UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 50-400-LA
CAROLINA POWER & LIGHT COMPANY	)	
	)	ASLBP No. 99-762-02-LA
	)	
(Shearon Harris Nuclear Power Plant)	)	
	)	

AFFIDAVIT OF KENNETH C. HECK
IN SUPPORT OF NRC STAFF'S WRITTEN SUMMARY

I, Kenneth C. Heck, being duly sworn, do hereby state as follows:

1. My name is Kenneth C. Heck. I am employed by the Nuclear Regulatory Commission as a Quality Operations Engineer in the Quality Assurance and Safety Assessment Section, Quality Assurance, Vendor Inspection, Maintenance & Allegations Branch, Division of Inspection Program Management in the Office of Nuclear Reactor Regulation. I am responsible for reviews of submittals involving quality assurance for design, construction and operations. In addition, I have thirty years of experience in the commercial nuclear power field, including design engineering, system engineering, and oversight of nuclear safety programs. This includes active participation in construction activities, including design engineering and startup testing. I have eleven years of direct involvement in startup or restart of commercial nuclear reactors. A statement of my professional qualifications is attached hereto.

2. The purpose of my testimony is to address the Atomic Safety and Licensing Board (Board) concerning Technical Contention 3. as set forth in the Board's Memorandum and Order (Ruling on Standing and Contentions) dated July 12, 1999. Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 NRC 25 (1999). Specifically, this affidavit addresses the first paragraph of the contention, as it relates to 10 C.F.R. Part 50, Appendix B, Criteria XIII and XVII:

> CP&L's proposal to provide cooling of pools C & D by relying upon the use of previously completed portions of the Unit 2 Fuel Pool Cooling and Cleanup System and the Unit 2 Component Cooling Water System fails to satisfy the quality assurance criteria of 10 CFR Part 50, Appendix B, specifically Criterion XIII (failure to show that piping and equipment have been stored and preserved in a manner that prevents damage or deterioration) . . . and Criterion XVII (failure to maintain necessary records to show that all quality assurance requirements are satisfied).

This affidavit also addresses the third paragraph of the contention:

> The Alternative Plan submitted by Applicant is also deficient because 15 welds for which certain quality assurance records are missing are embedded in concrete and inspection of the welds to demonstrate weld quality cannot be adequately accomplished with a remote camera.

3. By letter dated December 23, 1998 (Exhibit 1), the Carolina Power & Light Company (the Licensee) requested an amendment to Facility Operating License NPF-63 for Shearon Harris Nuclear Power Plant to place spent fuel pools C and D in service in order to increase the spent fuel storage capacity of the facility. Further information was provided in letters dated April 30, 1999 (Exhibit 2) and October 29, 1999 (Exhibit 4). An on-site inspection was conducted from November 15-19, 1999, and an inspection report was issued

on December 28, 1999. (Exhibit 4). The purpose of the inspection was to assess the implementation of the construction quality assurance program in the construction of spent fuel pools C and D, evaluate the alternative weld inspection program and evaluate the plans for commissioning the equipment for the C and D spent fuel pools. (Exhibit 4, page 1). The inspection team members were two Region II inspectors with considerable experience in evaluating sites during the construction phase (William Crowley and Joseph Lenahan) and Don Naujock and myself from Headquarters.

4. The spent fuel storage facility at Shearon Harris is located in the fuel handling building. The two pools at the south end of the building are referred to as pools A and B. The two pools at the north end of the building are referred to as pools C and D. Shearon Harris was originally designed as a four unit site. Pools A and B were to serve Units 1 and 4; pools C and D were to serve Units 2 and 3. Construction proceeded on the four unit site until December 1981, when the licensee informed the NRC that Units 3 and 4 had been canceled. (Exhibit 5). NUREG-1038, "Safety Evaluation Report related to the operation of Shearon Harris Nuclear Power Plant, Units 1 and 2," dated November 1983, concluded that Units 1 and 2 could be operated by the applicant without endangering the health and safety of the public (Exhibit 6, page iii). However, Unit 2 was canceled soon afterward, leaving Unit 1 as the only unit to be completed and licensed, with commercial operation beginning in May 1987 (Exhibit 2, Enclosure 8, page 1 -2 of 13). The cancellation of Unit 2 is also discussed in a December 21, 1983, letter from the Counsel for the applicants to the ASLB (Exhibit 7). The construction permit for Units 2, 3, and 4 expired on June 1, 1986, June 1,

1990, and June 1, 1987 respectively. Federal Register Notice of Issuance of Construction Permits, 43 Fed Reg 4465 (1978). (Exhibit 8.)

6. Pools C and D are described in the Final Safety Analysis Report for Unit 1, page 9.1.3-1 (Exhibit 9). The proposed license amendment would authorize the licensee to expand the storage facility by placing pools C and D in service. (To facilitate the clarity of subsequent testimony, I may refer to pools C and D as the Unit 2 pools and to pools A and B as the Unit 1 pools.)

7. Units 1 and 2 were constructed during the same period in accordance with a single quality assurance program. The licensee has submitted a copy of the QA program for control of ASME code-related activities, which was in effect during the construction phase (Exhibit 2, Enclosure 5). This quality assurance program applies to the equipment and piping being discussed as part of this amendment.

