FPL

Florida Power & Light Company, 6501 South Ocean Drive, Jensen Beach, FL 34957

November 25, 2002

L-2002-221
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

RE: St. Lucie Unit 1
Docket No. 50-335
Proposed License Amendment
Spent Fuel Pool Soluble Boron Credit

Pursuant to 10 CFR 50.90, Florida Power and Light Company (FPL) requests to amend Facility Operating License DPR-67 for St. Lucie Unit 1 by incorporating the attached Technical Specification (TS) revisions. The proposed amendment would eliminate the need to credit Boraflex™ neutron absorbing material for reactivity control in the Unit 1 spent fuel pool and credit a combination of soluble boron and fuel position within the storage racks to maintain reactivity within the effective neutron multiplication factor limits of 10 CFR 50.68.

Attachment 1 is an evaluation of the proposed changes. Attachment 2 is the Determination of No Significant Hazards Consideration. Attachment 3 is the Environmental Assessment Report. Attachment 4 is the Spent Fuel Pool Boron Dilution Analysis Report. Attachment 5 contains the affected TS pages marked-up to show the proposed changes. Attachment 6 contains the word-processed TS changes, and Attachment 7 contains an informational copy of the proposed TS Bases changes.

A proprietary and a non-proprietary version of the supporting Holtec License Amendment Report have been provided as Enclosures 2 and 3. Enclosure 2 contains information that is considered proprietary pursuant to 10 CFR 2.790. Enclosure 3 contains the non-proprietary version. The affidavit required by 10 CFR 2.790 is provided in Enclosure 1. FPL requests that the proprietary version of Enclosure 2 be withheld from public viewing.

The St. Lucie Facility Review Group and the FPL Company Nuclear Review Board have reviewed the proposed amendment. In accordance with 10 CFR 50.91(b)(1), copies of the proposed amendment are being forwarded to the State Designee for the State of Florida.

Note that this submittal proposes to generically remove the description of the poison material in the spent fuel racks from the Unit 1 Section 5 TSs. FPL submitted an earlier license amendment to add a cask pit spent fuel storage rack to each unit (FPL letter L-2002-187, dated October 23, 2002), which also added a description of the Boral™ poison material design feature used in the St. Lucie Unit 1 cask pit spent fuel storage racks. This submittal will justify removing the poison material description added by the cask pit spent fuel storage rack submittal.

Regarding the proposed schedule for this amendment, FPL requests that it be approved no later than December 10, 2003, and follow issuance of the Proposed License Amendments transmitted by FPL letter L-2002-187, "Addition of Cask Pit Spent Fuel Storage Racks Technical Specification Requirements." Please issue the amendment to be effective on the date of issuance with implementation by end of the first St. Lucie Unit 1 refueling outage following approval.

This proposed license amendment may require noticing with respect to the hybrid hearing procedures under 10 CFR 2.1107, because this may involve a proceeding on an application for a license amendment falling within the scope of Section 134 of the Nuclear Waste Policy Act of 1982. Although the proposed changes do not effect an "expansion of spent nuclear fuel storage capacity," they do represent a means to preserve storage capacity that could otherwise be lost due to potential future Boraflex™ degradation.

Please contact us if there are any questions about this submittal.

Very truly yours,

Donald E. Jernigan
Vice President
St. Lucie Plant

DEJ/KWF

Attachments
Enclosures

cc: Mr. W. A. Passetti, Florida Department of Health

STATE OF FLORIDA)
) ss.
COUNTY OF ST. LUCIE)

Donald E. Jernigan, being first duly sworn, deposes and says:

That he is Vice President, St. Lucie Plant, for the Nuclear Division of Florida Power and Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

Donald E. Jernigan

STATE OF FLORIDA

COUNTY OF St. Lucie

Sworn to and subscribed before me

this 25th day of November, 2002

by Donald E. Jernigan, who is personally known to me.

Signature of Notary Public-State of Florida

Julie G. Mueller

Name of Notary Public (Print, Type, or Stamp)

Julie G. Mueller
Commission #DD146224
Expires: Oct 07, 2006
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Atlantic Bonding Co., Inc.

EVALUATION OF PROPOSED TS CHANGES

1.0 BACKGROUND INFORMATION

Florida Power and Light Company (FPL) requests to amend Facility Operating License DPR-67 for St. Lucie Unit 1 by incorporating the attached Technical Specification (TS) revisions. This proposed amendment to the St. Lucie plant Unit 1 TS is being submitted for NRC approval to: (1) eliminate the need to credit Boraflex™ neutron absorbing material for reactivity control in the Unit 1 spent fuel pool (SFP), and (2) credit a combination of soluble boron and fuel positioning within the storage racks to maintain SFP reactivity within the effective neutron multiplication factor (k_{eff}) limits of 10 CFR 50.68.

St. Lucie Unit 1 is currently licensed to store 1706 fuel assemblies in the SFP.[1] The SFP contains 17 stainless steel storage rack modules of various sizes. Four Region 1 rack modules are located along the SFP south wall and contain a total of 342 storage cells. Individual cells in the Region 1 racks are separated by a nominal center-to-center pitch of 10.12 inches including a flux-trap water gap, and are capable of storing either fresh or irradiated fuel. The remaining thirteen SFP rack modules are a Region 2 design with a total capacity of 1364 fuel assemblies. Individual cells in the Region 2 racks are separated by a nominal center-to-center pitch of 8.86 inches. Region 2 has no intra-module flux-trap water gap, and it can only store enriched fuel assemblies with characteristics that satisfy the requirements of TS 5.6.1.b. The configuration and cross-sectional dimensions of the Boraflex™ panels surrounding each storage cell are shown in Figures 9.1-24 and 9.1-25 of the Unit 1 Updated Final Safety Analysis Report (UFSAR).

Previous St. Lucie Unit 1 criticality analyses credited Boraflex™ for neutron absorption, with no credit taken for SFP soluble boron. Because nuclear industry experience has demonstrated that the Boraflex™ material undergoes gamma radiation-induced degradation in the SFP environment, FPL proposes to eliminate its reliance on Boraflex™ for reactivity control in the St. Lucie Unit 1 SFP. Therefore, reactivity characteristics of the SFP Region 1 and Region 2 storage racks have been reanalyzed, considering a variety of fuel storage arrangements, but neglecting the presence of Boraflex™. These analyses also consider the effects on reactivity of post-irradiation cooling time, fuel depletion due to burnup, the presence of fuel rod axial blankets or control element assemblies (CEAs) in some fuel assemblies, and soluble boron.

A boron dilution analysis of the SFP has also been performed to support the minimum boron concentration requirement of the new criticality analysis. The plant systems, environmental factors, and operational scenarios that have been

1 A separate license amendment request has been submitted to increase the total Unit 1 storage capacity by adding a storage rack in the cask pit area adjacent to the SFP. The above amendment request is limited to the racks located in the SFP, and does not involve or impact the cask pit rack.

evaluated as potential contributors to an inadvertent dilution event are described in the dilution analysis attached to this amendment request.

This proposed amendment does not require any physical change to the St. Lucie Unit 1 facility. The existing SFP storage racks will remain in place, without modification. In addition, the storage rack modules now designated for Region 1 and Region 2 storage will remain unchanged, and the number of storage locations in each region will also stay the same. The irradiated fuel now stored in the SFP will be rearranged to optimize reactivity control of the storage configuration. No storage locations will be created or lost by implementing the rules to control fuel assembly placement that are proposed herein.

Precedent Licensing Actions

The licensing precedent for using soluble boron in water to provide criticality control in SFPs has already been established. Section (b)(4) of 10 CFR 50.68 allows credit for soluble boron to maintain the effective neutron multiplication factor (k_{eff}) of the SFP at 0.95 or less.

The Nuclear Regulatory Commission (NRC) has approved license amendments at other plants to eliminate reliance on Boraflex™ and to credit soluble boron in conjunction with fuel repositioning for SFP reactivity control. In 1999, the South Texas Project Units 1 and 2 received a license amendment to revise the criticality analysis and rack utilization schemes by allowing credit for SFP soluble boron. In 2002, the Diablo Canyon Unit 1 and 2 licenses were amended to credit soluble boron rather than credit Boraflex™ in the SFP criticality analysis. Other plants with similar license amendment requests include Palisades, North Anna Units 1 and 2, and Seabrook.

In 1999, the NRC approved a license amendment for St. Lucie Unit 2 that credited the presence of soluble boron in the SFP; this amendment increased the licensed storage capacity of existing spent fuel storage racks. St. Lucie Unit 2 fuel storage racks do not contain Boraflex™.

Precedent for removing the description of neutron absorber materials (Boraflex™ and Boral™) from Unit 1 TS Section 5.6, Design Features, is provided in Section 4.3.1 of NUREG-1432, "Standard Technical Specifications for Combustion Engineering Plants" (Rev. 2). However, when SFP reactivity control no longer relies on Boraflex™, removing reference to Boraflex™ from TS 5.6 is justified without licensing precedent.

2.0 DESCRIPTION OF PROPOSED CHANGES

FPL proposes to modify St. Lucie Unit 1 TS Sections 3/4.9.11, Storage Pool Water Level, and 5.6, Design Features - Fuel Storage, as described below. A markup of the specific wording changes is shown in Attachment 5.

a. **TS Index**: The index would be revised to rename TS 3/4.9.11 from "Storage Pool Water Level" to "Spent Fuel Storage Pool."

b. **TS 3/4.9.11**: This section would be renamed "Spent Fuel Storage Pool" and the current TS 5.6.1.a.3 requirement to maintain the SFP boron concentration ≥ 1720 ppm would be added to Limiting Condition for Operation (LCO) 3.9.11. In addition, a new Action statement would be added to be effective when boron concentration drops below the LCO limit, and a new surveillance requirement would be added to verify SFP boron concentration at least once per 7 days.

c. **TS 5.6.1.a.1**: This section would be revised to maintain k_{eff} less than 1.0 when the racks are flooded with unborated water, rather than the current requirement to maintain less than or equal to 0.95 when the racks are flooded with unborated water.

d. **TS 5.6.1.a.3**: The SFP boron concentration requirement would be moved to TS 3.9.11 and this section would be replaced with a new requirement to maintain k_{eff} less than or equal to 0.95 when the racks are flooded with water containing 500 ppm boron, which includes allowance for biases and uncertainties as described in UFSAR Section 9.1.

e. **TS 5.6.1.a.4**: The Boraflex™ neutron absorber requirement would be deleted and replaced with a requirement that enriched fuel assemblies meet the new k_{eff} limits according to new TS 5.6.1.b.

f. **TS 5.6.1.a.5**: A new specification that provides storage requirements for reactor vessel flux reduction assemblies (VFRAs).

g. **TS 5.6.1.a.6**: A new specification that identifies the criteria to be used when positioning other fissile material within the fuel storage racks.

h. **TS 5.6.1.b**: This section would be deleted and replaced with a new section that prescribes the maximum fuel assembly planar average initial U-235 enrichment for all spent fuel storage racks, and imposes the restrictions on loading Region 1 and Region 2 SFP storage racks found in new Figures 5.6-1 and 5.6-2 and new Tables 5.6-1 and 5.6-2. The revised text of Section 5.6.1.b also recognizes that the proposed Region 1 cask pit rack is designed to accommodate the storage of any fuel enriched to ≤ 4.5 maximum weight percent, including fresh fuel.

i. **Figure 5.6-1**: The existing figure would be deleted and replaced with new Figure 5.6-1, "Allowable Region 1 Storage Patterns and Fuel Alignments," and **Figure 5.6-2**, "Allowable Region 2 Storage Patterns and Arrangements." The new figures describe the checkerboard loading patterns and restrictions imposed by TS 5.6.1.b.

j. **New Tables 5.6.1**, "Minimum Burnup as a Function of Enrichment for Non-Blanketed Assemblies," and **5.6.2**, "Minimum Burnup as a Function of Enrichment for Blanketed Assemblies," would be added. The new tables define the minimum burnup requirements for the seven new spent fuel types called out in new Figures 5.6-1 and 5.6-2.

k. **TS 3/4.9.11 Bases** would be revised to reflect changing the section title and adding the SFP boron concentration LCO.

3.0 BASIS/JUSTIFICATION FOR PROPOSED CHANGES

3.1 OVERVIEW

The basis for requesting the proposed changes to the St. Lucie Unit 1 TSs is to eliminate reliance on Boraflex™ in the SFP storage racks because of anticipated Boraflex™ degradation in the SFP environment. Eliminating reliance on Boraflex™ will avoid a future operating and maintenance burden associated with potential loss of storage capacity and potential replacement of storage racks.

A new criticality analysis has been performed to support this amendment request. A License Amendment Report (LAR) was prepared by the SFP rack vendor to summarize the methodology, assumptions, and results of the new analysis based on partial credit for soluble boron and other neutron absorbers, other than Boraflex™. The proprietary version of the LAR is Enclosure 2 to this amendment request.

A boron dilution analysis was also prepared for this proposed amendment to demonstrate that an inadvertent dilution event would not reduce the SFP boron concentration to a value less than the minimum requirement of the criticality analysis. The boron dilution analysis is found in Attachment 4.

The following sections summarize the criticality and boron dilution analyses, and discuss other issues that support revising the St. Lucie Unit 1 TSs to credit soluble boron in the SFP.

3.2 CRITICALITY CONSIDERATIONS

Overview

A new St. Lucie Unit 1 criticality analysis (found in Section 4.0 of Enclosure 2) was performed to demonstrate that the existing SFP storage racks are capable of meeting the requirements of 10 CFR 50.68(b)(4) for Region 1 and Region 2 storage configurations, when credit is taken for the presence of soluble boron and when Boraflex™ is not credited. The analysis acceptance criteria were:

(1) maintain the SFP effective neutron multiplication factor (k_{eff}) less than or equal to 0.95 with the storage racks fully loaded with fuel of the highest permissible reactivity and with the pool flooded with borated water at a nominal operating temperature corresponding to the highest reactivity, and

(2) maintain k_{eff} of the SFP below 1.0 when the fuel pool is flooded with unborated water.

The maximum calculated k_{eff} values include a conservative allowance for biases and uncertainties in the reactivity calculations, including manufacturing tolerances, such that the final value for k_{eff} satisfies the required limits with a 95% probability at a 95% confidence level.

The St. Lucie Unit 1 SFP is currently licensed to store up to 1706 assemblies in four Region 1 rack modules and thirteen Region 2 rack modules. The new criticality analysis applies to all 17 SFP storage rack modules that contain Boraflex™, but it does not apply to a new proposed Region 1 cask pit rack, which is designed with Boral™ neutron absorbing panels. This cask pit rack is designed to accommodate both fresh fuel and a portion of recently irradiated offload fuel.

In addition to crediting the presence of soluble boron in the spent fuel pool, the new criticality analysis also credits the presence of full strength CEAs placed in selected fuel bundles, as well as other neutron absorbers in the fuel design. In order to efficiently perform the analysis, it was necessary to group together fuel assemblies having similar reactivity characteristics and to establish different localized storage arrangements (i.e., checkerboard patterns) within the racks for assemblies with unique reactivity groupings.

Analysis Methodology

The principal analytical tool used for the criticality analysis was the three-dimensional Monte Carlo code MCNP4a developed at the Los Alamos National Laboratory. MCNP4a was selected because it has been previously verified for criticality analyses and it has been previously reviewed and approved by the NRC for similar applications. MCNP4a calculations used continuous energy cross-section data based on ENDF/B-V and ENDF/B-VI. Benchmark calculations are presented in Appendix 4A of Enclosure 2. The MCNP4a calculations for this analysis used the same computer platform and cross-section libraries applied to the benchmark calculations.

Analyses of fuel depletion during St. Lucie Unit 1 power operation were performed with CASMO-4, a two-dimensional multi-group transport theory code based on capture probabilities. CASMO-4 is used to determine the isotopic composition of irradiated fuel. Restart calculations in the storage rack geometry are used to determine the reactivity effect of fuel and rack tolerances, and to perform various studies.

Fuel Assembly Types Analyzed

The analysis evaluated a total of seven irradiated fuel assembly types that reflect different burnup thresholds and reactivity groupings. The following table ranks each type of fuel assembly by its relative reactivity (Type 1 is highest; Type 7 is lowest), the SFP storage region(s) for which the fuel type was analyzed, the textual description used in the analysis, and the corresponding minimum assembly burnup requirement based on an initial enrichment of 4.5 weight percent:

Assembly Type	Storage Region	Description	Minimum Burnup @ 4.5 w/o U-235
1	1	Case 2 "once burned"	17.51 GWd/MTU
2	1	Case 3 "twice burned"	24.95 GWd/MTU
3	1	Case 3 "lower reactivity"	34.66 GWd/MTU
	2	Case 4 "high reactivity"	
4	2	Case 1 "high reactivity"	42.98 GWd/MTU
5	1	Case 2 "low reactivity"	44.00 GWd/MTU
6	2	Case 5 "medium reactivity"	48.80 GWd/MTU
7	2	Case 1 "low reactivity"	56.20 GWd/MTU

The seven assembly type numbers appear in the checkerboard storage patterns, fuel alignments and the allowed special arrangements shown on new TS Figures 5.6-1 and 5.6-2, and in the new TS minimum burnup Tables 5.6-1 and 5.6-2.

Fuel Storage Configurations Analyzed

Five fuel storage patterns (or cases) with different combinations of the above fuel assembly types were analyzed. Two configurations are for Region 1 storage and three configurations are for Region 2 storage, as follows:

Case 1: A Region 2 checkerboard of Type 4 and Type 7 fuel assemblies [Pattern "**C**"]
Case 2: A Region 1 checkerboard of Type 1 and Type 5 fuel assemblies [Pattern "**A**"]
Case 3: A Region 1 checkerboard of Type 2 and Type 3 fuel assemblies [Pattern "**B**"]
Case 4: A Region 2 checkerboard of Type 3 fuel assemblies, with and without CEAs [Pattern "**D**"]
Case 5: A Region 2 uniform loading of Type 6 fuel assemblies [Pattern "**E**"]

The pattern letter shown in brackets corresponds to the loading pattern depicted on new TS allowable loading figures for Region 1 (Figure 5.6-1) and Region 2 (Figure 5.6-2).

Burnup vs Enrichment Curves

For each evaluated storage pattern and for each assembly type within a pattern, the minimum required burnup to qualify a fuel assembly for storage in the pattern has been determined as a function of the initial enrichment of the fuel. These functions, also termed burnup versus enrichment curves, were established as polynomial functions in the form of:

$$BU = [A \cdot E^2] + [B \cdot E] + C$$

where:

BU	=	Burnup in GWD/MTU
E	=	Initial Enrichment (weight percent)
A,B,C	=	Coefficients

The current inventory of irradiated fuel at St. Lucie Unit 1 contains fuel assemblies with axial blankets, as well as fuel assemblies without axial blankets. In addition, Unit 1 fuel assemblies have large variations in their post-irradiation cooling time; some assemblies have cooled more than 20 years. Therefore, coefficients for each fuel type were calculated, for both non-blanketed and blanketed assemblies, and for relevant post-irradiation cooling times of up to 20 years. The resulting coefficients are compiled in two new TS tables: Table 5.6-1 for non-blanketed assemblies and Table 5.6-2 for blanketed assemblies.

From the information in TS Tables 5.6-1 and 5.6-2, a complete set of burnup versus enrichment curves can be generated for each fuel type, as shown in Enclosure 2, Figures 4.6.1 through 4.6.6. However, the proposed Unit 1 TSs will contain the minimum burnup information in tabular form, rather than as a complex set of curves.

