program in the TS provides additional assurance that the effects of power operation are monitored throughout facility life, including the proposed extension period.

As required by 10 CFR 50.61, the Summer vessel has been evaluated for vulnerability to pressurized thermal shock (PTS). The licensee submitted such an evaluation in a January 23, 1986 letter to the staff. As shown in Table 4-2 of WCAP-10998, Revision 1, of that submittal (noted in this SE as Table 1), the PTS analysis shows that at the end of a 40-year life, the value of RT/NDT at the vessel beltline will be approximately 162 degrees F.

This value is about 110 degrees F lower than the screening criterion of 10 CFR 50.61. The analysis presented by the licensee demonstrated that PTS will not be a limiting factor in the design life of the Summer vessel.

The Summer reactor vessel was qualified to the ASME Code, Section III, 1971 Edition. The detailed design and analysis was performed by Chicago Bridge and Iron Company and was approved by Westinghouse. The reactor vessel analysis was performed in three parts: thermal evaluation, stress calculations and fatigue evaluation. A thermal transient evaluation was performed to calculate the thermal gradients through various critical sections of the vessel due to each transient evaluated. Stresses were then calculated using results from the thermal evaluation in addition to pressure loads, mechanical loads, seismic and LOCA loads. The 40-year design life was verified in the fatigue evaluation. The fatigue evaluation combined data from the thermal transients and stress intensities to calculate a total fatigue usage factor. All areas analyzed were qualified to the Code allowable.

Based on the above, the licensee concluded that the Summer reactor pressure vessel is fully qualified for 40 years of full power operation.

The staff has completed their review of the Summer reactor vessel in regard to fracture toughness requirements for protection against pressurized thermal shock events as required by 10 CFR 50.61. The staff has found that the reactor vessel meets the fracture toughness requirements of 10 CFR 50.61 for 32 effective full power years of operation. The staff has determined that the reactor beltline material with the controlling reference temperature (RT_{PTS}) at 23 effective full power years is the intermediate Shell plate A9154-1. The RT_{PTS} was calculated to be 155.3 degrees F for A9154-1. Considering the "expiration Date of Proposed Operating License (October 2022)" in Table 1, the staff estimated the RT_{PTS} of A9154-1 to be 161 degrees F. The estimated RT_{PTS} may increase depending on the actual neutron fluence; however, it is well below the pressurized thermal shock screening criterion of 270 degrees F. The staff finds that the reactor vessel for Summer meets the criteria of 10 CFR 50.61 for the requested license extension to a 40-year operating life.

Environmental Qualification of Electrical Equipment

Summer has in place a program for the environmental qualification of safety-related electrical equipment (EQ program) in compliance with 10 CFR 50.49 and NUREG-0588. As indicated, Supplement 4 to the Summer SER, dated August 1982, indicated this. This program was audited by the NRC at the time of the operating license review and found acceptable. As noted in Inspection Report No. 50-395/88-01, dated May 2, 1988, the NRC has inspected the Summer EQ Program and found it to be implemented in accordance with Section 50.49 and applicable NRC guidance, though some deficiencies have been identified and are being corrected. In the licensee's response to Inspection Report 88-01, they indicated that they were implementing an Equipment Qualification Enhancement Program.

The licensee has stated that the Class 1E electrical systems at Summer were designed for a full 40-year operating life and that the EQ program fully supports extension of the operating license to a 40-year term.

The licensee indicated that the EQ program assigns a "qualified life" to each item of electrical equipment within its scope. This qualified life is established using available test data and engineering analysis. In many cases, this qualified life is at least forty years. Equipment that is required to operate post-accident was designed for a qualified life sufficient to ensure continued operability in the event an accident occurred on the last day of its design qualified life. Where the qualified life is less than forty years, the EQ program and Technical Specification surveillance requirements (e.g., Technical Specification 3/4.8.2 on electrical power systems including batteries) ensure equipment replacement or maintenance prior to expiration of the qualified life.

The staff has concluded and the EQ inspection team has verified that the licensee has implemented an environmental qualification program meeting the requirements of 10 CFR 50.49 and that such a program will be unaffected by the extension of the operating license to 40 years from the date of issuance of the OL.