8. My testimony addresses the substantiating evidence that provides reasonable assurance that the welds were completed in accordance with applicable regulatory requirements and, consequently, provide an acceptable level of quality and safety.

Acceptability of the Unit 2 Fuel Pool Cooling System for Unit 1 Service.

9. A significant portion of the equipment for fuel pools C and D was installed during original construction in the late 1970s and early 1980s. This equipment was procured and installed to applicable quality assurance requirements. System piping and large equipment, such as the fuel pool cooling heat exchanger, have been stored in-place in the fuel handling building since cancellation of Unit 2 in 1983. Smaller components, such as pump

motors, have been maintained under controlled storage. The systems were being installed under the Unit 2 construction permit, which expired on June 1, 1986 (Exhibit 8) and has never been incorporated into the operating license for Unit 1.

10. According to the licensee's application, the Fuel Pool Cooling and Cleanup System (FPCCS) and associated Component Cooling Water System (CCWS) piping will be completed in accordance with the CP&L quality assurance program (Exhibit 2, Enclosure 1, page 5 of 6). A copy of the licensee's QA program applicable to completion of these systems has been submitted by the licensee (Exhibit 2, Enclosure 14). In instances where the licensee's QA Program does not address specific American Society of Mechanical Engineers (ASME) Section III quality assurance requirements, the licensee has developed a set of supplemental quality assurance requirements to specifically address these items (Exhibit 1, Enclosure 8, page 13 of 13).

11. As part of the modification plan to incorporate pools C and D under the Unit 1 license, the licensee plans to implement a commissioning plan, or dedication process, which will ensure that the equipment will meet applicable design and quality assurance requirements and that the completed equipment is capable of performing its design functions (Exhibit 2, Enclosure 16, pages 8-10).

12. Missing Weld Documentation. This issue concerns missing records for 52 field welds. This section addresses substantiating evidence that the welds were completed to the required level of quality and safety. The evidence includes records documenting activities that were completed subsequent to completion of the subject welds, such as

hydrostatic testing of piping lengths that contained these welds and concrete emplacement records. These activities are stringently controlled such that multiple verifications and sign-offs attest to the fact that all weld requirements were met prior to initiating these activities. In addition, complementary quality assurance records, documenting satisfactory resolution of deficiencies identified during installation provide convincing evidence that welding was performed under an effective quality assurance program which identified and corrected deficiencies at variance with the licensee's welding program. Indeed, copies of some of the missing records are attached to these corrective action documents. In addition to quality assurance and construction records that substantiate satisfactory completion of the subject welds, the licensee's quality assurance program provides evidence of a well-controlled construction process that resulted in successful completion and startup of a commercial nuclear reactor and the uncertainty associated with the quality of 52 welds, for which the records are missing, is small.

13. Regulatory Requirements General Design Criterion 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Section 50.55a, "Codes and Standards," of 10 CFR Part 50 requires that components of the reactor coolant pressure boundary be designed, fabricated, erected, and tested in accordance with the requirements for Class 1 components of Section III of the ASME Boiler and Pressure Vessel Code or equivalent standards. Regulatory Guide

1.26 is the principal document used in staff reviews for identifying, on a functional basis, the components important to safety as Quality Groups A, B, C, or D. (Exhibit 10). The relevant items in this case are Group C components. Group C standards are applied to components of the cooling water systems. The American Society of Mechanical Engineers Boiler and Pressure Vessel Code standards for Class 1, 2, and 3 components are acceptable for satisfying GDC 1, for Groups A, B, and C components, respectively. CP&L has used the terminology Class 1, 2, and 3, and nonnuclear safety in classifying components, as defined in ANSI N18.2a-1975 (Exhibit 11), for the design of systems at Shearon Harris. These classifications correspond to NRC Quality Groups A, B, C and D, respectively. The classification of structures, components and systems important to safety is given in the Shearon Harris FSAR. Table 3.2.1-1 (Exhibit 9). The FPCCS cooling piping is classified as Safety Class 3, designed to ASME III, Class 3 requirements.

14. ASME Requirements. Applicable requirements concerning the missing documentation are provided by the ASME Code Section III, Subsection NA, 1974 Edition, Winter 1976 Addenda (Exhibit 12). Subsection NA of the code provides general requirements for the construction of nuclear power plant items such as vessels, storage tanks, piping, pumps, valves, and core support structures, and components of the nuclear power system of any power plant. Subsection ND of the code provides rules for the construction of Class 3 components (Exhibit 13). The code (NA-8420) requires that "field installation of welds shall be verified on Data Report Form N-5" (Exhibit 12, page 59). The N-5 forms, as well as data report forms for other Code items, are provided in Appendix V to Subsection

NA (Exhibit 12, page 211). The form is annotated to allow the use of supplemental sheets in the form of lists, sketches, or drawings in accordance with a prescribed format.

15. The licensee's Construction Quality Assurance procedure CQA-16, "Preparation and Submittal of ASME Code Data Reports," (Exhibit 14) establishes requirements for the preparation of ASME code data reports N-3 and N-5. I examined this procedure and consider the requirements and guidelines to be clear and sufficiently detailed for demonstrating compliance with Code reporting requirements.