Special Fuel Loading Rules

In addition to analyzing the five loading cases [patterns] above, the criticality analysis established additional rules that cover special loading configurations. A portion of the Region 2 storage racks faces the fuel pool wall. The peripheral row of storage cells adjacent to the wall was analyzed to hold higher reactivity (Type 3) fuel, crediting the increased neutron leakage in this area. In addition, a designated area was established in Region 2 racks for fuel inspection and reconstitution, allowing a limited number of fresh fuel assemblies to be placed in a predefined pattern surrounded by empty cells. Reactivity effects of interfaces between adjacent rack modules with dissimilar storage arrangements were also evaluated to assure that under all credible conditions, the fuel pool reactivity will not exceed regulatory limits of ≤ 0.95 in borated water and < 1.0 in unborated water. These evaluations led to the following loading requirements:

1. Normally, each rack module will contain only one fuel loading configuration, i.e., Pattern A or B for a Region 1 rack, and Pattern C, D, or E for a Region 2 rack. However, a rack module may contain more than one permissible configuration if an empty row is used to separate fuel stored in one configuration from fuel arranged in another configuration.

2. For adjacent Region 1 rack modules, checkerboard patterns A and B must be aligned across the gap between the modules such that a high reactivity fuel assembly on one side of the gap must face a low reactivity assembly across the gap. This restriction is shown by the allowed Region 1-to-Region 1 fuel alignment requirements on new TS Figure 5.6-1.

3. For adjacent Region 2 rack modules or a Region 2 rack facing a Region 1 rack, checkerboard patterns need not be aligned across the gap; i.e., a high reactivity assembly on one side of the gap can face a high reactivity assembly across the gap.

4. For Region 2 racks facing the pool wall or the cask pit wall, the outer row of cells facing the wall is qualified to accept assemblies meeting the burnup and enrichment requirements for Type 3 fuel assemblies, and need not contain a CEA, regardless of the fuel assembly characteristics in the remainder of the Region 2 rack. The permissible configuration is shown in new TS Figure 5.6-2.

5. Fresh fuel assemblies can be placed within a Pattern C or Pattern E configuration in a Region 2 storage rack module, as long as each fresh assembly directly faces 4 empty cells, and each of the diagonal cells is either empty or contains a Type 4, 6, or 7 assembly. A fuel rod basket may be substituted for any fresh fuel assembly. Empty cells may contain non-actinide material, such as an empty fuel assembly skeleton, or other hardware, so long as the material occupies no more than 75% of the cell volume. These configurations are shown in new TS Figure 5.6-2.

Abnormal and Accident Conditions Evaluated

Credible abnormal and accident conditions were evaluated for reactivity effects. The Double Contingency Principle of ANSI N16.1-1975 precludes the need to assume a boron dilution event concurrent with abnormal and accident conditions. This principle provides the rationale for why the St. Lucie Unit 1 boron dilution analysis does not consider the time required to reduce fuel pool boron concentration from its initial value of 1720 ppm to the 1090 ppm value required to compensate for a misloaded fuel assembly (see the Analysis Results discussion below). The conditions evaluated include off-normal temperature and water density effects, a dropped fuel assembly, and the mispositioning of a fresh fuel assembly both inside and outside the storage racks. Of these conditions, the most limiting event was found to be the misload of a fresh fuel assembly into an empty cell in a Region 2 rack between two other fresh assemblies.

Analysis Results

The new criticality analysis demonstrated that the effective neutron multiplication factor (k_{eff}) for all five loading patterns is less than or equal to 0.95 when the storage racks are assumed to be fully loaded with fuel of the highest permissible reactivity and the pool is assumed to be flooded with 500 ppm borated water at a temperature corresponding to the highest reactivity. In addition, the analysis demonstrated that k_{eff} is less than 1.0 when the fuel pool is assumed to be flooded with unborated water. The maximum calculated values of the neutron multiplication factor include a conservative allowance for biases and uncertainties, as described in Section 4.6 of Enclosure 2, including manufacturing tolerances, and k_{eff} is calculated with a 95% probability at a 95% confidence level. The minimum SFP soluble boron concentration of 1720 ppm permitted by TSs is well above the 500 ppm boron concentration value required by the new criticality analysis to meet acceptance criteria.

The most limiting accident condition considered by the new criticality analysis involves the mispositioning of a fresh fuel assembly in a Region 2 rack module during fuel inspection or reconstitution activities. The mispositioned fuel assembly is placed in a cell, intended to remain empty, between and directly adjacent to two other fresh fuel assemblies undergoing repair or inspection. A minimum SFP soluble boron concentration of 1090 ppm is necessary to ensure that k_{eff} remains less than or equal to 0.95 for this worst-case misloading event. St. Lucie Unit 1 TSs require that the fuel pool soluble boron concentration be maintained ≥ 1720 ppm at all times, and plant procedures require maintaining the fuel pool boron concentration between 2000 ppm and 2400 ppm. Therefore, the normal SFP boron concentration will ensure that greater than 5% subcriticality is maintained during any fuel misloading event.

3.3 ANALYSIS OF BORON DILUTION EVENT

A SFP dilution analysis has been performed to support crediting soluble boron in the new SFP criticality analysis. The objective of the dilution analysis was to demonstrate that the minimum boron concentration in the SFP required by the criticality analysis to assure $k_{eff} \leq 0.95$ will be maintained following the detection and mitigation of a boron dilution event. The analysis is included in Attachment 4.

The boron dilution analysis includes an evaluation of the following plant-specific features:

- dilution sources
- boration sources
- fuel pool instrumentation
- fuel pool related plant procedures
- piping
- impact of a loss of offsite power
- boron dilution initiating events
- boron dilution times and volumes

Unit 1 TS 5.6.1.a.3 requires the SFP boron concentration to be maintained ≥1720 ppm. Although this minimum value was used for the analysis, plant procedures require that the SFP boron concentration be maintained between 2000 ppm and 2400 ppm. The boron concentration credited in the criticality analysis is 500 ppm. The SFP contains approximately 296,800 gallons of borated water, based on fully loaded storage racks (including a cask pit rack) and the pool level being at its nominal value. With these initial conditions, the dilution analysis shows that a volume of unborated water (approximately 366,000 gallons) larger than the SFP initial volume is necessary to dilute the SFP from 1720 ppm to 500 ppm boron.

The dilution analysis also demonstrates that adequate time is available to identify and mitigate any postulated dilution event before the limiting value of 500 ppm is reached and k_{eff} approaches the 0.95 limit. Each potential source of unborated make-up was evaluated, and it was found that the limiting credible dilution scenario (from the primary water tank) required at least 45 hours of continuous make-up to reduce the fuel pool boron concentration to 500 ppm. This duration presumes that continuous makeup to the primary water tank was provided by the site water treatment plant. During this period, the dilution and its attendant indications would have to go unnoticed or be ignored by the plant staff. One of the initial indications a dilution is in progress would be control room annunciation of SFP high level. The analysis also demonstrates that other plant features and operator rounds would provide early identification that a dilution event was in progress.

The results of the SFP dilution analysis, summarized in Section 5.0 of Attachment 4, conclude that an unplanned or inadvertent dilution event that would reduce the SFP boron concentration from 1720 ppm to 500 ppm is not a credible event. Therefore, the SFP dilution analysis supports the criticality analysis requirement to maintain $k_{eff} \leq 0.95$ when credit is taken for soluble boron.

3.4 OTHER ISSUES

a. Commitment for Boraflex™ Testing

This amendment request, if approved, would eliminate reliance on Boraflex™ for SFP reactivity control. The Unit 1 License Renewal (LR) proposed license amendment contains a commitment for continued Boraflex™ testing.

b. Impact on SFP and Local Thermal-Hydraulic Analyses

The proposed changes do not increase the decay heat load imposed on the pool, the SFP cooling system, or the environment. The proposed changes only add new restrictions on the relative positioning of fuel assemblies within the fuel pool storage racks. This amendment does not increase the number of fuel assemblies that may be stored in the pool and it does not adversely affect the properties controlling local heat transfer from fuel rod cladding. Therefore, the proposed amendment does not change the conclusions of previous SFP bulk temperature and local rack thermal-hydraulic analyses.

c. Seismic/Structural Analysis of the SFP Racks

Implementation of the proposed amendment requires no physical change to the existing SFP storage racks or to the fuel pool itself. Elimination of credit for Boraflex™ does not structurally alter the existing SFP racks in any way. The same rack locations will continue to be used for storing fuel assemblies; as such, the weight assumptions used in the seismic/structural analyses are unchanged. Soil and foundation characteristics of the material underlying the fuel handling building are not changed by the elimination of credit for Boraflex™ or by repositioning fuel within the storage racks. Therefore, the proposed amendment does not affect the existing SFP rack and pool structural analyses.

d. Radiological Considerations

Radwaste Generation

Solid, liquid, or gaseous radwaste generation will not be increased as a result of implementing this proposed amendment, because the required changes involve no new processes or equipment that could result in additional radwaste generation. Repositioning irradiated fuel within the storage racks does not require the removal of appreciable material from the fuel pool for disposal. Repositioning the existing irradiated fuel will not increase the rate of evaporation of fuel pool water; consequently, the rate of tritium release will not be increased. The ability to reposition fuel assemblies within the SFP is an inherent feature of the plant design, independent of this license amendment. Historically, movement of irradiated fuel has not resulted in a significant increase in suspended radioactive material in the SFP water.

Occupational Exposure

Repositioning of irradiated fuel assemblies will be necessary to implement the rules on fuel placement shown in new TS Figures 5.6-1 and 5.6-2. The number of fuel movements required may add to the occupational exposure of fuel handling personnel during the repositioning task. Prior to repositioning, all irradiated fuel stored in the SFP will have cooled for at least a period of months, and most fuel will have cooled for several years. In combination with fuel pool purification, the extended period of radioactive decay will yield dose rates of approximately 0.5 mrem/hr to workers on the fuel pool operating deck. Considering the duration of the repositioning task, this dose level is expected to yield a total accumulated dose of < 2 person-rem. Occupational dose considerations are also discussed in Attachment 3, Environmental Assessment.

e. Fuel Handling Accident Consequences and Probability

The radiological consequences of a Fuel Handling Accident (FHA) evaluated in Unit 1 UFSAR Section 15.4 are not increased by this proposed amendment. The SFP fuel inventory, the fuel pool fission product partition factor and the FHA radiological source term remain the same, irrespective of these changes. The effects on reactivity of an FHA occurring in the SFP storage racks were evaluated as part of the new criticality analysis in Section 4 of Enclosure 2; these effects were found to be acceptable. The structural implications of an FHA are not changed by this proposed amendment, because neither the spent fuel storage racks nor the fuel handling equipment are modified in any way.

Although there will be a one-time fuel assembly repositioning campaign to implement the new fuel positioning rules, the probability of an FHA is not increased. The probability of an FHA is a function of equipment design and the operating procedures used to handle irradiated fuel. The proposed amendment affects neither of these features. As discussed previously, the manipulation of fuel assemblies to achieve conformance with new rules can be accomplished without approval of this amendment request. Therefore, approval of this amendment request is not a prerequisite to the repositioning effort; it is only required to credit its beneficial effects; thus, this amendment does not result in any significant increase in the probability of an FHA.

f. Removal of Neutron Absorber Material(s) Description From TS 5.6.1a.4

TS Section 5.6.1.a.4 currently contains the statement: "Neutron absorber (boraflex) installed between spent fuel assemblies in the storage racks in Region 1 and Region 2." The new criticality analysis eliminates credit for Boraflex™ neutron absorption in the SFP racks. Therefore, this TS sentence can be removed. Although the racks will continue to contain Boraflex™, the description of Boraflex™ in the TSs as a required rack neutron absorber is no longer appropriate or necessary.

In addition to removing the Boraflex™ description, this proposed amendment also removes a similar description for Boral™ material that was included in the same TS section by a recent amendment request for the new cask pit rack.[2] The added sentence stated: "Neutron absorber (boral) installed between spent fuel assemblies in the Region 1 cask pit storage rack." The bases for removing this sentence are: (1) Boral™ panels in the new cask pit are clad with stainless steel and are not subject to alteration or modification, (2) other rack construction materials that absorb neutrons are not listed in the TS, and (3) a similar sentence is not found in the Improved Standard Technical Specifications (ISTS) for CE plants (NUREG-1432, Rev. 2). Section 4.3.1 of the ISTS includes a statement for rack nominal center-to-center distance between fuel assemblies, but does not describe rack neutron absorbing materials.

2 The proposed license amendment for addition of the Unit 1 cask pit spent fuel storage rack was submitted in FPL letter L-2002-187, dated October 23, 2002.

g. Placement of Control Element Assemblies (CEAs)

The new criticality analysis credits the reactivity suppression provided by full strength CEAs for Region 2 loading Pattern "D," as shown in new TS Figure 5.6-2. In this pattern, the CEAs are checkerboarded in Type 3 fuel assemblies (i.e., assemblies containing CEAs are diagonal to each other) throughout the rack.

St. Lucie administrative controls provide for the transfer and placement of CEAs in SFP fuel assemblies. The controls include: (1) pre- and post-movement CEA position maps provided by Reactor Engineering, (2) requirements to physically orient the maps with the SFP and to ensure that the CEA handling tool is placed over the correct fuel assembly location prior to CEA withdrawal or insertion, and (3) verification that CEA positions are correct after completion of the specified CEA shuffles. These controls, or other controls that are equivalently robust, will be used during the fuel repositioning campaign.

4.0 CONCLUSION

The new criticality analysis performed for the St. Lucie Unit 1 spent fuel storage racks demonstrates that the existing racks comply with the reactivity limits of 10 CFR 50.68(b)(4) when fully loaded with fuel of the highest permissible reactivity, considering the analyzed storage arrangements, when credit is taken for a portion of the soluble boron present, but without considering credit for Boraflex™. A Unit 1 specific SFP dilution analysis has demonstrated that the soluble boron concentration in the SFP following the detection and mitigation of any credible dilution scenario will be greater than the value required to assure k_{eff} does not exceed 0.95.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Description of amendment request: The proposed license amendment to the St. Lucie Unit 1 Facility Operating License DPR-67 will modify plant Technical Specifications (TSs) and the associated spent fuel pool (SFP) criticality analyses to: (1) eliminate credit for the Boraflex™ neutron absorber in SFP fuel storage racks, (2) credit specific rules to control fuel assembly positioning in the SFP racks, and (3) establish a Limiting Condition for Operation (LCO) for the SFP soluble boron concentration and require periodic surveillance of this parameter. A revised criticality analysis credits a portion of the soluble boron present in the SFP water and credits these specific fuel positioning rules to achieve the subcriticality margin in the SFP required by 10 CFR 50.68. In addition, a new SFP dilution analysis was performed that supports the criticality analysis requirement for a minimum soluble boron concentration.

Pursuant to 10 CFR 50.92, a determination may be made that a proposed license amendment involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows.

1) Would operation of the facility in accordance with the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   No. The proposed amendment to eliminate reliance on Boraflex™ and to credit SFP soluble boron for reactivity control in the spent fuel pool storage racks was evaluated for impact on the following previously evaluated events:

   - A fuel handling accident (FHA)
   - A fuel mispositioning event
   - A cask drop accident
   - A loss of spent fuel pool cooling

   The proposed amendment does not modify the facility. A new criticality analysis credits existing soluble boron in the SFP water and specific fuel positioning rules for reactivity control, without requiring any physical changes to the fuel storage racks. The amendment does not change any rack module location or any module's designation as Region 1 or Region 2 storage.

   There is no significant increase in the probability of a fuel handling accident in the SFP that is caused by crediting soluble boron and new fuel positioning rules, rather than

Boraflex™, for reactivity control. The probability of a fuel handling accident is a function of the equipment design and procedures used when handling irradiated fuel. Neither of these features is affected when soluble boron, instead of Boraflex™, is credited for reactivity control in the SFP.

There is no increase in the probability of an accidental fuel assembly mispositioning when crediting the presence of soluble boron in fuel pool water for reactivity control. Fuel assembly selection and manipulation will continue to be controlled by approved fuel handling procedures; these procedures require the identification of a verified target location prior to grappling the assembly. Fuel placement will be in accordance with the revised TS.

There is no increase in the consequences of either an FHA or an accidental mispositioning of a fuel assembly into the SFP racks. Consequences of a FHA are not increased because the proposed amendment does not change the fuel fission product inventory, local meteorological conditions, or the fission product partition factor provided by fuel pool water. The consequences of an accidental misload are not increased because the criticality analysis demonstrates that the fuel array will remain sub-critical, even if the pool contains a boron concentration below the minimum level required by Technical Specifications. The TS will ensure that an adequate SFP soluble boron concentration is maintained for all conditions.

The proposed fuel positioning rules do not cause the total radionuclide inventory present in the spent fuel pool to increase, or alter the type or mass of casks that may be placed in the fuel pool, or alter any facet of operation of the spent fuel cask crane. No characteristics of the existing spent fuel cask drop analysis for Unit 1 are affected by the proposed fuel positioning rules or by credit for soluble boron. Therefore, there is no increase in either the probability or the consequences of a cask drop accident caused by this change.

The proposed change does not increase either the probability or the consequences of a loss of normal SFP cooling. The proposed fuel positioning rules do not require any interaction with the fuel pool cooling system. Credit for a portion of the existing soluble boron concentration does not change its interaction with the fuel pool cooling system. The ability to detect and mitigate a loss of SFP cooling event is unchanged, and the revised criticality analysis considered the effects of boiling in the SFP and found them acceptable.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2) Would operation of the facility in accordance with the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   No. The proposed change does not modify the physical plant, nuclear fuel, or the design function and operation of the spent fuel pool storage racks at St. Lucie Unit 1.

   A TS controlled minimum concentration of soluble boron has always been required in the St. Lucie Unit 1 spent fuel pool; as such, the possibility of an inadvertent fuel pool dilution event has always existed. However, the spent fuel pool dilution analysis that accompanies this submittal demonstrates that no credible dilution event could increase fuel pool reactivity such that the effective neutron multiplication factor (k_{eff}) exceeds 0.95. Therefore, implementation of credit for soluble boron to control reactivity in the SFP will not create the possibility of a new or different type of criticality accident.

   The limiting fuel assembly mispositioning event does not represent a new or different type of accident. The mispositioning of a fuel assembly within the fuel storage racks has always been possible. The locations of SFP rack modules and the specific modules assigned to each storage region remain unchanged; analysis results show that the storage racks remain subcritical, with substantial margin, following a worst-case fuel misloading event. Therefore, a fuel assembly misload event that involves new fuel storage arrangements required by the criticality analysis does not result in a new or different type of criticality accident.

   Therefore, the proposed change does not create the possibility of a new or different type of accident from any accident previously evaluated.

3) Would operation of the facility in accordance with the proposed amendment involve a significant reduction in a margin of safety?

   No. The revised fuel positioning requirements proposed by this license amendment provide sufficient safety margin to ensure that the spent fuel pool storage racks will always remain subcritical. To comply with the requirements of 10 CFR 50.68 when crediting soluble boron, the current TS reactivity limit for the fuel storage racks (i.e., k_{eff} less than or equal to 0.95 when flooded with unborated water) will be replaced with two separate limits (k_{eff} less than 1.0 when flooded with unborated water, and k_{eff} less than or equal to 0.95 when flooded with water containing 500 ppm boron).

   The proposed amendment maintains the 0.95 reactivity limit by a combination of restrictions on fuel characteristics and fuel positioning, storage cell geometry and by crediting a portion of the soluble boron in the SFP, rather than by crediting Boraflex.

The proposed license amendment does not reduce the margin of safety provided by the soluble boron normally present in fuel pool water; the TS minimum permissible boron concentration is not decreased. The TS minimum required value of 1720 ppm is substantially greater than the 500 ppm value required by the updated criticality analysis to assure k_{eff} remains ≤ 0.95 for non-accident conditions; it is also substantially greater than the soluble boron concentration necessary to compensate at a 95% probability, with a 95% confidence for the limiting postulated reactivity anomaly in the fuel pool storage racks.

