**EXHIBIT 4**

**UNITED STATES OF AMERICA**
**NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

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

**AFFIDAVIT OF MICHAEL J. DEVOE**

| | | |
|---|---|---|
| COUNTY OF WAKE | ) | |
| | ) | ss: |
| STATE OF NORTH CAROLINA | ) | |

I, Michael J. DeVoe, being duly sworn, do on oath state as follows:

1. I am a resident of the State of North Carolina. I am employed by Carolina Power & Light Company ("CP&L") and work at CP&L's headquarters office in the Nuclear Fuel Services Unit of the Nuclear Fuels Management & Safety Analysis Section. My business address is 410 South Wilmington Street, Raleigh, North Carolina, 27601.

2. I am a nuclear engineer. I earned a Bachelor of Science degree in Nuclear Engineering from the University of Wisconsin, Madison, in 1978. I earned a Master of Science degree in Mechanical Engineering from the University of California, Berkeley, in 1984. I have been elected to membership in the academic honor societies of Tau Beta Pi (engineering) and Sigma Pi Sigma (physics). In addition to my academic education in nuclear engineering, I have also taken many professional training courses in nuclear

power reactor design and analysis during my career. This includes professional training in nuclear fuel performance, neutronics, transient analysis, design calculations and verification, and Harris Nuclear Plant systems. I am a Registered Professional Engineer in the State of North Carolina, and have so been since 1991.

3. I have over 20 years of professional experience performing and reviewing nuclear criticality analyses for commercial nuclear power plants. From 1979 to 1984, I worked for the General Electric Company, in San Jose, California, as a nuclear engineer. In that capacity, I performed nuclear fuel cycle analyses, reactor core design, and system transient analyses. For the past 15 years, I have been employed by CP&L as a nuclear engineer in several succeeding positions. I began working for CP&L in 1984 in the Neutronic and Incore Analysis Units of the Nuclear Fuel Section. In that capacity I performed nuclear criticality analyses in the course of doing nuclear power plant core and fuel system design, core management, and reload licensing. I worked as Acting Unit Manager for the Incore Analysis Unit during 1990-1991. During this time I advanced to the role of Technical/Team Leader for reload core design and operations support for CP&L's Brunswick Nuclear Plant. In 1992, my section was retitled the Nuclear Fuels Management & Safety Analysis Section. In 1996, I assumed the duties of interfacing with the nuclear fuel vendor to ensure the procurement of appropriate nuclear fuel and related engineering services. Beginning in 1997, I was given responsibility of determining the acceptability of design and manufacturing changes for CP&L nuclear fuel, in addition to monitoring nuclear fuel performance and consulting on fuel fabrication surveillances. In my current position, I am responsible for performing the

Owner's Review of the nuclear criticality analyses for Harris Nuclear Plant pools C & D. A copy of my resume is included as Attachment A to this affidavit.

4. The purpose of this affidavit is to describe CP&L's Owner's Review of the supplemental fresh fuel assembly misplacement criticality analysis performed for CP&L by Holtec International. This review confirmed that the misplacement analysis used the correct input assumptions for fuel assembly, storage rack, and pool characteristics for Harris spent fuel pools C and D, and produced results consistent with the reviewer's expectations.

5. I was responsible for the CP&L Owner's Review of the supplemental fuel assembly misplacement criticality analysis performed for Harris Nuclear Plant pools C & D. This criticality analysis is entitiled "Evaluation of Fresh Fuel Assembly Misload in Harris Pools C and D" ("Harris Misplacement Analysis") and was performed by Holtec International. This analysis is documented in the Holtec Report numbered HI-992283, which is included as Attachment B to Exhibit 3, the Affidavit of Everett L. Redmond II, Ph.D.

