UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-250 OLA-2
FLORIDA POWER & LIGHT COMPANY	)	50-251 OLA-2
	)	
(Turkey Point Plant, Units 3 and 4)	)	(SFP Expansion)

AFFIDAVIT OF LAURENCE I. KOPP
REGARDING CONTENTION 10

I, Laurence I. Kopp, being duly sworn state:

1. I am a Nuclear Engineer in the Reactor Systems Branch of the Division of PWR Licensing-B in the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Prior to November 24, 1984, I was a Reactor Physicist in the Core Performance Branch of the Division of Systems Integration, Office of Nuclear Reactor Regulation. A summary of my professional qualifications and experience is attached.

2. The purpose of this affidavit is to address Contention 10, which states:

> CONTENTION 10. That the increase of the spent fuel pool capacity, which includes fuel rods that are more highly enriched, will cause the requirements of ANSI NI6-1975 [sic] not to be met and will increase the probability that a criticality accident will occur in the spent fuel pool and will exceed 10 C.F.R. Part 50, A62 criterion.

> BASES FOR CONTENTION. The increase in the number of fuel rods stored and the fact that many of them may be more highly enriched and have more reactivity will increase the chances that the fuel pool will go critical, and cause a major criticality accident, and perhaps explosion, that will release large amounts of radioactivity to the environment in excess of the 10 C.F.R. 100 criteria.

I have read the "Licensee's Motion for Summary Disposition of Intervenors' Contentions", the "Licensee's Statement of Material Facts As To Which There Is No Genuine Issue To Be Heard With Respect to Intervenors' Contentions," dated January 23, 1986. The material facts stated in relation to Contention 10 are correct and I concur in the conclusions reached in the supporting affidavit.

3. Criticality can be defined as the state when the number of neutrons released by fission is exactly balanced by neutrons being lost from the system by absorption and leakage, resulting in a self-sustaining nuclear chain reaction. The symbol k_{eff} (k-effective) or effective multiplication factor is defined as the ratio of the number of neutrons per unit time produced by fissions to the number of neutrons per unit time lost by absorption and leakage. Criticality occurs when k_{eff} is exactly 1.0 yielding a self-sustaining nuclear chain reaction. If k_{eff} is less than 1.0, the system is subcritical and if k_{eff} is greater than 1.0, the system is supercritical.

4. General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," states that criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations. The NRC's acceptance criterion for assuring that GDC 62 is met is found in the Standard Review Plan (SRP), Section 9.1.2, which requires maintaining a storage array neutron multiplication factor (k_{eff}) less than 0.95 in spent fuel pools during normal and accident conditions. This is an adoption of the criteria contained in American National Standard Institute (ANSI) N18.2-1973. Therefore, even for accident conditions, the Staff requires

spent fuel pools to be at least 5% subcritical (k_{eff} no greater than 0.95) to supply adequate margin to assure that the requirement of GDC 62 (k_{eff} less than 1.0) is met.

5. The Staff's regulatory guidance for conducting analyses of spent fuel pools is found in SRP 9.1.2 and in the April 14, 1978 letter from Brian Grimes transmitting the NRC "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," written by the staff and directed to all applicants. This guidance provides for the use of certain conservative assumptions and consideration of a variety of uncertainties (calculational, mechanical and materials uncertainties) in arriving at the k_{eff} value for a given spent fuel storage array. The conservative assumptions are that: (a) the k_{eff} of the racks be calculated for the highest reactivity fuel anticipated for storage at the temperature (within pool limits) yielding the highest k_{eff}; (b) pure water instead of borated water is in the pool; and (c) the fuel array is infinite in lateral and axial dimensions.

6. In order to allow fuel with a maximum uranium 235 (U-235) enrichment of 4.5 weight percent to be stored in the spent fuel racks, the spent fuel pool was modified under the present reracking amendments in two major ways. First, the strong neutron absorber Boraflex was added to the fuel assembly storage cannister walls. Second, the spent fuel pool was divided into two regions.

7. The Boraflex captures neutrons which would have otherwise been available for fission. Therefore, for a given spacing between fuel assemblies, the addition of Boraflex to the fuel assembly storage cannister walls results in a significant reduction in k_{eff}. In addition,

this Boraflex addition can also be used to allow storage of higher enriched fuel at closer center-to-center spacings while still maintaining the same k_{eff} value. This latter approach was used in the design of Region I of the modified spent fuel pool.