No credible dilution of the fuel pool can result in an SFP soluble boron concentration less than the minimum value required by the criticality analysis. Therefore, an inadvertent dilution event can not challenge safety margins.

Based on these evaluations and the supporting analyses, operating the facility with the proposed amendment does not involve in a significant reduction in any margin of safety.

Based on the determination made above, the proposed amendment involves no significant hazards consideration.

Environmental Consideration

Although the proposed license amendment does not involve any physical changes to the facility, the amendment will change requirements with respect to the use of a facility component located within the restricted area as defined in 10 CFR Part 20. The proposed amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and the proposed amendment involves no significant increase in the amount of heat released from the facility. However, because of the scope of fuel repositioning that could be required to implement this amendment, the occupational radiation exposure to workers involved in the reposition task is expected to increase. Based on occupational dose considerations, FPL concluded that it is prudent to include an environmental assessment discussing the appropriate topics set forth in 10 CFR 51.30 and that, pursuant to 10 CFR 51.21, the assessment is included as Attachment 3 to this amendment request.

Conclusion

FPL concludes, based on the considerations discussed above: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

St. LUCIE UNIT 1

ENVIRONMENTAL ASSESSMENT

Environmental Assessment

Identification of the Proposed Action:

The license amendment proposed herein by Florida Power & Light (FPL) would modify St. Lucie Unit 1 Technical Specifications (TSs) to eliminate any reference to, or credit for, the Boraflex™ neutron absorber present in the existing spent fuel storage racks. It is desirable to eliminate reliance on Boraflex™ for reactivity control because industry experience, and experience at FPL, has demonstrated that the Boraflex™ absorber degrades in a spent fuel pool environment and that this degradation will eventually necessitate a de-rate or modification of the fuel storage racks. To demonstrate compliance with regulatory requirements for fuel storage when Boraflex™ is assumed to not be present, criticality analyses performed to support the proposed Unit 1 license amendment credit the presence of soluble boron in the fuel pool during non-accident conditions. These revised criticality analyses of the spent fuel storage racks also credit the favorable reactivity effects of fuel burnup, the presence of control element assemblies (CEAs) in certain fuel assemblies, and the isotopic decay and transmutation that occurs in nuclear fuel as a function of post-irradiation cooling time.

The proposed amendment to the TSs eliminating credit for the negative reactivity of Boraflex™ will not change the licensed storage capacity of any existing Unit 1 spent fuel pool storage rack module. However, the proposed change will preclude the need to modify the storage racks, reduce rack module storage capacity or change U-235 enrichment limits in the future as the Boraflex™ continues to degrade.

Implementation of this license amendment will be accomplished through a campaign to reposition the existing inventory of irradiated fuel, within the fuel storage racks, such that each assembly complies with requirements of the updated criticality analysis. Fuel discharged from the core subsequent to the repositioning campaign will be placed in the fuel storage racks using the guidance proposed for inclusion in the revised TS Section 5.6.1.

Need for the Proposed Action:

The proposed operating license amendment discussed in this environmental assessment permits the continued placement of 1706 fuel assemblies, having reactivity characteristics consistent with analysis assumptions, in the existing St. Lucie Unit 1 spent fuel storage racks, irrespective of the presence or condition of the Boraflex™ neutron absorber. Crediting the presence of soluble boron in the fuel pool, together with a campaign to optimally position the existing inventory of irradiated fuel, has been determined to represent the best method of maximizing storage capacity in the existing spent fuel racks when Boraflex™ is assumed to not be present. A storage capacity of 1706 fuel assemblies is sufficient to preserve full core fuel offload capability until the year 2005. Maintaining the existing fuel pool storage capacity also complements the proposed cask pit storage rack to defer the need for: (1) dry storage of irradiated fuel discharged from St. Lucie Unit 1; (2) shipments of irradiated fuel from Unit 1 to St. Lucie Unit 2; and (3) a re-rack of the Unit 1 fuel pool to beyond year 2005. Conversely, a de-rating of the capacity of existing fuel storage racks at Unit 1 could lead to the premature implementation of dry storage at St. Lucie, the unnecessary or excessive transshipment of irradiated fuel between various FPL nuclear units, or the premature shutdown of St. Lucie Unit 1. Implementation of any of these alternatives involves an irreversible commitment of incremental natural resources.

Environmental Impacts of the Proposed Action:

Thermal Impact

The total heat load rejected to the environment by St. Lucie Unit 1 is about 6.2 E9 Btu/hr. Thermal loads on the fuel pool cooling system and on the environment will not increase as a result of the proposed license amendment because the quantity, initial enrichment and burnup characteristics of irradiated fuel to be placed in the spent fuel pool storage racks are unchanged. The quantity of heat rejected to the spent fuel pool cooling system will continue to be bounded by values discussed in Chapter 9 of the updated FSAR. The proposed license amendment will not adversely affect thermal performance of the intermediate heat exchanger system, i.e., component cooling water; this system accepts heat rejected by the fuel pool cooling system. Additionally, the proposed license amendment will not increase the ambient temperature of the ultimate heat sink or alter its seasonal fluctuations in temperature.

Radiological Impact – Solid Radioactive Waste

Solid radioactive waste may be considered that portion of the activated or contaminated material produced on-site that requires permanent sequestering or disposal. Implementation of the proposed license amendment does not require any addition to permanently installed plant hardware. No modification of the spent fuel storage racks is required to implement the proposed change. As noted earlier, compliance with requirements of the proposed license amendment will be achieved principally through repositioning the current inventory of irradiated fuel and by crediting the presence of soluble boron. Existing requirements for the periodic inventory of special nuclear material (SNM) and the chemical analysis of fuel pool water for dissolved boron will assure continued compliance. After the initial fuel relocation campaign, nuclear material added to the fuel pool inventory will be positioned in accordance with guidance included in revised TS Section 5.6.1. Repositioning the existing inventory of stored irradiated fuel within the fuel pool will not generate appreciable solid radioactive waste. The generation of solid radioactive waste resulting from future discharges of irradiated fuel from the reactor can be minimized by assuring the existing fuel storage racks are fully utilized prior to implementing a dry storage option. The proposed license amendment assures that maximum advantage will be taken of the existing fuel storage racks.

Continued degradation of the installed Boraflex™ absorber material has an adverse effect on water quality in the spent fuel pool. This degradation of water quality is most evident as an increase in turbidity and by the elevated levels of suspended silica. While the reactor coolant system (RCS) does not normally contain silica or silica producing materials, silica can enter the RCS through the water transfer operations that accompany refueling. Silica deposited on fuel cladding can adversely affect its heat transfer properties, particularly during power operation. Excessive concentrations of silica in reactor makeup water can require additional or non-standard water processing or the discarding of inventory as liquid radioactive waste. Implementation of the proposed license amendment will permit FPL to initiate actions that remove silica from the Unit 1 fuel pool water without adversely affecting any component or structure credited to control fuel pool reactivity. Often, actions designed to remove silica from fuel pool water have the unintended side effect of accelerating Boraflex™ degradation. Removing silica from fuel pool water using filtration or a reverse osmosis process may temporarily increase filter loadings or radioactive material disposal requirements. However, actions to remove the suspended silica are, in the aggregate, beneficial because they reduce the requirements for specialized post processing of refueling water inventory and they also reduce the likelihood that reactor makeup water would require disposal as liquid radioactive waste.

Radiological Impact – Gaseous Radioactive Waste

The net effect of the proposed action is to ensure the optimal use of existing installed fuel storage racks by preserving the current licensed storage capacity of 1706 fuel assemblies when Boraflex™ is not credited. Repositioning irradiated fuel within the St. Lucie Unit 1 spent fuel storage racks, as is necessary to implement the proposed license amendment, does not increase the quantity of gaseous fission products present in spent fuel, change the fuel pool fission product partition factor or increase the probability of fission product release to the environment. The fuel repositioning campaign at Unit 1 will be controlled by policies and procedures that have demonstrated effectiveness in preventing damage to fuel assemblies and fuel storage racks. Implementing the proposed license amendment does not increase the fuel pool heat generation rate, so there will be no increase in the rate of evaporation of the fuel pool water inventory or in the amount of gaseous tritium released from the fuel pool. Actions subsequent to the fuel repositioning campaign that remove suspended silica from fuel pool water will not increase the inventory of gaseous fission products. The quantity of gaseous fission products present is a function of the amount of irradiated fuel stored in the fuel pool, enrichment and burnup characteristics of the stored fuel, and its post-irradiation cooling time. None of these characteristics or limits is modified by the proposed license amendment.

Occupational Dose Considerations

At commencement of the fuel repositioning campaign, all irradiated fuel stored in the racks will have cooled for at least a period of months and most irradiated fuel will have cooled for several years. In addition to reducing the potential accident source term associated with any fuel handling accident, the extended period of radioactive decay provides assurance that ambient dose levels to workers involved in repositioning fuel will be significantly below the 2.5 millirem/hour (mrem/hr) value discussed in updated FSAR Section 9.1.4.1. Using an estimated ambient dose rate of 0.5 mrem/hr to represent conditions on the fuel pool operating deck, as well as conservative estimates of the crew size and job duration, yields a total expected dose attributable to the repositioning task of less than 2 person-rem. Any single individual participating in this activity, from initiation through completion, would incur a cumulative dose of less than 500 mrem. For comparison, the St. Lucie site target for cumulative personnel radiation exposure during year 2002 (a year with one scheduled refueling outage) is 115 rem.

Accident Induced Radioactive Release

A handling accident that results in perforation of fuel rod cladding could occur during the fuel assembly repositioning campaign that implements this license amendment. However, no accidents involving fuel or cask mishandling or damage to fuel storage racks have occurred at St. Lucie. Consequently, the policies and procedures used to control fuel movement within the storage racks have demonstrated that they can adequately control this evolution. No changes to the method of handling irradiated fuel or to the techniques used to place irradiated fuel within the selected storage cell are required to implement the proposed license amendment. Manipulation of selected fuel will continue to be performed one assembly at a time. Information supplied by fuel fabricators to FPL indicates that degraded structural integrity of long-stored irradiated fuel is not expected and that no special handling of this irradiated fuel is required. Implementation of the proposed license amendment does not require changes in the operation or the permissible range of motion of the spent fuel handling machine. Hoist cable loads will continue to be monitored during fuel movement to ensure motion is not restricted. No crane grapple modifications are required to implement the proposed license amendment. Interlocks on the spent fuel machine will continue to restrict motion of the spent fuel machine bridge and trolley when the hoist is inserting or withdrawing an assembly.

The existing analyses of record pertaining to the radiological consequences of a fuel handling accident at St. Lucie Unit 1 and the radiological consequences of a postulated drop of a spent fuel cask have been examined to assess the impact of the proposed license amendment. As earlier noted, repositioning the existing inventory of fuel assemblies within the fuel pool storage racks to conform with requirements of the proposed license amendment can not increase the quantity of fission products present in the spent fuel pool.

As presented in updated FSAR Section 15.4.3, the most recent analysis of a fuel handling accident concludes that bounding results are achieved by assuming the accident occurs within the containment building, while personnel airlock doors are open, at 72 hours after reactor shutdown. FPL's review of the methodology and input values used in this analysis supports a conclusion that its calculated dose consequences bound the consequences of any fuel handling accident that could occur during implementation or subsequent to implementation of the proposed license amendment. Therefore, the radiological consequences of a fuel handling accident will not be changed by the proposed license amendment.

Section 9.1.4.3 of the updated St. Lucie Unit 1 FSAR discusses the analyses performed to quantify the consequences of a cask drop accident.

Implementation of the proposed license amendment does not require placing a fuel cask inside the fuel handling building (FHB) or the loading of irradiated fuel into a pre-positioned transfer or transportation cask. The proposed license amendment does not provide a rationale or basis to modify the required post-irradiation fuel cooling time prior to placing a fuel cask in the cask pit area; no modification of cooling time requirements is proposed. The proposed license amendment does not involve any changes to the method of operating the spent fuel cask crane or to its range of motion. The proposed license amendment does not alter the required height of the water column above irradiated fuel seated in the spent fuel storage racks; as a result, the fission product partition factor assumed in the safety analysis will not be adversely affected. No movement of loads in excess of the TS 3.9.7 limit (i.e., the nominal weight of a fuel assembly, CEA and the associated handling tool) is permitted over other fuel assemblies in the fuel storage pool. In general, protection from a cask drop onto stored irradiated fuel is provided by the basic layout of the FHB, although FSAR Section 9.1.4.3d postulates an improbable scenario that could result in a cask drop onto certain fuel storage cells in one rack module. As is also noted in updated FSAR Section 9.1.4.3d, additional protection from crane travel over stored fuel is provided by the crane bridge and trolley end stop limit switches, and their mechanical backups; bridge bumpers and trolley chocks. Thus, implementation of the proposed license amendment will have no effect on the radiological consequences of dropping a loaded spent fuel cask.

Alternatives to the Proposed Activity:

Shipment of Irradiated Fuel to a Permanent Storage or Disposal Facility

Shipping irradiated fuel from St. Lucie to a high-level radioactive storage or disposal facility is an alternative to maintaining the existing fuel storage capacity at St. Lucie Unit 1. However, the Department of Energy's (DOE's) high-level waste repository is not expected to begin receiving spent fuel until approximately 2010 and no site for an interim federal storage facility has been identified or licensed. FPL's first shipment allocation occurs the second year DOE accepts irradiated fuel (e.g., year 2011). Trends in the performance of Boraflex™ observed at FPL's Turkey Point units indicate that significant impairment of Boraflex™ functionality could be observed at St. Lucie Unit 1 prior to 2011, or before DOE is prepared to accept irradiated fuel for disposal. Additionally, the number of storage locations rendered unusable to accept fuel as a result of Boraflex™ degradation can not be easily predicted and may not match FPL's spent fuel shipment allocation. Therefore, shipping spent fuel from Unit 1 to a DOE repository or interim federal storage facility is not considered an alternative to maintaining the existing licensed storage capacity of the spent fuel pool.

Shipping Irradiated Fuel to a Reprocessing Facility

The domestic reprocessing of spent fuel shipped from St. Lucie Unit 1 is not a viable method of compensating for a reduction in licensed spent fuel storage capacity because there are no commercial reprocessing facilities operating in the United States. For reprocessing to be an effective alternative, spent fuel from St. Lucie would have to be shipped to an overseas facility in quantities sufficient to compensate for the postulated levels of Boraflex™ degradation. This approach has not been previously used and implementing it would require approval from numerous government entities. Therefore, reprocessing of spent fuel is not considered an acceptable alternative to compensate for degradation of Boraflex™ in the spent fuel storage racks.

Ship Spent Fuel to Another Utility or Site or to St. Lucie Unit 2, for Storage

Fuel assemblies irradiated at St. Lucie Unit 1 could be shipped to St. Lucie Unit 2 or to Turkey Point to temporarily compensate for any loss of storage caused by Boraflex™ degradation at Unit 1, but this transfer of fuel between units creates no additional storage locations. Fuel transfer would accelerate the loss of fuel pool storage at the receiving end and it provides no net system benefit. Turkey Point fuel pool storage racks have been optimized to accommodate irradiated fuel with a lattice design and reactivity characteristics different from those used at St. Lucie Unit 1. Storage of Unit 1 fuel at Turkey Point would both limit the storage of future discharged Turkey Point fuel and represent a less than optimal use of the existing Turkey Point storage capability. In addition, transferring irradiated fuel to Turkey Point would complicate efforts to compensate for the on-going Boraflex™ degradation observed in its spent fuel storage racks. Shipping irradiated fuel from St. Lucie to Turkey Point could require Turkey Point to accelerate its plans to develop an on-site dry storage facility (an independent spent fuel storage installation [ISFSI]), or to develop an ISFSI where none would otherwise be required, without eliminating the need to develop an ISFSI at the St. Lucie site. Similarly, shipment of irradiated fuel from St. Lucie Unit 1 to St. Lucie Unit 2 does not obviate the need for additional spent fuel storage at the St. Lucie site, although it can serve to equalize the dates when each unit requires additional storage.

FPL knows of no other utility that is prepared to accept shipments of irradiated fuel from St. Lucie Unit 1 for long-term storage at its site.

For these reasons, and considering the increased fuel handling and additional occupational radiation exposure incurred during the shipment of irradiated fuel, the alternative of shipping St. Lucie Unit 1 fuel to Turkey Point or to St. Lucie Unit 2 for storage is not an acceptable method of compensating for Boraflex™ degradation at St. Lucie Unit 1.

Alternatives that Retain the Existing St. Lucie Unit 1 Fuel Storage Capacity

FPL has considered a variety of alternatives, other than a fuel repositioning campaign and partial credit for fuel pool soluble boron, that could maintain the existing licensed fuel storage capacity of St. Lucie Unit 1. Fuel rod consolidation was examined as a potential alternative and was eliminated for a variety of reasons, including the lack of large-scale industry experience and the potential for fission product release because of rod damage during disassembly. The DOE considers consolidated fuel to be a non-standard waste form; consequently, FPL is also concerned that the presence of irradiated fuel in this form could delay its removal from the site.

The addition of neutron absorbing inserts to the existing Unit 1 fuel storage racks or to stored fuel placed in the racks was examined and later rejected because the large quantity of inserts necessary to adequately control the fuel pool reactivity had a significantly greater cost than the alternative selected. Installing poison inserts in the racks or in fuel placed in the racks will also increase the volume of radioactive waste that must be disposed of or decontaminated during decommissioning of the spent fuel pool.

Replacing each of the existing St. Lucie Unit 1 fuel pool storage rack modules with a design that contains a neutron absorbing material not susceptible to dissolution, such as borated stainless steel or a boron aluminum matrix, could preserve the existing licensed fuel storage capacity. However, FPL does not consider this the optimal alternative because of the increased expense and occupational exposure associated with a re-rack of the fuel storage pool. Additionally, this alternative requires handling and repositioning each fuel assembly stored in the fuel pool at least once, and it generates a significant volume of radioactive waste, chiefly in the form of discarded fuel rack storage modules, which must be decontaminated or buried as low-level radioactive waste.

The early implementation of dry storage for irradiated fuel at the St. Lucie site was considered as an alternative to the proposed credit for fuel pool soluble boron and the associated fuel repositioning campaign. To implement this alternative, FPL would select irradiated fuel with burnup, enrichment, and cooling time characteristics appropriate for dry storage from the existing St. Lucie Unit 1 inventory and would load this fuel into a fuel cask or a multi-purpose canister (MPC). Dry storage of irradiated fuel would have the effect of reducing the fuel pool inventory, but the in-pool locations containing irradiated fuel suitable for cask loading are unlikely to correspond to those fuel pool locations experiencing the limiting levels of Boraflex™ degradation. As a result, a post-cask loading campaign to reposition the remaining fuel within the fuel storage racks would be required to ensure stored fuel assembly characteristics are consistent with the local condition of Boraflex™. The alternative proposed by FPL, i.e., crediting the presence of soluble boron in the fuel pool, and optimizing the pool storage configuration, achieves an equivalent final state in the fuel storage racks with significantly less effort and without a requirement to place fuel in dry storage. As a result, the alternative of early implementation of dry storage for irradiated fuel at St. Lucie was rejected by FPL because the proposed alternative TS discussed above would provide the required storage at lower cost and with less environmental impact.