6. In my capacity as lead of the Owner's Review for the Harris Misplacement Analysis, I personally reviewed Revision 0 of the analysis report HI-992283. In this review, I also reviewed those sections of the Holtec International report "Licensing Report for Expanding Storage Capacity in Harris Spent Fuel Pools C and D" ("Harris Licensing Report"), report number HI-971760, revision 3, which is referenced in the Harris Misplacement Analysis. This report is included in Attachment B to Exhibit 1, the Affidavit of R. Steven Edwards. As part of the CP&L Owner's Review, I also requested

that the Harris Misplacement Analysis report be reviewed by other competent engineering reviewers at CP&L, including Robert Kunita and Steven Edwards. Robert Kunita and I reviewed the criticality analysis from a nuclear discipline perspective. Steven Edwards reviewed the criticality analysis from a mechanical discipline and Project Manager perspective.

7. The CP&L review of the Harris Misplacement Analysis followed the same quality assurance procedures required by CP&L for all technical, safety-related analyses performed by outside vendors. These review procedures include Lead and Concurrent Owner's Reviews and are discussed in the CP&L Procedure No. EGR-NGGC-0003, entitled "Design Review Requirements."

8. As stated above, I reviewed the Harris Misplacement Analysis, HI-992283, from a nuclear discipline perspective. I also reviewed those sections of the Harris Licensing Report, HI-971760, that are referenced in the Harris Misplacement Analysis. I specifically reviewed the criticality analysis to ensure that the fuel characteristics used in the analysis correctly reflected the spent fuel assemblies to be licensed for possession at the Harris Nuclear Plant. This included fuel assemblies discharged from the nuclear reactors of CP&L's Harris Nuclear Plant, Robinson Nuclear Plant, and Brunswick Nuclear Plant. I reviewed the analysis assumptions to ensure that the maximum reactivity fresh fuel assembly at Harris was the basis of the misplacement analysis. I also reviewed the analysis to ensure that the spent fuel storage racks and the spent fuel pool configuration used in the criticality analysis accurately reflected what is proposed in the subject license amendment request for Harris pools C & D. In addition to ensuring that

the assumptions accurately reflected the fuel assemblies, spent fuel pools, and spent fuel storage racks for Harris pools C & D, I also reviewed the results of the criticality analysis for consistency and reasonableness with respect to the other criticality analyses I have reviewed.

9. As a result of my review in conformance with CP&L procedure No. EGR-NGGC-0003, I confirmed that the fuel assembly characteristics used in the Harris Misplacement Analysis do, in fact, reflect the spent fuel to be stored in Harris pools C & D pursuant to the subject license amendment request. I confirmed that the fuel assembly assumed to be misplaced reflected the maximum possible reactivity of any fuel licensed to be possessed at Harris, which includes the assumption of a maximum fresh fuel assembly uranium enrichment of five weight percent uranium-235. I also confirmed that the spent fuel pool configuration and spent fuel storage rack design used in the Harris Misplacement Analysis do reflect Harris pools C & D and the spent fuel storage racks to be used in pools C & D pursuant to the license amendment request.

10. I confirmed that the results of the Harris Misplacement Analysis demonstrate that the fuel in the storage racks will remain subcritical ($k_{inf} < 1.00$) even following the misplacement of a fresh fuel assembly with the maximum permissible reactivity, including a uranium enrichment of five weight percent uranium-235, into a spent fuel storage rack assumed to be otherwise filled with spent fuel of the maximum reactivity permissible under the enrichment and burnup curve for the spent fuel storage racks in the license amendment request, and assuming no credit for soluble boron in the spent fuel pool water. I also confirmed that the results of the analysis demonstrate that

400 parts per million (ppm) of soluble boron in the spent fuel pool water is sufficient to maintain the reactivity ($k_{inf}$) of the above described storage rack configuration below 0.95. [Harris operating procedures require 2000 ppm of soluble boron in the spent fuel pools.] These results from the criticality analysis in the Harris Misplacement Analysis are consistent with my expectations, based on my experience as a nuclear engineer performing and reviewing nuclear criticality analyses.