Mechanical Equipment

At the time of the issuance of the operating license, the NRC concluded that the design of safety-related components, component supports, reactor internals, and non-Code items conformed to Standard Review Plan (SRP) 3.9.1 and satisfied General Design Criteria (GDC) 14 and 15 of Appendix A to 10 CFR Part 50 for conditions and events expected over the lifetime of the plant. As support for the proposed license amendment, the licensee considered the effect of the OL extension on mechanical equipment and concluded that there would be no significant impact.

The licensee stated that mechanical equipment for Summer was either 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, Nuclear Steam Supply System (NSSS) mechanical equipment and balance-of-plant equipment were designed and procured for 40-year design life. Thus, the original design and operational considerations for mechanical equipment, encompassed the proposed extension of operation.

However, some items of equipment and subcomponents are not expected to last 40 years. Surveillance, maintenance and testing requirements for mechanical equipment are in place to verify operability of the equipment or detect degradation and ensure that equipment that does degrade is replaced or other corrective action taken. In addition, subcomponents such as nonmetallics (gaskets, O-rings) are inspected and replaced, as necessary, as part of routine maintenance in order to ensure the design life of the equipment. Surveillance, inspection and testing requirements at Summer include the following:

1. 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, inspections of a representative sample of pressure retaining welds, inservice performance testing of pumps and valves and inservice testing of certain supports. These requirements apply throughout the operating life of a facility and will provide reasonable assurance that mechanical equipment will be properly monitored throughout the operating life.
2. 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. Examples include valve leakage testing (TS 4.4.6.2.2 and 3/4.4.6), pressure testing of the Reactor Building air lock (TS 4.6.1.2), and stroke time testing of Main Steam Line Isolation Valves (TS 4.7.1.5).
3. 10 CFR Part 50, Appendix J. Equipment and components associated with containment penetrations, including containment isolation valves, are subject to leak rate testing under 10 CFR Part 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 (TS 4.6.1.1.c and 4.6.1.2).

In addition to the above programs, the licensee has initiated programs to address identified concerns with items of mechanical equipment. For example, a program was established to address erosion/corrosion concerns in carbon-steel piping. This program is a long-term erosion/corrosion monitoring program to maintain the structural integrity of piping systems and will be incorporated into an engineering procedure. Similarly, a program to address boric acid corrosion concerns identified in NRC Generic Letter 88-05 has been developed.

The staff has concluded that the above-described activities assist in providing reasonable assurance that mechanical equipment will be properly maintained throughout the operating life of the plant, including the extension of the operating license to 40 years after the issuance of the OL.

Structures

For the OL review, all Seismic Category I structures for Summer, including the containment, the concrete and structural steel internal structures, and foundations, were reviewed and found acceptable by the staff. The structures were designed to resist various combinations of dead loads, live loads, environmental loads including those due to external phenomena such as wind, tornadoes, and earthquakes, as well as loads generated by design basis accidents including pressure, temperature and pipe rupture effects. The prestressed concrete containment was designed in accordance with ASME Code, Section III, and American Concrete Institute Standards ACI 318 and ACI 349. The staff found the design, materials, construction methods and quality assurance utilized for the containment to be acceptable for satisfying relevant requirements of GDC 2, 4, 16 and 50 of Appendix A to 10 CFR Part 50.

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

The reinforced concrete containment is generally known not to be susceptible to significant degradation with time. 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 ten-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.

For the OL review, the Summer station'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 GDC 2 and 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.

At the time of licensing, the service water intake structure and pumphouse were identified as being potentially subject to degradation due to their settlement relative to the west embankment of the service water pond. A condition to the operating license (License Condition 2.C(5)) requires a program to monitor the condition of the intake structure and embankment. In addition, the licensee committed to a program to monitor the pumphouse and intake structure for settlement twice a year (unless a lesser frequency is acceptable) for the life of the plant. Thus far the monitoring reports under License Condition 2.C(5) indicate that the intake structure, pumphouse and embankment remain within design limits. The monitoring programs ensure that the settlement, cracks and other changes in the intake structure, pumphouse and embankment are detected and corrected as necessary. These programs will remain in effect during the service life of the plant (unless changed after NRC review and approval) and will ensure the structural integrity of the intake structure, pumphouse and embankment during the full term of the license, including the proposed extension.

The staff has reviewed the above considerations on structures and has concluded that the plant structures will not be adversely affected by the proposed extension of the operating license to 40 years from the date of issuance of OL.