8. Region II of the modified spent fuel pool was designed to allow a larger number of fuel assemblies to be stored at a closer spacing than in Region I. Therefore, Region II cannot accept fuel of as high an enrichment as is capable of storage in Region 1. Because of the depletion (burnup) of fissionable U-235 with operating time in a nuclear reactor, a fuel assembly will have a lower U-235 enrichment and, therefore, a lower reactivity, the longer it remains in the reactor. Region II accounts for this by allowing fuel to be stored only after it has attained a given pre-calculated burnup. This burnup dependency for spent fuel storage has been applied previously by various licensees (Arkansas Nuclear One Unit 1, Fort Calhoun Unit 1, St. Lucie Unit 2, Ginna Unit 1) and has been approved by the NRC.

9. The Licensee performed two criticality analyses. The first analysis was for Region I of the spent fuel pool which will have 10.6 inch center-to-center spacing and can be used for storage of fresh or spent fuel with an enrichment equal to or less than 4.5 weight percent U-235. The second analysis was for Region II which will have a 9.0 inch center-to-center spacing, and, therefore, will be limited to storage of fuel assemblies meeting certain required burnup considerations. As previously mentioned, these spent fuel racks differ from the original Turkey Point racks in that the spacing between fuel assemblies has been

reduced because of the addition of a strong neutron absorber (Boraflex) around the fuel storage cans.

10. The Licensee's consideration of the required calculational uncertainties, conservative assumptions, and worst case design basis accidents resulted in a predicted k_{eff} of 0.9403 for Region I and a predicted k_{eff} of 0.9304 for Region 2. Both values include all required uncertainties. For Region I, the total uncertainty of 0.0253 is the statistical combination of the method uncertainty, the uncertainty in the calculation, and mechanical uncertainties due to tolerances and spacing. The mechanical uncertainties were treated either by making worst case assumptions (e.g., using the minimum rather than the nominal value of the boron loading) or by performing sensitivity studies to obtain a value of the uncertainty in k_{eff} due to the uncertainty in dimensions and Boraflex neutron absorbing properties. For Region II, the total uncertainty of 0.0284 considered the same uncertainties mentioned above along with the burnup reactivity uncertainties.

11. The Staff review of criticality consideration for the reracked spent fuel pool is in Sections 2.1 through 2.15 of the November 21, 1984 Safety Evaluation (SE) on the amendments. As indicated in the SE, the Staff's review of the Licensee's criticality calculations consisted of determining that generally accepted calculational methods, verified by comparison with experiments, were used, and that the assumptions and uncertainties have been treated appropriately.

The Staff reviewed the assumptions made in the performance of the criticality analyses and concluded that they are consistent with NRC guidelines noted above and are acceptable. These include use of the highest permitted enrichment, a pure water moderator at a density of 1.0 gram per cubic centimeter, and an infinite array of assemblies.

12. The Staff reviewed the uncertainties and biases included in Licensee's analysis and concluded that the uncertainties meet our requirements and are acceptable. For Region I, the uncertainties include variation in poison pocket thickness, stainless steel thickness, cell interior dimensions, center-to-center spacing, neutron absorbing properties of Boraflex, and fuel rod bowing. For Region II, additional uncertainties due to the buildup of plutonium and other fission products with irradiation are also included. Each of the calculational uncertainties were determined at least at a 95 percent probability at a 95 percent confidence level (95/95) in accordance with NRC guidance.

13. The Staff reviewed the verification of the calculation methods. The KENO-IV code is widely used in the industry for the purpose of calculating fuel rack criticality. The set of benchmark critical experiments used to verify the calculational method encompasses the enrichment, separation distance and separating material used in the racks. The set of experiments used to verify the PHOENIX code for the Region II reactivity calculations is adequate and encompassed the pellet size and enrichment of the fuel proposed for storage in the Turkey Point racks. The uncertainties in the burnup and plutonium worth are verified against Yankee Core 5 isotopics and comparisons with the Westinghouse design LEOPARD/TURTLE code package. The Staff concludes that adequate verification of the codes used in the criticality analyses has been performed.

14. Thus, the results of the calculation for Regions I and II meet our acceptance criterion of k_{eff} less than or equal to 0.95 including all uncertainties at the 95/95 probability/confidence level.