16. Quality Assurance Program. The "CP&L Corporate Quality Assurance Program" (Exhibit 2, Enclosure 14) was the basis for the overall quality assurance program used for the engineering and construction of the Shearon Harris Nuclear Power Plant. The guidance provided by the corporate program is supplemented by Sections 1.8 and 17.3 of the FSARs for individual CP&L nuclear plants (Exhibit 9).

17. With regard to Contention 3, the cited Appendix B criteria are: XIII. Handling, Storage, and Shipping; XVI, Corrective Actions, and XVII, Quality Assurance Records. The licensee's QA program description describes respectively how these criteria are met in Section 5.0, Material and Equipment Control, Section 12, Conditions Adverse to Quality and Corrective Action, and Section 14.0, Quality Assurance Records and Document Control. (Exhibit 2, Enclosure 14).

18. The principal regulatory guide (RG) applicable to quality issues during the construction phase is RG 1.28, "QA Program Requirements for Design and Construction" (Exhibit 15). The complementary standard is N45.2, "QA Program Requirements for

Nuclear Facilities" (Exhibit 16). NRC reviews of quality assurance program descriptions for the design and construction phases are conducted in accordance with NUREG-0800, Standard Review Plan 17.1, "Quality Assurance During the Design and Construction Phase" (Exhibit 17).

19. Quality Assurance During Construction. The licensee filed an application in 1971 to construct and operate four units at the Shearon Harris site. Construction permits were issued in 1978. Prior to issuance of the construction permits, the staff reviewed and approved the quality assurance program controlling construction activities. (Exhibit 20, pp. 141-142). Construction proceeded on all four units under a single quality assurance program. Units 3 and 4 were canceled in 1978 (Exhibit 5). NUREG-1038, "Safety Evaluation Report related to the operation of Shearon Harris Nuclear Power Plant," issued in November 1983, summarizes the staff's review and evaluation of Unit 1 and Unit 2 and concludes that, pending completion of the units in conformity with the construction permits, the operation of these units can be conducted without endangering the health and safety of the public and that such activities will be conducted in compliance with applicable regulatory requirements (Exhibit 6, page 23-1). NUREG-1038 Chapter 3.9.3 addresses the staff review of ASME Code Class 1, 2, and 3 components (Exhibit 6, pages 3-41 to 3-44). The Fuel Handling Facility, common to Units 1 and 2 is addressed in Chapter 9.1, and the Fuel Pool Cooling System is addressed in Chapter 9.1.3 (Exhibit 6, pages 9-4 to 9-7). Based on its review, the NRC staff concluded that the system is in conformance with applicable General Design Criteria as they relate to protection against natural phenomena, missiles and environmental

effects, sharing of systems, cooling capability, inservice inspection, functional testing, fuel cooling and radiation protection, and monitoring provisions, and with the guidelines of Regulatory Guides 1.13, 1.26, and 1.29 as they relate to the system's design and quality and seismic group classification (Exhibits 18, 10, 19). The fact that Units 1 and 2 shared a common design basis, which was concurrently reviewed and approved by the staff, and that both units were constructed under a common quality assurance program, using a single source of oversight and construction personnel, provides reasonable assurance that the quality of construction for Unit 2 was similar to the quality of construction for Unit 1.

20. Missing Quality Records for Welds. CP&L states in the amendment request that quality records for 52 field welds were inadvertently lost during a site cleanup effort. In lieu of these required records, the licensee's alternative plan is based on (1) an effective quality assurance program during construction, with documentation substantiating that these welds were completed to an acceptable level of quality and (2) inspection of the original welds for compliance with quality requirements (Exhibit 1, Enclosure 8). A discussion of the inspection of the original welds and resolution of deficiencies, if any, will be provided by staff of the Materials and Chemical Engineering Branch and is not addressed herein. The licensee's alternative plan is described in Enclosure 8 of the license amendment request, dated December 23, 1998. As part of the alternative plan, construction era documents were compiled to substantiate the quality of the Unit 2 fuel pool cooling piping (Exhibit 1, Enclosure 8). These documents define the requirements that were associated with the procurement, storage, handling, and installation of the piping. These documents include

work procedures for welding, weld material control, piping installation, concrete placement, and hydrostatic testing. Development of the sequence of installation through controlling procedures establishes the activities related to quality (tests, inspections, reviews, etc.), which by procedure would have to be satisfactorily completed in order to meet specific documented construction milestones, such as concrete placement and hydrostatic tests. Construction records related to construction of the spent fuel pools and associated equipments have also been compiled. These records include hydrostatic test records and concrete placement tickets.

