Entergy

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RBG-45982

July 10, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: River Bend Station, Unit 1
Docket No. 50-458
License Amendment Request
Control Rod Scram Time Testing Frequency (LAR 2001-35)

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) hereby requests the following amendment for the River Bend Station, Unit 1 (RBS) Technical Specifications. This proposed amendment requests an increase in the control rod scram time testing interval from 120 days to 200 days of full power operation. Entergy considers this change to be a cost beneficial burden reduction item.

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that this change involves no significant hazards considerations. The bases for these determinations are included in the attached submittal.

The proposed change includes one new commitment as summarized in Attachment 4.

This request is similar to one approved for Grand Gulf Nuclear Station (TAC # MB1304).

Entergy requests approval of the proposed amendment by December 15, 2002. Once approved, the amendment shall be implemented within 60 days of approval. Although this request is neither exigent nor emergency, your prompt review is requested.

If you have any questions or require additional information, please contact Bill Brice at 601-368-5076.

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 10, 2002.

Sincerely,

William R. Brian
Director - Engineering
River Bend Station

WRB/WBB/bal

Attachments:
1. Analysis of Proposed Technical Specification Change
2. Proposed Technical Specification Changes (mark-up)
3. Changes to TS Bases pages (for information only)
4. List of Regulatory Commitments

cc: U. S. Nuclear Regulatory Commission
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Attachment 1

RBG-45982

Analysis of Proposed Technical Specification Change

1.0 DESCRIPTION

This letter is a request to amend Operating License NPF-47 for River Bend Station, Unit 1 (RBS).

The proposed change will revise the Technical Specifications (TS) to increase the control rod scram time testing interval from 120 days to 200 days of full power operation. Entergy considers this change to be a cost beneficial burden reduction item.

2.0 PROPOSED CHANGE

1. The following TS is affected by the proposed change:

   SR 3.1.4.2 Control Rod Scram Times Surveillance Requirement

   The proposed change revises the frequency for performing sample tests of control rod insertion time from 120 days cumulative operation in MODE 1 to 200 days cumulative operation in MODE 1.

2. The following TS Basis is affected by the proposed change:

   B SR 3.1.4.2

   The Bases are being changed to reflect the new acceptance criteria used to determine if additional sampling is required as discussed below. Since the TS Bases are controlled under the 10 CFR 50.59 Program, the markup of the Bases section is provided for information only.

Currently, the sampling frequency as well as the determination of what constitutes a "representative sample" is based on operating experience and on the additional testing done at more frequent intervals as required by Limiting Condition for Operation (LCO) 3.1.3 "Control Rod Operability" and LCO 3.1.5, "Control Rod Scram Accumulators." This is discussed in the current basis for Surveillance Requirement (SR) 3.1.4.2. The basis goes on to explain that "The sample remains 'representative' if no more than 20% of the control rods in the tested sample are determined to be 'slow.'" Additional testing is required if this limit is exceeded. In order to compensate for the uncertainties inherent to this type of basis, we propose to change the basis for this SR to help account for some of those uncertainties. Entergy will change the 20% acceptance criteria to 7.5%. This aligns with the 7.5% of the total control rods allowed to have scram times that exceed the specified limit. Having no more than 7.5% of the total number of control rods allowed to be "slow" ensures that the scram reactivity assumed in the Design Basis Accident (DBA) and transient analysis is met. This is true even with a single stuck control rod, as is allowed by LCO 3.1.3, "Control Rod Operability", concurrent with another control rod failing to scram, in order to meet single failure criteria. We believe that this provides sufficient conservatism and provides additional statistical basis for our proposed change.

In summary, the proposed change revises the frequency for performing sample tests of control rod insertion time from 120 days to 200 days of full power operation. Entergy considers this change to be a cost beneficial burden reduction item.

3.0 BACKGROUND

RBS TSs are written to assure proper function of control rod insertion through the use of surveillance testing. Following each refueling outage and each reactor shutdown of 120 days or more, all control rods are tested. In addition, for long periods of continuous operation, TS SR 3.1.4.2 requires a representative sampling as follows:

Surveillance: Verify, for a representative sample, each tested control rod scram time is within the limits of Table 3.1.4-1 with the reactor steam dome pressure $\geq$950 psig.

