UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	
FLORIDA POWER & LIGHT COMPANY	Docket Nos. 50-250 OLA-2 50-251 OLA-2
(Turkey Point Nuclear Generating Units 3 & 4)	(Spent Fuel Pool Expansion)

LICENSEE'S MOTION FOR SUMMARY DISPOSITION OF INTERVENORS' CONTENTIONS

Pursuant to 10 C.F.R. § 2.749, Florida Power & Light Company (FPL or Licensee) hereby files a motion for summary disposition of each of Intervenors' contentions in the above captioned proceeding. In support of this motion, Licensee has attached "Licensee's Statement Of Material Facts On Intervenors' Contentions As To Which There Is No Genuine Issue To Be Heard" and the following affidavits:

1. Affidavit of Rebecca K. Carr on Contention No. 3 (January 22, 1986) ("Carr Affidavit on Contention 3").
2. Affidavit of Rebecca K. Carr on Contention No. 4 (January 22, 1986) ("Carr Affidavit on Contention 4").
3. Affidavit of Harry E. Flanders, Jr. on Contention Number 5 (January 23, 1986) ("Flanders Affidavit").

4. Affidavit of Leonard T. Gesinski on Contention No. 5 (January 21, 1986) ("Gesinski Affidavit").
5. Affidavit of Rebecca K. Carr on Contention No. 6 (January 22, 1986) ("Carr Affidavit on Contention 6").
6. Affidavit of Dr. Gerald R. Kilp on Contention No. 6 (January 20, 1986) ("Kilp Affidavit").
7. Affidavit of Eugene W. Thomas on Contention No. 6 (January 22, 1986) ("Thomas Affidavit").
8. Affidavit of Rebecca K. Carr on Contention No. 7 (January 22, 1986) ("Carr Affidavit on Contention 7").
9. Affidavit of Joseph L. Danek on Contention No. 7 (January 21, 1986) ("Danek Affidavit").
10. Affidavit of Daniel C. Patton on Contention Nos. 6 and 8 (January 22, 1986) ("Patton Affidavit").
11. Affidavit of William A. Boyd on Contention 10 (January 20, 1986) ("Boyd Affidavit").

As discussed below, the Licensee contends that there is no genuine issue of material fact regarding the matters set forth in the attached Statement and affidavits, and that the Licensee is entitled to a decision in its favor as a matter of law.

I. Background of Proceeding

By means of a letter dated March 14, 1984, from J. W. Williams, Jr. (FPL) to Darrell G. Eisenhut of the Nuclear Regulatory Commission (NRC), FPL submitted a request to amend the operating licenses for Turkey Point Units 3 and 4 to modify the existing spent fuel storage facilities for these units in order to increase their storage capacity. In support of this request, FPL submitted a "Spent Fuel Storage Facility Modification Safety Analysis Report" (SAR).

A notice of FPL's request was published in the Federal Register at 49 Fed. Reg. 23715 (June 7, 1984). In response to this notice, Joette Lorion and the Center for Nuclear Responsibility, Inc. (collectively referred to herein as "Intervenors") filed a "Request for Hearing and Petition for Leave to Intervene" on July 9, 1984.

At various times during its review, the NRC Staff submitted written questions to FPL regarding its request to expand the capacity of the Turkey Point spent fuel pools. FPL submitted written responses to these questions which supplemented the information in the SAR. Following completion of its review, the NRC Staff determined that the requested amendments involved no significant hazards consideration, and it issued the amendments on November 21, 1984, accompanied by a Safety Evaluation (SE).

The Intervenors submitted an "Amended Petition To Intervene" on March 7, 1985, which listed ten contentions that the Intervenors proposed be admitted for litigation in this proceeding. Following a prehearing conference on March 27, 1985, the Licensing Board issued a Memorandum and Order dated September

16, 1985, which accepted the Intervenors as a party to this proceeding and admitted Contentions 3, 4, 5, 6, 7, 8 and 10 for the purposes of litigation.

On October 28, 1985, the Licensee served interrogatories upon the Intervenors. Intervenors filed "Intervenors' Response to Licensee's Interrogatories to Center for Nuclear Responsibility and Joette Lorion" (Intervenors' Response to Interrogatories) on November 27, 1985. No other discovery has been conducted by any party in this proceeding.

II. Legal Standards for Summary Disposition

Summary disposition of contentions in NRC proceedings is governed by 10 C.F.R. § 2.749. 1/

Under 10 C.F.R. § 2.749(a), any party may move, with or without supporting affidavits, for a decision in its favor as to all or any part of the matters involved in the proceeding. 2/ Such a motion must be accompanied by "a separate, short and concise statement of the material facts as to which . . . there is no genuine issue to be heard." Id. Any other party may

1/ The standards for summary disposition under 10 C.F.R. § 2.749 are similar to those standards for summary judgment under Rule 56 of the Federal Rules of Civil Procedure. Tennessee Valley Authority (Hartsville Nuclear Plant, Units 1A, 2A, 1B, and 2B), ALAB-554, 10 NRC 15, 20 n.17 (1979); Cleveland Electric Illuminating Co. (Perry Nuclear Power Plant, Units 1 and 2), ALAB-443, 6 NRC 741, 753-54 (1977).

2/ We note in particular that NRC regulations permit the Board to grant summary disposition "as to all or any part of the matters involved in the proceeding." 10 C.F.R. § 2.749(a). If the Board identifies some issues within a contention in this proceeding which must be tried, we request that the Board grant summary disposition as to the other issues.

support or oppose the motion. If it opposes the motion, a party must file its own statement of the material facts as to which it contends there is a genuine issue to be heard. Material facts are deemed to be admitted unless controverted by the opposing party. Id.

Under 10 C.F.R. § 2.749(b), when a motion for summary disposition is filed and is supported by affidavits, "a party opposing the motion may not rest upon the mere allegations or denials of his answer." Instead, the opposing party's "answer by affidavits or as otherwise provided in this section must set forth specific facts showing that there is a genuine issue of fact." Id. See also Houston Lighting & Power Co. (Allens Creek Nuclear Generating Station, Unit 1), ALAB-629, 13 NRC 75, 77-78 (1981); Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), LBP-83-56, 18 NRC 421, 430 (1983). In particular, "[t]he opposing party's facts must be material, substantial, not fanciful, or merely suspicious." Gulf States Utilities Co. (River Bend Station, Units 1 and 2), LBP-75-10, 1 NRC 246, 248 (1975) (footnotes omitted). A party may not oppose a motion for summary disposition "on the vague supposition that something may turn up" at hearings, id.; nor may an opposing party rely upon general denials coupled with a claim that more information is needed for the party to evaluate the movant's analyses. Virginia Electric and Power Co. (North Anna Nuclear Power Station, Units 1 and 2), ALAB-584, 11 NRC 451 455 (1980). Furthermore, Section 2.749(b) provides that "[a]ffidavits shall set forth such facts as would be admissible in evidence and shall show affirmatively that the affiant is competent to testify to the matters stated therein." If such an answer is not filed, summary disposition shall be granted, if appropriate. 10 C.F.R. § 2.749(b).

Under 10 C.F.R. § 2.749(d), summary disposition shall be granted

> if the filings in the proceeding, depositions, answers to interrogatories, and admissions on file, together with the statements of the parties and the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a decision as a matter of law.

The Commission has encouraged the use of the summary disposition procedure "so that evidentiary hearing time is not unnecessarily devoted to" issues where there is no genuine issue of material fact. Statement of Policy on Conduct of Licensing Proceedings, CLI-81-8, 13 NRC 452, 457 (1981). The Appeal Board has also endorsed the use of summary disposition as "an efficacious means of avoiding unnecessary and possibly time-consuming hearings on demonstrably insubstantial issues." Houston Lighting and Power Co. (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 NRC 542, 550 (1980); Gulf States Utilities Co. (River Bend Station, Units 1 and 2), ALAB-183, 7 AEC 222, 228 (1974).

III. Discussion of Contentions

A. Contention 3

Contention 3 and the bases for the contention state as follows:

Contention 3

> That the calculation of radiological consequences resulting from a cask drop accident are not conservative, and the radiation releases in such an accident will not be ALARA, and will not meet with the 10 CFP [sic] Part 100 criteria.

Bases for Contention

> The Florida Power and Light Company did not comply with the conservative assumption for a cask drop accident that are specified in the Standard Review Plan 15.7.5 (5) and Regulatory Guide 125 [sic] (5), in that they used a 1.0 radial peaking factor, rather than a 1.65 factor. Thus, the potential offsite dose using the more conservative calculations could cause FPL to exceed the 10 CFP [sic] Part 100 criterion.

