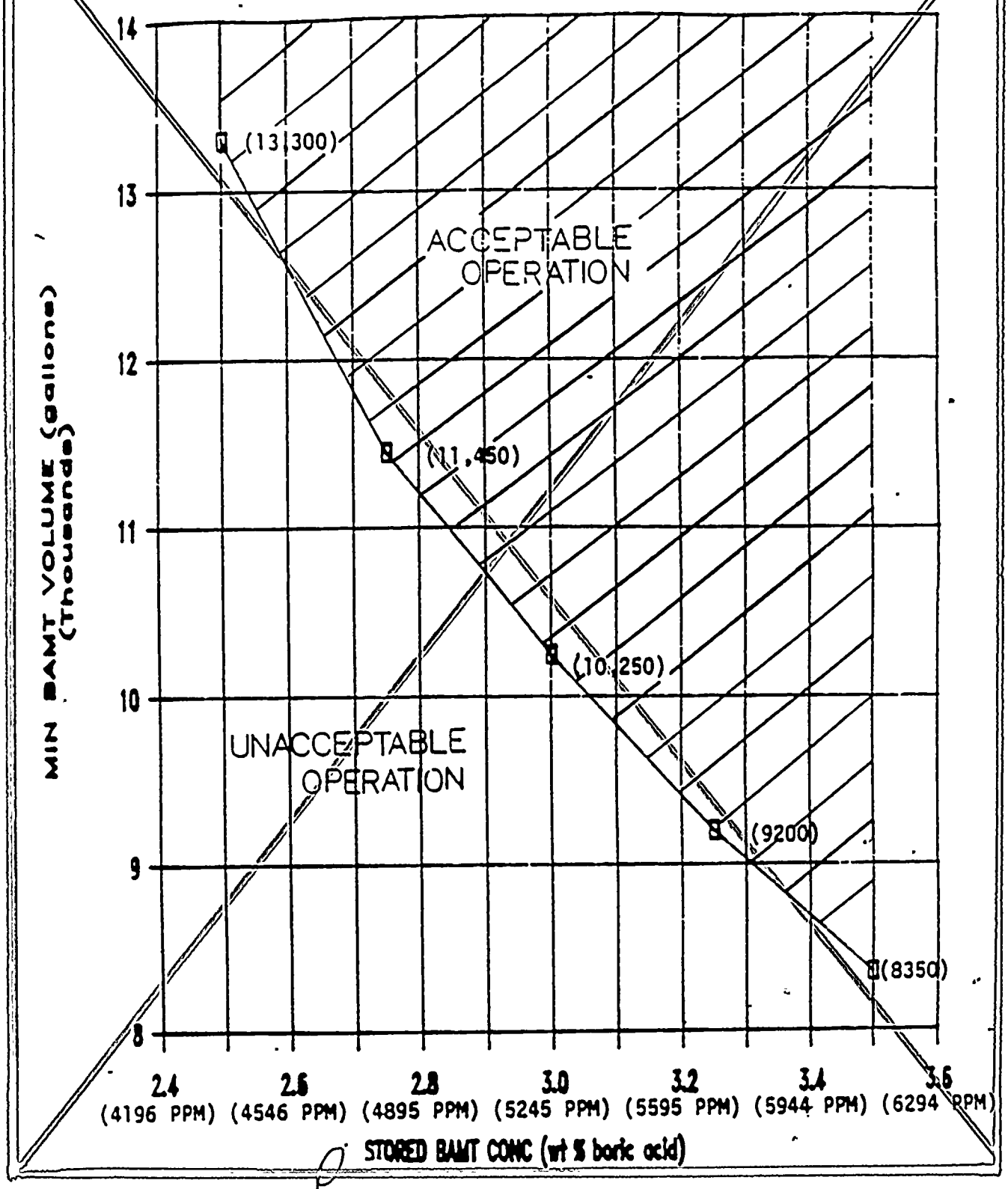
St. Lucie Unit 1
Docket No. 50-335
Proposed License Amendment
Boric Acid Makeup Tank Minimum
Inventory Requirements