21. Substantiating Construction Records. CP&L has submitted (Exhibit 2, Enclosure 3) a matrix of construction records pertaining to the spent fuel pool C and D cooling system. The matrix identifies the 52 welds for which records are missing and the proposed resolution. Thirty-seven of these welds are accessible and, consequently, subject to examination. The accessible welds are not the subject of Contention 3. Fifteen of the welds are located in piping which has been embedded in concrete and, consequently, not accessible for direct examination. Substantiation of these embedded welds relies, in part, on available construction records. Sequential installation steps must be completed prior to beginning a subsequent step. For example, prior to hydrostatic testing of a section of piping, the licensee's quality control/quality assurance staff verify that welds within the scope of a hydrostatic test have been satisfactorily completed in accordance with applicable requirements. The licensee has provided records for hydrostatic tests performed on 13 of the 15 embedded welds (Exhibit 2, Enclosure 8). These records substantiate that the

completed welds were in compliance with ASME and other quality requirements and evidenced by signoffs by responsible quality assurance/quality control personnel and witnessed by the Authorized Nuclear Inspector, who served as an independent third party. Because hydrostatic tests cannot be commenced until all required procedures have been satisfactorily completed, the records provide reasonable assurance that the welds had been completed in compliance with applicable quality requirements prior to hydrostatic testing.

22. Site Inspection. A site inspection was conducted from November 15-19, 1999, (Exhibit 4) for the purpose of reviewing issues related to the licensee's alternate plan to compensate for the missing weld records. A primary objective of this inspection was the review of construction era procedures, records, and other documentation that provide substantiating evidence that the subject welds were completed to an acceptable level of quality and safety. I personally reviewed the following items: records required by Section III of the ASME Code, quality assurance program procedures, quality assurance audits of the effectiveness of ASME program implementation and vendors of equipment associated with the fuel pool; and corrective action records. Records associated with weld activities, hydrostatic testing, and concrete placements were reviewed by other members of the inspection team. I discussed the course of these reviews by other inspectors on a daily basis. The following sections discuss the results of these reviews.

23. ASME Documentation. ASME Data Reports for Unit 1. The design basis for the fuel pool cooling system for Unit 1 (Pools A and B), currently in operation is identical

to the design basis for the fuel pool cooling system (Pools C and D); they are described in Section 9.1.3 of the Shearon Harris FSAR (Exhibit 9). Because these pools were installed in the same building, procurement of major components and installation of most system piping and equipment was performed during the same time period, in the late 1970s and early 1980s. They were procured and installed to the same ASME requirements and in accordance with a single ASME Quality Assurance Program (Exhibit 2, Enclosure 5). Therefore, it is reasonable to expect the same level of quality to be applied to both fuel pool cooling systems. The ASME N-5 data package for Unit 2 cannot be completed because 49 weld records are missing. To assess the adequacy of the site quality assurance program in controlling activities and processes related to the data package, I reviewed N-stamp documentation for the Unit 1 fuel pool cooling system. Upon completion of all Code-related systems supporting the operation of Unit 1, an N-3 Code Data Report was submitted to the National Board of Boiler and Pressure Vessel Inspectors on August 15, 1986. The data report contains the documentation required by Section III of the ASME Code for registration of the N-stamp systems for Unit 1. Included in this data report are the Code-required data packages for nuclear piping (ASME Form N-5). I examined the N-5 data packages for the Unit 1 fuel pool cooling system and associated component cooling water system. These packages had been accepted by the National Board for N-Stamp registration. The N-5 data package was complete and satisfactory, with summary data for the welds, hydrostatic tests, and certified material test reports.

Examination of the ASME records, as specified above, demonstrates that welding of the fuel pool cooling and associated component cooling water piping for the Unit 1 and Unit 2 pools, was performed during the same time period, by a common pool of welders qualified to the same requirements, and in accordance with a common system of procedural requirements. Therefore, acceptance for N-stamp registration of the quality of the welds for the Unit 1 pool provides credible substantiating evidence that the welding of similar piping for the Unit 2 pool was of comparable quality.

ASME Data Reports for Unit 2. N-5 data packages for the piping systems supporting operation of Pools C and D cannot be submitted for N-stamp registration because records for 52 field welds are missing. However, records for other equipment, such as heat exchangers, pumps, strainers, and welds made to prefabricated pipespools are complete. To test the completeness of these records, I randomly selected two data packages for review: an NPV-1 data package for Pump 2B-SB and an N-2 NPT data package for strainer 3-SF-53-5A-2. The data package for the pump included a Certificate of Compliance, a manufacturer's code data report, material certification, hydrostatic test reports, performance test reports, welding ticket records, dimensional inspection records, a cross-section drawing, and an as-built drawing. I found the NPV-1 summary package to be complete and satisfactory. The data package for the strainer included an ASME data report, a Certificate of Conformance, liquid penetrant inspection reports, a product quality control check list, material test reports, an inspection and test report, dimensional inspection records, and sequence traveler. I found the N-2 NPT summary package to be complete and satisfactory. The completeness and adequacy of the

N-5 data package for the Unit 1 field welds provides substantiating evidence that a similar level of quality and safety was provided for the Unit 2 field welds and that the issue is a matter of missing documentation, not weld quality. The completeness and adequacy of the two Unit 2 data packages randomly selected provides substantiating evidence of compliance with ASME requirements, except for the missing weld documentation.