11. Based on the conclusions of my review, as summarized above, I had no adverse comments and approved the Harris Misplacement Analysis performed by Holtec International. I documented my findings approving the criticality analysis with no adverse comments on the CP&L Record of Lead Review comment sheet, pursuant to CP&L procedure.

12. The other CP&L reviewers participating in the Owner's Review, Robert Kunita and Steven Edwards, also concluded that they approved the Harris Misplacement Analysis with no adverse comment. These reviewers documented their findings on the CP&L Record of Concurrent Review comment sheet.

13. The completed set of CP&L Owner's Review comment sheets, all of which indicate the reviewer's approval of the Harris Misplacement Analysis, with no adverse comments, is included as Attachment B to this affidavit.

I declare under penalty of perjury that the foregoing statements and my statements in the attached report are true and correct.

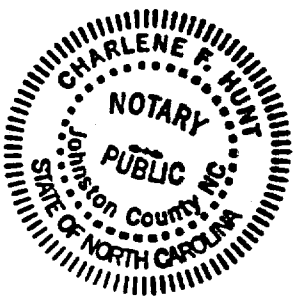
Michael J. DeVoe

Michael J. DeVoe
December 29, 1999

Subscribed and sworn to before me this
29th day of December, 1999

Charlene F. Hunt

My commission expires 6/12/04



**Michael J. DeVoe**
(919-546-6599)

Education:

MS Mechanical Engineering - University of California, Berkeley - 1984
BS Nuclear Engineering - University of Wisconsin, Madison - 1978
Physics, Pre-Engineering - University of Wisconsin, Whitewater - 1976

Professional Affiliations:

Registered Professional Engineer, NC - 1991
American Nuclear Society Member
Tau Beta Pi Engineering Honor Society Member
Sigma Pi Sigma Physics Honor Society Member

Experience Prior to Joining CP&L:

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| January 1979 - September 1982 | Program Engineer - General Electric Company, San Jose, California. Participant in General Electric Company's Edison Engineering and Engineering Training Programs. This involved six rotating work assignments of six months duration each; one and a half years of company taught applied engineering studies; and nine months of graduate study at the University of California - Berkeley. |
| September 1982 - June 1984 | Reload Nuclear Engineer - General Electric Company, San Jose, California. Performed a variety of reload nuclear engineering design activities in support of several operating boiling water reactor projects. Work areas included fuel cycle analysis, core design, system transient analysis, and core management. |

Experience with CP&L:

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|---|---|
| July 1984 - July 1990 | Senior Engineer - Nuclear Fuel Section, Neutronic and Incore Analysis Units. Performed methods development, core and fuel system design, core management, reload licensing, and operations support for the Brunswick Units. Served as Technical/Team Leader for Brunswick reload activities. |
| July 1990 - July 1991 | Acting Unit Manager - Nuclear Fuel Section, Incore Analysis Unit. Promoted to Project Engineer in September 1990. |
| July 1991 - July 1992 | Project Engineer - Nuclear Fuel Section, Incore Analysis Unit. Continued to serve as Technical/Team Leader for Brunswick reload activities. |
| July 1992 - November 1992 | Rotating Assignment - Brunswick Site Assistance Team. Assisted in the development of revised Temporary Modification and CAP Programs. |

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|---|---|
| November 1992 - June 1996 | Project Engineer - Nuclear Fuels Management & Safety Analysis Section, BWR Fuel Engineering Unit. Continued Technical/Team Leader role for Brunswick reload core design and operations support. Section representative for the power uprate, 24 month fuel cycle, and ITS implementation teams. Provided failed fuel detection and management guidance. |
| June 1996 - October 1997 | BWR Fuel Project Engineer - Nuclear Fuels Management & Safety Analysis Section. Served as reload ESR responsible engineer and overall coordinator. Interfaced with fuel vendor to procure nuclear fuel and related engineering services. Administered the reload contract as designated single point of contact. Interfaced with Brunswick on fuel related issues. |
| October 1997 - Present | Project Engineer - Nuclear Fuels Management & Safety Analysis Section, Nuclear Fuel Services Unit. Responsible for determining the acceptability of proposed fuel mechanical design and manufacturing changes (BWR and PWR). Participate in and serve as technical consultant for fuel fabrication surveillances. Perform Owners Reviews of the IF-300 and Pool C & D criticality evaluations - support licensing interactions with NRC. Perform Source term evaluations to support E-plan updates and extended operating cycle Chapter 15 evaluations. Monitor fuel performance and provide leaker detection and management recommendations. Participate in poolside examination of discharged failed assemblies and assist in root cause determination. |

