ATTACHMENT I

Marked-up Technical Specification Pages:

ST. LUCIE UNIT I

3/4 1-6 (with insert)
B 3/4 1-1 (with insert)

ST. LUCIE UNIT 2

3/4 1-5 (with insert)
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SURVEILLANCE REQUIREMENTS (Continued)

4.1.1.4.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each ~~refueling.~~ fuel loading

b. At any THERMAL POWER, within 7 EFPD after ~~initially~~ reaching a RATED THERMAL POWER equilibrium boron concentration of 800 ppm.

Note: delete "initially"

c. ~~At any THERMAL POWER, within 7 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm.~~

Insert attached

INSERT FOR ST. LUCIE UNIT 1

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At any THERMAL POWER, within 7 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm. The MTC determination of this paragraph is not required if the results of Surveillance Requirements 4.1.1.4.2a. and 4.1.1.4.2b. are within a tolerance of ±2.0 pcm/°F from corresponding design values.

3/4.1.1 BORATION CONTROL

3/4.1.1.1 and 3/4.1.1.2 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration, and RCS T_{avg}. The most restrictive condition occurs at EOL, with T_{avg} at no load operating temperature, and is associated with a postulated steam line break accident and resulting uncontrolled RCS cooldown. In the analysis of this accident, a minimum SHUTDOWN MARGIN of 3.6% Δk/k is required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN required by Specification 3.1.1.1 is based upon this limiting condition and is consistent with FSAR accident analysis assumptions. For earlier periods during the fuel cycle, this value is conservative. With $T_{avg} \leq 200°F$, the reactivity transient resulting from a boron dilution event with a partially drained Reactor Coolant System requires a 2% Δk/k SHUTDOWN MARGIN and restrictions on charging pump operation to provide adequate protection. A 2% Δk/k SHUTDOWN MARGIN is 1.0% Δk/k conservative for Mode 5 operation with total RCS volume present, however LCO 3.1.1.2 is written conservatively for simplicity.

3/4.1.1.3 BORON DILUTION AND ADDITION

A minimum flow rate of at least 3000 GPM provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual during boron concentration changes in the Reactor Coolant System. A flow rate of at least 3000 GPM will circulate an equivalent Reactor Coolant System volume of 11,400 cubic feet in approximately 26 minutes. The reactivity change rate associated with boron concentration changes will be within the capability for operator recognition and control.

3/4.1.1.4 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limiting values assumed for the MTC used in the accident and transient analyses were $+ 0.7 \times 10^{-4}$ Δk/k/°F for THERMAL POWER levels < 70% of RATED THERMAL POWER, $+ 0.2 \times 10^{-4}$ Δk/k/°F for THERMAL POWER levels > 70% of RATED THERMAL and $- 2.8 \times 10^{-4}$ Δk/k/°F at RATED THERMAL POWER. Therefore, these limiting values are included in this specification. ~~Determination of MTC at the specified conditions ensures that the maximum positive and/or negative values of the MTC will not exceed the limiting values.~~ (Insert Attached)

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The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. The surveillance requirements for measurement of the MTC during each fuel cycle combined with the Technical Specification Surveillance Requirement 4.1.1.1.2 are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurances that the coefficient will be maintained within acceptable values throughout each fuel cycle.

MODERATOR TEMPERATURE COEFFICIENT

LIMITING CONDITION FOR OPERATION

3.1.1.4 The moderator temperature coefficient (MTC) shall be:

a. Less positive than $+0.5 \times 10^{-4}$ delta k/k/°F at ≤ 70% RATED THERMAL POWER,

b. Less positive than $+0.3 \times 10^{-4}$ delta k/k/°F at > 70% RATED THERMAL POWER, and

c. Less negative than -2.7×10^{-4} delta k/k/°F at RATED THERMAL POWER.

APPLICABILITY: MODES 1 and 2*#

ACTION:

With the moderator temperature coefficient outside any one of the above limits, be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.1.4.1 The MTC shall be determined to be within its limits by confirmatory measurements. MTC measured values shall be extrapolated and/or compensated to permit direct comparison with the above limits.

4.1.1.4.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading.

b. At any THERMAL POWER, within 7 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 800 ppm.

c. ~~At any THERMAL POWER, within 7 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm.~~

Insert attached

*With K_{eff} greater than or equal to 1.0.

#See Special Test Exceptions 3.10.2 and 3.10.5.