24. Quality Assurance Audit Program. The effectiveness of the ASME Quality Assurance Program was verified by corporate audits. I retrieved a listing of these audits from the licensee's document data base and found that eight of these audits had been conducted during the period from March 19, 1979 through February 19, 1992. From the list of audits, I randomly selected audit QAA/170-6 for review. The audit report, conducted from September 21-29, 1981, concluded that the Shearon Harris construction, engineering, and QA programs adequately met ASME code requirements, except for eleven findings and sixteen concerns. I reviewed the findings, the corresponding proposed corrective actions, and QA closure documentation. The findings and concerns were typically associated with procedural and training requirements and indicative of careful auditing, rather than programmatic weaknesses. I found the corrective actions to be reasonable, implemented within a reasonable time period, and properly closed by the quality assurance organization. The completeness and ad equacy of the audit program, based on the audit randomly selected, provides substantiating evidence of an effective ASME program and adequate corporate oversight.

25. Quality Assurance Audits of Vendors. I reviewed a licensee audit of a vendor, conducted from May 22-23, 1974 at the fabrication facility of Southwest Fabricating & Welding Company. The audit was conducted to verify the effectiveness of the vendor's Appendix B quality assurance program, which was invoked through the purchase order for prefabricated piping used for the Unit 1 and 2 spent fuel cooling systems. I found the audit to be thorough, the corrective actions to be appropriate and timely, and properly closed by the licensee's quality assurance organization. The completeness and adequacy of the audit program, based on a randomly selected audit, provides substantiating evidence of adequate oversight of vendors supplying safety-related equipment for the spent fuel cooling systems.

26. Effectiveness of the Construction Quality Assurance Program. A copy of the ASME Quality Assurance Manual for the Construction of the Shearon Harris Nuclear Plant was provided by the licensee in support of the subject license amendment, by letter dated April 30, 1999 (Exhibit 3, Enclosure 5). This manual provides quality measures that assure compliance with the quality requirements of the ASME Boiler and Pressure Vessel Code, Section III, Division 1, Nuclear Power Plant Components, and applicable Federal, State and local regulations and codes. The Manual was applicable to all construction on site, including the spent fuel pools for Unit 1 and Unit 2.

27. Quality Assurance/Quality Control Implementing Procedures. Procedures and processes during construction require that field welds be subject to multiple inspections and documentation reviews. I reviewed the system of procedures, which implement the requirements of the site quality assurance program. These procedures control all of the

construction activities and processes that could affect the quality of construction. The procedures reviewed were in effect during the construction period from 1979-1983 when the bulk of the weld activities on the spent fuel cooling systems was performed.

CQA-1	Personnel, Training and Qualification
CQA-2	QA Document Control
CQA-4	QA Records
CQA-8	Material Issue Surveillance
CQA-12	Mechanical Equipment Installation Monitoring
CQA-14	Application and Control of "N" Type Symbol Stamps
CQA-15	Assignment and Control of National Board Serial Numbers
CQA-16	Preparation and Submittal of ASME Code Data Reports
CQA-18	Control of Site Fabrication/Modification of Piping Subassemblies
CQA-20	Surveillance of Contractor Welding and Related Activities
CQA-22	Welding Activity Monitoring
CQA-24	Procurement Control
CQA-28	QA Surveillance
CQA App. A	Quality Assurance Forms
CQC-2	Nonconformance Control
CQC-4	Procurement Control
CQC-6	Receiving Inspection
CQC-8	Storage Control
CQC-10	Cleanness Control
CQC-12	Mechanical Equipment Installation Control
CQC-13	Concrete Control
CQC-19	Weld Control
CQC-20	Post-Weld Heat Treatment Control
CQC-22	Hydrostatic Test Inspection
CQC-23	Systems Turnover

The procedures consistently implemented the requirements of the QA program for code-related activities, established by the ASME QA Manual (Exhibit 2, Enclosure 5), and defined process requirements in sufficient detail to provide effective process control. Because of the issue concerning the quality of the field welds for which certain records are missing, particular attention was given to review of CQC-19, " Weld Control." In addition, procedures for processes subsequent to completion of field welds contain prerequisites that the welds have been satisfactorily performed, that all deficiencies associated with the subject welds have been resolved, and that closure documentation for welds has been reviewed by quality assurance, with concurrence by the ANI. Because of the importance of these prerequisites in assuring the satisfactory completion of welds, I also reviewed CQC-22, and CQC-13. A summary of my review and conclusions is provided in the following sections.

28. Weld Control (CQC-19). CQC-19 assigns the Welding QA/QC Specialist the responsibility for: (1) reviewing and verifying data and designated hold points for the weld data reports (WDRs), which document the code-required data; (2) ensuring that completed WDRs are forwarded to the Authorized Nuclear Inspector; and (3) supervising the QC inspectors in the performance of weld inspections and monitoring activities related to welding. With respect to the quality of the subject field welds, the required data is documented on the WDR, reviewed, and approved by the Welding QA/QC Specialist. QA inspection personnel are trained in accordance with CQA-1 for proficiency in determining that weld quality meets applicable code requirements. After the documentation for a field weld has been determined to be acceptable, associated documents are assembled and the package transmitted to QA Records in accordance with CQA-4. Based on my review of CQC-19, I concluded that the procedure provided adequate control of the weld process to provide a basis for stating that there is reasonable assurance that completed field welds met applicable code requirements.