In admitting Contention 3, the Licensing Board "limit[ed] it to the basis asserted by" Intervenors; i.e., "that the calculations are not adequately conservative because of the radial peaking factor used." Memorandum and Order (September 16, 1985), p. 12. The Board also ruled that Intervenors' reference to ALARA was "inappropriate because ALARA generally applies to routine operation, not accidents." Id. However, the Board did note that the Intervenors could allege that the release limits in Parts 20 and 50 will be exceeded in the event of an accident. Id.

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

The radiological impacts of a postulated accident involving a cask dropping onto stored spent fuel assemblies depends upon the amount of fission products contained in the assemblies, which in turn is proportional to the power produced by the assemblies throughout their operation in the reactor core. The power produced by an assembly varies from assembly to assembly depending upon its location in the core. One method of quantifying this variation is to calculate the ratio of the power of each assembly to the power of the average assembly. The term "radial peaking factor" can be expressed as the ratio of the maximum assembly power to the average assembly power. Thus, the radial peaking factor applies only to the assemblies which produce the maximum power, and the other assemblies have a ratio of power to average power which is lower than the assemblies with the radial peaking factor. 3/

Assumptions which the NRC Staff has found acceptable for use in analysis of cask drop accidents are contained in NRC Standard Review Plan (SRP) Section 15.7.5 and NRC Regulatory Guide 1.25. In particular, Regulatory Guide 1.25 does not specify the number of assemblies which should be assumed to be damaged as a result of a cask drop accident. Instead, Regulatory Guide 1.25 states that a conservative approach "is to assume that the assembly with the peak [fission product] inventory is the one damaged," that the fission product inventory should be calculated using "an appropriate radial peaking factor," and that the minimum acceptable radial peaking factor for a pressurized water reactor (such as Turkey Point) is 1.65. 4/

3/ Carr Affidavit on Contention 3, ¶¶ 4-6.

4/ Id., ¶ 7.

The Licensee's analysis of cask drop accidents at Turkey Point consisted of two cases, each of which used a different assumption regarding the number of freshly discharged assemblies damaged by the cask drop and regarding the radial peaking factor of those assemblies. In Case 1, it was assumed that all assemblies in the spent fuel pool (including 80 freshly discharged assemblies) would be damaged and that the radial peaking factor of the 80 freshly discharged assemblies was 1.65. In Case 2, it was assumed that all assemblies in the spent fuel pool (including a full core offload of 157 assemblies) would be damaged without applying any radial praking factor to these assemblies (which is mathematically equivalent to a radial peaking factor of 1.0). In each case, the radiological doses calculated as a result of the analysis were well within the doses specified in the guidelines of 10 C.F.R. Part 100, which are the acceptance criteria identified in SRP Section 15.7.5. The Part 100 guidelines are commonly used in the nuclear industry for evaluating accident conditions. 5/ 6/

5/ *Id.*, ¶¶ 8-13.

6/ It is clear that the accident dose guidelines in 10 C.F.R. § 100.11, and not the limits in 10 C.F.R. Parts 20 and 50, are the appropriate criteria for evaluating the acceptability of the radiological consequences of cask drop accidents. Initially, it should be noted that other licensing boards have utilized 10 C.F.R. Part 100 to determine whether the consequences of a cask drop accident are acceptable. *See, e.g.*, *Dairyland Power Cooperative* (La Crosse Boiling Water Reactor), LBP-80-2, 11 NRC 44, 60-61, *aff'd*. ALAB-617, 12 NRC 430 (1980); *Portland General Electric Co*. (Trojan Nuclear Plant), LBP-78-32, 8 NRC 413, 429-33 (1978), *aff'd*. ALAB-531, 9 NRC 263 (1979). Furthermore, the limits in 10 C.F.R. Parts 20 and 50 do not apply to accident conditions.

In both Case 1 and Case 2, the radial peaking factors used were appropriate given the assumptions regarding the number and type of fuel assemblies damaged. In Case 1, the radial peaking factor of 1.65 specified in Regulatory Guide 1.25 was applied to the 80 freshly discharged assemblies (which is in excess of a normal core offload). Use of a radial peaking factor was appropriate in this case since 80 assemblies may produce higher than average power while in the reactor core (and therefore have a higher than average amount of fission products). However, use of this factor is conservative because it implies that over half of the assemblies in the core produced the peak power, which is not realistic. 7/

In Case 2, no radial peaking factor was applied to a full core offload. The full core offload accounts for all fission products in the reactor core (including the inventory of the peak power assemblies and the lowest power assemblies).

The only limits on releases of radioactivity in 10 C.F.R. Part 50 are those contained in Appendix I, which pertains to design objectives for assuring that radioactive releases are as low as is reasonably achievable (ALARA). As the Licensing Board has already ruled, ALARA applies to routine operation, not to accidents. (Memorandum and Order (September 16, 1985), p. 12. See also United States Department of Energy (Clinch River Breeder Reactor Plant), LBP-82-31, 15 NRC 855, 861 (1982). Similarly, another licensing board found that the limits of 10 C.F.R. Part 20 "are applicable to normal reactor operation, rather than accident conditions." Florida Power and Light Co. (Turkey Point Nuclear Generating Station, Units 3 and 4), LBP-81-14, 13 NRC 677, 702-03, aff'd. ALAB-660, 14 NRC 987 (1981). Thus, it is not appropriate to compare the calculated doses resulting from a cask drop accident against the limits specified in 10 C.F.R. Parts 20 and 50.

7/ Carr Affidavit on Contention 3, ¶ 14.

Therefore no additional adjustment is necessary or appropriate to account for assemblies with higher than average assembly power. 8/

Finally, in both Case 1 and Case 2, no radial peaking factor was applied to the fuel assemblies assumed to be discharged during previous refuelings. Due to the large number of assemblies assumed to be discharged during previous refuelings, these assemblies would be representative of the assemblies in an entire core. Therefore, application of a radial peaking factor to these assemblies is also unnecessary and inappropriate. 9/

For purposes of litigation, another analysis performed by Licensee using the assumptions in Case 2, except that a radial peaking factor of 1.65 was applied to the full core offload. The results of this analysis were also well within the guidelines of 10 C.F.R. Part 100. 10/

As documented in its Safety Evaluation of the Turkey Point spent fuel pool expansion, the NRC Staff performed an independent evaluation of a cask drop accident. The Staff's

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8/ Id., ¶ 15.

9/ Id., ¶ 16. The Carr Affidavit on Contention 3, ¶ 16, also demonstrates that application of a radial peaking factor of 1.65 to the assemblies assumed to be discharged during previous refuelings would not significantly affect the results of the dose analyses, since these assemblies contribute relatively little to offsite doses due to radioactive decay of their fission products.

10/ Id., ¶ 17.

evaluation also demonstrated that the results of a cask drop accident at Turkey Point would be well within the guidelines of 10 C.F.R. Part 100. 11/

In sum, FPL performed two analyses of postulated cask drop accidents at Turkey Point, one of which used the radial peaking factor of 1.65 specified in Regulatory Guide 1.25 and one of which did not use a radial peaking factor. In each case, the assumptions regarding the radial peaking factor were appropriate given the number of assemblies assumed to be damaged, and the results were well within the guidelines of 10 C.F.R. Part 100. Furthermore, even if the second case had applied a radial peaking factor of 1.65 as suggested by the Intervenors, the results still would be well within the guidelines of 10 C.F.R. Part 100. The NRC Staff's independent evaluation of a postulated cask drop accident at Turkey Point also demonstrated that the radiological consequences of such an accident would be well within the Part 100 guidelines. Since there is no dispute regarding these material facts, Licensee is entitled to summary disposition of Contention 3.

B. Contention 4

Contention 4 and the bases for Contention 4 states as follows:

11/ SE, pp. 11-12.

Contention 4

> That FPL has not provided a site specific radiological analysis of a spent fuel boiling event that proves that offsite dose limits and personal exposure limits will not be exceeded in allowing the pool to boil with makeup water from only seismic Category 1 sources.

Bases for Contention

> FPL used calculation [sic] performed for the Limerick plant to prove that they would not exceed radiological limits in a spent fuel pool boiling accident. FPL should not be allowed to extrapolate Limerick's study for their own, because there are many differences between the two plants which could be critical. For example, the saturation noble gas and iodine inventories could be greater for the Turkey Point plant as a result of fuel failure and increased enrichment; more than 1% of the fuel rods may be defective at Turkey Point because of the asme [sic] fuel failure; and the gap activity of noble gases, such as krypton 85, and fission products such as radioactive iodine may also be greater for Turkey Point.