15. In sum, as stated in Section 2.15 of the Safety Evaluation related to the amendments, the Staff concludes that the criticality aspects of the design of the Turkey Point spent fuel racks and the Licensee's criticality analysis is acceptable. Since criticality does not occur for any postulated normal or accident condition, there is no release of radioactivity to the environment and the 10 CFR Part 100 guidelines are met.

The foregoing and the attached statement of professional qualifications are true and correct to the best of my knowledge and belief.

Laurence I. Kopp

Laurence I. Kopp

Subscribed and sworn to before me this 18th day of February, 1986

Malinda L. McDonald

Notary Public

My commission expires: 7/1/86

STATEMENT OF PROFESSIONAL QUALIFICATIONS OF

DR. LAURENCE I. KOPP

Education: Fairleigh Dickinson University, B.S. Physics, 1956
Stevens Institute of Technology, M.S. Physics, 1959
University of Maryland, Ph.D., Nuclear Engineering, 1968

Professional Experience:

U.S. Nuclear Regulatory Commission
Nuclear Engineer (1965 - Present)

Safety evaluations of reactor core design as described in applications for Construction Permits and Operating Licenses, topical reports submitted by reactor vendors and licensees on safety-related subjects, criticality analyses of fresh and spent fuel storage racks.

Westinghouse Astronuclear Laboratory
Senior Scientist (1963 - 1965)

Design and analyses of reactor physics aspects of nuclear propulsion systems related to NERVA program including development of computer programs.

Martin-Marietta Corporation
Senior Engineer (1959 - 1963)

Design and analyses of reactor physics aspects of advanced concept reactors such as the fluidized bed and compact space reactors. Development of analytical methods and computer codes for nuclear reactor design and analysis.

Federal Electric Corporation
Senior Programmer (1957 - 1959)

Developed and programmed various computer codes for DEWLINE project including payroll, statistical analysis of failure rates, and inventory control.

Curtiss Wright Research Division
Physicist (1956 - 1957)

Assisted in development and programming of reactor analysis methods.

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CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE TO LICENSEE MOTION FOR SUMMARY DISPOSITION OF CONTENTIONS" and NOTICES OF APPEARANCE in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or as indicated by an asterisk, by deposit in the Nuclear Regulatory Commission's internal mail system, or as indicated by double asterisks, by express mail, this 18th day of February, 1986:

*Dr. Robert M. Lazo, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Dr. Emmeth A. Luebke
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Dr. Richard F. Cole
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Michael A. Bauser, Esq.
Newman & Holtzinger, P.C.
1615 L St., NW
Washington, DC 20036

Joette Lorion
7269 SW 54th Avenue
Miami, FL 33143

Norman A. Coll, Esq.
Steel, Hector & Davis
4000 Southeast Financial Center
Miami, FL 33131-2398

*Atomic Safety and Licensing
Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Atomic Safety and Licensing
Appeal Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555

*Docketing & Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mitzi A. Young
Counsel for NRC Staff

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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DOCKETING & SERVICE
BRANCH

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NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney herewith enters an appearance in the captioned matter. In accordance with § 2.713(b) of the Commission's Rules of Practice, the following information is provided:

Name:	Lois R. Finkelstein
Address:	Office of the Executive Legal Director U.S. Nuclear Regulatory Commission Washington, DC 20555
Telephone Number:	(301) 492-7520
Admissions:	Supreme Judicial Court of Massachusetts
Name of Party:	U.S. Nuclear Regulatory Commission Staff Washington, DC 20555

Respectfully submitted,

Lois R. Finkelstein

Lois R. Finkelstein
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 18th day of February, 1986

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NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney herewith enters an appearance on behalf of the NRC Staff in the captioned matter. In accordance with 10 C.F.R. § 2.713(b) the following information is provided:

Name	-	Mary E. Wagner
Address	-	U.S. Nuclear Regulatory Commission Office of the Executive Legal Director Washington, DC 20555
Telephone Number	-	Area Code (301) 492-8659
Admission	-	Court of Appeals, State of New York District of Columbia Court of Appeals
Name of Party	-	NRC Staff U.S. Nuclear Regulatory Commission Washington, DC 20555

Mary E. Wagner

Mary E. Wagner
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 18th day of February, 1986