29. Hydrostatic Test Inspection (CQC-22). CQC-22 establishes the requirements for performing hydrostatic test inspections to ensure that the tests are performed in accordance with applicable procedures and specifications. The procedure is directly applicable to hydrostatic testing of piping containing the subject field welds. The Mechanical QA Specialist is responsible for verifying that the completed documentation for the piping is on file. This includes verification that all activities associated with field welds within the scope of a hydrostatic test have been satisfactorily completed and that the welds meet applicable quality requirements. The responsibilities of the Mechanical QA Specialist and QA inspection personnel are sufficiently defined to provide reasonable assurance that the quality of hydrostatic testing is in compliance with applicable procedures and specifications. After a hydrostatic test has been documented and accepted by the Authorized Nuclear Inspector, the associated documents are assembled and reviewed by the Mechanical QA Specialist, who verifies that manufacturing/fabrication records for components within the boundaries of the test have been received and accepted and that there are no nonconformances on any of the components.

Based on review of CQC-22, I concluded that the procedure provided adequate control of the hydrostatic testing to ensure that weld records had been satisfactorily completed and accepted before commencement of hydrostatic testing.

30. Concrete Placement (CQC-13). CQC-13 requires that, prior to concrete placement, a Concrete Placement Report be completed. This report attests that all activities in the affected area have been satisfactorily completed and that access to the area to be

covered by concrete is no longer required. As each craft completes its work, the Craft Superintendent signs off the report, signifying that a particular activity, such as mechanical, electrical, welding, nondestructive examination, or cleanup, is complete and ready for concrete pour. The sign-off must be completed by all Craft Superintendents whether or not they have material in the particular placement, as a safeguard against omissions. After sign-off by the Craft Superintendents, Field Engineering signs the report, verifying that required design attributes, such as the correct location and anchoring of embedded conduit, grounding, inserts, sleeves, piping, and plumbing, are complete and correct. After all crafts have completed their work, the Construction Inspector signs the report, signifying, among other things, that all Code welds have been inspected and approved by Quality Assurance. Subsequently, Quality Control and Quality Assurance sign the report, signifying that all of their oversight activities have been completed and the items to be embedded are in compliance with applicable requirements. Finally, after all required disciplines, QC and QA, the Construction Inspector, and engineering signoffs are complete, the Area Superintendent authorizes concrete placement activities to proceed. The completed Concrete Placement Report is transmitted to QA Records in accordance with CQA-4.

Based on review of CQC-13 and of Construction Procedure WP-05, Rev 7, "Concrete Placement," I concluded that the procedure provides reasonable assurance the subject welds were completed, documented, and determined by the construction quality assurance staff to be compliant with applicable code and quality requirements prior to being embedded.

31. Oversight of Welding Activities. To assess the effectiveness of the site QA/QC program in identifying and resolving problems associated with welding activities, I examined a sample of QA/QC reports documenting deficiencies identified during the period from 1979 through 1983. These records included deficiency and disposition reports (DDRs), nonconformance reports (NCRs), and reports of QA/QC monitoring and surveillance of field activities. All corrective action reports reviewed were properly dispositioned, resolved, and properly closed and archived. The deficiencies identified on these reports were judged to be non-programmatic or pervasive and typical of those to be expected for a large construction project.

32. A number of QC monitoring and surveillance activities were reviewed. These activities document inspector field observations. The reports are generated from day-to-day observation of ongoing construction activities and generally covered such areas as material control, welding equipment, welder training and qualification, weld procedure compliance, and review of weld data reports for accuracy and completeness. Based on my review of DDRs, NCRs, and reports of QC field observations, I concluded that inspection personnel actively monitored the welding activities and processes for compliance with ASME code and QA program requirements. Deficiencies were accurately reported, corrective actions promptly taken, and appropriately resolved. All corrective action documents reviewed were in compliance with QA document requirements. The documentation provides substantiating evidence that the quality assurance program during the period of welding had been effectively implemented.

33. Welding Control Procedures. The inspectors reviewed the welding control procedures to verify that weld activities and processes were controlled in accordance with applicable code requirements. These procedures provide detailed control for all aspects of the welding process, including qualification of procedures and welders, control of welding materials, control of welding variables, and quality documentation for each weld. The following procedures were reviewed:

MP-01	Qualifying of Welding Procedures
MP-02	Procedure for Qualifying Welders and Welding Operators
MP-03	Welding Material Control
MP-06	General Welding Procedure for Carbon Steel Weldments
MP-07	General Welding Procedure for Stainless Steel Nickel Base and Nonferrous Weldments
MP-09	Welding Equipment Control
MP-10	Repair of Base Materials and Weldments
MP-11	Training and Qualification of Metallurgical/Welding Engineering and Support Personnel
MP-12	Control of Special Welding Materials for BOP and Welding Material for Non-Permanent Plant
MP-13	Welder Qualification for Areas of Limited Accessibility

Based on examination of these procedures, the staff inspectors concluded that at the time of original construction of the existing fuel pool cooling system, a comprehensive weld program was in place to control and document pipe welding in accordance with Section III of the ASME Boiler and Pressure Vessel Code.

34. Review of Weld-Related Records. The inspectors reviewed records that provide substantiating evidence that the embedded welds were completed to an acceptable level of quality. A discussion of those reviews is contained in the following paragraphs.