ATTACHMENT 1

ST. LUCIE UNIT 1 MARKED-UP TECHNICAL SPECIFICATION PAGES

Page	3/4 1-17
Insert	A (Revised Figure 3.1-1)
Page	3/4 1-18
Page	B 3/4 1-2

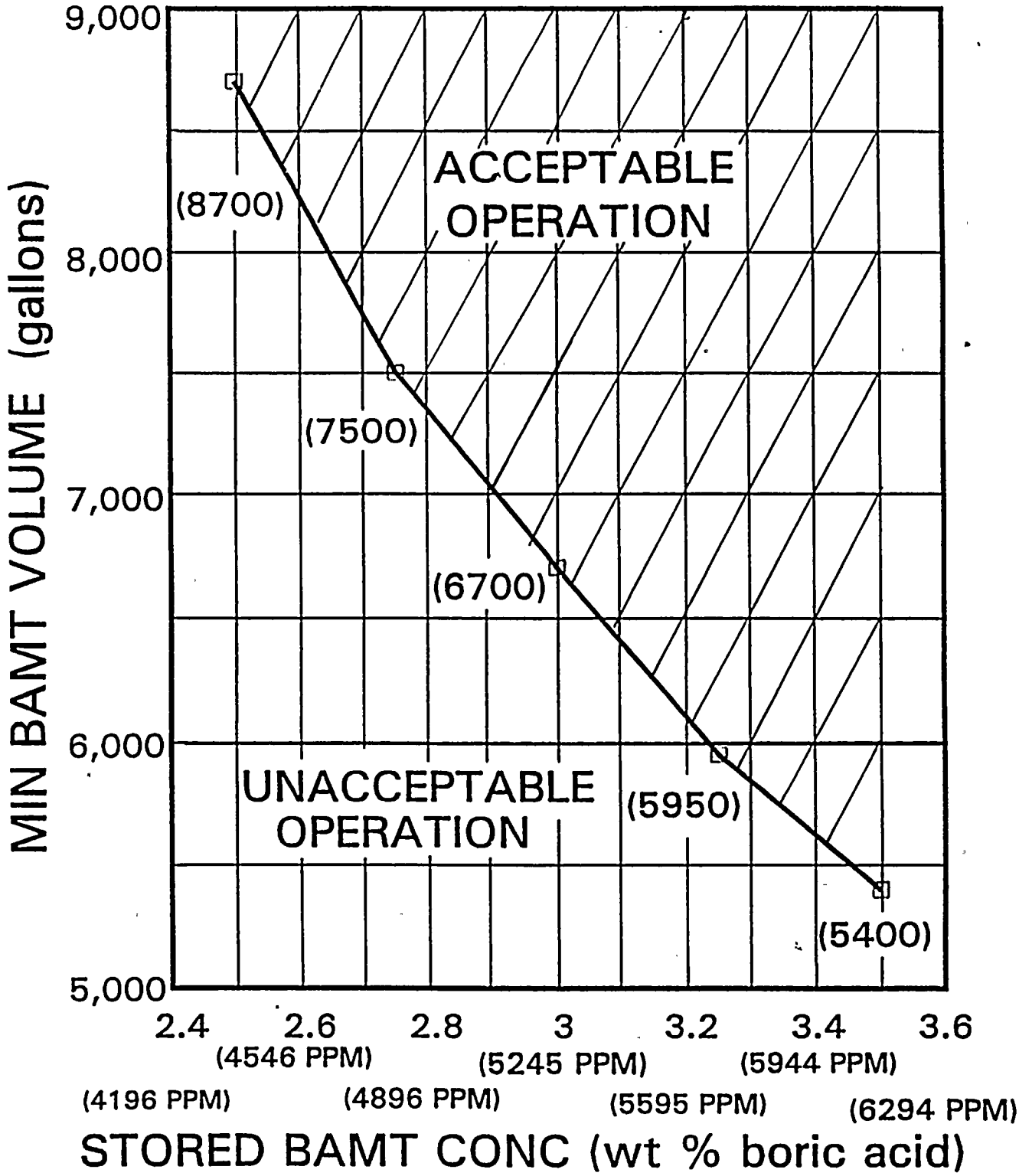
FIGURE 3.1-1 ST.LUCIE 1 MIN BAMT VOLUME VS STORED BAMT CONCENTRATION



REPLACE WITH INSERT - A FROM NEXT PAGE

FIGURE 3.1-1 ST. LUCIE 1 MIN BAMT VOLUME

VS STORED BAMT CONCENTRATION



INSERT -A

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION.

3.1.2.8 At least two of the following four borated water sources shall be OPERABLE:

a. Boric Acid Makeup Tank 1A in accordance with Figure 3.1-1. ~~and in the range of 3.2 to 3.5 weight percent boric acid (5595 to 6119 ppm boron)~~. delete

b. Boric Acid Makeup Tank 1B in accordance with Figure 3.1-1. ~~and in the range of 3.2 to 3.5 weight percent boric acid (5595 to 6119 ppm boron)~~. delete

c. Boric Acid Makeup Tanks 1A and 1B with a minimum combined contained borated water volume in accordance with Figure 3.1-1.

d. The refueling water tank with:

1. A minimum contained volume of 401,800 gallons of water,

2. A minimum boron concentration of 1720 ppm,

3. A maximum solution temperature of 100°F,

4. A minimum solution temperature of 55°F when in MODES 1 and 2, and

5. A minimum solution temperature of 40°F when in MODES 3 and 4.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With only one borated water source OPERABLE, restore at least two borated water sources to OPERABLE status within 72 hours or make the reactor subcritical within the next 2 hours and borate to a SHUTDOWN MARGIN equivalent to at least 2000 pcm at 200°F; restore at least two borated water sources to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

SURVEILLANCE REQUIREMENTS

4.1.2.8 At least two borated water sources shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the boron concentration in each water source,