In admitting Contention 4, the Board "limited [it] to the factual basis provided." Memorandum and Order (September 16, 1985), p. 13. 12/

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

12/ This Memorandum and Order also stated that the contention was "accepted provided that personnel and offsite dose limts are specified as those in Parts 20 and 100." For the reasons discussed with respect to Contention 3, the limits in Part 20 are not applicable to accident conditions and the guidelines in Part 100 are the appropriate criteria for determining the acceptability of radiological doses resulting from postulated accident conditions.

An analysis of the radiological effects of spent fuel pool boiling was performed by Licensee in response to an NRC Staff question. The NRC Staff has not issued guidance (in the form of a Standard Review Plan Section, Regulatory Guide, or other document) for the performance of such an analysis. Accordingly, the analysis for Turkey Point was performed consistently with the methodology and assumptions used in a similar analysis for the Limerick plant, which the NRC had previously found acceptable. However, the Turkey Point analysis only used assumptions applicable to Turkey Point or to pressurized water reactors (PWRs) in general, and the assumptions used in the Turkey Point analysis were not the same in every case as those used in the Limerick analysis. In short, the Limerick analysis was not "extrapolated" for use at Turkey Point. 13/

In particular, the Intervenors refer to Licensee's assumptions regarding noble gas and iodine inventories, failed fuel percent, and gap activities of noble gases and iodine as a basis for their contention that a site specific radiological analyses for a postulated spent fuel boiling accident was not performed for Turkey Point. However, in each of these cases, the Turkey Point analysis used either site specific data or generically applicable data, as shown below:

- The saturation noble gas and iodine inventories used in the Turkey Point analysis were based on assumptions regarding power levels, initial

13/ Carr Affidavit on Contention 4, ¶ 3.

enrichments, and burnups specifically applicable to Turkey Point, and different assumptions regarding these factors were used in the Limerick analysis. 14/

o The Turkey Point analysis assumed 1% fuel failure, which is the same as the assumption used in the Limerick analysis. However, the 1% assumption used in the Turkey Point analysis was conservatively derived from measurements at PWRs with zircaloy cladding, which indicate a failed-fuel percent which is approximately a factor of ten lower than the 1% assumption. Similarly, actual measurements at Turkey Point have shown a failed fuel percent of far less than 1%. 15/ Thus, 1% failure is an assumption which is generically applicable to PWRs and is conservative based upon actual Turkey Point data. 16/

14/ *Id.*, ¶ 4.

15/ Intervenors rely upon the issuance of Amendment Nos. 95 and 89 to the licenses for Turkey Point Units 3 and 4, respectively, on August 31, 1983, for the proposition that Turkey Point has experienced fuel failure. (Intervenors' Response to Interrogatories, p. 6). These amendments were issued in response to relatively high levels of activity in the coolant during Cycle 8 for Unit 3. Examination of the fuel for Unit 3 Cycle 8 revealed that about 0.1% of the fuel rods had failed (*i.e.*, had experienced pin hole leaks). (Carr Affidavit on Contention 4, ¶ 5 n.5). This number is far less than that assumed in the Turkey Point analysis, thereby indicating the conservative nature of that assumption.

16/ Carr Affidavit on Contention 4, ¶ 5.

- Assumptions regarding gap activities of noble gases and iodine in the Turkey Point analysis were the same as those specified in NRC Regulatory Guide 1.25 and are widely accepted within the nuclear industry as conservative. One of these same assumptions was also used in the Limerick analysis. 17/

The results of the Turkey Point analysis were a small fraction of the 10 C.F.R. Part 100 guidelines. 18/

As documented in its Safety Evaluation of the Turkey Point spent fuel pool expansion, the NRC Staff performed an independent accident evaluation of the radiological consequences of spent fuel pool boiling. The Staff's evaluation also demonstrated that the radiological consequences of spent fuel pool boiling would be a small fraction of the 10 C.F.R. Part 100 guidelines. 19/

In sum, a plant-specific spent fuel pool boiling analysis was performed by the Licensee for Turkey Point. This analysis employed the general methodology used in a similar Limerick analysis, but used assumptions which are applicable to Turkey Point or generically applicable to PWRs. The results of the analysis were a small fraction of the applicable guidelines

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17/ Id., ¶ 6.

18/ Id., ¶ 7.

19/ SE, p. 15. This conclusion was conditioned on the provision that sufficient make up water capacity would be available. The Staff found that such capacity was available.

in 10 C.F.R. Part 100. Similarly, an independent evaluation by the NRC Staff also demonstrated that the results of spent fuel pool boiling at Turkey Point would be a small fraction of the Part 100 guidelines. Since there is no dispute regarding these material facts, Licensee is entitled to summary disposition of Contention 4.

C. Contention 5

Contention 5 and the bases for the contention state as follows:

Contention 5

> That the main safety function of the spent fuel pool, which is to maintain the spent fuel assemblies in a safe configuration through all environmental and abnormal loadings, may not be met as a result of a recently brought to light unreviewed safety question involved in the current rerack design that allows racks whose outer rows overhang the support pads in the spent fuel pool. Thus, the amendments should be revoked.

Bases for Contention

> In a February 1, 1985 letter from Williams, FPL, to Varga, NRC which describes the potential for rack lift off under seismic event conditions [sic]. This is clearly an unreviewed safety question that demands a safety analysis of all seismic and hurricane conditions and their potential impact on the racks in question before the license amendments are issued, because of the potential to increase the possibility of an accident previously evaluate [sic], or to create the possibility of a new or different kind of accident caused by loss of structural integrity. If integrity is lost, the damaged fuel rods could cause a criticality accident.

In admitting Contention 5 for litigation, the Licensing Board stated that the issue involved in this contention "is not whether the potential for lift-off during a seismic event is an unreviewed safety question, but whether there is a deficiency in the current rack design and a necessity for a restriction on loading to prevent potential lift-off." Memorandum and Order (September 16, 1985), pp. 13-14. The Licensing Board further rejected hurricane loads as a basis for Contention 5. Id.

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

The new storage racks for the Turkey Point spent fuel pools are free-standing and are not anchored to the floor or braced to the pool walls. Some of the outer storage locations of the new racks overhang (extend beyond) the support pads for the racks. 20/

In a letter dated September 28, 1984, FPL provided the NRC Staff with the results of an evaluation which showed that the spent fuel pool storage racks would not lift off the pool during a seismic event. 21/ This evaluation was predicated upon the existence of certain administrative controls which would prohibit the loading of outer rows of a rack if those rows overhang the support pads of the rack and if the remaining rows of the rack were empty. The NRC concluded that rack lift-off would not occur

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20/ Flanders Affidavit, ¶ 4.

21/ Letter from J.W. Williams, Jr. (FPL) to Steven A. Varga (NRC), answer to question 4, dated September 28, 1984.

based upon the evaluation in the September 28, 1984, letter, and it issued the amendments authorizing the spent fuel pool expansions on this basis. 22/

In a letter dated February 1, 1985, FPL presented the analysis of the potential for lift-off during a seismic occurrence in the event that the outer rows of the racks which overhang the support pads were fully loaded while the rest of the racks remain empty. This analysis showed that rack lift-off could occur, but that the results of such lift-off would be acceptable. FPL requested that the NRC review the results of this analysis and concur that the analysis is acceptable. 23/ This letter provides the basis for Contention 5.

In a letter dated February 26, 1985, from the NRC to FPL, the NRC stated that FPL's request for review of the analysis represented a change in a basis supporting NRC issuance of the amendments authorizing the Turkey Point spent fuel pool expansions. The NRC further stated that FPL could make such changes without prior NRC approval provided that a review performed in accordance with the provisions of 10 C.F.R. §50.59 determined that neither a technical specification change nor an unreviewed safety question is involved. The NRC also stated that it would not take any further action on FPL's request until it received clarification with respect to whether FPL had performed an

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22/ Letter dated February 26, 1985, from Daniel G. McDonald (NRC) to J.W. Williams, Jr. (FPL).

23/ Letter dated February 1, 1985, from J.W. Williams, Jr. (FPL) to Steven A. Varga (NRC).

analysis pursuant to 10 C.F.R. §50.59. 24/ In a letter dated November 13, 1985, FPL withdrew its February 1, 1985 request and stated that it would review any change in the basis supporting issuance of the amendments in accordance with the provisions of 10 C.F.R. §50.59. 25/

In sum, the licensing basis for the new spent fuel storage racks for Turkey Point is predicated upon the existence of administrative controls which prevent loading of the overhanging rows while the remainder of the rack is empty and which thereby preclude lift-off. As is demonstrated below, even if FPL had not established these administrative controls, there would be no need for the NRC to impose a restriction on loading to prevent rack lift-off.