35. Weld Records. The licensee has reinspected all accessible field welds for the Unit 2 fuel pool cooling system and associated component cooling water system pipe and pipe attachments. Reinspection has included visual and liquid penetrant examination, recording of welder identification, and verification of welder qualification. The information has been used to create new weld data reports for the accessible welds for which documentation is missing.

In addition to reviewing the reinspection records, weld records for Unit 1 welds were reviewed. These welds were made using the same welding QC program during the same construction period as the Unit 2 welds. Record review included inspection of weld data reports, welder qualification records, weld QC inspector records, NDE examiner qualification records, welding procedures, and welding qualification records. The original construction records were retrievable, legible, and complete. The records provided evidence that an effective quality program had been implemented during original construction.

36. Hydrostatic Test Records. The inspectors reviewed the records documenting completion of hydrostatic tests applicable to the piping welds embedded in concrete. Hydrostatic test records for 13 of the 15 embedded welds were reviewed. The records document the hydrostatic test boundaries (i.e., identification of welds within the scope of the hydrostatic test), the piping design pressure, hydrostatic test pressure, the test medium and temperature, test data, and test results.

Before a hydrostatic test is performed, Quality Assurance verifies that manufacturing/fabrication records for components within the boundaries of the test have been accepted and that there are no open non-conformances for any of these components. This ensures that field welds within the hydrostatic test boundaries had been completed and accepted as compliant with all Code and quality assurance requirements.

Test prerequisites required QA verification that all documentation for piping within the scope of the test was complete. The inspectors verified that the test specified that all weld records had been completed and that the weld quality had been accepted as satisfactory prior to beginning the test. The test records substantiate that all embedded welds were tested at a minimum of 25 percent above design pressure. Although hydrostatic test records are not available for embedded welds 2-SF-8-FW-65 and -66, evidence of completion is documented as part of the resolution of Deficiency and Disposition Report 794, which addresses an issue related to hydrostatic testing of the welds attaching the liner plate to the piping spool pieces. The DDR package documents hydrostatic test dates of July 19, 1979 and July 24, 1979 for these embedded welds.

Based on the above, the inspectors concluded that the hydrostatic test records provide reasonable assurance that the welds were completed in accordance with the applicable requirements.

37. Concrete Placement Records. Six fuel pool cooling lines embedded in concrete have field welds for which ASME Code-required records are not available. The inspectors reviewed the concrete placement records for fuel pool C and D, which document that all work in the affected area had been completed prior to placement of concrete. The inspectors determined the applicable concrete placement reports for the embedded welds and

reviewed the subject reports for completeness, as specified by construction procedure WP-05. In addition, WP-102, Installation of Piping, requires verification that all piping is installed per design drawings. Additional requirements, referenced by WP-102, ensure that hydrostatic testing of piping to be embedded in concrete had been satisfactorily completed. The inspectors concluded that these procedural requirements provide evidence that documentation of the adequacy of the embedded welds was complete and that hydrostatic testing had been completed prior to the placement of concrete.

38. NRC Inspections During the Construction Phase. The NRC actively monitored construction activities during the peak period from 1978 through 1983. I reviewed inspection reports for this period for items related to piping installation and welds. Several deficiencies dealing with the general subject of welding were identified in these reports. Most of these deficiencies were relatively minor (Severity Level V and VI) and would not be cited under the current inspection program and would be resolved through the licensee's corrective action program. All deficiencies were typical of what one would expect for oversight of a large construction project and are not indicative of any programmatic weakness in the licensee's weld program.

39. Summary Conclusion Regarding Missing Weld Records. To summarize the above testimony regarding substantiating evidence that the subject field welds were completed to an acceptable level of quality and safety, there is substantial documentation that supports the conclusion that the subject welds were completed with an acceptable level of quality and safety. The Unit 1 fuel pool has supported Unit 1 operation since the beginning

of commercial operation in 1987 and has operated without significant problems for more than twelve years. The Unit 1 fuel pool and Unit 2 fuel pool share a common design basis, which had been reviewed and approved by the NRC.

Pools C and D were constructed during the same period as work was proceeding on Unit 1 and work on both units was controlled by the same quality assurance program and implementing quality procedures. Based on review of the quality assurance program, I conclude that an effective quality assurance program had been implemented and oversight of the program by the quality assurance organization was effective in controlling process activities in accordance with applicable Code and quality assurance requirements. Deficiencies identified by the licensee and by NRC inspectors were relatively minor in nature and not symptomatic of any programmatic weakness in the licensee's welding program. Third party review of all Code welds was provided by an independent, authorized nuclear inspection agency.

Procedural requirements, notably those for hydrostatic testing and concrete placement, provide reasonable assurance that the subject welds had been satisfactorily completed, that outstanding nonconformances had been appropriately resolved and that required documentation was complete and accurate prior to performing these sequential installation steps. Existing documentation (such as corrective action documents, which reference and include substantiating evidence) provide additional assurance that the welds were completed to an acceptable level of quality. Therefore, I conclude that a sufficient basis exists to state with reasonable assurance that the subject welds were completed with an acceptable level of quality and safety.

40. The attached documents are true and correct copies of the documents relied upon in this affidavit.

41. The foregoing statements made by me are true and correct to the best of my knowledge, information and belief.

Kenneth C. Heck

CIRCE E. MARTIN NOTARY PUBLIC MONTGOMERY CO. MD.