3/4.1.1.5 MINIMUM TEMPERATURE FOR CRITICALITY

The MTC is expected to be slightly negative at operating conditions. However, at the beginning of the fuel cycle, the MTC may be slightly positive at operating conditions and since it will become more positive at lower temperatures, this specification is provided to restrict reactor operation when T_{avg} is significantly below the normal operating temperature.

3/4.1.2 BORATION SYSTEMS

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from all operating conditions of 2000 pcm after xenon decay and cooldown to 200°F. The maximum boration capability requirement occurs at EOL from full power equilibrium xenon conditions. This requirement can be met for a range of boric acid concentrations in the Boric Acid Makeup Tanks (BAMTs) and Refueling Water Tank (RWT). This range is bounded by ~~8350~~ 5400 gallons of 3.5 weight percent (6119 ppm boron) boric acid from the BAMTs and ~~14,000~~ 17,000 gallons of 1720 ppm borated water from the RWT to ~~13,300~~ 8700 gallons of 2.5 weight percent (4371 ppm boron) boric acid from the BAMTs and ~~9,000~~ 13,000 gallons of 1720 ppm borated water from the RWT. A minimum of 45,000 gallons of 1720 ppm boron is required from the RWT if it is to be used to borate the RCS alone.

The requirements for a minimum contained volume of 401,800 gallons of borated water in the refueling water tank ensures the capability for borating the RCS to the desired level. The specified quantity of borated water is consistent with the ECCS requirements of Specification 3.5.4. Therefore, the larger volume of borated water is specified here too.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity change in the event the single injection system becomes inoperable.