The NRC Staff has identified criteria which it will accept for the performance of seismic analysis of spent fuel storage racks. Standard Review Plan (SRP) Section 9.1.2 states that the storage racks should be designed to seismic Category I requirements (i.e., able to withstand the effects of the Safe Shutdown Earthquake (SSE) and remain functional). Section III of the NRC "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications" (NRC Position Paper) identifies criteria for performing criticality analyses for spent fuel pools under accident conditions, and it states that the presence

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24/ Letter dated February 26, 1985, from Dnaiel G. McDonald (NRC) to J.W. Williams, Jr. (FPL).

25/ Letter dated November 13, 1985, from J.W. Williams, Jr. (FPL) to Steven A. Varga (NRC).

of soluble boron in the pool water may be taken into account when analyzing the effects of earthquakes. Finally, Section IV of the NRC Position identifies criteria for performing evaluations of the mechanical and structural integrity of spent fuel racks. Among other things, these criteria state that the ASME (American Society of Mechanical Engineers) Code is acceptable for deriving allowable stresses in spent fuel racks, and that the design of the storage racks is acceptable if the amplitudes of sliding motion are minimal, if impact between storage racks and the pool walls is prevented, and if the factors of safety against tilting of the racks are within specified values. The criteria discussed above are widely used in the nuclear industry for performing seismic analyses of spent fuel racks, and they are recognized as being conservative. 26/

The Licensee's seismic analyses of the new spent fuel storage racks for Turkey Point were performed in accordance with the NRC Staff's criteria. The racks were designed in accordance with seismic Category I requirements. The presence of soluble boron in the Turkey Point spent fuel pool water will maintain the stored spent fuel assemblies subcritical, even under postulated accident conditions resulting from earthquakes. The structural analysis of the storage racks was based upon the allowable

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26/ Flanders Affidavit, ¶¶ 6-10.

stresses of the ASME Code, and the remainder of the mechnical and structural analysis of the racks was performed in accordance with Section IV of the NRC Position Paper. 27/

More specifically, the Licensee's seismic analysis of the Turkey Point spent fuel storage racks utilized the following conservative assumptions:

- The maximum seismic acceleration used in the analyses was the design basis SSE acceleration for the Turkey Point Plant specified in the Updated Final Safety Analysis Report (FSAR) for Turkey Point.
- The structural damping of the seismic acceleration provided by the storage racks was consistent with the value provided in the Updated FSAR for welded steel frame structures, and damping provided by the spent fuel pool water was conservatively neglected.
- A range of coefficients of friction between the racks and the pool floor embedments were used in order to produce the maximum rack horizontal displacement and the maximum rack horizontal overturning force.
- The storage racks were assumed to be hydrodynamically coupled, thereby producing maximum deflections, loads, and stresses.

27/ Id., ¶¶ 11-13; Boyd Affidavit, ¶¶ 33-40.

No loads on the racks were assumed as a result of sloshing of the pool water, since such sloshing would occur in the upper elevations of the pool above the top of the racks. 28/

The Licensee's seismic analysis was performed in two phases. The first phase employed a two-dimensional nonlinear model of an individual rack cell. The results of the first phase provided input to the second phase of the analysis, which employed a three-dimensional linear model for the purpose of calculating loads and stresses in the storage racks. Use of these two models enabled the Licensee to account for both the nonlinear and three-dimensional responses of the storage racks. In particular, the model used in the first phase directly accounted for nonlinearities and provided input for correcting the loads calculated by the linear model used in the second phase. Similarly, the model used in the second phase provided three-dimensional response data for loads and stresses, and use of a two-dimensional model in phase one to calculate displacements was appropriate because the fuel assembly and storage cell are structurally symmetric about either the x or y horizontal axis. 29/

The Licensee's seismic analysis of the Turkey Point spent fuel storage racks was performed for two cases. The first case provides the licensing basis for the storage racks and is predicated upon the existence of administrative controls to

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28/ Flanders Affidavit, ¶¶ 14-18.

29/ Flanders Affidavit, ¶¶ 19-22.

prevent loading of overhanging rows while the remainder of the rack is empty. In the second case, it was assumed that the administrative controls did not exist and that the overhanging rows were loaded while the remainder of the rack is empty. In both cases, the results of the analysis demonstrated that the fuel rack stresses would be within the ASME Code allowable limits, and that the maximum displacement of the fuel racks would be less than the size of the gap between adjacent racks and between the racks and the pool wall (thus precluding impact between the racks or the racks and the wall). Furthermore, in Case 1, it was demonstrated that rack lift-off from the floor would not occur. Although some lift-off (0.18 inches) was predicted to occur in Case 2, lift-off of free-standing racks under seismic conditions is not uncommon, and the structural members of the racks are designed to accomodate the stresses produced by lift off. In particular, it was found that the minimum factor of safety against overturn in Case 2 would be eight, which is substantially greater than the 1.5 minimum factor of safety referenced in the NRC Position Paper. Consequently, the results of the analyses conform with the NRC Staff's acceptance criteria and demonstrate that the spent fuel storage racks will be maintained in a safe configuration during postulated seismic events. 30/

30/ Flanders Affidavit, ¶¶ 23-25.

As documented in Section 2.3 of the NRC Staff's Safety Evaluation and the accompanying Technical Evaluation Report (TER) prepared by the Franklin Research Center (FRC), the NRC Staff performed a review of the Licensee's analysis for Case 1. 31/ The Staff and FRC found that the Licensee's analysis and results were acceptable. 32/

The Licensee also considered the impact of seismic events on the fuel assemblies in the spent fuel storage racks. The fuel assemblies are designed to withstand steady state and transient reactor operating conditions (including earthquakes) throughout their lifetime in the reactor. These conditions in the reactor are far more severe than those postulated in the Turkey Point spent fuel pool under seismic conditions. Furthermore, the Licensee performed seismic analyses to confirm that the spent fuel assemblies in the storage racks could withstand the seismic loads imposed by a safe Shutdown Earthquake at Turkey Point. Based upon the analyses discussed in the preceding paragraphs, it was determined that the maximum acceleration imposed on a fuel assembly resulting from contact with the storage racks would be 1.6g (where g is the acceleration of the Earth's gravity). Finite element analysis of the spent fuel assemblies indicates that the assemblies could withstand an

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31/ The Staff did not review the Case 2 analysis in the Safety Evaluation, since Case 2 does not form a licensing basis for the Turkey Point spent fuel pool expansion amendments. See Letter dated February 26, 1985, from Daniel G. McDonald (NRC) to J.W. Williams, Jr. (FPL).

32/ SE, § 2.3; TER, §§ 3.1-3.3.

acceleration of 36g without failure. Therefore, the integrity of the spent fuel assemblies will be maintained while stored in the Turkey Point spent fuel pools under postulated seismic conditions. 33/

In sum, the Licensee performed a seismic analysis of the new spent fuel storage racks for Turkey Point in accordance with NRC Staff criteria. The results of this analysis demonstrated that the loads and stresses in the racks would be within ASME Code allowable limits, that the racks would not impact each other or the pool walls as a result of sliding of the racks, and that there would be adequate margins of safety against tilting of the racks. Since there is no genuine issue regarding these material facts, the Licensee is entitled to summary disposition of Contention 5.

D. Contention 6

Contention 6 and the bases for the contention state as follows:

Contention 6

> The Licensee and Staff have not adequately considered or analyzed materials deterioration or failure in materials integrity resulting from the increased generation and heat and radioactivity, as a result of increased capacity and long term storage, in the spent fuel pool.

33/ Gesinski Affidavit, ¶¶ 5-8; Flanders Affidavit, ¶ 26.

Bases for Contention

> The spent fuel facility at Turkey Point was originally designed to store a lesser amount of fuel for a short period of time. Some of the problems that have not been analyzed properly are:
>
> (a) deterioration of fuel cladding as a result of increased exposure and decay heat and radiation levels during extended periods of pool storage.
>
> (b) loss of materials integrity of storage rack and pool liner as a result of exposure to higher levels of radiation over longer periods.
>
> (c) deterioration of concrete pool structure as a result of exposure to increased heat over extended periods of time.

In admitting this contention, the Licensing Board limited the phrase "long-term storage" to the "storage period authorized by the amendments." Memorandum and Order (September 16, 1985), p. 14.