Reducing the Generation Rate of Spent Fuel at St. Lucie

To minimize the quantity of irradiated fuel generated during full power operation at St. Lucie Unit 1, FPL has developed efficient core loading patterns that maximize the utilization of fissile material within each fuel assembly, consistent with license limits on total fuel rod exposure. Maximizing the use of fissile material within each fuel assembly ensures that the minimum amount of spent fuel is created for each unit of electricity generated at St. Lucie Unit 1. FPL also regularly examines the inventory of previously irradiated fuel stored in the fuel pool, to identify assemblies where the reactivity, mechanical design and burnup characteristics would permit reinsertion in the core. Reinsertion of irradiated fuel is favored where possible because of the corresponding reduction in feed assembly requirements. Batch discharge burnups for St. Lucie Unit 1 fuel regularly approximate 45 GWD/MTU and peak fuel rod exposures approach 60 GWD/MTU by the time of discharge. Therefore, the small number of potential reinsertions of previously irradiated fuel into the Unit 1 core can not compensate for the degree of Boraflex™ degradation expected in the future.

Long term operation of St. Lucie Unit 1 at reduced power can decrease the rate at which additional fuel assemblies are added to the existing inventory of irradiated fuel, but it will do nothing to reduce the number of irradiated assemblies already present. If St. Lucie Unit 1 were to operate at a reduced power level, or to cease operation completely, another power generation facility would be required to increase its power output. This increased power production by another facility could result in an increase in airborne pollution and greenhouse gas emissions. Additionally, once storage racks are filled with irradiated fuel, the rate at which the Boraflex™ present in these spent fuel storage racks degrades is independent of the power level in the reactor.

The No Action Alternative

Denial of the proposed license amendment will not stop or inhibit the dissolution of the Boraflex™ neutron absorber that is presently installed in St. Lucie Unit 1 spent fuel storage racks. Denial of the proposed license amendment will not eliminate the need to identify and implement some method of compensating for the loss of a source of negative reactivity credited in spent fuel pool licensing calculations; however, it would eliminate one method of compensating for this reactivity loss.

Longer term, if the proposed license amendment was denied, FPL would review the remaining options available to compensate for Boraflex™ degradation and would select an alternative approach. As can be seen from the evaluation of alternatives presented in this environmental assessment, other measures to compensate for Boraflex™ degradation are likely to have a greater adverse impact on the environment.

Summary and Conclusion:

This environmental assessment demonstrates that the proposed license amendment and the repositioning of irradiated fuel necessary to implement this amendment do not generate appreciable quantities of gaseous or solid radioactive waste or change the type of effluents that may be released from the St. Lucie site. Occupational exposure incurred by personnel involved in the fuel repositioning campaign necessary to implement this license amendment will be a small fraction of the St. Lucie site's annual exposure budget.

In this assessment, FPL has concluded that none of the proposed alternatives that could compensate for Boraflex™ degradation at St. Lucie Unit 1 can do so with an impact on the environment that is less than the impact of the chosen option.

The proposed modifications to St. Lucie Unit 1 TSs will not increase the probability of occurrence of any fuel cask drop accident or increase the consequences of this event beyond the consequences discussed in Section 9.1.4 of the updated FSAR.

Implementing the proposed license amendment will not increase the probability of occurrence of a fuel handling accident or increase the consequences of this event beyond the consequences discussed in updated FSAR Section 15.4.

Based on this environmental assessment, FPL has concluded that implementation of the proposed license amendment will not have a significant effect on the human environment or result in significant occupational exposure. Additionally, implementation of the proposed license amendment will not result in the generation of significant levels of radioactive waste.

SPENT FUEL POOL BORON

DILUTION ANALYSIS

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1.0 PURPOSE AND SCOPE

The purpose of this evaluation is to examine the potential for an inadvertent dilution of the St. Lucie Unit 1 spent fuel pool. To comply with Technical Specification requirements, the Unit 1 spent fuel pool contains at least 1720 ppm of soluble boron at all times. FPL proposes to credit the negative reactivity associated with a portion of this soluble boron concentration in an updated spent fuel pool criticality analysis. Because 500 ppm of soluble boron will be credited in the criticality analysis for non-accident conditions (see Section 4.6 of Enclosure 2), this evaluation will identify the plant systems interfacing with the spent fuel pool that could, through a failure, malfunction or operator error, credibly initiate a dilution event. The Boraflex™ neutron absorber material installed in the Unit 1 spent fuel pool storage racks is not credited in the criticality analysis. Times required for the loss of reactivity margin to an effective neutron multiplication factor (k_{eff}) of 0.95 are quantified. Acceptance criteria will be met if this evaluation concludes sufficient time is available to detect and mitigate any credible dilution event before the k_{eff} design basis value of 0.95 is exceeded.

This boron dilution analysis has been prepared using a format consistent with the guidance provided in Section 3.7, _Soluble Boron Credit Methodology_ of the 1988 Enclosure to the NRC letter from Timothy E. Collins (NRC) to Tom Greene (WOG), dated October 25, 1996, Safety Evaluation by the Office of Nuclear Reactor Regulation related to Topical Report WCAP-14416-P, _Westinghouse Spent Fuel Rack Criticality Analysis Methodology_.

2.0 INTRODUCTION

A boron dilution analysis has been completed to support crediting soluble boron in the St. Lucie Unit 1 spent fuel pool criticality analysis. The boron dilution analysis includes an evaluation of the following plant-specific features:

- dilution sources
- boration sources
- fuel pool instrumentation
- fuel pool related plant procedures
- piping
- impact of a loss of offsite power
- boron dilution initiating events
- boron dilution times and volumes

This dilution analysis has been completed to ensure that sufficient time remains available to detect and mitigate a dilution event before the spent fuel pool criticality analysis design basis value of $k_{eff} \leq 0.95$ is violated.

The postulated dilution scenarios presented in this report were developed after examining the plant systems and components that interface with the Unit 1 spent fuel pool. Periodic activities performed by plant operators that involve the spent fuel pool or systems interfacing with the spent fuel pool were also considered. Usually, this analysis postulates the occurrence of multiple failures, as in the failure to correctly position a valve at the completion of an evolution coincident with a failure of an annunciator in the control room to alarm, or the failure of personnel to appropriately respond to an alarm. Routine inspections of general areas or of specific systems in the vicinity of the spent fuel pool by operations or by security personnel were also considered; in some instances these inspections or rounds are assumed to lead to discovery of the inadvertent dilution.

Applying the principle that multiple accident or abnormal events need not be postulated to occur simultaneously, this evaluation does not consider the simultaneous occurrence of an inadvertent fuel pool dilution and any other abnormal occurrence or accident condition, such as a mispositioned fuel assembly, to be a credible scenario. Enclosure 2 demonstrates that a boron concentration of 1090 ppm, coincident with the limiting mispositioned fuel assembly, will maintain $k_{eff} \leq 0.95$.

3.0 SPENT FUEL POOL AND RELATED SYSTEM FEATURES

This section provides background information on the spent fuel pool and its related systems and features. Figure 1 on page 28 of this attachment presents a one-line diagram of spent fuel pool related fluid systems.

3.1 Spent Fuel Pool

The purpose of the spent fuel pool is to provide for the safe storage of irradiated fuel assemblies. The fuel pool is filled with borated water. The water functions as a sink for decay heat generated by the irradiated fuel, as a transparent shield to reduce personnel radiation exposure and to reduce the quantity of radioactive gases released to the environment following a fuel handling accident. Evaporation of fuel pool water occurs on a continuous basis due to the decay heat from irradiated fuel, and periodic fuel pool makeup is required. Because the evaporation process does not remove boron, makeup may be from an unborated water source. Over time, evaporation without compensatory makeup will actually increase the fuel pool boron concentration.

The spent fuel pool is a reinforced concrete structure with a minimum 0.188 inch thickness welded steel liner. A network of stainless steel angles (i.e., channels) is attached to the outside of each pool liner wall and to the underside of the pool liner floor. This network is designed to collect and detect any liner leakage. The fuel handling building (FHB) and fuel pool have been designed as a seismic Class I structure. The nominal fuel pool water depth is 38.5 feet. The fuel pool operating deck is located above grade at the 62 foot elevation of the FHB.

The St. Lucie Unit 1 fuel pool consists of two regions that are thermally and hydraulically coupled. The larger region is used only for the storage of fuel; the smaller region will be used primarily for loading of fuel storage or transportation casks although, with a cask pit rack installed, the smaller region can be used to accommodate some of the irradiated fuel offloaded from the core. The refueling (or transfer) canal lies adjacent to the larger pool and connects it to a refueling cavity inside the containment building during fuel transfer operations. If draining the refueling canal is desired following the completion of fuel movement, a bulkhead may be installed to isolate the refueling canal from the spent fuel storage pool. The 36.25 foot elevation of the keyway bottom is above the top of the fuel seated in the spent fuel storage racks. When installed, the elevation of the top of the bulkhead is below the elevation of the spent fuel pool operating deck. An upper panel of the bulkhead contains a 3 inch by 4 inch hole to facilitate overflow. This overflow hole is located approximately 16 inches below the top of the bulkhead.

The net water volume contained in the spent fuel pool and cask loading area when the pool water level is at the low level alarm set point is at least 39,480 ft^3 (or 295,349 gallons). With the fuel pool water level at the nominal 60 foot elevation, the contained water volume is 296,872 gallons. Each of these values consider the volume displaced by a full loading of irradiated fuel in the storage racks and in the cask pit rack. When filled to the nominal 60 foot elevation, the fuel transfer canal represents an additional volume of approximately 47,500 gallons.

3.2 Spent Fuel Storage Racks

The spent fuel storage racks are designed to seismic Category I requirements and will support and protect spent fuel assemblies during both normal operation and accident conditions. As installed, the storage racks consist of 17 distinct modules of varying sizes in two regions of the spent fuel pool and an additional rack module intermittently installed in the cask pit area. Section 4.6.14.2 of Enclosure 2 indicates that the storage racks are also designed to limit the neutronic interaction between any fuel assembly seated in the storage racks and a hypothetical dropped assembly lying on top of the storage racks.

3.3 Spent Fuel Pool Cooling System

The St. Lucie Unit 1 spent fuel pool cooling system is designed to remove the decay heat generated by irradiated fuel assemblies stored in the pool. The fuel pool cooling system consists of two full capacity pumps for normal duty and one full capacity heat exchanger; either pump is capable of directing flow to the heat exchanger. The fuel pool heat exchanger rejects heat to the component cooling water system, which in turn is cooled by the ultimate heat sink. Piping for the fuel pool cooling system is Quality Group C, non-seismic and is arranged so that no piping failure will drain the fuel pool below the top of the stored fuel assemblies. The fuel pool cooling system has no piping ties into other plant systems.

Each potential fuel pool cooling system flow path consists of a pump, the heat exchanger, valves, piping and instrumentation. The fuel pool cooling system suction line penetrates the pool liner at an elevation of 56 feet (the operating deck elevation is 62 feet). The return line penetrates the fuel pool liner on the opposite side of the pool at an elevation of 59.25 feet. The fuel pool cooling return line has a 0.5-inch anti-siphon hole placed 1.0 foot below the normal pool water level. The elevation of the top of the fuel storage racks is approximately 36.13 feet.

The system is capable of removing the decay heat load generated by a routine full core offload of irradiated fuel initiated 120 hours after reactor shutdown together with 1826 assemblies discharged from previous cycles.

3.4 Spent Fuel Pool Purification System

The spent fuel pool cleanup or purification system is designed to maintain water clarity and to control water chemistry. The purification system interfaces with the fuel pool separate from the spent fuel pool cooling system. It consists of a fuel pool purification pump, a pump suction strainer, a fuel pool purification filter, a fuel pool ion exchanger, an ion exchanger strainer, a surface debris skimmer, and various valves and instrumentation. Purification is conducted on an intermittent basis as required by fuel pool conditions. The fuel pool purification pump has a design flow rate of 150 gpm. The fuel pool purification suction line has a 0.25-inch diameter siphon breaker hole placed 1.0 foot below the normal pool water level.

In addition to purifying the fuel pool water, the refueling water tank and reactor (refueling) cavity water may be cleaned through connections to the purification loop.

3.5 Dilution Sources

In the following discussion, the primary water system and demineralized water refer to systems downstream of the site water treatment plant, whereas service water generally refers to a system and piping upstream of the water treatment plant or to flow not processed through the water treatment plant.

3.5.1 Primary Makeup Water (PMW) System

Plant procedures require the periodic determination of spent fuel pool boron concentration to assure that it remains greater than the Technical Specification 5.6.1.a.3 limit of 1720 ppm. At fuel pool boron concentrations of ≥2300 ppm, procedures permit the primary water tank (PWT) to be used as a source of makeup. This evaluation assumes that the PWT contains water with 0 ppm soluble boron. Any primary water makeup to the fuel pool shall be made through a hose connected to a 2-inch diameter line. One locked closed, manually operated valve (V-15322) located upstream of the hose connection and above the cask storage area must be opened for delivery to occur. A dedicated fuel pool level watch is required when unborated water, such as from the PWT, is being added to the SFP.

Primary water can also be supplied to the fuel pool using portions of the fuel pool purification system piping. A flow path from the primary water pumps to the purification system is used in resin flushing operations. With this flow path, primary water enters the purification system downstream of the fuel pool ion exchanger through a 2-inch line. Independent verification of valve manipulations is used to assure a correct system lineup prior to initiating the resin flushing evolution. The inadvertent addition of primary water to the fuel pool at the conclusion of resin flushing operations requires mispositioning (i.e., opening) two manually operated valves, including the downstream ion exchanger outlet valve.

Normally, one primary water pump is in service; the second pump remains in standby and is automatically started in response to low pump discharge header pressure. This low header pressure condition is alarmed in the Unit 1 control room. Each pump has a design flow rate of 300 gpm at a discharge pressure of approximately 115 psi and it provides flow to a variety of plant equipment including the chemical and volume control system and the waste management system. A small portion of pump discharge flow is recirculated back to the PWT. As installed, primary water pumps are at grade elevation, next to the PWT. Thus, there is an elevation difference of almost 50 feet between the primary water pump discharge and the FHB primary make-up water piping that supplies makeup to the Unit 1 fuel pool. Field inspection confirms that pump discharge pressure is maintained at approximately 115 psi. The nominal maximum flow through valve V-15322 with a single pump in operation will be taken as 90 gpm.

The primary water pumps draw suction from the 150,000-gallon capacity PWT. This tank has high and low level alarms that annunciate locally and in the control room. The St. Lucie site water treatment plant provides the makeup to the Unit 1 primary water tank.

3.5.2 Demineralized and Service Water Systems

The Unit 1 demineralized water pumps supply demineralized water for both St. Lucie units. Each of these pumps has a design flow rate of 190 gpm. The St. Lucie Unit 1 updated FSAR states that the demineralized water system functions to distribute a supply of water for makeup to various systems and to supply water for laboratory use. Demineralized water is supplied to the component cooling water surge tank as required. Demineralized water for both units is stored on-site in a single 10,000-gallon tank.

No demineralized water system lines serve the Unit 1 FHB.

The service water system is common to both St. Lucie units; it supplies water for use in plant wash down stations, decontamination facilities and the potable water system. Service water is stored on-site in two 500,000-gallon city water storage tanks.

A 2-inch diameter service water line enters the FHB, however there is no service water piping in the vicinity of the Unit 1 fuel pool. Once inside the FHB the single 2-inch line branches to two normally closed globe valves with downstream quick connect/disconnect couplings. Fire protection in the vicinity of the spent fuel pool is not provided by service water flow; wall mounted fire extinguishers are credited.

The lack of service water piping in the vicinity of the fuel pool and the lack of a connection between the city water storage tanks and the primary water tank ensure that the service water system does not represent a viable fuel pool dilution source.

3.5.3 Component Cooling Water

Component cooling water (CCW) is the cooling medium for the spent fuel pool cooling system heat exchanger. The portion of the CCW system that interacts with the fuel pool heat exchanger is non-seismic Quality Group D. There is no direct connection between the component cooling water system and the spent fuel pool cooling water system. However, if a leak were to develop in the fuel pool heat exchanger, a connection would be made. To date, two heat exchanger tubes have been plugged as a result of an in-service 100% eddy current examination. Neither of the these tubes were leaking prior to being plugged; there have been no known tube leaks in the spent fuel pool heat exchanger since the heat exchanger entered service in 1976.

The CCW system contains a surge tank that is designed to accommodate fluid volumetric changes and to maintain a static pressure head at the suction of each CCW pump. Any leakage path between the fuel pool heat exchanger shell and tube side will result in a reduction in the surge tank level and will cause demineralized water to be added to the CCW surge tank via an automatic water level control system. The capability also exists to supply makeup to the surge tank from the fire protection system, however, this alternate flow path is maintained in a locked closed condition. A continued reduction in surge tank level below the level for automatic makeup will trigger a low-level alarm in the control room. For the purposes of this evaluation it is assumed that, following the heat exchanger tube leak, makeup of demineralized water to the CCW surge tank is uninterrupted. As a result, unborated component cooling water will continue to enter the spent fuel pool cooling system, resulting in a gradual decrease in the pool boron concentration.

The continued makeup of demineralized water to the surge tank will eventually result in makeup to the demineralized water tank and may result in a low-level alarm in the Unit 1 control room.

It was previously noted that demineralized water for both St. Lucie units is stored on-site in a single 10,000-gallon tank. Plant drawings indicated that the CCW surge tank for St. Lucie Unit 1 has a capacity of approximately 2040 gallons. If it is assumed that the entire demineralized water tank capacity is dedicated to Unit 1, the sum of these two volumes is less than 5% of the spent fuel pool water volume. Multiple instances of diverting the entire demineralized water tank contents to the Unit 1 spent fuel pool would be required to achieve any appreciable dilution.

The limited amount of water available from the component cooling water and demineralized water systems ensure that a spent fuel pool heat exchanger leak can not result in any significant dilution of the spent fuel pool. Additionally, the plant has numerous engineered features available to assist operations personnel in identifying any leakage. Dilution paths involving the addition of demineralized water to the CCW surge tank are not considered further in this analysis.

As noted above, fire protection system piping is connected to the CCW surge tank behind a locked closed valve (V15500). Fire pumps 1A and 1B provide motive force for the water-based portion of the fire protection system; the start of either pump is annunciated in the Unit 1 control room. Receipt of the control room alarm requires dispatching plant personnel to ascertain the cause of the pump start. Engineered features and administrative controls ensure that a fuel pool dilution resulting from makeup to the CCW surge tank via the fire protection system is not a credible event.

3.5.4 Resin Flush Line/Resin Fill Connection

The primary water system has piping connections into the fuel pool purification system at the fuel pool ion exchanger and downstream of the ion exchanger. These connections are used, approximately once each (18-month) fuel cycle, to flush spent resin from the ion exchanger. Each of these primary water lines is 2 inches in diameter and contains two manually operated, normally closed globe valves between the primary water system header and the fuel pool purification loop. By procedure, the outlet valve from the fuel pool ion exchanger is closed and tagged so as to isolate the downstream portion of the fuel pool purification loop and the spent fuel pool during the resin flushing operation.

Discussions with health physics personnel indicate that a typical resin flush requires less than 195 ft^3 (1460 gallons) of demineralized water. Estimates for a worst case scenario are that twice this water volume (390 ft^3) would be required. For this worst case it is assumed that the resin cask would require de-watering and refilling to complete the resin transfer and that all 2920 gallons of demineralized water would be added to the spent fuel pool. Because of the small volume of water involved, this evolution does not represent a dilution path that could present a viable challenge to fuel pool reactivity margin.

Following removal of spent resin from the fuel pool ion exchanger, new resin beads are added and the ion exchanger is re-aligned to the purification system. Initial operation of a fresh resin bed will trap boron in the ion exchanger until a saturation level is reached. Experience has shown that placing a fresh resin bed in service will decrease the fuel pool boron concentration by approximately 15 ppm. This change in boron concentration is insignificant.

The fuel pool ion exchanger technical manual recommends a 100 gpm flow rate during resin sluicing operations. Although the ion exchanger outlet valve is tagged closed, following the completion of resin flushing, this primary water flow rate to the fuel pool will be assumed to exist.