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At any THERMAL POWER, within 7 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm. The MTC determination of this paragraph is not required if the results of the tests required in Surveillance requirements 4.1.1.4.2a. and 4.1.1.4.2b. are within a tolerance of ± 2.0 pcm/^{o}F from corresponding design values.

[illegible]

[illegible]

[illegible]

3/4.1.1 BORATION CONTROL

3/4.1.1.1 and 3/4.1.1.2 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration, and RCS T_{avg}. The most restrictive condition occurs at EOL, with T_{avg} at no load operating temperature, and is associated with a postulated steam line break accident and resulting uncontrolled RCS cooldown. In the analysis of this accident, a minimum SHUTDOWN MARGIN of 5.0% delta k/k is required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN requirement is based upon this limiting condition and is consistent with FSAR safety analysis assumptions. At earlier times in core life, the minimum SHUTDOWN MARGIN required for the most restrictive conditions is less than 5.0% $\Delta k/k$. With T_{avg} less than or equal to 200°F, the reactivity transients resulting from any postulated accident are minimal and a 3% delta k/k SHUTDOWN MARGIN provides adequate protection.

3/4.1.1.3 BORON DILUTION

A minimum flow rate of at least 3000 gpm provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual during boron concentration reductions in the Reactor Coolant System. A flow rate of at least 3000 gpm will circulate an equivalent Reactor Coolant System volume of 10,931 cubic feet in approximately 26 minutes. The reactivity change rate associated with boron concentration reductions will therefore be within the capability of operator recognition and control.

Combined with Surveillance Requirement 4.1.1.1.2 on overall core reactivity balance

3/4.1.1.4 MODERATOR TEMPERATURE COEFFICIENT

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. The surveillance requirements for measurement of the MTC during each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurances that the coefficient will be maintained within acceptable values throughout each fuel cycle.

ATTACHMENT 2

Safety Evaluation

Introduction

The proposed change to the St. Lucie Units 1 and 2 Technical Specifications is to modify the requirement to perform a Moderator Temperature Coefficient (MTC) test near the end of each cycle. Under the proposed change this test would not be required if tests conducted at earlier times in the cycle, design MTC calculations, and core reactivity characteristics predict satisfactory MTC behavior will be obtained for the remainder of the cycle.

The change modifies St. Lucie Units 1 and 2 Technical Specification Surveillance Requirement 4.1.1.4.2 for the Moderator Temperature Coefficient and the associated bases. The values of the MTC Limiting Conditions of Operation, which will not be changed, are listed in Technical Specification 3.1.1.4.

The proposed change is based on the acceptable performance of the MTC design methodology demonstrated over the operating history of Units 1 and 2, on the cycle specific verification of MTC methodology demonstrated by tests conducted earlier in the cycle, and on the surveillance of the parameters which influence the reactivity behavior of the reactor.

In addition to modifying the end-of-cycle surveillance requirements for both units, St. Lucie Unit 1 Surveillance Requirement 4.1.1.4.2.b is also modified for consistency with Combustion Engineering Standard Technical Specifications (NUREG 0212 Rev. 2) and St. Lucie Unit 2 Technical Specifications.

Discussion

MTC is affected by many factors which vary from cycle to cycle. The most significant factor affecting MTC is the Reactor Coolant System (RCS) boron concentration. This is discussed in the Combustion Engineering Standard Technical Specifications (NUREG 0212 Rev. 2) bases for MTC surveillance criteria which states "this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup." Coolant density variations caused by temperature variations result in changes of the total mass of moderator and RCS boron present in the core. When RCS temperature rises, the

thermal expansion of the RCS coolant displaces moderator and soluble boron from the core. This thermal expansion results in two separate effects. First, when RCS temperature rises, the reduction in the mass of water in the core results in a negative reactivity change. This negative component due to moderator displacement is nearly constant throughout the cycle because the mass of water displaced for a given rise in temperature is constant throughout the cycle. The second effect resulting from RCS thermal expansion is that during expansion soluble boron is displaced from the core. The amount of boron displaced is directly proportional to the RCS boron concentration (i.e. early in cycle the largest number of boron atoms are displaced; later in cycle many fewer are displaced). The reduction in mass of soluble boron in the core increases the reactivity of the core. The proportionality of the effect to the boron concentration means that the positive reactivity effects of thermal expansion would decrease gradually throughout the cycle. The net result is that MTC is near zero or slightly positive at the beginning of the cycle when the RCS boron concentration is the highest, and it decreases almost linearly to large negative values as the boron concentration is reduced to compensate for the burnup of fuel throughout the cycle.