Siting

The Exclusion Area consists of the area within approximately a one mile radius of the Summer Reactor Building. The licensee owns all the property within the Exclusion Area which includes parts of Monticello Reservoir and the Fairfield Pumped Storage Facility. In accordance with South Carolina state law, the surface water of Monticello Reservoir is public domain; however, there is limited recreational use of that part which falls within the Exclusion Area. Arrangements with State and local authorities exist to control movement of people on the reservoir in the event of a plant emergency. Also, Duke Power Company owns a 68-foot wide right-of-way for a transmission line through the Exclusion Area, but the licensee has the authority to control activities in this area, if necessary. No changes to the exclusion area boundary are proposed for the requested extended license period; and, therefore, the licensee's authority to control activities within the Exclusion Area will not be affected by the proposed extension.

The V. C. Summer Low Population Zone (LPZ) has an outer radius of 3 miles. The nearest population center containing more than about 25,000 persons is the city of Columbia. Columbia's corporate limit is approximately 23 miles southeast of the facility. The licensee has estimated that development occurring in the northwestern suburbs of Columbia could bring the boundary of Columbia to within 15 miles of the site over the lifetime of the facility. In addition, it is possible that the area around Winnsboro, 15 miles northeast of the facility, may also grow to a population of 25,000 over the lifetime of the facility. The licensee has found the

distance from the facility to the current population center, Columbia, or to any other population center likely to develop over the lifetime of the facility, including the requested extended period, to be greater than one and one-third times the low population zone distance of three miles as required by 10 CFR Part 100.

The Final Environmental Statement (FES) for Summer based on the 1970 census, projected a 14.5% increase in population within 50 miles of the Summer Station from 1970 to 1979, and a 67.3% increase from 1979 to 2010. The licensee has compared those projected population increases with current available data. The level of population projected in the FES for 1980 is extremely close to the 1980 census data. However, the licensee's population projections, as reported by the South Carolina Division of Research and Statistical Services and the Data Resources Inc., (DRI), State Economic Service, for the years 1990 and 2000 are substantially less than those projections contained in FES, reflecting an expected downward trend in the population of the region. Specifically, the projection for 2020, based on 1980 census data, is lower than the population projected for the year 2010 in the FES. Therefore, the licensee has concluded that new projections of population distribution, as related to a nine year extension of Summer operating license, are bounded by the previous FES projections.

The staff has reviewed the licensee's information. The details of the staff's review are contained in the associated Environmental Assessment dated December 28, 1989. Accordingly, the Commission's conclusions regarding 10 CFR Part 100 siting criteria for Summer are that the exclusion area, LPZ, and population center distances meet the guidelines of 10 CFR Part 100 and are not changed by the proposed license extension.

Based on all of the above, it is concluded that extension of the operating license for Summer to allow a 40-year service life from the date of issuance of the OL is consistent with the conclusion reached in the initial Summer SER in that all issues associated with operational safety and population changes have already been addressed. Accordingly, the staff finds the proposed extension of the expiration date of the Facility Operating License for Summer to be acceptable.

3.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.30, 51.32, 51.35, the Commission has determined that the proposed action will not have a significant affect on the quality of the human environment.

A Notice of Issuance of an Environmental Assessment and Finding of No Significant Impact relating to the proposed extension of the Facility Operating License expiration date for the V. C. Summer Nuclear Station, Unit No. 1, was published in the Federal Register on January 3, 1990 (55 FR 183).

4.0 CONCLUSION

The Commission made a proposed determination that the amendments involve no significant hazards consideration which was published in the Federal Register on May 7, 1986 (51 FR 16934), and consulted with the State of South Carolina. No public comments were received, and the State of South Carolina did not have any comments.

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: J. J. Hayes, Jr.

Dated: January 3, 1990

Table 1

V. C. SUMMER REACTOR VESSEL BELTLINE RT_{PTS} AND FLUENCE VALUE

<u>Reactor Vessel Beltline Material</u>	RT_{PTS} (degrees F)		
	Current End of Cycle 2 (10/5/1985)	Expiration of Present Operating License (3/21/2013)	Expiration of Proposed Operating License (10/22/2022)
Intermediate Shell Plate A9154-1	118	155	162
Intermediate Shell Plate A9153-2	62	94	99
Lower Shell Plate C9923-1	86	113	118
Lower Shell Plate C9923-2	86	113	118
Intermediate Shell Longitudinal Welds	23	42	46
Intermediate to Lower Shell Circumferential Weld	31	56	60
Lower Shell Longitudinal Welds	23	42	46