3.5.5 Fire Protection System

The FHB contains no fire hydrants or hose stations; primary fire protection within the building is provided by wall mounted fire extinguishers and by the building's inherently low content of combustible material. Fire hydrants are located external to the FHB in the vicinity of the primary water storage tank and in the component cooling water (CCW) area immediately east of the FHB. A designated fire hose storage location is also adjacent to the FHB, between it and the CCW area. Thus, dilution of the spent fuel pool due to activation of the fire suppression system is not a credible event.

3.5.6 Intake Cooling Water System

The intake cooling water system is the makeup source of last resort for the Unit 1 spent fuel pool. Plant management or the Technical Support Center must approve its use for fuel pool makeup because this system will introduce salt water into the fuel pool. An intake cooling water standpipe is attached to the exterior of the FHB and enters the FHB above the 62-foot level on the east side of the fuel pool. This standpipe is capped at the exterior of the FHB; a pipe wrench is required to remove the end cap. A short segment of system piping runs inside the FHB, from the wall penetration to near the surface of the fuel pool. To utilize the intake cooling water system for fuel pool makeup, a flexible hose must be routed from the CCW pump pit across a road and connected to the lower end of the standpipe attached to the FHB.

Several non-routine manual actions are required to use the intake cooling water system for fuel pool makeup. The use of the intake cooling water system for this purpose requires specific plant management approval. Therefore, this evaluation concludes that the intake cooling water system does not represent a credible fuel pool dilution pathway.

3.5.7 Dilution From Pipe Break Events

The FHB is a seismic category I reinforced concrete structure containing the spent fuel pool, spent fuel cask area, refueling canal, spent fuel cooling and purification pumps, heat exchangers, filters and ventilation equipment. The FHB exterior walls, floors and interior partitions are designed to protect the equipment inside from the effects of hurricane and tornado winds, temperature, external missiles and flooding. The fuel pool portion of the FHB including the walls and roof directly above the pool is designed to withstand, without penetration, the impact of high velocity external missiles that might occur during the passage of a tornado. The spent fuel pool is located above grade with a pool floor elevation of 21.5 feet, a cask pit floor elevation of 18.0

feet and an operating deck elevation of 62 feet. Spent fuel cask removal is through a key-controlled normally closed L-shaped door in the FHB roof. Any opening of the L-shaped door requires that the site security force first energize the security system computer controlled power interlock for this door and then unlock either the local or the remote control station for door operation.

Although the L-shaped door and FHB structure provide a high degree of protection from severe weather, a rupture of piping in the vicinity of the fuel pool will be postulated. Any weather event severe enough to cause a piping failure here is also likely to cause a loss of offsite power (LOOP). The only piping available for rupture in the vicinity of the Unit 1 spent fuel pool which could cause a pool dilution event is the short segment of primary water piping that penetrates the north wall of the FHB at approximately the 68-foot elevation. If a LOOP were to occur concurrent with the piping failure, no appreciable dilution would result because neither the primary water pumps, the fuel pool cooling pumps, nor the fuel pool purification pump are automatically loaded onto the emergency diesel generator(s). A number of manual actions would be required to energize one of these pumps. Therefore, dilution resulting from a tornado or hurricane is not considered a credible event and is not considered further in this analysis.

If a piping rupture were to occur while offsite power remained available, dilution of the fuel pool could result. To conservatively bound the primary water flow rate to the fuel pool in the event of a piping system failure, the calculated maximum nominal delivery rate will be increased by 50%. Thus, if a primary water pump were in operation, the failure of primary water piping near the fuel pool could result in an unborated water flow rate of up to 135 gpm, based on pump specifications and the piping layout. The effect of a dilution of this magnitude is examined in Section 4.3.4 of this report.

3.5.8 Fuel Pool Dilution Caused by a Precipitation Event

As previously noted, the L-shaped door in the roof of the FHB is normally closed. However, if the L-shaped door were to remain open during a prolonged precipitation event, the water level in the fuel pool would increase and some dilution of the pool would occur. Section 2.3.1.2b of the St. Lucie Unit 2 updated FSAR notes that the record 24-hour rainfall for the United States occurred in Yankeetown, Florida following passage of a 1950 hurricane. The effect of a dilution of this magnitude on the Unit 1 spent fuel pool is examined in this report.

3.5.9 Dilution Sources and Flow Rate Summary

Based on the evaluation of potential spent fuel pool dilution sources summarized above, the following dilution sources were determined to be capable of providing a significant amount of non-borated water to the spent fuel pool. The potential for these sources to dilute the spent fuel pool boron concentration down to the design basis boron concentration of 500 ppm (obtained from Enclosure 2) is evaluated in Section 4.0 of this report.

SOURCE	APPROXIMATE FLOW RATE (gpm)
Primary water system makeup through V15322	90
Primary water addition following completion of resin sluicing operations	100
Rupture of primary water piping near fuel pool	135
Precipitation event through an open FHB L-shaped door	38.7 inches

3.6 Boration Sources

The normal source of borated water to the spent fuel pool is from the refueling water storage tank (RWT). With the exception of a relatively complicated, non-standard valve lineup from the primary water pumps or from the boric acid makeup (BAM) tanks through the RWT, no makeup to the fuel pool flows through the chemical and volume control system (CVCS) piping.

3.6.1 Refueling Water Tank

The Unit 1 refueling water tank is connected to the spent fuel pool purification loop through separate inlet and outlet lines. These connections are used as a flow path for makeup to the fuel pool from the RWT and are also used to process the contents of the RWT through the purification filters and ion exchanger. Using the makeup flow path, the purification pump can supply a makeup flow rate to the fuel pool of approximately 150 gpm. Technical Specification 3.5.4 requires that the boron concentration in the RWT be maintained at least 1720 ppm.

3.6.2 Boric Acid Makeup Tank

The contents of either BAM tank can be directed to the RWT using one of the two boric acid makeup pumps. From the RWT, this fluid may be used to borate the spent fuel pool as described in Section 3.6.1 of this report. To pass flow from the BAM tanks to the RWT, valves must be repositioned to utilize this non-standard lineup, including opening two valves that are normally closed. To be considered operable, Technical Specification 3.1.2.7 (applicable to Modes 5 and 6) requires a BAM tank contain at least 3650 gallons of water with a concentration of at least 4371 ppm boron. Figure 3.1-1 of Technical Specifications details the relationship between the concentration and required quantity of boric acid present in the BAM tanks while in Modes 1 through 4. Technical Specification 3.1.2.8, *Borated Water Sources – Operating*, requires that BAM tanks contain between 5400 gallons and 8700 gallons of a boric acid solution whose concentration is between 4371 and 6119 ppm.

3.6.3 Direct Addition of Boric Acid

If necessary, the boron concentration of the spent fuel pool can be increased by emptying barrels of dry boric acid directly into the fuel pool. The spent fuel pool cooling system flow and the thermal convection created by irradiated assemblies stored in the fuel pool will promote dissolution and mixing of the dry boric acid.

3.7 Spent Fuel Pool Instrumentation

Instrumentation is available at St. Lucie Unit 1 to monitor spent fuel pool water level, temperature and radiation levels near the fuel pool and the fuel transfer canal. Additional instrumentation, with control room annunciation, is available to monitor the status of each spent fuel pool cooling pump motor, the pump discharge pressure and the quantity of CCW return flow from the spent fuel pool heat exchanger. Local instrumentation is available to indicate the purification pump suction and discharge pressure.

The instrumentation provided to monitor the spent fuel pool water level and temperature has a local indication and is annunciated in the control room. Each of these control room alarms is located on a reactor turbine gauge board (RTGB) panel that has a safety-related power supply, however, there are no Class 1E electrical services in the FHB. The instrumentation which monitors area radiation levels in the vicinity of the spent fuel pool provides high radiation alarms locally and also annunciates in the control room.

The spent fuel pool water level is maintained at a nominal elevation of 60 feet. Level alarms will actuate in the control room at ± 2 inches from this value. A change of one foot in the spent fuel pool level with the refueling canal bulkhead removed would require approximately 10,368 gallons of water. A dilution event initiated with the fuel pool at the low level alarm point and a boron concentration of 1720 ppm would decrease the boron concentration approximately 17.3 ppm by the time the upper level alarm setpoint is reached.

3.8 Administrative Controls

The following administrative controls are in place to control and monitor the spent fuel pool boron concentration and water inventory:

1. In accordance with Operations Department Instructions, plant operations personnel perform rounds in the FHB, including the vicinity of the spent fuel pool, at least once per day.

2. Security personnel periodically tour the Unit 1 FHB. These [twice per day] rounds include visits to the operating deck surrounding the spent fuel pool. During these tours, security personnel would readily notice any uncontrolled fuel pool makeup emanating from ruptured primary water system piping. They would also readily notice the presence of standing water on the operating deck if the fuel pool were to overflow.

3. Plant procedures require that the spent fuel pool and refueling water tank boron concentrations be determined weekly.

4. The normal operating procedure that controls makeup to the fuel pool specifies the makeup water source to be used based on the boron concentration present in the fuel pool. Use of a non-borated makeup source is permitted only if the most recent chemistry analysis indicates a spent fuel pool boron concentration greater than or equal to 2300 ppm .

5. Administrative controls on the use of primary water dilution paths are present. Administrative controls are also present for the positioning of valves in lines connecting the RWT and spent fuel pool.

6. A dedicated level watch is required during filling of the refueling canal and during any spent fuel pool level change if the control room annunciation is inoperable. Control room level and temperature annunciation is required to be operable prior to the initiation of any full core fuel offload to the spent fuel pool.

The current administrative controls on spent fuel pool boron concentration will be evaluated and upgraded, if necessary, prior to the implementation of any license amendment permitting credit for soluble boron in the spent fuel pool criticality analysis. Procedures will ensure that appropriate constraints are in place to control boron concentration during normal and off-normal conditions.

3.9 Piping

Less than 10 linear feet of primary water piping is routed through the FHB in the vicinity of the spent fuel pool. This piping is 2-inch Schedule 40 line attached to the north wall of the FHB. An additional 5 to 10 feet of 2-inch auxiliary steam system piping is also present near the fuel pool.

3.10 Loss of Offsite Power

Of the dilution sources listed in Section 3.5.9 of this report, only the precipitation event with an open L-shaped door and the discarded scenario involving fire pump makeup coincident with a broken heat exchanger tube are capable of providing non-borated water to the spent fuel pool during a loss of offsite power (LOOP). A fire pump start is enabled 45 seconds after a LOOP event; it is not enabled following a LOOP/LOCA event. After being enabled, the fire pump will start only if the firewater header pressure decreases below 85 psig. An emergency diesel generator (EDG) provides backup to the normal power supply for control room annunciators and certain process instrumentation, including fuel pool level and temperature.

A LOOP also affects the ability to respond to a dilution event. The fuel pool purification pump is not a load automatically placed on either emergency diesel generator, although sufficient uncommitted capacity exists to permit its manual loading. Manual boron addition could be used if it became necessary to increase spent fuel boron concentration during a LOOP.

Spent fuel pool cooling pumps are not automatically loaded onto the Unit 1 EDGs following a LOOP. The 1A fuel pool cooling pump is to be manually loaded onto an EDG during the 13th load block (approximately 1.34 hours) following a LOOP or LOOP/LOCA event. Each fuel pool cooling system pump has a running load of approximately 29.7 kw. The available uncommitted diesel generator capacity is sufficient to permit manual loading of a fuel pool cooling pump onto the EDG following a loss of offsite power or following a loss of offsite power coincident with a LOCA.

4.0 SPENT FUEL POOL DILUTION EVALUATION

4.1 Description of Methodology Used

In its initial configuration (prior to any postulated dilution) the Unit 1 spent fuel pool is essentially a filled container with an open top. Because the container is considered to be basically full, any additional volume added (beyond that required to reach the bulkhead spillway slot) is removed in one of two ways: 1) by overflow of the fuel pool; or 2) through an independent, concurrent action to open the return line flow path from the spent fuel pool purification loop to the RWT. Either mechanism is also assumed to remove soluble boron. As is discussed elsewhere in this evaluation, the valve on the return line to the RWT is administratively controlled and is maintained in a locked closed condition. Thus, the more likely mechanism for the removal of excess volume (and boron) from the fuel pool following an inadvertent dilution is through fuel pool overflow.

The methodology used in the following calculations provides conservative results for those cases where there is no spillage (e.g. filling the fuel pool from the low level alarm point) since spillage is assumed to remove boron. Without spillage, there is no loss of boron.

Irrespective of the removal pathway, the rate of change of boron concentration in the fuel pool is described by the following equation.

$$V\, dC/dt = -QC$$

Where:

V = Spent fuel pool volume (nominally 296,872 gallons)
C = Fuel pool boron concentration
Q = Volumetric flow rate of unborated water
t = dilution time

The solution of the above equation can be written as:

$$C(t) = C(0)\, e^{-t/\tau}$$

Where:

C(0) = Initial boron concentration
τ = V/Q = boron dilution time constant

For example, if Q is assumed to be 100 gallons/minute, then $\tau = 2968.7$. The boron concentration after 1500 minutes (25 hours) of dilution from 1720 ppm is:

$$C(1500) = 1720\ e^{-1500/2968.7}$$

And $C(1500) \approx 1038$ ppm

The volume of water added during this 1500 minute dilution is 150,000 gallons (1500 minutes * 100 gallons/minute).

This evaluation is primarily concerned with the time required to reach a specific boron value. For ease of calculation, the above equation may be rewritten as:

$$t = \ln(C_o/C) * V/Q$$

or

$$t = \ln(Co/C) * \tau$$

where:

C is the boron concentration endpoint
All other terms are as defined above

4.2 Calculation of Boron Dilution Times and Volumes

As previously noted, the total fuel pool water volume available for dilution of 296,872 gallons. This value is for the fuel pool and the cask loading area filled to the 60 foot elevation, net of storage racks and contained fuel. The value of net pool water volume is conservatively derived by assuming all storage locations in the fuel pool and the cask pit are occupied and that the occupying fuel assemblies are comprised entirely of Zircaloy, which is the lowest density material of construction. The water volume that could be present in the refueling transfer canal (approximately 47,500 gallons) is also neglected in this calculation.

The cask loading area is separated from the remainder of the fuel pool by a partial-height wall. This wall is designed to ensure, along with other plant features, that a cask drop accident will not cause damage to stored fuel or cause irradiated fuel stored in the fuel pool to become uncovered if the cask pit area liner were perforated. This design also assures that the spent fuel pool and the cask loading area are thermally and hydraulically coupled.

Procedures identify the operating band for boron concentration in the Unit 1 spent fuel pool as between 2000 ppm and 2400 ppm. Based on the Enclosure 2 criticality analysis performed for St. Lucie Unit 1, the soluble boron required to maintain a spent fuel $k_{eff} \leq 0.95$, including the effect of manufacturing tolerances, uncertainties and fuel burnup, with a 95% probability at a 95% confidence level (95/95) is less than 500 ppm.

For the purposes of identifying the required dilution times and volumes, the initial spent fuel pool boron concentration is assumed to be at the Technical Specification limit of 1720 ppm. Evaluations are based on the spent fuel pool being diluted from 1720 ppm to 500 ppm. To dilute the combined pool/cask area volume of 296,872 gallons from 1720 ppm to 500 ppm would require 366,777 gallons of non-borated water. With an initial boron concentration of 2000 ppm, dilution to 500 ppm would require 411,552 gallons of non-borated water.

This analysis assumes thorough mixing of all non-borated water added to the fuel pool. If fluid mixing is insufficient, it is conceivable that a localized volume of non-borated water could form somewhere in the spent fuel pool. Enclosure 2 results demonstrate that the effective neutron multiplication factor (k_{eff}) of the St. Lucie Unit 1 spent fuel pool will remain <1.0 on a 95/95 basis when the spent fuel pool is filled with non-borated water.

As Section 4.1 of this report demonstrates, the time to dilute depends on the initial volume of the fuel pool and the postulated rate of dilution. The dilution times and required volumes for the scenarios discussed in Sections 4.3 and 4.4 of this report have been calculated based on the equations given in Section 4.1.

4.3 Evaluation of Boron Dilution Events

The postulated boron dilution events in the Unit 1 spent fuel pool are evaluated below:

4.3.1 Primary Water Makeup to the Spent Fuel Pool (through V15322)

The contents of the primary water tank can be transferred to the Unit 1 spent fuel pool through a single 3-inch branch line using primary water pumps as the motive force. This primary water line diameter reduces to 2 inches at the FHB. The line enters the FHB at elevation 68 feet-10 inches and is attached to the north wall adjacent to and above the spent fuel pool. Makeup to the fuel pool through this 2-inch line may be accomplished by unlocking valve V15322 and connecting a flexible hose. Valve V15322 is the procedurally specified primary water makeup path.

The primary water tank (PWT) capacity is 150,000 gallons. Normally, the tank contains unborated water, although the PWT is not typically analyzed for boron content. If the PWT is filled to capacity and the entire contents transferred to the spent fuel pool, the fuel pool would be diluted by at most 682 ppm down to a final boron concentration of 1038 ppm. Using the maximum nominal flow rate through V15322, this dilution would require more than 27 hours.

To avoid overflow of the spent fuel pool or the receipt of a high level alarm during the addition of primary water, a coincident draining of the existing fuel pool inventory would be required. The spent fuel pool may be drained to the refueling water tank or, for smaller volumes, to the equipment drain tank. To accomplish draining by the normal method, procedural guidance requires opening a locked closed return line from the spent fuel pool to the refueling water tank. Additionally, the fuel pool purification pump must be aligned to remove fuel pool inventory.

The postulated dilution event described above requires adding the entire contents of the primary water tank to the fuel pool. It still leaves the soluble boron concentration in the spent fuel pool more than 500 ppm greater than the concentration necessary to provide assurance $k_{eff} \leq 0.95$. Using the procedurally specified makeup flow path at the maximum nominal flow rate, more than 27 hours of continuous dilution would be required to deplete the primary water tank. In a real-life situation, the rising fuel pool level would cause water to overflow the transfer canal bulkhead, enter the fuel pool ventilation duct banks and subsequently overflow onto the operating deck (where operator and security personnel rounds are made) as the additional primary makeup water is added.

If we postulate that the St. Lucie site water treatment plant continues to provide automatic makeup to the Unit 1 PWT at a rate equal to the assumed rate of fuel pool dilution through the valve V15322 flow path (i.e., 90 gpm) and if we postulate that the continued reduction in PWT level does not lead to cavitation of the primary water pumps, then an additional 40.1 hours of dilution is required to reduce the fuel pool boron concentration from 1038 ppm to a value such that $k_{eff} = 0.95$.

This evaluation shows that the direct addition of primary water to the fuel pool through V15322 is not a dilution path that represents a credible challenge to the reactivity margin required by Enclosure 2. This conclusion is based on the several factors listed below:

- The large quantity of unborated makeup water required to achieve a significant dilution,
- The difficulty in adding large quantities of makeup water to the fuel pool without causing overflow,
- The frequency of rounds in the FHB by operations and security personnel; intervals between area inspections are substantially less than the period needed to dilute the fuel pool to a condition where k_{eff} = 0.95,
- The available fuel pool and primary water tank instrumentation, and
- The presence of a locked closed valve on the return line leading to the RWT.

4.3.2 Primary Water Addition through Resin Flush Line

During a resin sluicing operation, primary water flowing at approximately 100 gpm is used to move depleted resin from the fuel pool ion exchanger to the spent resin tank or to an external shipping cask. This dilution scenario assumes that following a resin sluicing evolution the primary water flow stream is not secured, but is inadvertently redirected to the spent fuel pool as makeup. Dilution of the fuel pool is postulated to occur as a result of flow through a two-inch primary water line downstream of the fuel pool ion exchanger. Dilution flow would enter the spent fuel pool through the purification loop with the primary water pumps providing motive force.