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ATTACHMENT 2

EVALUATION OF PROPOSED TS CHANGES

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Introduction

Florida Power and Light Company (FPL) proposes to change the St. Lucie Unit 1 (PSL1) Technical Specifications (TS) which define the operable borated water sources required for Modes 1, 2, 3, and 4. The proposed revision adjusts the minimum required Boric Acid Makeup Tank (BAMT) liquid volume as a function of stored boric acid concentration such that a single BAMT will be capable of holding the entire range of specified inventories. The revised requirements are based on a recently completed operational analysis that employed conservative physics parameters representing present and planned PSL1 core reloads in conjunction with a previously approved plant cooldown methodology. The analysis demonstrates that the required reactivity control can be assured by a range of BAMT inventories that are less than those required by existing Limiting Condition for Operation (LCO) 3.1.2.8. The proposed BAMT inventory requirements will improve operational flexibility and are similar to the corresponding TS requirements for St. Lucie Unit 2.

Description of Changes

TS Figure 3.1-1, "St. Lucie 1 Minimum BAMT Volume vs. Stored BAMT Concentration," is revised to reflect a reduced volume requirement corresponding to the existing range of boric acid concentrations.

TS 3.1.2.8.a and 3.1.2.8.b are revised by deleting the presently stated range of boric acid concentration and ppm boron.

The Bases for LCO 3/4.1.2 (Page B 3/4 1-2) are updated to show the revised BAMT and Refueling Water Tank (RWT) volumes which conservatively bound the range of boric acid concentrations utilized to meet the maximum boration capability requirement.

Background

The boric acid makeup system provides assurance that the required shutdown margin is met during all modes of reactor operation by injecting borated water into the Reactor Coolant System (RCS). Two BAMTs, each having a maximum capacity of 9700 gallons (only 9450 gallons assumed useable), serve as storage tanks for the makeup

system during normal plant operating conditions. The Refueling Water Tank (RWT) serves as a borated water source for accident mitigation and can also be used in conjunction with the BAMTs for normal operations, including plant cooldown. Credit is not taken for boron addition to the RCS from the BAMTs for the purpose of reactivity control in the accidents analyzed in Chapter 15 of the PSL1 Final Safety Analysis Report.

Combustion Engineering Report CEN-353(F), "Boric Acid Concentration Reduction Effort, Technical Bases and Operational Analysis," served as the technical basis for the BAMT inventory requirements established by existing Figure 3.1-1 and TS 3.1.2.8 (Amendment 94 to Facility Operating License No. DPR-67; June 6, 1988). Figure 3.1-1 specifies the minimum required BAMT liquid volume (contained in one or both tanks) as a function of stored boric acid concentration over the range of 2.5 - 3.5 weight percent (wt%). The figure is consistent with the analytical results of CEN-353(F) which defined, in part, the plant conditions at operating Modes 1 through 4 that will conservatively maintain the required safe shutdown margin.

TS 3.1.2.8 requires at least two independent borated water sources during operation in Modes 1 through 4. Since the sources need only include one BAMT (1A or 1B) to satisfy this LCO, and considering that one BAMT has a maximum capacity of 9700 gallons, a minimum individual BAMT boric acid concentration of 3.2 wt% is specified in TS 3.1.2.8.a and b. This constraint results in limiting the range of permissible inventories for the selected tank to a very narrow operating band of Figure 3.1-1, e.g., approximately 9450 gallons at 3.2 wt% to 8350 gallons at 3.5 wt% boric acid concentration. The full range of BAMT inventories shown in Figure 3.1-1 (13,300 gallons at 2.5 wt% to 8350 gallons at 3.5 wt%) is permissible only if the combined borated water volume of both BAMTs is used in conjunction with the RWT to satisfy the LCO.

A reassessment of CEN-353(F) was made to determine if operating flexibility could be achieved whereby the required quantity of stored borated water inventories could be reduced and the narrow operating band (approx. 1100 gallons and 0.3 wt% boric acid) for a single BAMT could be expanded within the scope of concentrations available from Figure 3.1-1. The result of this effort is CEN-353(F), Revision 3 with Supplement 1 (Enclosure 1 to this submittal).

Evaluation

The minimum volume of borated water stored in the BAMTs is proposed to be reduced from the range of 8,350 - 13,300 gallons to the range of 5,400 - 8,700 gallons for Modes 1 through 4. The corresponding range of stored boric acid concentrations in the BAMTs is 3.5 - 2.5 wt%, respectively. This range of concentrations is the same as previously approved by Amendment No. 94 to the Unit 1 Facility Operating License.