Relevant CP&L Training/Qualification:

BNP ESP Training (Initial and Continuing)
- BWR Neutronics Engineer Training Guide
- BWR Transient Analysis Engineer Training Guide
- BWR Fuel Performance Engineer Training Guide
- Design Verifier Training
- Design Calculation Training
- ESR Training

HNP Basic Systems Course
10 CFR 50.59 Qualification (BNP, HNP, RNP)
BNP Tech Reviewer
OJT/TPE
Lead Assessor
Root Cause Investigation

Nuclear Generation Group Supervisory Development Program, Class 94-02.
Nuclear Generation Group Professional Support Assessment Center, 6/3/96.

ATTACHMENT 2
Sheet 1 of 1
Record of Lead Review

Design HNP ESR 95-00442 "Install Racks in Spent Fuel Pool C" Revision 0

"Evaluation of Fresh PWR Fuel Assembly Misloaded in Harris Pools C and D," Holtec Report HI-992283, approved 9/20/99.

The signature below of the Lead Reviewer records that:
- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☐ **Engineering Review** ■ **Owner Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**_____

☒ YES ☐ N/A **Other Records are attached.** (Two Concurrent Reviews)

Mike DeVoe / [signature] Nuclear 10/15/99
**Lead Reviewer (print/sign)** **Discipline** **Date**

| Item No. | Deficiency | Resolution/Date |
|---|---|---|
| N/A | **No Deficiencies.** | Deficiencies identified during review of the draft version of the report have been adequately resolved in this final version - MJD 10/14/99. |
| N/A | Footnote on page 7 states the B-10 content was assumed to be 19.1 %. This is acceptable as it is conservative relative to the published range of 19.1 to 20.x %. Most reference sources cite an abundance of 19.8 - 19.9 %. | Comment Only - Resolution Not Required - MJD 10/14/99. |
| N/A | In Tables 4 and 5, the bias, temperature correction, and uncertainties were not applied (as in the draft report) since a delta k-inf is being calculated. This is acceptable. | Comment Only - Resolution Not Required - MJD 10/14/99. |
| N/A | In Tables 4 and 5, the MNNP-4 results have changed slightly due to correction of a soluble boron input error discovered by the preparer during self-assessment prior to QA review. Corrected values do not change original conclusions | Comment Only - Resolution Not Required - MJD 10/14/99. |

FORM EGR-NGGC-0003-2-0

ATTACHMENT 3
Sheet 1 of 1
Record of Concurrent Review

Design HNP ESR 95-00442 "Install Racks in Spent Fuel Pool C" Revision 0

"Evaluation of Fresh PWR Fuel Assembly Misloaded in Harris Pools C and D," Holtec Report HI-992283, approved 9/20/99.

Concurrent Reviewer Robert Kunita / Robert Kunita Discipline Nuclear
(Print/Sign)

☐ Design Verification Review ☐ Engineering Review ☒ Owner Review
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ Special Engineering Review _____

| Item No. | Deficiency | Resolution/Date |
|---|---|---|
| 1 | Use of a 5x5 array in Section 7.2 is not justified as being appropriate or resulting in conservative answers. | See attached October 13, 1999 email, from Everett Redmond of Holtec. |
| 2 | Use of 4.5x4.5 PWR array adjacent to a 6.5x6.5 BWR array in Section 7.3 is not justified as being appropriate or resulting in conservative answers. | See attached October 13, 1999 email, from Everett Redmond of Holtec. |
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EGR-NGGC-0003-3-0

**Kunita, Robert**

**From:** Everett [everett_redmond@holtec.com]
**Sent:** Wednesday, October 13, 1999 1:31 PM
**To:** mike.devoe@cplc.com; robert.kunita@cplc.com
**Cc:** Scott Pellet

Mike, Robert-

At Mike's request, here is a brief additional explanation of the models used in the misload accident scenario.