While other factors such as variations in initial fuel enrichment, use of burnable poisons, and changes in isotopic inventory due to fuel depletion have a significant effect on MTC, the magnitudes of these effects are much less than the magnitude of the effects due to RCS boron and they have less variability over the cycle than does the effect of RCS boron. These other factors which affect MTC directly by changing the neutron flux spectrum also affect MTC indirectly by changing the reactivity of the core. The RCS boron concentration is adjusted to compensate for these other reactivity changes and therefore also affect MTC.

Because continuous measurement of MTC is not possible, design calculations are used to predict the MTC behavior throughout the reactor cycle. Periodic MTC tests assure the accuracy of these design calculations. Current Technical Specification Surveillance Requirements 4.1.1.4.2.a through 4.1.1.4.2.c specify three required MTC tests. For Unit 1, MTC testing must be performed (1) during initial start-up following reload, (2) within 7 EFPD of reaching a rated thermal power equilibrium boron concentration and (3) within 7 EFPD of reaching an equilibrium boron concentration of 300 ppm. For Unit 2, MTC testing must be performed (1) during initial start-up following reload, (2) within 7 EFPD of reaching an equilibrium boron concentration of 800 ppm and (3) within 7 EFPD of reaching an equilibrium boron concentration of 300 ppm.

Currently, acceptable MTC values beyond the 300 ppm point in the cycle are assured by an EOC design value which is within Technical Specification limits. The accuracy of the design calculations will have been verified by three previous tests in the cycle, including the test at 300 ppm.

Under the proposed change, the requirement for an MTC test at 300 ppm would be eliminated in most instances. Specifically, if the results of the two MTC tests previously performed for a given cycle are in agreement with design predictions within acceptance criteria, and if the core reactivity balances specified in Surveillance Requirement 4.1.1.1.2 demonstrate that the measured values of the required parameters have been within 1% delta k/k of the normalized design values, then the 300 ppm MTC measurement test may be omitted. This change would have no effect on operations before the 300 ppm RCS boron concentration was reached. The only change involved is the manner in which Technical Specification compliance would be assured in the time between reaching 300 ppm and the end of the cycle. During this period, compliance would be assured by a design EOC MTC value which would be within Technical Specification limits. Two, instead of three, successful MTC tests will have been completed earlier in the cycle to confirm the validity of the design MTC calculations.

The methodology used to calculate the end of cycle MTC value will have been verified twice earlier in the cycle by performance of Surveillance Requirements 4.1.1.4.2.a and 4.1.1.4.2.b. This will demonstrate that the analytical methods have adequately modelled the current cycle. Because the two tests will have been conducted at substantially different RCS boron concentrations (differences up to 700 ppm), the ability to model the MTC variation versus boron concentration will also have been demonstrated.

Due to uncertainties associated with the design calculations and with measurements, ± 2 pcm/^{o}F (± 2*10-5 delta k/k/^{o}F) has been established as an acceptance criteria for the comparison of measured and design values by Advanced Nuclear Fuels Corporation (ANF) (Reference 1). Combustion Engineering (C-E) uses a value of ± 3 pcm/^{o}F (Reference 2). MTC calculations performed by other fuel vendors/utilities use similar values as acceptance criteria. Because ± 2 pcm/^{o}F is the more restrictive of the values provided by current St. Lucie fuel vendors, and because this value is consistent with the ANSI Standard for Reload Startup Physics Tests for Pressurized Water Reactors (ANSI/ANS Standard 19.6.1-1985), this value has been established as the acceptance criteria specified in Surveillance Requirement 4.1.1.2.c for both units.

Verification of the design methodology is also provided by monitoring the core reactivity. This is accomplished by tracking the soluble boron concentration versus core exposure. Because the same analytical tools are used to develop core reactivity and MTC design predictions, verification of the accuracy of the design boron letdown prediction increases the confidence in the predicted MTC values. Demonstration that the core depletion is proceeding in the predicted manner also supports the validity of the assumptions used in the MTC calculations.