The methodology and analytical results to support the request for changes to Figure 3.1-1 and TS 3.1.2.8 are documented in Combustion Engineering Report CEN-353(F), Revision 3 with Supplement 1 (Enclosure 1 to this submittal). Calculations are included for the boron concentration required in the RCS to maintain a safe shutdown margin during all plant operational modes and for the stored borated water inventory that must be available to meet these demands. The shutdown margin requirements are consistent with those specified in TS 3.1.1.1 and 3.1.1.2 for Modes 1 through 4, and 5 through 6, respectively. The scenario utilized to define the boration requirements for the most limiting time in core cycle, the cooldown methodology, and the calculational methodology employed in this analysis are the same as those used in the technical basis for the existing TS.

Required RCS Boron Concentration: Utilizing the previously documented methodology of CEN-353(F), refined core physics data (Appendix 5 of Enclosure 1) which conservatively bound present and future planned PSL1 core reloads were applied to the analysis. Analytical and measurement uncertainties were included in the analysis to ensure that the upper bound boron requirements were predicted for all operational modes. The analytical results of Revision 3 to CEN-353(F) show that the shutdown margin requirements are assured by a smaller RCS boron concentration than was predicted by earlier analyses.

Available Borated Water Inventory (Figure 3.1-1): The reduction in required RCS boron concentration facilitates a reduced inventory of stored borated water in the makeup system. Additional BAMT inventory reductions were possible by increasing the makeup water provided by the RWT during the plant cooldown scenario. Assuming no change in the approved range of stored boric acid concentration of 2.5 - 3.5 wt% in the BAMTs, the amount of boration that will satisfy the RCS requirements was determined. Conservative assumptions were utilized to maximize the boration demand. These

assumptions are similar to those used in the technical basis for the existing inventory requirements. The additional demand on RWT inventory has no impact on the existing TS minimum required volumes and boron concentrations.

The volume reduction analysis in Revision 3 to CEN-353(F) contains an adjustment of +1000 gallons to the calculated BAMT inventories to provide additional borated water for auxiliary spray while depressurizing the RCS to below High Pressure Safety Injection (HPSI) pump shutoff head (page 29 of Enclosure 1). This allowance is based on an assumption that motor operated valve V2504, which aligns the RWT to the charging pump suction, fails to automatically open when required by low Volume Control Tank (VCT) level. Supplement 1 to Revision 3 of CEN-353(F), however, provides final volume adjustments to arrive at the proposed inventory range for Figure 3.1-1. These adjustments include: (a) +500 gallon allowance for conservatism and (b) removal of the +1000 gallon allowance for supplying auxiliary spray from the BAMTs. Removal of the auxiliary spray allowance is based on taking credit for manual handwheel operation of V2504. These supplementary BAMT volume adjustments were found acceptable in a similar analysis for St. Lucie Unit 2 (Amendment No. 40 to Facility Operating License NPF-16; March 13, 1989) and are equally applicable to PSL1.

TS 3.1.2.8.a and 3.1.2.8.b: These specifications include a limitation on individual BAMT boric acid concentration of 3.2 wt% (minimum) unless the combined volumes of both BAMT 1A and 1B are being used in conjunction with the RWT to satisfy the Borated Water Sources LCO. The restriction resulted from recognition that the two independent borated water sources required by TS 3.1.2.8 need only include one BAMT and that the full range of existing Figure 3.1-1 inventories required for the concentration range of 3.5 - 2.5 wt% exceeded the capacity of either tank. The proposed stored inventory range of 5,400 - 8,700 gallons corresponding to boric acid concentrations of 3.5 - 2.5 wt%, respectively, is within the capacity of a single BAMT (assumed useable volume 9450 gallons). Therefore, the limitation of 3.2 wt% (minimum) for the boric acid concentration in an individual BAMT is no longer required.