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

Calculations were performed by the Licensee to determine the heat and radiation loads in the Turkey Point spent fuel pools following the expansion. Temperatures of the water in the pools could reach boiling during a postulated loss of cooling accident. However, under normal conditions, the temperatures are not expected to exceed 143^{o}F and will usually be less. For materials stored for forty years in the spent fuel pools, the cumulative gamma dose was calculated to be 1.9×10^{10} Rads and the cumulative neutron fluence was calculated to be 4.8×10^{13}

n/cm^2. Alpha and beta radiation are not a concern because they do not have an ability to penetrate materials deeply enough to appreciably affect the structural integrity of these materials. 34/

The fuel assemblies for Turkey Point are composed of Zircaloy, Type 304 stainless steel, and Inconel. The fuel assemblies and cladding are designed to withstand the radiation levels and heat loads present in a reactor, which are far more severe than those in the Turkey Point spent fuel pools. The neutron fluences in the spent fuel pools (which are the cause of virtually all of the radiation induced changes in Zircaloy, Inconel, and stainless steel) are eight orders of magnitude below those in the reactor core during full power operation. Therefore, this radiation will have an insignificant impact on the integrity of the fuel cladding. The corrosion rate of Zircaloy is approximately 1/100,000 inch per year at $500^{o}F$ and at the higher heat fluxes in a reactor and is substantially lower at the much lower temperatures predicted for the spent fuel pools. Additionally, the corrosion rate for Type 304 stainless steel has been shown not to exceed 6/10,000 inches per 100 years in an oxygenated borated water environment similar to that in the spent fuel pools, and corrosion rates for Inconel are at least as low as those for stainless steel. Thus, over a forty year period in the spent fuel pool, corrosion would not have any appreciable impact on the structural integrity of the fuel assemblies and

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34/ Kilp Affidavit, ¶¶ 5-6; Patton Affidavit, ¶¶ 9-11, 13-15.

cladding. Similarly, stress-corrosion cracking, hydriding, and galvanic attack are not expected to have any impact on the structural integrity of the materials. Finally, it may be noted that spent fuel has been stored safely for more than three decades, and hot cell examination of fuel stored for more than ten years found no measurable changes due to corrosion or hydriding and no loss of integrity. Therefore, the fuel assemblies and cladding can be stored safely in excess of 40 years in the Turkey Point spent fuel pool. 35/

The spent fuel storage racks are constructed of Type 304 stainless steel and contain a neutron absorbing material called Boraflex. As discussed above with respect to the fuel assemblies, Type 304 stainless steel is virtually immune to corrosion at spent fuel pool temperatures, and the neutron radiation levels in the spent fuel pool are orders of magnitude below those levels sufficient to produce any appreciable impact upon the structural integrity of stainless steel. Boraflex (which is a silicone-based polymer containing boron carbide) has undergone extensive testing which indicates that Boraflex retains its neutron attentuation capabilities after being exposed to an environment of borated water and gamma and neutron radiation levels substantially exceeding those anticipated for 40 years of

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35/ Kilp Affidavit, ¶¶ 7-14.

fuel storage at Turkey Point. Therefore, the spent fuel racks may be expected to maintain their material integrity under the conditions expected in the spent fuel pools for Turkey Point. 36/

The spent fuel pool liner plate is also composed of Type 304 stainless steel. Stainless steel was chosen for the liner plate because of its demonstrated ability to perform in nuclear power plant applications which are more severe than those in the spent fuel pool (such as the stainless steel in the fuel assemblies in the reactor). Gamma radiation has a negligible effect on the mechanical properties of non-organic materials such as stainless steel, and the results of neutron irradiation tests have demonstrated that stainless steel can withstand neutron fluences which are orders of magnitude higher than those predicted for the spent fuel pools. Similarly, stainless steel maintains its integrity and long-term stability at temperatures in excess of 1000°F, which is far above the temperatures expected in the spent fuel pool. Therefore, no appreciable deterioration or loss of integrity of the spent fuel pool liner will occur as a result of its long-term exposure to heat and radiation levels in the Turkey Point spent fuel pool. 37/

The spent fuel pool structure consists of reinforced concrete, which is a material commonly used in the nuclear industry. Concrete structures can withstand neutron fluences

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36/ Kilp Affidavit, ¶¶ 15-19.

37/ Carr Affidavit on Contention 6, ¶¶ 4-5, 7; Thomas Affidavit, ¶¶ 11-12, 16.

which are orders of magnitude above those expected in the Turkey Point spent fuel pool, and gamma radiation has a negligible effect on the mechanical properties of concrete. Similarly, temperatures below approximately 300°F have an insignificant effect on the properties of the type of concrete materials used in the Turkey Point spent fuel pool structures, and the reinforcing steel in the structures maintains its integrity and stability at temperatures far above that which will be experienced by the Turkey Point spent fuel pool structures. Therefore, no appreciable materials degradation of the reinforced concrete pool structures at Turkey Point is expected. 38/

The thermal stresses imposed on the pool structure were analyzed by the Licensee. The thermal effects of the increased capacity of the spent fuel pools results in only minor variations in the original design condition. The most severe thermal loads on the structures are caused by the difference between the ambient temperature outside the pool and the temperature of the pool water. Thermal stresses resulting from this differential were calculated assuming a boiling temperature for the pool water and a steady state outside ambient temperature of 30°F (which is extremely conservative given the south Florida location of Turkey Point and the time required to develop a steady state temperature gradient in the 3-foot thick pool walls). Using methods addressed in American Concrete Institute Committee Report 349,

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38/ Carr Affidavit on Contention 6, ¶¶ 6-7; Thomas Affidavit, ¶¶ 11, 13-16.

stresses in the walls and floor of the spent fuel pool were calculated and shown to be within the licensing condition imposed on the original design. Similarly, an analysis was conducted to determine the effects of thermal, hydrostatic and hydrodynamic loads on the liner plate system, and this analysis also showed that there would be no loss of function of this liner. 39/

As documented in Section 2.2 of its Safety Evaluation, the NRC Staff also evaluated the potential for degradation of the materials wetted by the pool water (except for the fuel assemblies). The Staff concluded that the corrosion that will occur in the spent fuel pool environment should be of little significance during the life of the plant, that the Boraflex will not undergo significant degradation during its expected service life, and that the compatibility and stability of the materials used in the expanded spent fuel pools are adequate based on test data and actual service experience in operating reactors.

In sum, the fuel assemblies and cladding are designed to withstand the conditions in the reactor, which are far more severe than those in the spent fuel pools. The structural materials used in the storage racks, pool liner, and pool structure are widely used in the nuclear industry and have a demonstrated ability to withstand the radiation levels and heat loads expected in the Turkey Point spent fuel pools. Consequently, no appreciable deterioration of the materials in the pool is expected, and the materials will maintain their func-

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39/ Thomas Affidavit, ¶¶ 6-10.

tional integrity. Since there is no genuine issue concerning these material facts, the Licensee is entitled to summary disposition of Contention 6.

E. Contention 7

Contention 7 and the bases for the contention state as follows:

Contention 7

> That there is no assurance that the health and safety of the workers will be protected during spent fuel pool expansion, and that the NRC estimates of between 80-130 person rem will meet ALARA requirements, in particular those in 10 C.F.R. Part 20.

Bases for Contention

> FPL's estimates of between 80-130 rem/person are much higher than the NRC's estimate for reracking of 40-50 person/rem [sic], and much higher than experience at other nuclear plants. Thus, there [sic] estimates are not ALARA.

In admitting Contention 7, the Licensing Board "limited [it] to the basis offered" by the Intervenors. Memorandum and Order (September 16, 1985), p. 15.

This contention has, in part, been rendered moot by subsequent events. The expansion of the storage capacity of Turkey Point Unit 3 was completed in March 1985, resulting in a collective occupational radiation exposure of 13.17 person-rem (which agrees with industry experience of about 25 person-rem for a two-unit spent fuel pool expansion). 40/ Therefore, all that

40/ Danek Affidavit, ¶¶ 2, 32; Carr Affidavit on Contention 7, ¶¶ 21-24.

remains at issue is whether the expansion of the Unit 4 spent fuel pool will be performed so as to maintain occupational exposures "as low as is reasonably achievable" (ALARA).

Additionally, it should be noted that Contention 7 does not frame an appropriate question under the Commission's regulations. The ALARA principle embodied in 10 C.F.R. Part 20 does not specify numerical limits on collective occupational radiation exposures. Instead, 10 C.F.R. § 20.1(c) states that licensees should "make every reasonable effort to maintain radiation exposures as low as is reasonably achievable." This section defines ALARA as meaning "as low as is reasonably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic energy in the public interest." Thus, the appropriate question is not whether the Licensee's numerical estimates of occupational exposure are ALARA, but instead whether the Licensee will take every reasonable measure to maintain occupational exposures ALARA during the Turkey Point spent fuel pool expansion. As is discussed below, the Licensee has made conservative estimates of the occupational exposure to be incurred during the spent fuel pool expansions, and it has taken every reasonable measure to maintain occupational exposures ALARA.