As the dilution flow enters the spent fuel pool, the pool level will rise unless a coincident pool draining evolution is undertaken. Without a coincident draining, the high level alarm will annunciate in the control room; if makeup continues, the pool will overflow the bulkhead separating it from the transfer canal, overflow into the pool ventilation ducts, and eventually overflow onto the operating deck. Any of these effects would be visible to operators or security personnel during their rounds.

Draining the spent fuel pool is controlled by plant procedures and is undertaken as described in Section 4.3.1 above. Pool letdown flow is normally directed to the refueling water tank to conserve water and because of its greater capacity. As noted earlier, the refueling water tank is isolated from the spent fuel pool by locked closed valves in both the supply and return lines.

Twenty-five hours are required to transfer the entire contents of the primary water tank to the spent fuel pool at the assumed 100 gpm dilution rate. As discussed in Section 4.3.1, the contents of the primary water tank are sufficient to dilute the pool to approximately 1038 ppm, but are insufficient, unless additional makeup is postulated, to dilute the fuel pool to 500 ppm. Enclosure 2 demonstrates that k_{eff} of the fuel pool equals 0.95 at a soluble boron concentration of < 500 ppm. If the 100 gpm flow rate to the fuel pool is maintained and if adequate makeup to the primary water tank from the site water treatment plant is assumed, an additional 36.1 hours are required to reduce the soluble boron concentration to 500 ppm.

Thus, assuming sufficient makeup water is available, 61.1 hours would be required to dilute the Unit 1 spent fuel pool to 500 ppm using the purification system flow path.

4.3.3 Precipitation Event Through an Open FHB L-Shaped Door

Normally, the FHB L-shaped door is maintained closed. The site Security Department controls keys and the energized power interlocks required for opening this door. Station air is used to maintain the FHB hatch seal inflated and low station air pressure is alarmed in the control room. However, if this L-shaped door were to be left open during a prolonged precipitation event, dilution of the spent fuel pool could occur. When open, the cross section of the L-shaped door exposes only a small fraction of the fuel pool to any precipitation flux. For the purposes of this evaluation, a conservative value of the horizontal and vertical cross sectional area exposed by the open L-shaped door was determined to be a value of 613.4 ft^2. Further, the fuel pool is assumed to not overflow as a result of the additional water volume. Initial pool boron concentration is maintained at the 1720 ppm Technical Specification limit.

The volume associated with 38.7 inches of precipitation falling on a 613.4 ft^2 area is 14,799 gallons. This volume of unborated water would be sufficient to decrease the pool boron concentration by approximately 84 ppm.

This simplified, conservative analysis demonstrates that the rainfall associated with an extreme precipitation event over the St. Lucie Unit 1 spent fuel pool is not sufficient to cause a dilution event that would present a credible challenge to fuel pool reactivity margins. This dilution initiator is not considered further in this evaluation.

4.3.4 Dilutions Resulting from Seismic Events or Random Pipe Breaks

A seismic event could cause a rupture of the primary water system piping near the spent fuel pool. As discussed in Section 3.9 of this report, the length of this piping run is less than 10 feet. For a seismic (or other) event at St. Lucie Unit 1 where offsite power remains available, it is assumed that a rupture of the primary water line inside the FHB could result in flow of up to 135 gpm, as discussed in Section 3.5.7 of this report. Continuous dilution of the fuel pool, at this flow rate, would achieve a 500 ppm boron concentration in approximately 45 hours.

Seismic instrumentation is installed at St. Lucie with annunciation in the Unit 1 control room. If a seismic event were to occur at St. Lucie, the site emergency plan will be activated. Plant procedures applicable to off-normal conditions require that an inspection of each unit's spent fuel pool be completed within two hours following any seismic event at St. Lucie. Fuel pool level and temperature will be determined during this inspection, as will the condition of primary water piping in the vicinity of the fuel pool.

With a sustained dilution rate of 135 gpm to the fuel pool through the ruptured primary water line and with offsite power available, the primary water tank will be emptied in 18.5 hours. As presented in Section 4.3.1, a reduction in boron concentration of 682 ppm would result irrespective of the assumed flow rate through any broken pipe. The effective neutron multiplication factor (k_{eff}) for the spent fuel pool will remain < 0.95 following this quantity of unborated makeup.

If offsite power is not available, the primary water pumps would not be available and thus, there would be no dilution source.

The specific location of primary water system piping, above the operating deck and attached to the north wall of the spent fuel pool, ensures that any randomly initiated breaks in this system would be detected during periodic rounds by operations or security personnel.

As a result, no dilution of the fuel pool due to a random pipe break or a seismic event can credibly be considered to challenge the fuel pool reactivity margins required by Enclosure 2. Irrespective of this conclusion, a dilution rate of 135 gpm is considered in Section 4.5 of this evaluation.

4.4 Evaluation of Infrequent Spent Fuel Pool Configurations

4.4.1 Dilution of Spent Fuel Pool with Cask Storage Area Isolated

At St. Lucie Unit 1, the design of the cask storage area is such that it can not be isolated from the rest of the spent fuel pool.

4.4.2 Filling the Refueling Canal

To prepare for refueling activities, the fuel transfer (refueling) canal must be filled. As earlier noted, a bulkhead is normally installed between the fuel pool and the refueling canal. The top of this bulkhead contains a spillway or slot at a point below the elevation of the fuel pool ductwork but above the level that activates the control room's fuel pool high level alarm. Plant procedures used for filling the transfer canal specify that, using makeup from the refueling water tank the fuel pool level should be increased until flow through this slot is observed. Because the control room annunciator indicating fuel pool high level will continuously alarm during this evolution, procedures require an operator to be stationed in the fuel pool area while the refueling canal is being filled.

If the makeup for this evolution were to inadvertently come from the primary water tank instead of from the RWT, a fuel pool dilution could result. Filling the 47,500 gallon refueling canal using primary water as a makeup source would reduce the boron concentration in the fuel pool by approximately 284 ppm. This reduction in pool boron concentration is not sufficient to present a credible challenge to the 500 ppm boron limit required by Enclosure 2. Therefore, this event is not considered further in this analysis.

4.4.3 Operation of Two Primary Water Pumps

Most of the discussion presented above considering dilution of the fuel pool due to unborated flow provided by the primary water pumps considers one pump to be in operation. While operation of one PMW pump represents the normal condition, low header pressure will cause an automatic start of the second pump. Operation of two primary water pumps could result in a greater fuel pool dilution rate.

An increased primary water flow rate will deplete the primary water storage tank (PWT) inventory more quickly, but it does not increase the overall quantity of available makeup. Assuming a constant temperature in the fuel pool, and if fuel assemblies are not being manipulated, final k_{eff} of the fuel pool is a function of the total dilution flow (i.e., boron concentration) but not the rate of dilution. As a result, reactivity of the fuel pool will be the same when PWT inventory is depleted, irrespective of dilution rate.

4.5 Summary of Dilution Events

Sections 3.5, 4.3, and 4.4 of this evaluation consider a variety of fuel pool dilution events that could provide unborated water to the Unit 1 spent fuel pool. An examination of these postulated dilution scenarios, the plant design features and its administrative controls show that most postulated dilution events do not represent a credible challenge to the fuel pool reactivity margin requirements from Enclosure 2. Together, the St. Lucie water treatment plant and the Unit 1 primary water tank or, when considering the backup source of CCW surge tank makeup, the city water storage tank, are assumed to be capable of providing the 366,777 gallons of water necessary to dilute the fuel pool from 1720 ppm to 500 ppm. Based on the analysis in Section 4.3, the limiting scenario would require at least 45.2 hours of continuous undetected dilution.

For this scenario to result in a successful dilution of the spent fuel pool to 500 ppm, the addition of more than 366,700 gallons of water over a period of nearly 48 hours would have to go unnoticed. Alternatively, multiple indications of an off-normal event would have to be ignored. One of the first indications of an off-normal event would be receipt of a high level alarm in the control room from spent fuel pool instrumentation. If pool level continues to rise above the level alarm setpoint, borated water from the fuel pool will spill through the slot in the bulkhead separating the fuel pool from the transfer canal. When the transfer canal is filled, continued addition of makeup to the fuel pool will cause borated water to enter the fuel pool ventilation ducts. If the control room's high level alarm were to fail and the presence of water in the fuel pool ventilation ducts is not detected the fuel pool would overflow. Subsequently, plant operators and security personnel would observe and walk through standing water on the fuel pool operating deck as they make their rounds. Any overflow of the fuel pool will be readily detected in time to take corrective actions. Together, operations and security personnel make at least three sets of rounds through the FHB in the vicinity of the spent fuel pool per day; during the approximately 48 hours required for the limiting dilution five or six sets of rounds would be made.

For any of these dilution scenarios to successfully add over 366,700 gallons of unborated water to the spent fuel pool, plant operators would also have to fail to question or investigate the continuous makeup of water to the primary water tank and fail to recognize that the need for 366,777 gallons of primary water makeup was unusual.

If the assumed flow rate of unborated water to the St. Lucie Unit 1 spent fuel pool were increased to 500 gpm, more than 12 hours would be required to reduce the pool boron concentration to 500 ppm. Thus, even a spent fuel pool dilution at a flow rate significantly higher than that assumed in Sections 4.3 and 4.4 of this report would still be detected by alarms, flooding, or personnel rounds before the boron concentration reached 500 ppm.

5.0 CONCLUSIONS

A boron dilution analysis applicable to the St. Lucie Unit 1 spent fuel pool has been completed. From this dilution analysis, it is concluded that an unplanned or inadvertent event that would result in a dilution of the spent fuel pool boron concentration from 1720 ppm to 500 ppm is not a credible event. This conclusion is based on the following:

1. More than 366,700 gallons of unborated water would be required to dilute the Unit 1 spent fuel pool to the design k_{eff} value of 0.95. To actually achieve this dilution, plant personnel would be required to take continued, manual actions to assure that this quantity of water would be delivered to the spent fuel pool.

2. Plant procedures require the Unit 1 fuel pool soluble boron concentration be maintained greater than 1720 ppm at all times. The fuel pool boron concentration is actually maintained within a range of 2000 ppm to 2400 ppm.

3. The normal makeup path to the spent fuel pool from the primary water system is maintained locked closed. No designated alternate primary water makeup path exists.

4. In-place administrative controls on the primary letdown path from the spent fuel pool (i.e., valve V07101 in the RWT return line is normally in a locked closed condition) ensure that any prolonged, inadvertent fuel pool makeup would result in pool overflow.

5. The large volume of water required to achieve a meaningful dilution would be readily detected by plant personnel through installed alarms, overflow of the spent fuel pool and flooding in the FHB, or by security and operations personnel during their normal rounds on the spent fuel pool operating deck and elsewhere in the plant.

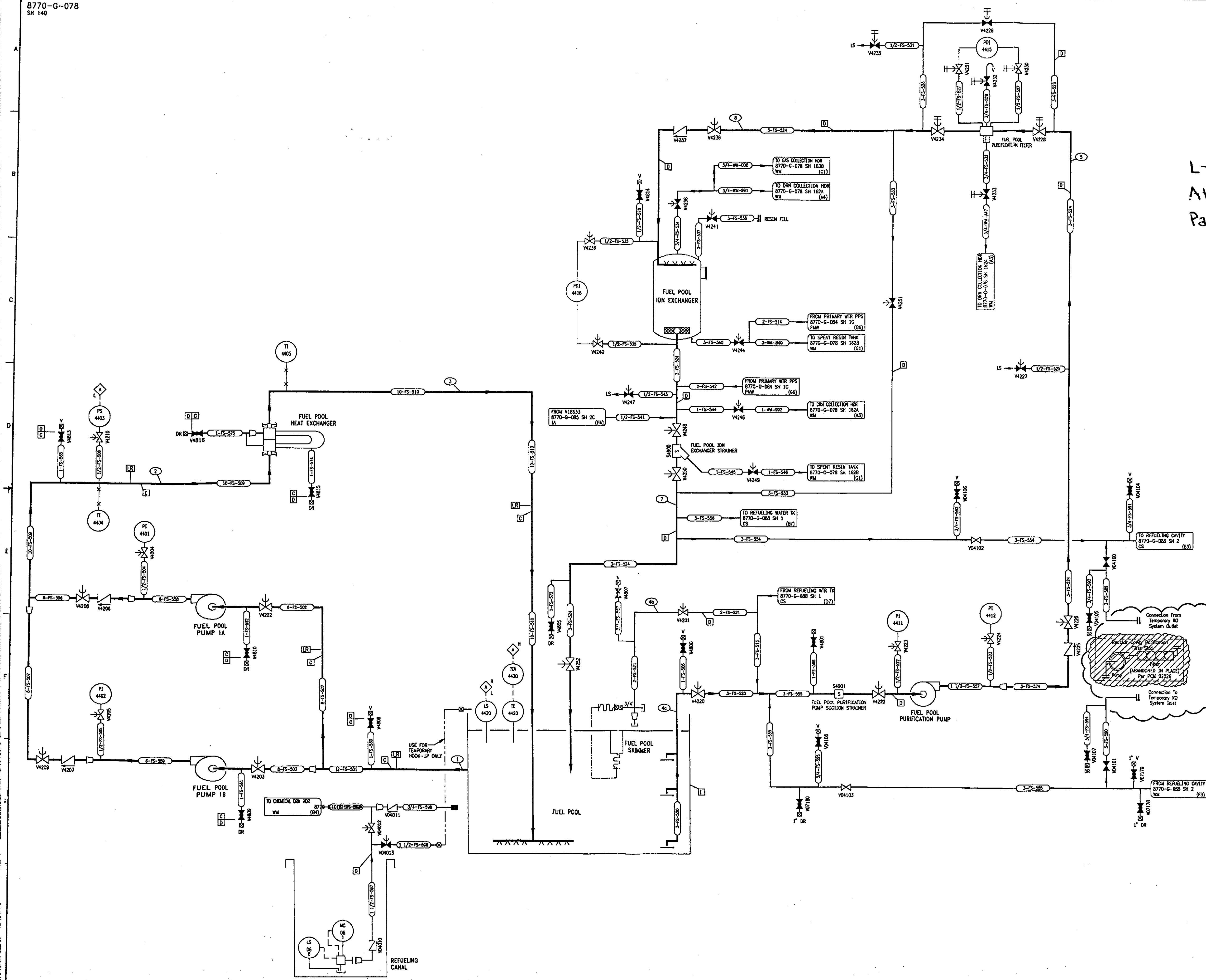
6. Available flow rates to deliver unborated water to the spent fuel pool ensure that sufficient time is available for operations personnel to detect and respond to any dilution event.

All dilution scenarios examined in this analysis utilize 1720 ppm as the initial soluble boron concentration in the spent fuel pool, and utilize 500 ppm as the boron endpoint. It is important to reiterate that the spent fuel pool boron concentration is procedurally maintained greater than 1720 ppm (typically >2000 ppm) and that the assumed 500 ppm endpoint ensures that k_{eff} of the storage racks will always be ≤ 0.95. The criticality analysis discussed in Enclosure 2 demonstrates that the spent fuel pool will remain subcritical with non-borated water in the pool including the effect of any relevant biases or uncertainties. Thus, even if the spent fuel pool were diluted to 0 ppm, which would require significantly more water than the 366,777 gallons presented above, the fuel storage racks would remain subcritical and the health and safety of the public would be assured.

8770-G-078
SH 140

NO	DATE	DESCRIPTION	BY	CH	APPROVED		
10	8/25/97	DCR 960029: REDRAWN	CJG	GM			SHM
11	6/9/98	DCR 980084: ADD:(G3) CODE BOUNDARY. REV:(F5) LINE NUMBER.	GM	HS			SHM
12	7/18/01	DCR 010005 ADD:C3,F3,D2 & E4) LICENSE RENEWAL FLAGS.	GM	HS			SHC
13	6/25/02	PCM 02026 ADD:(F7) ABANDONED PUMP & NOTES FOR TEMPORARY CONNECTIONS.		GW			

L-2002-221
Attachment 4
Page 28 of 28



REFERENCE DRAWINGS

PIPE, VALVES & INSTRUMENT SYMBOLS	8770-G-078 SH 100
VALVE LIST	8770-A-051
LINE LIST	8770-B-052
VALVE OPERATIONAL NUMBER INDEX	8770-B-053
INSTRUMENT INSTALLATION DETAILS	8770-B-231
INSTRUMENT LIST	8770-B-270C

NOTES

1. THE FUEL POOL PURIFICATION SUCTION LINE (3-FS-520) AND THE FUEL POOL COOLING RETURN LINE (10-FS-510) HAVE 1/4" AND 1/2" DRILLED HOLES RESPECTIVELY. LOCATED 1'-0" BELOW THE NORMAL POOL LEVEL TO SERVE AS SYPHON BREAKERS
2. FOR PUMP VENT & DRAIN CONNECTIONS SEE AUXILIARY PUMPS REF. DWG. 8770-G-078 SH. 105C.

NOTE:
THIS DRAWING IS MADE FROM REV. 9 OF DRAWING 8770-G-078 SH 140

REVISION OF THIS DRAWING MAY REQUIRE UPDATE OF THE FOLLOWING DOCUMENTS: FSAR FIGURE 9.1-3

FLORIDA POWER & LIGHT COMPANY
ST LUCIE PLANT
1978 - 890 MWe INSTALLATION - UNIT 1

FLOW DIAGRAM FUEL POOL SYSTEM

FLORIDA POWER & LIGHT COMPANY

SCALE: NONE	APPROVAL	DATE:
DIV: MECH		8770-G-078
DR: G GLATT		SHEET 140
CH: G MOERS		13

USM00283.DWG

ST. LUCIE UNIT 1 MARKED-UP TECHNICAL SPECIFICATION PAGES

Page viii
3/4 9-11
5-5
5-6*
5-6b – new Figure 5.6-1
5-6c – new Figure 5.6-2
5-6d – new Table 5.6-1
5-6e – new Table 5.6-2

* Note that the TS mark-up is based on the current TS wording at the time the submittal was made. FPL submitted an earlier license amendment to add cask pit spent fuel storage racks (FPL letter L-2002-187, dated October 23, 2002), which added a description of the Boral™ poison material design feature used in the cask pit spent fuel storage racks. This submittal will justify removing the poison material description added by the cask pit spent fuel storage rack submittal.

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

REFUELING OPERATIONS ← SPENT FUEL STORAGE POOL

~~**STORAGE POOL WATER LEVEL**~~

LIMITING CONDITION FOR OPERATION

3.9.11 As a minimum, 23 feet of water shall be maintained over the top of irradiated fuel assemblies seated in the storage racks.

APPLICABILITY: Whenever irradiated fuel assemblies are in the storage pool.

ACTION:

With the requirement of the specification not satisfied, suspend all movement of fuel assemblies and crane operations with loads in the fuel storage areas and restore the water level to within its limit within 4 hours. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.11 The water level in the storage pool shall be determined to be at least its minimum required depth at least once per 7 days when irradiated fuel assemblies are in the fuel storage pool.

Replace With

3.9.11 The Spent Fuel Pool shall be maintained with:

a. The fuel storage pool water level greater than or equal to 23 ft over the top of irradiated fuel assemblies seated in the storage racks, and
b. The fuel storage pool boron concentration greater than or equal to 1720 ppm.

APPLICABILITY: Whenever irradiated fuel assemblies are in the spent fuel storage pool.

ACTION:

a. With the water level requirement not satisfied, immediately suspend all movement of fuel assemblies and crane operations with loads in the fuel storage areas and restore the water level to within its limit within 4 hours.
b. With the boron concentration requirement not satisfied, immediately suspend all movement of fuel assemblies in the fuel storage pool and initiate action to restore the fuel storage pool boron concentration to within the required limit.
c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.11 The water level in the spent fuel storage pool shall be determined to be at least its minimum required depth at least once per 7 days when irradiated fuel assemblies are in the fuel storage pool.