Frequency: 120 days cumulative operation in Mode 1.

The basis of TS SR 3.1.4.2 defines a representative sample as "at least 10% of the control rods." There are 145 rods, so the minimum number of rod tests performed is 15. A successful test requires that less than 20% of the rods fail the scram time criteria, e.g., no more than 3 rods in 15 tested can be "slow" when compared to the scram time limits listed in TS Table 3.1.4-1. Otherwise the test sample is increased until less than 20% of the rods fail the time criteria. The Limiting Condition for Operation (LCO) allows up to 10 (7.5%) to be "slow" in the entire core and prevents two OPERABLE "slow" rods from occupying adjacent locations.

The 120-day testing interval currently required by TS SR 3.1.4.2 imposes an undue burden on plant operation. Due to fuel operating restrictions, each test requires a power reduction to perform this evolution. RBS would like to extend the period between testing to up to 200 days. This would allow more efficient overlap of the rod insertion timing test with the control rod sequence exchanges. Sequence exchanges are necessary approximately every 12 – 14 weeks (84 – 98 days). The extended test interval would allow insertion tests to be performed every other time the control rod-sequence exchange is performed since these exchanges also require a power reduction. In general, scram time testing complicates the sequence exchange maneuver, increases the amount of off-rated operating time, and increases the total number of rod movements during the sequence exchange.

4.0 TECHNICAL ANALYSIS

RBS historical scram time testing results show that only two "slow" rods have been identified during the past 15 years of operation and no inoperable rods have been identified. Since there have been no inoperable rods identified, the statistical analyses presented here will only consider "slow" rods. Since this testing is a sampling process, probability of detection is the critical factor in establishing the initial requirement of 10% sampling every 120 days. Now that

extensive historical data has been collected, the extreme reliability demonstrated by the rod insertion system justifies a relaxation in the sampling frequency.

The proposed change will not adversely impact plant operation. The actual rod insertion times and control rod reliability are not impacted by this proposed change; only the probability of detecting slow rods is impacted. There will be no change in the method of performing the tests. The extended test frequency will provide some positive safety benefits by reducing the complexity of half of the control rod sequence exchange maneuvers, reducing the likelihood of a reactivity or fuel related event.

Extending the allowable surveillance time between the 10% sampling from 120 days to 200 days decreases the number of sampled rods. Specifically, in a long operational run of between 480 and 540 days, a 200-day surveillance schedule will typically lead to two (2) fewer performances of the rod insertion tests as compared to a 120-day schedule. With the proposed 200-day frequency, some 30 fewer rods will be tested each operating cycle (15 tests per surveillance performance). Potentially fewer "slow" rods could be detected, implying more "slow" rods may unknowingly be left in service. Per the LCO, only 10 "slow" rods in the entire core with no two "slow" OPERABLE rods occupying adjacent locations are acceptable for plant operation.

There is no safety consequence resulting from "slow" rods so long as the plant does not exceed the Technical Specification 3.1.4 LCO requirement of no more than 10 slow rods in the entire core or no two OPERABLE "slow" rods occupying adjacent positions. It is highly unlikely that a combination of missed detections and known "slow" rods would lead to the requirement to take action in accordance with TS 3.1.4. Therefore, it is highly unlikely that the reduction in test frequency would have any impact on plant operation or safety.

The plant safety analysis assumes that all 10 slow rods take 7 seconds to reach notch position 13 which is very conservative based on actual rod performance. Control rod data shows that rods that have failed the time requirements are usually only a fraction of a second slower. In the unlikely event that, due to the reduction of test frequency, the plant is unknowingly operating with one or two more slow rods than the 10 slow control rods permitted by the LCO, the consequences would be minimal.

A calculation was done to verify that the impact on probability of detection of a "slow" rod is negligible if the testing interval is changed from 120 days to 200 days. A conservative approach was used to identify the "slow" rods by comparing the recorded scram times with the required scram times for RPV steam dome pressure of 950 psig. If the recorded time to either of the 3 notch locations (Notches 43, 29, and 13) exceeds the TS requirement, the rod was identified as a "slow" rod. From all the 3893 valid scram time data, only 2 rod insertion times were determined to be "slow." The success probability based on the RBS historical data is then (1 - 2/3893) = 99.949%, or the failure probability is (1 - 99.949%) = 0.051%.