The storage capacity of the Turkey Point spent fuel pools will be expanded by a process called reracking, which consists of replacing the old storage racks with new racks which can store fuel assemblies in a higher density array. In general, the reracking operation consists of several phases, including removal of the old racks, installation of new racks, transfer of spent fuel assemblies from the old racks to the new racks, and support services (such as quality assurance/quality control and health physics services). Due to space limitations, it is not possible to install all of the new racks at one time. Consequently, the reracking operation will be cyclical in nature, involving installation of several new racks, shuffling of spent fuel from several old racks to the new racks, removal of the old racks, and installation of new racks in the space vacated by the removal of the old racks. 41/

To promote the safe and efficient handling of the spent fuel racks, the water level in the spent fuel pools will be lowered approximately 8 feet during the rack handling operations but will be restored to normal levels during fuel handling operations. Once the water level has been lowered, a work platform will be installed in the spent fuel pool as a base for rack handling activities. Underwater work will be performed

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41/ Carr Affidavit on Contention 7, ¶ 6; Danek Affidavi, ¶ 2.

using long-handled tools, and therefore it is not anticipated that the use of divers will be necessary during reracking operations. 42/

During those periods when the water level is lowered, the system for cleanup of radioactive contaminants in the spent fuel pool water will not be in use. However, at other times prior to and during the reracking operation, the system will be dedicated to cleanup of the spent fuel pool water and will operate for sufficient times to ensure that any further reduction in the radioactivity in the pool water would be minimal. 43/

Two analyses were performed by the Licensee to estimate the total occupational exposure required for the reracking. As a result of the first analysis, the Licensee estimated that the collective exposure would be about 109 person-rem per unit. In response to a question from the NRC Staff, the Licensee performed a second analysis and lowered its estimate to 59 person-rem per unit. 44/

Both the original and revised estimates were based on the expected dose rates for each phase of the reracking operation and the expected person-hours required to complete each phase. Conservative assumptions regarding dose rates and person hours

42/ Carr Affidavit on Contention 7, ¶ 7.

43/ Id., ¶ 8; Danek Affidavit, ¶ 14.

44/ Carr Affidavit on Contention 7, ¶ 4 and Table 2.

were made in both the original and revised estimates to ensure that the estimates would not underpredict the actual exposures. 45/

The original estimate used conservative assumptions regarding both the dose rates and the person-hours. For example, a major contributor to the dose rates to workers was expected to be the radioactivity in the spent fuel pool water. The original estimate conservatively took no credit for removal of radioactivity from the spent fuel pool water due to operation of the cleanup system, and in fact the amount of radioactivity in the water was conservatively adjusted upward prior to use in the analysis. Similarly, when the original estimate was made, the number of person-hours required to complete all of the tasks was difficult to predict accurately, so conservative time estimates were used. As a result, the original estimate of 109 person-rem per unit was far higher than the 13.17 person-rem actually incurred in the reracking of Unit 3. 46/

Following NRC Staff questions regarding the original estimate, a review of the estimated dose rates and person-hours was performed, and a revised estimate was made using different assumptions. Data on the radioactivity in the spent fuel pool water demonstrated that operation of the cleanup system for a short period of time could significantly reduce isotopic concentrations in the water, and the original estimate of the dose

45/ Id., ¶¶ 5, 14, 20.

46/ Id., ¶¶ 9-14.

rates in and around the spent fuel pool was reduced to account for this. Additionally, the estimated dose rates for some activities were lowered when it was determined that the activities would be performed in a different area with lower dose rates than originally assumed. Finally, the estimated person-hours for certain tasks were also reduced after procedures for these tasks were finalized and more details about these tasks were known. As a result of these changes in assumptions, the original estimate of 109 person-rem was revised to 59 person-rem per unit, which is still far higher than the 13.17 person-rem actually incurred in the reracking of Unit 3. 47/

Both the original and revised estimates were conservative for several reasons. A primary reason why these estimates overpredicted the actual dose is attributable to the fact that little or no credit was taken for reductions in radioactivity in the pool water due to operation of the cleanup system. Actual dose rates in the spent fuel pool during the reracking of Unit 3 were significantly lower than the estimated values, due primarily to operation of the spent fuel pool cleanup system (which was enhanced by installation of a new resin prior to the reracking operation). Although the estimates are conservative, they served a useful purpose in that they identified where the Licensee's ALARA efforts should be focused. 48/

47/ Id., ¶¶ 15-20.

48/ Id., ¶¶ 22-24.

The Licensee implemented standard health physics techniques to maintain personnel exposures ALARA during the reracking of Unit 3, and similar techniques will be utilized during the reracking of Unit 4. 49/ These techniques include the following:

- Preplanning of activities and training of workers -- This consisted of several measures, including meetings of all groups involved in the reracking to discuss radiological protection, minimizing the number of workers and activities needed for reracking, training of workers in FPL's radiation protection program, control of work through use of radiation work permits, establishing written procedures to control the reracking activities, and providing on-the-job coverage by health physics technicians. 50/
- Reducing levels of radioactivity in work areas -- This was accomplished by operation of the spent fuel pool cleanup system, cleaning radioactive crud off the exposed walls of the spent fuel pool, removal of radioactive crud from the old storage

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49/ Danek Affidavit, ¶¶ 4-5.

50/ Id., ¶¶ 6-12.

racks prior to transfer from the spent fuel pool, and use of measures to prevent the spread of radioactive contamination. 51/

- Reducing the amount of time spent by workers in radiation areas -- This was accomplished by the use of procedures, training of workers, and practicing with remote tooling prior to the rerack. 52/
- Increasing the distance between workers and sources of radiation -- This was accomplished by use of remote tools, assembling work equipment in low radiation areas when practical, and controlling access to radiation areas. 53/
- Use of shielding and protective clothing -- This consisted of maintaining approximately fifteen feet of water in the spent fuel pool to shield workers from the spent fuel, use of protective clothing, and use of respirators when the potential for airborne radioactivity existed. 54/

51/ *Id.*, ¶¶ 13-17.

52/ *Id.*, ¶¶ 18-20.

53/ *Id.*, ¶¶ 21-24.

54/ *Id.*, ¶¶ 25-27.

- Radiation monitoring -- This consisted of use of personnel monitoring equipment, permanent area radiation monitoring, permanent airborne radioactivity detectors, and periodic airborne and area radiation monitoring. 55/

There are no additional measures which are reasonable and could have reduced the occupational exposures appreciably during the reracking. 56/

As documented in Section 2.6 of its Safety Evaluation, the NRC Staff reviewed the Licensee's measures for maintaining occupational radiation exposures ALARA during the reracking of the Turkey Point spent fuel pools. The Staff concluded that, based upon its review of these measures, the spent fuel pool modifications can be performed in a manner that will ensure that exposures to workers will be ALARA.

55/ Id., ¶¶ 28-30. On page 8 of Intervenors' Response to Interrogatories, Intervenors state that FPL's actions for maintaining doses ALARA during the reracking are not sufficient because the leakage detection system for the spent fuel pool is not operable. At one time, the leakage detection and collection system consisted of a monitoring trench behind the spent fuel pool liner for collecting and detecting any leaks, and a pump and piping for directing any leakage back to the spent fuel pool. During the reracking of Unit 3, the pump back portion of this system was not available. Since the spent fuel pools had been relined, no leakage was expected to occur. Any leakage would have remained in the monitoring trench behind the liner and would have contributed a negligible dose to workers involved in the reracking due to the distance between the workers and the trench and the shielding provided by intervening structures and objects. (Danek Affidavit, ¶ 31).

56/ Id., ¶ 7.

In sum, the Licensee made conservative estimates of the occupational radiation exposure to be incurred during the reracking of the Turkey Point spent fuel pools. The actual exposures during the reracking of Unit 3 were far less than those estimated and were similar to industry experience. FPL utilized standard health physics techniques to maintain exposures ALARA during the reracking of Unit 3, and will utilize similar techniques during the reracking of Unit 4. No additional measures could reasonably be taken to reduce occupational exposures appreciably. Since there is no genuine issue regarding these material facts, the Licensee is entitled to summary disposition of Contention 7.

F. Contention 8

Contention 8 and the bases for the contention state as follows:

Contention 8

> That the high density design of the fuel racks will cause higher heat loads and increase in water temperature which could cause a loss-of-cooling accident in the spent fuel pool, which could in turn cause a major release of radioactivity to the environment. And, that the decrease in the time that it takes the spent fuel to reach its boiling point in such an accident, both increases the probability of accidents previously evaluated and increase [sic] the chances accidents not previously evaluated.