In Section 7.2 a 5x5 model was used. This model had reflective boundary conditions on all sides which represented an infinite array of fuel cells. The fresh fuel assembly was placed in the center location. Therefore, the fresh fuel assembly is repeated every fifth cell with four burned assemblies between the fresh assemblies.

The accident being considered in the report is the misplacement of a single fresh assembly in the spent fuel pool. The 5x5 model was chosen because it is impractical to model the entire spent fuel pool and place a single fresh fuel assembly in the center. Therefore a smaller model with reflective boundary conditions is chosen to represent an infinite spent fuel pool. A 5x5 model is a reasonable size because the fresh fuel assemblies are essentially decoupled from each other with four burned assemblies between them. A smaller array size, for example a 3x3, would bring the fresh fuel assemblies closer together which would increase the neutronic coupling between these assemblies. This would result in a higher k-eff which is conservative. However, since the analyzed accident is the misplacement of a single fuel assembly it is not necessary to be overly conservative in the analysis (i.e. use the 3x3 model). Therefore, the 5x5 model is a reasonable and conservative representation of the misloading scenario.

In Section 7.3 a 4.5x4.5 PWR rack was modeled adjacent to a 6.5x6.5 BWR rack with reflective boundary conditions on all sides. As mentioned above it is impractical to model the entire spent fuel pool and place a single fuel assembly inside. Therefore a comprise was made. Since the PWR racks and BWR racks are of different sizes it is difficult to align the racks so that reflective boundary conditions can be used appropriately. It turns out that 4.5 PWR cells is essentially the same width as 6.5 BWR cells (within a centimeter or so). This provides a natural location for the reflective boundary condition. Alternatively 9 PWR cells could have been modeled across from 13 BWR cells. The result would have been the same except the model would have been twice as large and the computational time would have increased correspondingly. If the cells in the PWR rack adjacent to the BWR rack are labeled 1 2 3 4 0.5 the fresh fuel assembly is placed in location 3. Therefore, there are 4 burned PWR fuel assemblies to the left of the fresh fuel assembly before reaching the next fresh fuel assembly and 3 burned PWR fuel assemblies to the right of the fresh fuel assembly before reaching the next fresh fuel assembly. This is approach is accurate and slightly more conservative than the approach taken in Section 7.2.

I hope these explanations help to clarify the models. If you have further questions please do not hesitate to contact me.

Thanks
Everett

Everett Redmond II, Ph.D.
Holtec International
555 Lincoln Drive West
Marlton, NJ 08053

Phone: (856) 797-0900 Ext. 658
FAX: (856) 797-0909
Email: everett_redmond@holtec.com

HOLTEC INTERNATIONAL URL: http://www.holtecinternational.com

ATTACHMENT 3
Sheet 1 of 1
Record of Concurrent Review

**Design** HNP ESR 95-00442 "Install Racks in Spent Fuel Pool C" **Revision** 0

"Evaluation of Fresh PWR Fuel Assembly Misloaded in Harris Pools C and D," Holtec Report HI-992263, approved 9/20/99.

**Concurrent Reviewer** R. Steven Edwards / R Steven Edwards **Discipline** Mech
(Print/Sign)

☐ **Design Verification Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Engineering Review**

☒ **Owner Review**

☐ **Special Engineering Review** _____

| Item No. | Deficiency | Resolution/Date |
|---|---|---|
| | No Comments | |
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