Transients and Accidents: Credit is not taken for boron addition to the RCS from the BAMTs for the purpose of reactivity control in the accidents analyzed in Chapter 15 of the UFSAR. Therefore, the response of an operator to such events as steam line break, overcooling, boron dilution, et.al., will not be affected by a reduction in BAMT stored inventory and the minimum RWT inventory

required by existing TS will remain unchanged. In addition, action statements that are included in the TS to mitigate a loss of the required safe shutdown margin are conservatively based on use of the RWT to provide that boration capability and these TS will likewise be unaffected by the proposed BAMT inventories.

Containment Sump pH Calculations and Spray Additive System: FPL previously evaluated the high and low containment sump pH for post-accident conditions considering the maximum and minimum boric acid concentrations and water volumes for all available borated water sources in conjunction with worst-case mixing of these inventories. The associated calculations involved the determination of pH values at the Containment Spray nozzles as well as in the containment sump to determine the existing requirements for the caustic (NaOH) additive to the spray system. The required Sodium Hydroxide Chemical Storage Tank NaOH concentrations are consistent with the required pH values at the spray nozzles and are presently specified in TS 3.6.2.2.

Similarly, FPL evaluated the impact of the proposed BAMT inventory reduction on the pH at the spray nozzles and in the containment sump by revising the previous calculations. The results of the revised calculations show that both the containment sump pH and the spray nozzle exit pH will remain within the required range of 8.5 to 11.0. Therefore, modifications are not required to the caustic addition (NaOH) system as a result of this proposal.

Conclusion

The proposed Figure 3.1-1 and TS 3.1.2.8 are supported by the analytical results of an evaluation utilizing previously approved methodologies, worst-case assumptions, and allowances for uncertainties. The core physics data utilized in the analyses bound the present and future planned core designs for PSL1 and are required to be reviewed prior to core reload to verify that the data remains bounding. The revised BAMT inventories will continue to provide assurance that the safe shutdown margins specified in the Technical Specifications can be met for the most limiting conditions during core fuel cycles. The RWT requirements for accident mitigation have not been altered and the containment spray caustic addition system will continue to satisfy post-accident acceptance criteria. For these reasons, FPL considers that the proposed BAMT inventory requirements are acceptable.

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ATTACHMENT 3

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Pursuant to 10CFR50.92, 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; or (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) Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The proposed amendment will reduce the minimum borated water inventory required to be stored in the Boric Acid Makeup Tanks (BAMT) during unit operation in Modes 1 through 4. The reduction in BAMT inventory will not affect any equipment postulated to malfunction in the Updated Final Safety Analysis Report (UFSAR) to initiate an accident nor will it impact the operation of any other equipment whose malfunction could adversely affect safety- related structures, systems, or components. Credit is not taken for boron addition to the Reactor Coolant System from the BAMTs for purposes of reactivity control in accidents analyzed in the UFSAR. The minimum required capability to achieve and maintain safe shutdown for such events has not been altered. Therefore, operation of the facility in accordance with the proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

(2) Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any accident previously evaluated.

The reduction in minimum required BAMT inventory does not change the boration system function, configuration, operation, or design basis as described in the UFSAR. The proposed change does not alter the modes of plant operation and does not affect the operation of safety-related structures, systems, or components.

Therefore, operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

The reduced BAMT minimum inventory requirements are defined by analyses that utilize an approved plant cooldown scenario and conservative physics parameters representative of the present and future planned reactor core designs for St. Lucie Unit 1. The analytical methodology employed to determine the revised inventory requirements is the same as that used to establish the existing inventory requirements. The existing reactivity control Limiting Conditions for Operation (LCO) related to safe shutdown margins and redundant boron flow paths have not been altered. Sufficient quantities of borated water will continue to be stored in the BAMTs to assure compliance with these LCOs during the prescribed plant operating modes. Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

Based on the discussion presented above and on the supporting Evaluation of Proposed TS Changes, FPL has concluded that this proposed license amendment involves no significant hazards consideration.