Bases for Contention

> a) The NRC has stated in numerous documents that the water in spent fuel pools should normally be kept below 122 degrees F. The present temperature of the water at Turkey Point is estimated to be 127 degrees F. After

> the reracking, the temperature of the water could rise to 141 degrees on a normal basis, and could reach 180 degrees F. with a full core load added. In addition, the time for the spent fuel boiling point to be reached in a loss of cooling accident will go from 15 hours to 4 hours. Four hours is clearly not enough time to take action to prevent a major accident in the spent fuel pool from occurring. Thus, the increase in heat and radioactivity resulting from increases [sic] density will result in an increase in the probability of a major spent fuel pool meltdown occurring.
>
> b) There is also the possibility that a delay in the make up emergency water, could cause the zirconium cladding on the fuel rods to heat up to such higher temperatures that any attempt at later cooling by injecting water back into the pool could hasten the heat up, because water reacts chemically with heated zirconium to produce heat and possible explosions. Thus, the zirconium cladding could catch on fire, especially in a high density design, and create an accident not previously evaluated.

In admitting Contention 8, the Licensing Board "limited [it] to the basis offered" by the Intervenors. Memorandum and Order (September 10, 1985), p. 15.

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

The decay of fission products in spent fuel produces heat. The amount of decay heat generated by spent fuel decreases with time following reactor shutdown. During storage in the spent fuel pool, decay heat is removed by maintaining an adequate water level in the pool and through operation of the spent fuel pool cooling system. 57/

57/ Patton Affidavit, ¶¶ 3-4.

Each unit of Turkey Point has a spent fuel pool cooling system and a system for supplying make-up water to the spent fuel pool to replace water lost through evaporation. The heat removal rate of the spent fuel pool cooling system is a function of the temperatures of the spent fuel pool water and the component cooling water. The capacity of the makeup system is 100 gpm. 58/

The NRC Staff has issued guidance for spent fuel pool cooling in Standard Review Plan Section 9.1.3. Contrary to the Intervenors' contention, this guidance does not state that spent fuel pools should normally be kept below 122°F. 59/ Instead, SRP Section 9.1.3 states that the temperature of the pool should not exceed 140°F and the liquid level in the pool should be maintained under conditions associated with the maximum normal heat load with normal cooling systems in operation. Additionally, SRP Section 9.1.3 states that the temperature of the pool should be kept below boiling and the liquid level in the pool should be maintained for the abnormal maximum heat load from a full core offload with normal systems in operation. Finally, SRP Section 9.1.3 states, among other things, that the spent fuel pool

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58/ Id., ¶¶ 5-8.

59/ Contention 8 and the bases for the contention do not identify the NRC documents which allegedly state that the temperature of spent fuel water should normally be kept below 122°F, and the Intervenors were unable to identify any such documents in response to Licensee's interrogatories. See Intervenors' Response to Interrogatories, pp. 8-9.

cooling system should be seismic Category I or, in the alternative, the makeup system, the fuel pool building, and the ventilation and filteration system should be seismic Category I. 60/

The Licensee analyzed two cases to determine whether the Turkey Point spent fuel pool cooling and makeup systems have sufficient capacity to cool the spent fuel and maintain the water level in the pool following the spent fuel pool expansions. The first case postulated the addition of a number of fuel assemblies in excess of a normal core offload to the number of assemblies stored in the pool from previous refuelings. The second case postulated the addition of a full core offload. In both cases, it was assumed that the total number of assemblies in the spent fuel pool would slightly exceed the actual capacity of the new storage racks, and both analyses used other conservative assumptions regarding the amount of decay heat being generated and the amount of cooling being provided. 61/

In the first case, the Licensee determined that the temperature of the pool water would rise to a maximum of 143°F and that the maximum evaporation rate would be 1.5 gpm. This evaporation rate is well within the 100 gpm capacity of the makeup system. The maximum temperature of 143°F exceeds the 140°F guideline provided by the NRC Staff in SRP Section 9.1.3. However, the difference between the Licensee's calculated temperature and the temperature provided in the SRP is slight

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60/ Patton Affidavit, ¶¶ 11-13.

61/ Id., ¶¶ 9-12.

(only 3°F), the Licensee's temperature was calculated using conservative assumptions, and the Licensee determined that the temperature of the water would decrease to 140°F within a relatively short period of time (72 hours). 62/ Moreover, the spent fuel will remain adequately cooled and covered with water at all times under the conditions postulated in the first case. In its Safety Evaluation, the NRC Staff found the maximum temperature of 143°F to be acceptable. 63/

In the second case involving the full core offload, the Licensee determined that the temperature of the pool water would rise to a maximum of 183°F and that the maximum evaporation rate would be 5.5 gpm. This evaporation is well within the 100 gpm capacity of the makeup system, and the maximum temperature is less than boiling as recommended by SRP Section 9.1.2. Thus, the spent fuel will remain adequately cooled and covered with water at all times under the conditions postulated in the second case. 64/

In contrast with the guidance in SRP Section 9.1.3, the existing cooling system piping and makeup supply lines for the Turkey Point spent fuel pools are not seismic Category I and have not been designed to remain functional after a safe shutdown earthquake. Accordingly, the SAR for the spent fuel pool expansions and FPL's responses to NRC staff questions provided

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62/ Id., ¶¶ 9-11.

63/ SE, § 2.7.2.

64/ Patton Affidavit ¶ 12.

the results of analyses of loss of cooling to the spent fuel pool. These analyses showed that, with all positions in the new storage racks full with assemblies, the pool would not begin to boil until a minimum of 7.6 hours for a normal offload and 1.6 hours for a full core offload. Additionally, in response to the NRC Staff's review of FPL's application for the spent fuel pool expansion, FPL has committed to upgrade the spent fuel pool cooling loop such that it would remain functional after a safe shutdown earthquake. This upgrade will be completed by the end of the second refueling outage after issuance of the amendments for the spent fuel pool expansions. At that time, the cooling system will be in conformance with those portions of SRP Section 9.1.3 which recommend a seismic Category I cooling system. 65/ Accordingly, loss of cooling need not be considered after that time, since the cooling system will provide sufficient cooling in the event of a safe shutdown earthquake.

Prior to the time the seismic upgrade is completed, the number of fuel assemblies that is scheduled to be stored in the pools will be less than the approximately 600 assembly capacity of the pre-existing storage racks. This fact is amply demonstrated by Table 1 in the Patton Affidavit, which is reproduced below.

65/ Id., ¶¶ 8, 14-15.

TABLE 1

Number of Assemblies To Be Stored
in the Turkey Point Spent Fuel Pools

Turkey Point Unit 3

Cycle No.	Approx. Cycle Startup Date	Approx. Total No. Assemblies in Pool from all Previous Cycles	Comments
1 to 8	--	311	--
9	1/7/84	369	Amendment issued 11/21/84
10	07/17/85	475	--
11	3/7/86	481	Seismic Upgrade complete by end of Cycle 11 refueling outage

Turkey Point Unit 4

Cycle No.	Approx. Cycle Startup Date	Approx. Total No. Assemblies in Pool from all Previous Cycles	Comments
1 to 8	--	287	--
9	05/16/83	323	--
10	06/01/84	387	Amendment issued 11/21/84
11	03/30/86	445	--
12	12/15/87	503	Seismic Upgrade complete by end of Cycle 12 refueling outage

Thus, the number of assemblies in each of the Turkey Point spent fuel pools prior to the seismic upgrade will be less than the number FPL was authorized to store prior to issuance of the spent fuel pool expansion amendments, and the spent fuel pool expansion amendments will not result in an increase in the amount of cooling and makeup necessary for these assemblies. 66/ Consequently, as discussed below, cooling of these assemblies is governed by the pre-existing license conditions and need not be considered in conjunction with issuance of the amendments.

It is well established that an amendment proceeding is not an appropriate forum for considering an aspect of the design of a plant if the safety of that design is not adversely affected by the amendment. For example, in Wisconson Electric Power Co. (Point Beach Nuclear Plant, Units 1 and 2), LBP-82-88, 16 NRC 1335, 1342 (1982), an intervenor attempted to raise issues regarding the impacts of steam generator tube ruptures in an amendment proceeding involving sleeving of steam generator tubes, without showing how sleeving would exacerbate tube-failure or its consequences. The licensing board rejected such issues, ruling as follows:

> We do not think it appropriate to permit an intervenor to question the original design of the reactor or the systems not directly involved in this application, on the unexplained premise that they are somehow related to the steam generator. . . . The test of relevance we have applied is to ask whether an issue is relevant to "how the *sleeving* program would cause problems" or whether it reflects "unfavorably on the safety of *sleeving*." [Emphasis in original.]

66/ Id., ¶ 15.