Because values of MTC are closely related to reactor boron concentration it is useful to estimate the impact on MTC of deviations between the predicted core boron concentration and the measured boron value at the same exposure. To do this, the permissible upper bound on deviations between the measured and predicted boron values are estimated, taking into account the 1% deviation criteria from Surveillance Requirement 4.1.1.1.2. The resulting boron values are then multiplied by the rate of change of the MTC with respect to boron concentration. As an example, consider a very conservative value of boron worth for 300 ppm; eg. 8 pcm/ppm. If the total 1% deviation permitted by Surveillance Requirement 4.1.1.1.2 were due solely to boron then the maximum permissible deviation between measured and predicted boron values would be about 125 ppm. Typical values for the rate of change of the MTC with respect to changing boron concentration are less than 1.5 pcm/^{o}F/100 ppm (Reference 1). Therefore, the maximum MTC deviation which could result from the maximum boron concentration deviation allowed by Surveillance Requirement 4.1.1.1.2 is less than 2 pcm/^{o}F (125 ppm deviation * 1.5 pcm/^{o}F/100 ppm = 1.9 pcm/^{o}F). MTC deviations of this magnitude would be within the allowance for measurement uncertainty provided by the design acceptance criteria. Other core reactivity parameters monitored under Surveillance Requirement 4.1.1.1.2 have a less significant impact on MTC than RCS boron. Variation of these parameters within 1% delta k/k would affect MTC much less than 2 pcm/^{o}F.

In addition to the previously discussed MTC tests and reactivity surveillances, design calculations are verified by the low power physics testing program and the power ascension testing at the beginning of each cycle. These testing programs provide additional confirmation of design calculations by verifying such items as critical boron concentration, control rod worths and power distributions.

The proposed change will also modify St. Lucie Unit 1 Surveillance Requirement 4.1.1.4.2.b so that it will be consistent with the Combustion Engineering Standard Technical Specifications and with St. Lucie Unit 2 Technical Specifications. Under this change, the MTC Surveillance Requirement 4.1.1.4.2.a for low power physics testing will remain unchanged. However, the MTC Surveillance Requirement 4.1.1.2.b will be changed so that this surveillance will be required at a specific RCS soluble boron concentration (800 ppm) rather than within 7 Effective Full Power Days of reaching rated thermal power boron concentration.

References

1. St. Lucie Unit 1 Cycle 7 Startup and Operations Report, Exxon Nuclear Company, Inc. (now Advanced Nuclear Fuels Corp.), November 1985.

2. Letter, E.L. Trapp (C-E) to J.L. Perryman (FPL), "Transmittal of St. Lucie Unit 2 Cycle 3 Startup Test Predictions and Physics Data Book Information," F2-CE-R-078.

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ATTACHMENT 3

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

The standards used to arrive at a determination that a request for amendment involves no significant hazards consideration are included in the Commision's regulations 10 CFR 50.92, which states that no significant hazards considerations are involved if the 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.

Under the proposed changes, adequate assurances of compliance with current MTC limitations are maintained by the modified surveillance program. In addition to the MTC tests which will still be required during each cycle, the factors that affect the MTC will be monitored during the cycle as required by Technical Specification Surveillance Requirement 4.1.1.1.2. This ensures that the reactivity behavior of the core has been accurately calculated and that the MTC will remain within Technical Specification Limiting Conditions For Operations (LCO's).

Consequences of accidents previously evaluated will not be increased because this change will not require the modification of any assumption used in the input to the current safety analysis. The current safety calculations will remain valid because the allowed range of MTC values in Technical Specification 3.1.1.4 will not be changed.

The change to St. Lucie Unit 1 Surveillance Requirement 4.1.1.4.2.b will change the time in the cycle when the second MTC surveillance is required, so that this requirement will be consistent with Combustion Engineering Standard Technical Specifications (NUREG 0212 Rev. 2). This will not increase the probability of or consequences of any accident previously evaluated.

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(2) Use of the modified specification would not create the possibility of a new or different kind of accident from any accident previously evaluated.

No new accident initiators are created by the incorporation of the modified surveillance requirements. The change will not result in any change to the method of operating the plant.

(3) Use of the modified specification would not involve a significant reduction in a margin of safety.

The margin of safety will not be reduced as a result of this change because the range of allowed MTC values are defined by Technical Specification LCO's which will not be changed. The modified surveillance program will maintain the requirement to perform the EOC MTC test in the event the reactivity behavior during the cycle does not perform as predicted by design calculations. The modified surveillance program will continue to provide adequate assurance that the MTC characteristics are as predicted by design calculations and are within the range of accepted values.

Based on the above, we have determined that the amendment request does not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the probability of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety; and therefore does not involve a significant hazards consideration.