Sworn and Subscribed before me this 4th day of January, 2000.

Notary Public

My Commission Expires: March 1, 2003

Attachment 1

KENNETH C. HECK
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Sewanee, Tennessee 37383

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email: kch1@nrc.gov

SUMMARY OF SKILLS

Technical, supervisory, and management experience in the electric power industry and with assignments in engineering, project management, project engineering, plant start-up, plant and program evaluation, quality assurance, and licensing. Proficiencies include design engineering, control systems, electronics, accounting, and computer applications.

EXPERIENCE

Nuclear Regulatory Commission (May 1997 - Present)

Quality Operations Engineer (Headquarters), Inspection Program Management
- Review, evaluate, audit quality assurance programs and other administrative control aspects for nuclear power plants.
- Perform program development functions related to all aspects of the agency's quality assurance programs.
- Conduct inspections of vendors who provide products and services to the nuclear industry.

Tennessee Valley Authority

Lead Auditor, Quality Services (June 1995-October 1996)
- Provided staff augmentation services in the areas of quality assurance and licensing.
- Developed audit/consultation services for implementing international (ISO-9000) quality standards.

Principal Evaluator, Nuclear Assurance & Licensing (October 1988-June 1995)
- Conducted independent audits/evaluations of nuclear power programs, processes, and plant events.
- Served as Technical Secretary for the Nuclear Safety Review Board (senior safety oversight body) from shutdown of TVA's nuclear program through recovery of the Sequoyah and Browns Ferry nuclear plants.
- Conducted independent verifications of the effectiveness of completed corrected actions through successful startup of the Watts Bar nuclear plant.

Senior Evaluator, Nuclear Managers Review Group (March 1987 to October 1988)
- Developed and implemented a review program to assess activities associated with the design, construction and operation of TVA nuclear plants. Findings were reported directly to the Manager, Nuclear Power with recommendations for improvements.

Independent Contractor (December 1985-March 1987)

Design Engineer/System Engineer, Engineering Department

- Modified the integrated control system and non-nuclear instrumentation following shutdown of the Davis Besse nuclear plant.
- Developed engineering designs, implemented modifications, and tested control systems at power through successful program recovery.

Babcock & Wilcox (March 1970-November 1985)

Project Engineer, Plant Services (September 1984-November 1985)

- Developed and deployed hardware and inspection services for repair and maintenance of steam generators and pressure vessels.
- Managed field installation of fuel handling bridge in Kumatori, Japan.

Project Manager, International Business (June 1982-September 1984)

- Developed markets for B&W technology services in Europe and the Pacific Basin in partnership with international companies such as Brown Boveri (Germany), Framatome (France), Sumitomo (Japan) and McDermott International (Hong Kong).

Principal Engineer, Plant Performance (January 1980-June 1982)

- Supervised 9 member team developing operator guidelines for anticipated reactor transients.
- Specialized in original control system analysis and design, principal accomplishments including:
  - Developed course on plant control systems,
  - Consulted onsite on steam generator performance problems,
  - Completed operational/accident transient analyses for several nuclear contracts,
  - Performed failure modes and effects analysis for the integrated reactor control system,
  - Extended methods for reactor power determination,
  - Developed original analyses and conceptual control schemes for steam generator overfill, water hammer transients, anticipated transients without reactor scram, two-phase natural circulation cooling, and reactor vessel embrittlement.

Technical Advisor, Plant Design (January 1976-December 1980)

- On loan to Brown Boveri, Germany, through licensing of the reactor safety systems for the Muehlheim-Kaerlich nuclear plant, to consult on technical licensing issues and oversee the development of complex, nonproprietary computer codes for reactor safety analyses.

Senior Engineer, Technical Staff (March 1970-January 1976)

- Applied internal and industry research to nuclear plant design, provided technical assistance to the engineering department, and developed computer codes licensed for performing transient thermal-hydraulic analyses.

- On loan to Duke Power as test engineer during hot functional testing at Oconee nuclear power station.

EDUCATION

Master of Science/Bachelor of Science, Mechanical Engineering; Lehigh University
Master of Engineering Administration; George Washington University
Bachelor of Applied Accounting; Tennessee Wesley College
Associate of Computer Science; Chattanooga State
Associate of Electronics; U.S. Naval Electronics School

CERTIFICATIONS

Registered Professional Engineer (#20668, VA); Certified Quality Systems Auditor, ISO-9000 (#Q05630); Certified Manager (#02929); Toastmasters International (Able Toastmaster)

PROFESSIONAL ASSOCIATIONS

American Society of Mechanical Engineers, American Nuclear Society, American Society for Quality Control, Institute of Electrical and Electronic Engineers

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No.50-400-LA
	)	ASLBP No. 99-762-02-LA
(Shearon Harris Nuclear Power Plant)	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of " AFFIDAVIT OF KENNETH C. HECK IN SUPPORT OF NRC STAFF'S WRITTEN SUMMARY," in above-captioned proceeding have been served on the following by deposit in the NRC internal mail system, by hand delivery, as indicated by an asterisk, and by deposit in the U.S. Postal Service as indicated by double asterisk, this 10th day of January, 2000:

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