In Carolina Power and Light Co. (H.B. Robinson, Unit No. 2), ALAB-569, 10 NRC 557, 562 (1979), the Appeal Board stated that it did not have jurisdiction to consider safety questions arising from the Three Mile Island accident in an amendment proceeding involving an increase in authorized power level, because no safety questions arising from the accident would be made more serious by increasing the power level in the manner proposed by the licensee. Similarly, issues pertaining to cooling of the number of assemblies authorized to be stored under pre-existing license conditions are outside the scope of this proceeding, since the spent fuel pool expansion amendments will not increase the amount of cooling or makeup necessary for these assemblies.

Finally, Basis (b) for Contention 8 alleges that a zirconium cladding/water reaction is possible in the spent fuel pools. However, such a reaction does not occur at temperatures below 1000°F. As demonstrated above, adequate cooling and makeup will be provided for the stored spent fuel assemblies at Turkey Point, resulting in temperatures far below those necessary for a zirconium/water reaction. 67/

In sum, operation of the spent fuel pool cooling systems and makeup system will maintain pool temperatures below boiling and will maintain the water level in the pool for maximum heat loads associated with both a normal core offload and a full

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67/ Patton Affidavit, ¶ 16.

core offload. Since there is no genuine issue regarding these material facts, Licensee is entitled to summary disposition of Contention 8.

G. Contention 10

Contention 10 and the bases for the contention state as follows:

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 N16-1975 [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, A 62 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.

The contention originally proposed by the Intervenors referred to fuel rods which may have experienced fuel failure. In admitting Contention 10, the Licensing Board "limited [it] to whether added storage of fuel and more highly enriched fuel will cause a criticality accident." Memorandum and Order (September 16, 1985), p. 16.

The material facts regarding the issues raised by this contention are not in dispute. These facts are summarized below.

The Turkey Point spent fuel pool amendments authorize the replacement of the pre-existing spent fuel storage racks with new storage racks. The new racks can store spent fuel assemblies in a higher density array and can also accomodate the more highly enriched assemblies which are now authorized for use at Turkey Point. 68/

The Turkey Point spent fuel pool expansion amendments divide each spent fuel pool into two regions. Each region consists of new storage racks which have a different high density storage configuration and a different amount of neutron absorbers than the racks in the other region. The racks in Region 1 are designed to permit storage of a full core of unirradiated fuel assemblies with an enrichment of 4.5% of Uranium-235. The racks in Region 2 are designed to permit storage of fuel assemblies with a reactivity equivalent to a fuel assembly with an initial enrichment of 1.5% and zero burnup (which corresponds to an assembly with an initial enrichment of 4.5% and 39,000 MWD/MTU burnup). Additionally, during the interim period of installation of the new racks, the Region 2 racks are designed to accomodate storage of fuel assemblies with a zero burnup enrichment of up to 4.5% as long as the assemblies are stored in a checkerboard pattern. 69/

68/ Boyd Affidavit, ¶ 10.

69/ Id., ¶¶ 11-13.

Criticality analyses for spent fuel pools are governed by General Design Criterion (GDC) 62 of Appendix A to 10 C.F.R. Part 50, which states that "[c]riticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferrably by use of geometrically safe configurations." Guidance for preventing criticality in spent fuel pools is provided by the NRC Staff in Standard Review Plan (SRP) Section 9.1.2 and the NRC Position Paper. This guidance states that the effective neutron multiplication factor in spent fuel pools should be maintained at a value less than or equal to 0.95, including all uncertainties, under both normal and accident conditions. 70/

The design basis for the Turkey Point spent fuel pools requires that the k-effective of the fuel assemblies in the pools be less than 0.95 at a 95%/95% probability/confidence level. Consequently, the design basis for the Turkey Point spent fuel pools conforms with the criticality criterion provided by the NRC Staff. In this regard, it should be noted that Turkey Point utilized the 0.95 criterion prior to issuance of the amendments authorizing the spent fuel pool expansions, and the amendments did not modify or increase the design basis k-effective limit for the Turkey Point spent fuel pools. Thus, contrary to Intervenors' contention, the amendments will not increase the probability of a criticality accident. 71/

70/ Id., ¶¶ 15-16.

71/ Id., ¶ 17.

In general, the design of the Turkey Point spent fuel pool racks assures that the design basis k-effective limit will not be exceeded. Although the new spent fuel storage racks permit the storage of more highly enriched fuel assemblies in a higher density array than the pre-existing racks, the reactivity effects of these changes are counterbalanced by including a neutron absorber (Boraflex) in the storage racks. 72/

The Licensee performed analyses to confirm that the k-effective of the new storage racks will be within the design basis limits. In performing these analyses, the Licensee employed three computer codes (KENO-IV, PHOENIX, and CINDER) which have been verified by comparison against experimental data. Additionally, the analyses employed several conservative assumptions, including the following:

- assuming that the array of fuel assemblies is infinite in lateral and axial extent
- assuming lower concentrations of certain neutron absorbing fission products than actually present in the spent fuel
- neglecting neutron capture by the fuel assembly spacer grids and sleeves
- neglecting neutron capture by the boron in the spent fuel pool water
- assuming a spent fuel pool water density and temperature which maximizes the amount of moderation provided by the water.

72/ Id., ¶¶ 14, 18.

In addition to these conservative assumptions, the calculated values of k-effective accounted for biases and uncertainties either by using worst case assumptions or by increasing the nominally calculated value of k-effective to account for biases and uncertainties of the analytical methods and the biases and uncertainties attributable to factors such as material and mechanical construction tolerances of the metal storage rack cell walls, cell center-to-center spacing, cell bowing, and the Boraflex neutron absorbing properties. 73/

The results of these analyses demonstrate that the new storage racks conform with the design basis k-effective limit. The k-effective of the Region 1 storage racks was calculated to be 0.9403, including all uncertainties. The k-effective of the Region 2 storage racks with assemblies having a reactivity equivalent to a zero burnup enrichment of 1.5% was calculated to be 0.9304, including all uncertainties. Finally, the k-effective of the Region 2 storage racks with a checkerboard arrangement of assemblies having a zero burnup enrichment of 4.5% was calculated to be 0.8342 (this value did not include the effect of biases and uncertainties, since the k-effective of this arrangement would still be well-below 0.95 even if conservative assumptions were made regarding these biases and uncertainties). 74/

73/ Id., ¶¶ 19-25, 27, 29.

74/ Id., ¶¶ 26, 28, 32.

Finally, criticality effects of accidents involving the Turkey Point spent fuel pools were considered in accordance with the double contingency principle of ANSI (American National Standards Institute) N16.1-1975, which has been adopted as guidance by the NRC Staff in the NRC Position Paper. In effect, the double contingency principle states that it is not necessary to consider two unlikely, independent, and concurrent changes in conditions in performing criticality analyses. All of the criticality analyses for the Turkey Point spent fuel pool were performed assuming the absence of boron in the pool water, which is an accident condition. Under the double contingency principle, it is unnecessary to postulate an accident involving both the absence of this boron plus another independent change in conditions involving the spent fuel pool. Accordingly, the analyses of the criticality effects of other types of accidents take credit, where appropriate, for the negative reactivity present as a result of the borated water. The negative reactivity of the borated water more than offsets increases in k-effective resulting from other postulated accidents, such as the absence of Boraflex in the storage racks or mechnical or geometrical changes caused by an inadvertant drop of an assembly, a cask drop accident, an earthquake, or other credible accident. Consequently, the k-effective of the spent fuel pools would remain within limits even if these accidents were to occur. 75/

75/ Id., ¶¶ 33-40.

As documented in Section 2.1 of its Safety Evaluation for the Turkey Point spent fuel pool expansions, the NRC Staff reviewed the Licensee's analysis and found that the assumptions used were consistent with NRC Staff guidelines, that the treatment of uncertainties and biases met NRC Staff criteria, that the computer codes used were adequately verified, and that the results met the NRC Staff's acceptance criterion for a k-effective of less than or equal to 0.95. Accordingly, the NRC Staff concluded that the criticality aspects of the spent fuel storage racks were acceptable.

In sum, the criticality analyses performed for the Turkey Point spent fuel pool expansion amendments conform with applicable NRC Staff criteria. These analyses demonstrate that fuel assemblies of authorized initial enrichments and burnups to be stored in authorized storage patterns in the Region 1 and Region 2 racks will have a k-effective of less than 0.95, including all uncertainties, under both normal and accident conditions. The NRC Staff has reviewed these analyses and found them acceptable. Since there is no genuine issue regarding these material facts, the Licensee is entitled to summary disposition of Contention 10.

IV. Conclusion

For the foregoing reasons, the Licensee contends that there is no genuine issue of material fact regarding the Intervenors' contentions, and that the Licensee is entitled to a decision in its favor as a matter of law. Accordingly, Licensee's motion for summary disposition of these contentions should be granted.

Respectfully submitted,

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