4.9.11.1 Verify the fuel storage pool boron concentration is within limit at least once per 7 days.

DESIGN FEATURES

CONTROL ELEMENT ASSEMBLIES

5.3.2 The reactor core shall contain 73 full length and no part length control element assemblies. The control element assemblies shall be designed and maintained in accordance with the original design provisions contained in Section 4.2.3.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 700°F

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 11,100 ± 180 cubic feet at a nominal T_{avg} of 567°F, when not accounting for steam generator tube plugging.

5.5 EMERGENCY CORE COOLING SYSTEMS

5.5.1 The emergency core cooling systems are designed and shall be maintained in accordance with the original design provisions contained in Section 6.3 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.6 FUEL STORAGE

CRITICALITY

5.6.1.a The spent fuel pool and spent fuel storage racks ~~are designed and~~ shall be maintained with:

1. k_{eff} less than 1.0 when ~~or equal to 0.95 if~~ fully flooded with unborated water, which includes an allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

DESIGN FEATURES

CRITICALITY (Continued)

2. A nominal 10.12 inches center to center distance between fuel assemblies in Region 1 of the storage racks and a nominal 8.86 inches center to center distance between fuel assemblies in Region 2 of the storage racks.

Replace With Insert A

Also see * below

3. A boron concentration greater than or equal to 1720 ppm.

4. Neutron absorber (boraflex) installed between spent fuel assemblies in the storage racks in Region 1 and Region 2.

b. Region 1 of the spent fuel storage racks can be used to store fuel which has a U-235 enrichment less than or equal to 4.5 weight percent. Region 2 can be used to store fuel which has achieved sufficient burnup such that storage in Region 1 is not required. The initial enrichment vs. burnup requirements of Figure 5.6-1 shall be met prior to storage of fuel assemblies in Region 2. Freshly discharged fuel assemblies may be moved temporarily into Region 2 for purposes of fuel assembly inspection and/or repair, provided that the configuration is maintained in a checkerboard pattern (i.e., fuel assemblies and empty locations aligned diagonally). Following such inspection/repair activities, all such fuel assemblies shall be removed from Region 2 and the requirements of Figure 5.6-1 shall be met for fuel storage.

Replace With Insert B

c. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DRAINAGE

5.6.2 The fuel pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

5.6.3 The spent fuel pool is designed and shall be maintained with a storage capacity limited to no more than 1706 fuel assemblies.

5.7 SEISMIC CLASSIFICATION

5.7.1 Those structures, systems and components identified as seismic Class I in Section 3.2.1 of the FSAR shall be designed and maintained to the original design provisions contained in Section 3.7 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirement.

* 5.6.1.a.4. is being revised under a separate amendment request to include a description of the boral neutron absorber material in the new cask pit fuel storage rack. This amendment will delete the discussion of boral added by that separate amendment.

Inserts to Unit 1 TS page 5-6

<u>Insert A</u>:

3. A k_{eff} less than or equal to 0.95 when flooded with water containing 500 ppm boron, including an allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

4. For storage of enriched fuel assemblies, requirements of Criteria 1 and 3 shall be met by positioning fuel in the spent fuel storage racks consistent with the requirements of Specification 5.6.1.b.

5. Vessel Flux Reduction Assemblies (VFRAs), as defined in Section 9.1 of the Updated Final Safety Analysis Report, may be placed in any allowable fuel storage location.

6. Fissile material, not contained in a fuel assembly lattice, shall be stored in accordance with the requirements of Criteria 1 and 3.

<u>Insert B</u>:

b. Loading of spent fuel storage racks shall be controlled as described below. Criteria 2 and 3 below do not apply to the cask pit storage rack.

   1. The maximum initial planar average U-235 enrichment of any fuel assembly inserted in a spent fuel storage rack shall be less than or equal to 4.5 weight percent.

   2. Fuel placed in Region 1 of the spent fuel pool storage racks shall comply with the storage patterns and alignment restrictions of Figure 5.6-1 and the minimum burnup requirements of Table 5.6-1 and Table 5.6-2.

   3. Fuel placed in Region 2 of the spent fuel pool storage racks shall comply with the storage patterns or allowed special arrangements of Figure 5.6-2 and the minimum burnup requirements of Table 5.6-1 and Table 5.6-2. The allowed special arrangement for fresh fuel may be repeated, provided the applicable interface requirements specified by the safety analysis are met.

   4. Any fuel satisfying criteria 5.6.1.b.1, including fresh fuel, may be placed in the Region 1 cask pit storage rack.

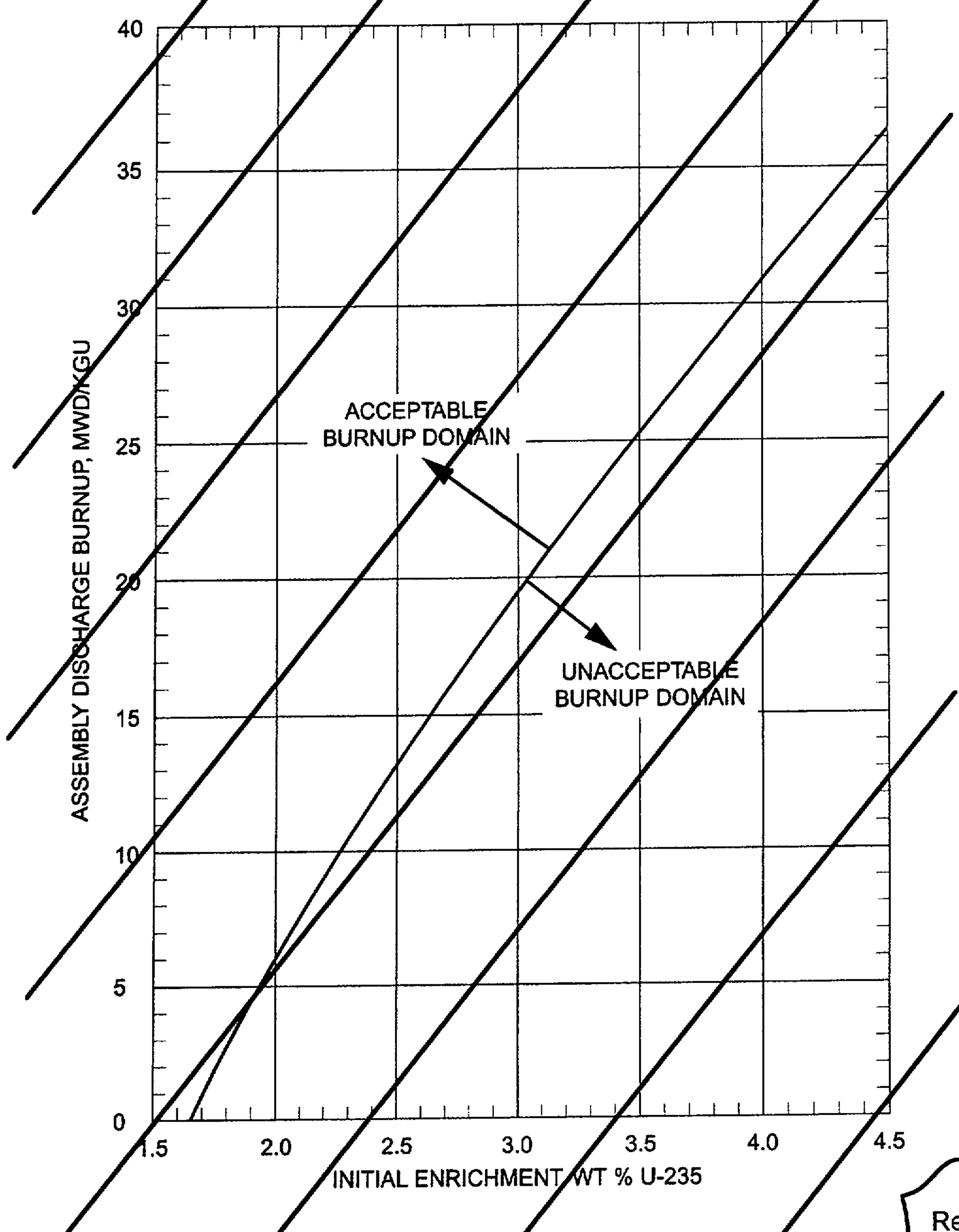
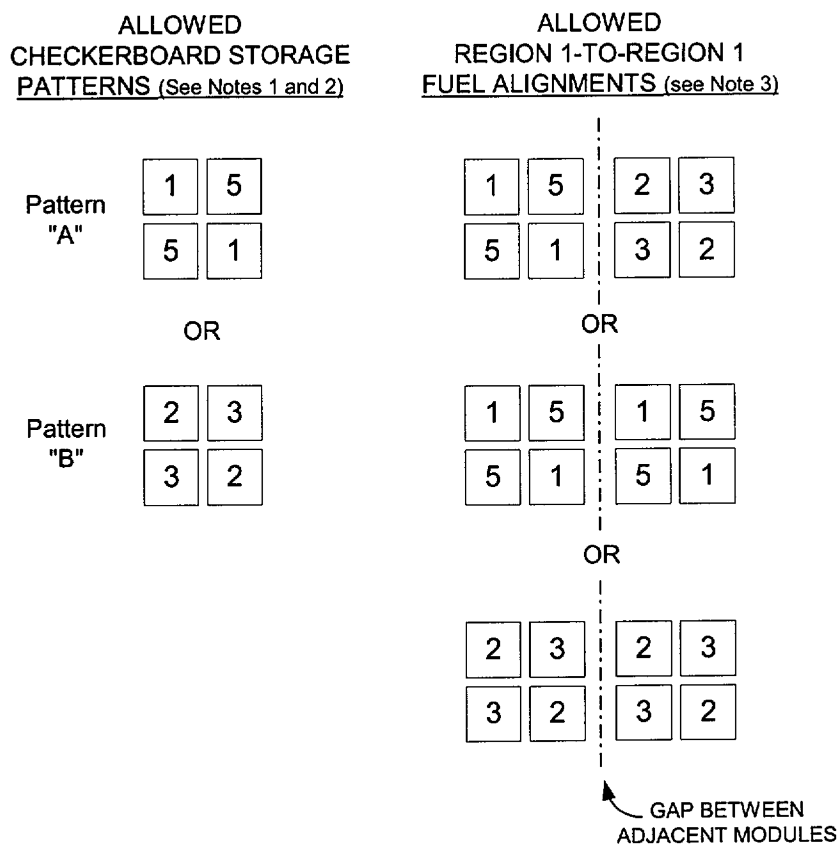


FIGURE 5.6-1

INITIAL ENRICHMENT VS. BURNUP REQUIREMENTS FOR STORAGE OF FUEL ASSEMBLIES IN REGION 2

Replace With New Figure 5.6-1



<u>NOTES</u>:

1. Numbering denotes fuel assembly type. Minimum burnup requirements for fuel assembly types 1, 2, 3, and 5 are defined in Tables 5.6-1 and 5.6-2.
2. The storage arrangement of fuel within a rack module may contain more than one pattern. Different fuel storage patterns within a rack module must be separated by an empty row of cells.
3. Interface restrictions on fuel placement apply between adjacent Region 1 rack modules. No interface restrictions apply between Region 1 racks and adjacent Region 2 racks.
4. Open cells within any checkerboard pattern are acceptable.

Figure 5.6-1

Allowable Region 1 Storage Patterns and Fuel Alignments

ALLOWED
CHECKERBOARD STORAGE
PATTERNS (See Notes 1 and 2)

4	7
7	4

Pattern "C"

OR

3 + CEA	3
3	3 + CEA

Pattern "D"

OR

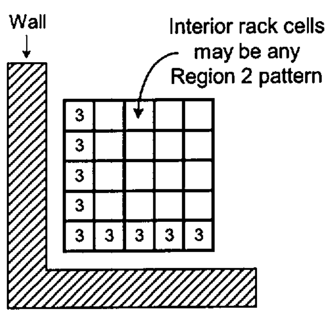
6	6
6	6

Pattern "E"

RACK INTERFACE
RESTRICTIONS

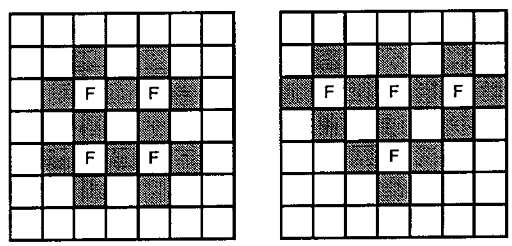
NONE

ALLOWED SPECIAL
ARRANGEMENTS:



(See Note 3)

Fresh Fuel Assemblies in Pattern "C" or Pattern "E" racks



F = FRESH FUEL ASSEMBLY

▒ = EMPTY CELL (See Note 4)

NOTES:

1. Numbering denotes fuel assembly type. Minimum burnup requirements for fuel assembly types 3, 4, 6, and 7 are defined in Tables 5.6-1 and 5.6-2.
2. The storage arrangement within a rack module may contain more than one checkerboard pattern (patterns "C," "D," or "E") provided an empty row of cells separates the patterns.
3. Fuel in peripheral cells need not contain CEAs. An empty row of cells separating these peripheral cells from the interior pattern is not required. Cells on the Region 2 periphery that form interior corners do not qualify for this arrangement.
4. Cells required to be empty as part of an allowed special arrangement may contain non-actinide material, such as an empty fuel assembly skeleton, as long as the material occupies no more than 75% of the cell volume.
5. Open cells within any checkerboard pattern are acceptable.

Figure 5.6-2

Allowable Region 2 Storage Patterns and Arrangements

Table 5.6-1
Minimum Burnup as a Function of Enrichment for Non-Blanketed Assemblies

Fuel Type	Cooling Time	Coefficients			Minimum Burnup (GWd/MTU) for Initial Enrichment			
		A	B	C	1.9 w/o	2.5 w/o	3.0 w/o	3.8 w/o
1	0 years	0.00	9.31	-24.39	0.00	0.00	3.54	10.99
2	0 years	0.00	10.51	-22.35	0.00	3.93	9.18	17.59
3	0 years	0.00	10.97	-14.71	6.13	12.72	18.20	26.98
4	0 years	-0.41	17.00	-21.39	9.43	18.55	25.92	37.29
	12 years	-0.54	16.22	-20.63	8.24	16.55	23.17	33.21
	15 years	-0.53	15.86	-20.07	8.15	16.27	22.74	32.54
	20 years	-0.46	15.11	-18.80	8.25	16.10	22.39	31.98
5	0 years	-0.74	17.49	-19.72	10.84	19.38	26.09	36.06
	5 years	-0.56	15.64	-17.65	10.04	17.95	24.23	33.70
6	0 years	-0.41	17.70	-17.97	14.18	23.72	31.44	43.37
	12 years	0.04	13.10	-12.56	12.47	20.44	27.10	37.80
	15 years	0.13	12.38	-11.83	12.16	19.93	26.48	37.09
	20 years	0.26	11.56	-11.16	11.74	19.37	25.86	36.52
7	0 years	-0.65	20.08	-16.52	19.29	29.62	37.87	50.40
	12 years	-0.65	17.76	-15.58	15.82	24.76	31.85	42.52
	15 years	-0.43	16.25	-13.84	15.48	24.10	31.04	41.70
	20 years	0.12	12.90	-9.61	15.33	23.39	30.17	41.14

NOTES:

1. Enter this table for a "non-blanketed assembly"; defined as a fuel assembly without any designed axial variation in uranium-235 enrichment to control the axial burnup distribution.

2. To qualify in a fuel type, the calculated burnup of a fuel assembly must exceed the "minimum burnup" given in the table for the "cooling time" and "initial enrichment" of the fuel assembly. Alternatively, for fuel assembly characteristics between the increments depicted in the table, "minimum burnup" may be calculated by inserting the "coefficients" for the associated "type" and "cooling time" into the polynomial function:

   $BU = A*E^2 + B*E + C$ where:

   BU = Minimum Burnup (GWD/MTU)
   E = Initial Maximum Planar Average Enrichment (weight percent uranium-235)
   A, B, C = Coefficients

3. Interpolation between values of cooling time is not permitted.

Table 5.6-2
Minimum Burnup as a Function of Enrichment for Blanketed Assemblies

Fuel Type	Cooling Time	Coefficients			Minimum Burnup (GWd/MTU) for Initial Enrichment				
		A	B	C	2.5 w/o	3.0 w/o	3.5 w/o	4.0 w/o	4.5 w/o
1	0 years	0.00	9.31	-24.39	0.00	3.54	8.20	12.85	17.51
2	0 years	0.00	10.51	-22.35	3.93	9.18	14.44	19.69	24.95
3	0 years	0.00	10.97	-14.71	12.72	18.20	23.69	29.17	34.66
4	0 years	-0.98	18.97	-22.54	18.76	25.55	31.85	37.66	42.98
	5 years	-0.74	16.54	-19.10	17.63	23.86	29.73	35.22	40.35
	10 years	-0.57	14.73	-16.49	16.77	22.57	28.08	33.31	38.25
	15 years	-0.46	13.54	-14.70	16.28	21.78	27.06	32.10	36.92
	20 years	-0.41	12.98	-13.74	16.15	21.51	26.67	31.62	36.37
5	0 years	-0.74	17.49	-19.72	19.38	26.09	32.43	38.40	44.00
	5 years	-0.56	15.64	-17.65	17.95	24.23	30.23	35.95	41.39
6	0 years	-0.24	14.23	-10.38	23.70	30.15	36.49	42.70	48.80
	5 years	-0.20	13.10	-9.24	22.26	28.26	34.16	39.96	45.66
	10 years	-0.23	12.70	-9.27	21.04	26.76	32.36	37.85	43.22
	15 years	-0.32	13.02	-10.48	20.07	25.70	31.17	36.48	41.63
	20 years	-0.47	14.08	-12.85	19.41	25.16	30.67	35.95	40.99
7	0 years	-0.84	19.25	-13.42	29.46	36.77	43.67	50.14	56.20
	5 years	-0.72	17.40	-12.03	26.97	33.69	40.05	46.05	51.69
	10 years	-0.66	16.32	-11.46	25.22	31.56	37.58	43.26	48.62
	15 years	-0.67	16.00	-11.73	24.08	30.24	36.06	41.55	46.70
	20 years	-0.76	16.45	-12.81	23.57	29.70	35.46	40.83	45.83

NOTES:

1. Enter this table for a "blanketed assembly"; defined as a fuel assembly with designed axial variation in uranium-235 enrichment to control the axial burnup distribution. Use Table 5.6-1 to characterize blanketed assemblies having a central zone initial planar average enrichment of less than 2.5 w/o.

2. To qualify in a fuel type, the calculated burnup of a fuel assembly must exceed the "minimum burnup" given in the table for the "cooling time" and "initial enrichment" of the fuel assembly. Alternatively, for fuel assembly characteristics between the increments depicted in the table, "minimum burnup" may be calculated by inserting the "coefficients" for the associated "type" and "cooling time" into the polynomial function: $BU = A*E^2 + B*E + C$

   where: BU = Minimum Burnup (GWD/MTU)
   E = Initial Maximum Planar Average Enrichment (weight percent uranium-235)
   A, B, C = Coefficients

3. Interpolation between values of cooling time is not permitted.

ST. LUCIE UNIT 1 WORD-PROCESSED TECHNICAL SPECIFICATION PAGES

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5-6a*
5-6b (Figure 5.6-1)
5-6c (Figure 5.6-2)
5-6d (Table 5.6-1)
5-6e (Table 5.6-2)

* Word processing the changes caused spillover onto TS page 5-6a

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

REFUELING OPERATIONS

SPENT FUEL STORAGE POOL

LIMITING CONDITION FOR OPERATION

3.9.11 The Spent Fuel Pool shall be maintained with:

a. The fuel storage pool water level greater than or equal to 23 ft over the top of irradiated fuel assemblies seated in the storage racks, and

b. The fuel storage pool boron concentration greater than or equal to 1720 ppm.

APPLICABILITY: Whenever irradiated fuel assemblies are in the spent fuel storage pool.

ACTION:

a. With the water level requirement not satisfied, immediately suspend all movement of fuel assemblies and crane operations with loads in the fuel storage areas and restore the water level to within its limit within 4 hours.

b. With the boron concentration requirement not satisfied, immediately suspend all movement of fuel assemblies in the fuel storage pool and initiate action to restore the fuel storage pool boron concentration to within the required limit.

c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.11 The water level in the spent fuel storage pool shall be determined to be at least its minimum required depth at least once per 7 days when irradiated fuel assemblies are in the fuel storage pool.

4.9.11.1 Verify the fuel storage pool boron concentration is within limit at least once per 7 days.

DESIGN FEATURES

CONTROL ELEMENT ASSEMBLIES

5.3.2 The reactor core shall contain 73 full length and no part length control element assemblies. The control element assemblies shall be designed and maintained in accordance with the original design provisions contained in Section 4.2.3.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 700°F

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 11,100 ± 180 cubic feet at a nominal T_{avg} of 567°F, when not accounting for steam generator tube plugging.

5.5 EMERGENCY CORE COOLING SYSTEMS

5.5.1 The emergency core cooling systems are designed and shall be maintained in accordance with the original design provisions contained in Section 6.3 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.6 FUEL STORAGE

CRITICALITY

5.6.1.a The spent fuel pool and spent fuel storage racks shall be maintained with:

1. k_{eff} less than 1.0 when fully flooded with unborated water, which includes an allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

DESIGN FEATURES

CRITICALITY (Continued)

2. A nominal 10.12 inches center to center distance between fuel assemblies in Region 1 of the storage racks and a nominal 8.86 inches center to center distance between fuel assemblies in Region 2 of the storage racks.

3. A k_{eff} less than or equal to 0.95 when flooded with water containing 500 ppm boron, including an allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

4. For storage of enriched fuel assemblies, requirements of Criteria 1 and 3 shall be met by positioning fuel in the spent fuel storage racks consistent with the requirements of Specification 5.6.1.b.

5. Vessel Flux Reduction Assemblies (VFRAs), as defined in Section 9.1 of the Updated Final Safety Analysis Report, may be placed in any allowable fuel storage location.

6. Fissile material, not contained in a fuel assembly lattice, shall be stored in accordance with the requirements of Criteria 1 and 3.

b. Loading of spent fuel storage racks shall be controlled as described below. Criteria 2 and 3 below do not apply to the cask pit storage rack.

1. The maximum initial planar average U-235 enrichment of any fuel assembly inserted in a spent fuel storage rack shall be less than or equal to 4.5 weight percent.

2. Fuel placed in Region 1 of the spent fuel pool storage racks shall comply with the storage patterns and alignment restrictions of Figure 5.6-1 and the minimum burnup requirements of Table 5.6-1 and Table 5.6-2.

3. Fuel placed in Region 2 of the spent fuel pool storage racks shall comply with the storage patterns or allowed special arrangements of Figure 5.6-2 and the minimum burnup requirements of Table 5.6-1 and Table 5.6-2. The allowed special arrangement for fresh fuel may be repeated, provided the applicable interface requirements specified by the safety analysis are met.

4. Any fuel satisfying criteria 5.6.1.b.1, including fresh fuel, may be placed in the Region 1 cask pit storage rack.

c. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DESIGN FEATURES

DRAINAGE

5.6.2 The fuel pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

5.6.3 The spent fuel pool is designed and shall be maintained with a storage capacity limited to no more than 1706 fuel assemblies.

5.7 SEISMIC CLASSIFICATION

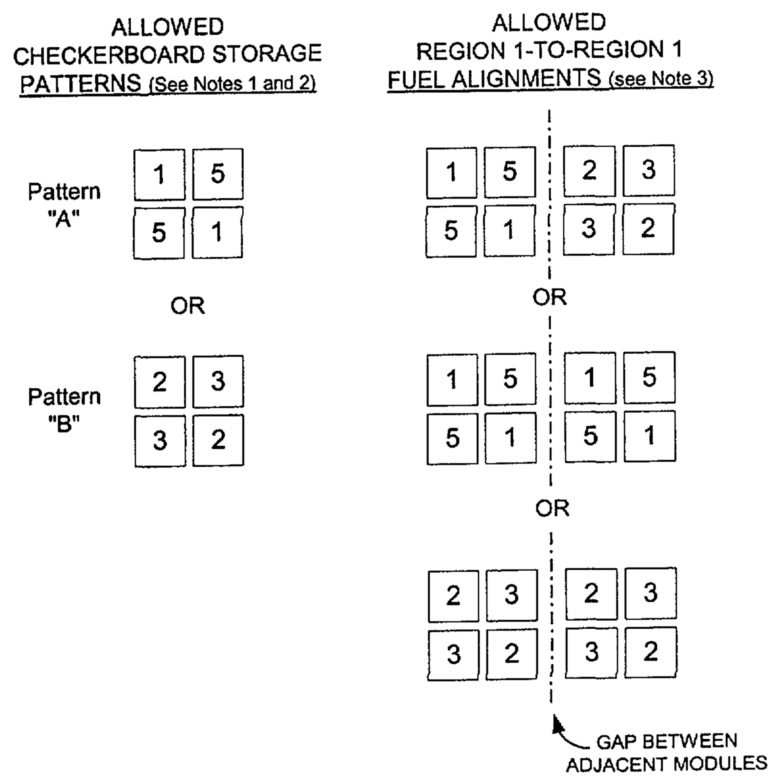
5.7.1 Those structures, systems and components identified as seismic Class I in Section 3.2.1 of the FSAR shall be designed and maintained to the original design provisions contained in Section 3.7 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirement.

5.8 METEOROLOGICAL TOWER LOCATION

5.8.1 The meteorological tower location shall be as shown on Figure 5.1-1.

5.9 COMPONENT CYCLE OR TRANSIENT LIMITS

5.9.1 The components identified in Table 5.9-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.9-1.



<u>NOTES</u>:

1. Numbering denotes fuel assembly type. Minimum burnup requirements for fuel assembly types 1, 2, 3, and 5 are defined in Tables 5.6-1 and 5.6-2.

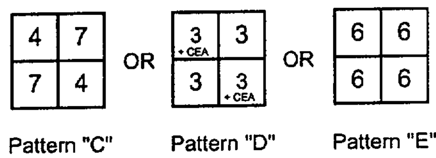
2. The storage arrangement of fuel within a rack module may contain more than one pattern. Different fuel storage patterns within a rack module must be separated by an empty row of cells.

3. Interface restrictions on fuel placement apply between adjacent Region 1 rack modules. No interface restrictions apply between Region 1 racks and adjacent Region 2 racks.

4. Open cells within any checkerboard pattern are acceptable.

FIGURE 5.6-1
Allowable Region 1 Storage Patterns and Fuel Alignments

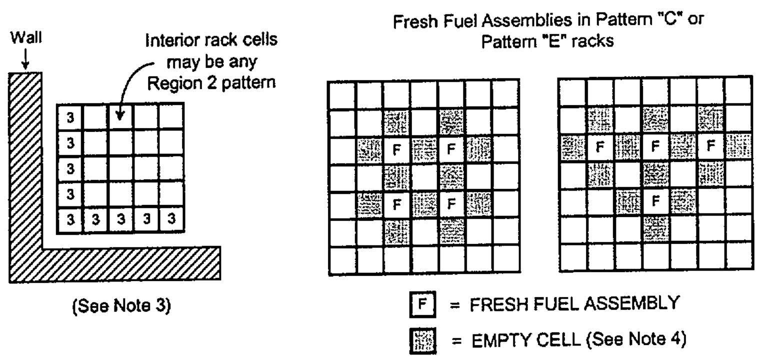
ALLOWED
CHECKERBOARD STORAGE
<u>PATTERNS (See Notes 1 and 2)</u>



RACK INTERFACE
<u>RESTRICTIONS</u>

NONE

ALLOWED SPECIAL
<u>ARRANGEMENTS</u>:



NOTES:

1. Numbering denotes fuel assembly type. Minimum burnup requirements for fuel assembly types 3, 4, 6, and 7 are defined in Tables 5.6-1 and 5.6-2.

2. The storage arrangement within a rack module may contain more than one checkerboard pattern (patterns "C," "D," or "E") provided an empty row of cells separates the patterns.

3. Fuel in peripheral cells need not contain CEAs. An empty row of cells separating these peripheral cells from the interior pattern is not required. Cells on the Region 2 periphery that form interior corners do not qualify for this arrangement.

4. Cells required to be empty as part of an allowed special arrangement may contain non-actinide material, such as an empty fuel assembly skeleton, as long as the material occupies no more than 75% of the cell volume.

5. Open cells within any checkerboard pattern are acceptable.

FIGURE 5.6-2
Allowable Region 2 Storage Patterns and Arrangements

TABLE 5.6-1
Minimum Burnup as a Function of Enrichment for Non-Blanketed Assemblies

Fuel Type	Cooling Time	Coefficients			Minimum Burnup (GWd/MTU) for Initial Enrichment			
		A	B	C	1.9 w/o	2.5 w/o	3.0 w/o	3.8 w/o
1	0 years	0.00	9.31	-24.39	0.00	0.00	3.54	10.99
2	0 years	0.00	10.51	-22.35	0.00	3.93	9.18	17.59
3	0 years	0.00	10.97	-14.71	6.13	12.72	18.20	26.98
4	0 years	-0.41	17.00	-21.39	9.43	18.55	25.92	37.29
	12 years	-0.54	16.22	-20.63	8.24	16.55	23.17	33.21
	15 years	-0.53	15.86	-20.07	8.15	16.27	22.74	32.54
	20 years	-0.46	15.11	-18.80	8.25	16.10	22.39	31.98
5	0 years	-0.74	17.49	-19.72	10.84	19.38	26.09	36.06
	5 years	-0.56	15.64	-17.65	10.04	17.95	24.23	33.70
6	0 years	-0.41	17.70	-17.97	14.18	23.72	31.44	43.37
	12 years	0.04	13.10	-12.56	12.47	20.44	27.10	37.80
	15 years	0.13	12.38	-11.83	12.16	19.93	26.48	37.09
	20 years	0.26	11.56	-11.16	11.74	19.37	25.86	36.52
7	0 years	-0.65	20.08	-16.52	19.29	29.62	37.87	50.40
	12 years	-0.65	17.76	-15.58	15.82	24.76	31.85	42.52
	15 years	-0.43	16.25	-13.84	15.48	24.10	31.04	41.70
	20 years	0.12	12.90	-9.61	15.33	23.39	30.17	41.14

NOTES:

1. Enter this table for a "non-blanketed assembly"; defined as a fuel assembly without any designed axial variation in uranium-235 enrichment to control the axial burnup distribution.

2. To qualify in a fuel type, the calculated burnup of a fuel assembly must exceed the "minimum burnup" given in the table for the "cooling time" and "initial enrichment" of the fuel assembly. Alternatively, for fuel assembly characteristics between the increments depicted in the table, "minimum burnup" may be calculated by inserting the "coefficients" for the associated "type" and "cooling time" into the polynomial function:

   $BU = A*E^2 + B*E + C$ where:

   BU = Minimum Burnup (GWD/MTU)

   E = Initial Maximum Planar Average Enrichment (weight percent uranium-235)

   A, B, C = Coefficients

3. Interpolation between values of cooling time is not permitted.

TABLE 5.6-2
Minimum Burnup as a Function of Enrichment for Blanketed Assemblies

Fuel Type	Cooling Time	Coefficients			Minimum Burnup (GWd/MTU) for Initial Enrichment				
		A	B	C	2.5 w/o	3.0 w/o	3.5 w/o	4.0 w/o	4.5 w/o
1	0 years	0.00	9.31	-24.39	0.00	3.54	8.20	12.85	17.51
2	0 years	0.00	10.51	-22.35	3.93	9.18	14.44	19.69	24.95
3	0 years	0.00	10.97	-14.71	12.72	18.20	23.69	29.17	34.66
4	0 years	-0.98	18.97	-22.54	18.76	25.55	31.85	37.66	42.98
	5 years	-0.74	16.54	-19.10	17.63	23.86	29.73	35.22	40.35
	10 years	-0.57	14.73	-16.49	16.77	22.57	28.08	33.31	38.25
	15 years	-0.46	13.54	-14.70	16.28	21.78	27.06	32.10	36.92
	20 years	-0.41	12.98	-13.74	16.15	21.51	26.67	31.62	36.37
5	0 years	-0.74	17.49	-19.72	19.38	26.09	32.43	38.40	44.00
	5 years	-0.56	15.64	-17.65	17.95	24.23	30.23	35.95	41.39
6	0 years	-0.24	14.23	-10.38	23.70	30.15	36.49	42.70	48.80
	5 years	-0.20	13.10	-9.24	22.26	28.26	34.16	39.96	45.66
	10 years	-0.23	12.70	-9.27	21.04	26.76	32.36	37.85	43.22
	15 years	-0.32	13.02	-10.48	20.07	25.70	31.17	36.48	41.63
	20 years	-0.47	14.08	-12.85	19.41	25.16	30.67	35.95	40.99
7	0 years	-0.84	19.25	-13.42	29.46	36.77	43.67	50.14	56.20
	5 years	-0.72	17.40	-12.03	26.97	33.69	40.05	46.05	51.69
	10 years	-0.66	16.32	-11.46	25.22	31.56	37.58	43.26	48.62
	15 years	-0.67	16.00	-11.73	24.08	30.24	36.06	41.55	46.70
	20 years	-0.76	16.45	-12.81	23.57	29.70	35.46	40.83	45.83

NOTES:

1. Enter this table for a "blanketed assembly"; defined as a fuel assembly with designed axial variation in uranium-235 enrichment to control the axial burnup distribution. Use Table 5.6-1 to characterize blanketed assemblies having a central zone initial planar average enrichment of less than 2.5 w/o.

2. To qualify in a fuel type, the calculated burnup of a fuel assembly must exceed the "minimum burnup" given in the table for the "cooling time" and "initial enrichment" of the fuel assembly. Alternatively, for fuel assembly characteristics between the increments depicted in the table, "minimum burnup" may be calculated by inserting the "coefficients" for the associated "type" and "cooling time" into the polynomial function:

   $BU = A*E^2 + B*E + C$ where:

   BU = Minimum Burnup (GWD/MTU)

   E = Initial Maximum Planar Average Enrichment (weight percent uranium-235)

   A, B, C = Coefficients

3. Interpolation between values of cooling time is not permitted

ST. LUCIE UNIT 1
PROPOSED TECHNICAL SPECIFICATION BASES CHANGES
(Information Only)

TS 3/4.9 Bases Table of Contents
TS 3/4.9.11 Bases

SECTION NO.: 3/4.9 REVISION NO.: 2	TITLE: TECHNICAL SPECIFICATIONS BASES ATTACHMENT 11 OF ADM-25.04 REFUELING OPERATIONS ST. LUCIE UNIT 1	PAGE: 2 of 8

TABLE OF CONTENTS

3/4.9 REFUELING OPERATIONS (continued)

BASES (continued)

3/4.9.8 SHUTDOWN COOLING AND COOLANT CIRCULATION (continued)

The requirement to have two shutdown cooling loops OPERABLE when there is less than 23 feet of water above the irradiated fuel in the core ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay heat removal capability. With the reactor vessel head removed and 23 feet of water above the irradiated fuel in the core, a large heat sink is available for core cooling, thus in the event of a failure of the operating shutdown cooling loop, adequate time is provided to initiate emergency procedures to cool the core.

3/4.9.9 CONTAINMENT ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment isolation valves will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material resulting from a fuel handling accident of a recently irradiated fuel assembly from the containment atmosphere to the environment. /R2

Recently irradiated fuel is defined as fuel that has occupied part of a critical reactor core within the previous 72 hours. /R2

3/4.9.4.10 and 3/4.9.11 WATER LEVEL – REACTOR VESSEL AND STORAGE POOL WATER LEVEL

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the accident analysis.

REPLACE WITH INSERT C

3/4.9.12 FUEL POOL VENTILATION SYSTEM – FUEL STORAGE

The limitations on the fuel handling building ventilation system ensures that all radioactive material released from a recently irradiated fuel assembly will be filtered through the HEPA filters and charcoal adsorber prior to discharge to the atmosphere. The OPERABILITY of this system and the resulting iodine removal capacity are consistent with the assumptions of the fuel handling accident analyses. /R2

Insert to Unit 1 TS 3/4.9.11 Bases

Insert C:

3/4.9.10 WATER LEVEL – REACTOR VESSEL

The restriction on minimum water level over the top of irradiated fuel assemblies ensures that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an assembly. The minimum water depth is consistent with the assumptions of the fuel handling accident analysis.

3/4.9.11 SPENT FUEL STORAGE POOL

The restriction on minimum water level over the top of irradiated fuel assemblies ensures that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an assembly. The minimum water depth is consistent with the assumptions of the fuel handling accident analysis.

The restriction on the minimum soluble boron concentration in the spent fuel storage pool ensures that if a boron dilution event should occur, the concentration of soluble boron remaining in the pool after the event is terminated is sufficient to maintain k_{eff} less than or equal to 0.95, consistent with the criticality analyses for the SFP storage racks (see TS 5.6.1.a.3).

St. Lucie Unit 1
Docket No. 50-335
Proposed License Amendment
Spent Fuel Pool Soluble Boron Credit

L-2002-221
Enclosure 1

AFFIDAVIT PURSUANT TO 10 CFR 2.790

(5 pages including this page)

AFFIDAVIT PURSUANT TO 10CFR2.790

I, Scott H. Pellet, being duly sworn, depose and state as follows:

(1) I am the Project Manager for Holtec International and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the document entitled "St. Lucie Unit 1 Spent Fuel Pool Storage Rack Boraflex Degradation Remedy," Holtec Report HI-2022940, revision 0. The proprietary material in this document is delineated by proprietary designation (i.e., shaded text) on pages 4-26, 4-27, and 4-29.

(3) In making this application for withholding of proprietary information of which it is the owner, Holtec International relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4), 2.790(a)(4), and 2.790(b)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by Holtec's competitors without license from Holtec International constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

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c. Information which reveals cost or price information, production, capacities, budget levels, or commercial strategies of Holtec International, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future Holtec International customer-funded development plans and programs of potential commercial value to Holtec International;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 4.a, 4.b, 4.d, and 4.e, above.

(5) The information sought to be withheld is being submitted to the NRC in confidence. The information (including that compiled from many sources) is of a sort customarily held in confidence by Holtec International, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by Holtec International. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within Holtec International is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures

outside Holtec International are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information classified as proprietary was developed and compiled by Holtec International at a significant cost to Holtec International. This information is classified as proprietary because it contains detailed historical data and analytical results not available elsewhere. This information would provide other parties, including competitors, with information from Holtec International's technical database and the results of evaluations performed using codes developed by Holtec International. Release of this information would improve a competitor's position without the competitor having to expend similar resources for the development of the database. A substantial effort has been expended by Holtec International to develop this information.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to Holtec International's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of Holtec International's comprehensive spent fuel storage technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by Holtec International.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

Holtec International's competitive advantage will be lost if its competitors are able to use the results of the Holtec International experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to Holtec International would be lost if the

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information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive Holtec International of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF NEW JERSEY)

) ss:

COUNTY OF BURLINGTON)

Scott H. Pellet, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Marlton, New Jersey, this 12th day of November, 2002.

Scott H. Pellet

Mr. Scott H. Pellet
Holtec International

Subscribed and sworn before me this 12th day of November, 2002.

Maria C Pepe

MARIA C. PEPE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 25, 2005