The calculation used the Student's t-multiplier for 99.73% confidence level, that is, 99.865% of all the tested scram times will be less than the (average + three standard deviations) value. The RBS historical data shows extremely good performance. The failure probability for times to notches 43 and 29 is 0.051%. The failure probability for times to notch 13 is 0.026% since only one data point exceeds the TS requirements.

The statistical analysis results also show that the (average + three standard deviations) values are all well below the TS requirements. This means that 99.865% can be established as the success probability for the scram time tests. Thus we have two success probabilities now. For conservatism, the lower value will be used for further evaluation, which is 99.865% based on the confidence level for the Student's t-distribution.

A simple calculation based on the failure probability (1 - 99.865% = 0.135%) could show roughly how many "slow" rods might have been missed due to reduced samples (30 tests for 2 additional samples during one cycle):

of "slow" rods missed per cycle = failure probability * 30 / cycle
= 0.135% * 30 / cycle = 0.0405 / cycle which is much lower than 1

The above result shows an extremely low probability for missing a "slow" rod due to the reduced samples.

Another way to estimate the probability of testing and finding a specific number of "slow" rods within the 30 tests that would not be performed is to use a binomial distribution. If p is the probability that an event will occur and q is the probability that it will fail (i.e., q = 1 - p). The probability that the event will happen exactly X times in N trials is given by the formula below. The binomial formula can be rewritten with p = 99.865% and q = 0.135% for detection exactly X "slow" rods:

$$P(X)=\binom{N}{X}p^X q^{N-X}=\frac{30!}{X!(30-X)!}0.99865^{30-X}0.00135^X$$

Then the cumulative probability for detecting up to X "slow" rods in the 30 tests can be calculated as:

$$P(0\,to\,X)=\sum_{I=0}^{X}P(I)$$

And the cumulative probability for detecting more than X "slow" rods in the 30 tests can be calculated as:

$$P(more\,than\,X)=1-\sum_{I=0}^{X}P(I)$$

Table 1 shows the results using binomial formula for detecting up to 4 "slow" rods:

Table 1. Probabilities of Detecting " Slow" Rods Given 30 Random Tests

X	Probability of Detecting Exactly X "Slow" Rods	Cumulative Probability of Detecting Up To X "Slow" Rods	Cumulative Probability of Detecting More Than X "Slow" Rods
	$P(X)$	$\sum P(X)$	$1-\sum P(X)$
0	0.960282889	0.960282889	3.97E-02
1	0.038944031	0.999226920	7.73E-04
2	0.00076336	0.999990280	9.72E-06
3	9.63134E-06	0.999999911	8.85E-08
4	8.78842E-08	0.999999999	6.21E-10

As shown in the Table, with X increasing, the cumulative probability for detecting more than X "slow" rods decreases exponentially. Using 10^{-6} as a cut-off value for significant probability, the probability of detecting more than 3 "slow" rods would be very insignificant. Even if these 3 "slow" rods did get missed by not performing these 30 additional tests, the probability of detecting more than 7 "slow" rods in the rest of the scram time tests and therefore exceeding the TS limit of 10 during a cycle is extremely low.

Another comparison can be made to calculate the cumulative probability of exceeding the LCO conditions over one cycle. Since the probability of detecting more than 10 "slow" rods based upon the previous analysis is extremely low, we will calculate the probability of more than 4 "slow" rods during the startup testing that includes all 145 rods and during both the additional surveillance test scenarios. The current TS frequency (120-day) will require 4 additional surveillance tests (60 scram time tests). The proposed TS frequency (200-day) will require 2 additional surveillance tests (30 scram time tests).

The equations for the calculation of the cumulative probabilities for detecting more than 4 "slow" rods are as following:

$$P(startup, >4\text{"slow"}) = 1 - \sum_{X=0}^{4} \frac{145!}{X!(145-X)!} 0.99865^{145-X} 0.00135^{X}$$

$$P(additional\ 120\ day, >4\text{"slow"}) = 1 - \sum_{X=0}^{4} \frac{60!}{X!(60-X)!} 0.99865^{60-X} 0.00135^{X}$$

$$P\left(additional\ 200\ day, > 4\ "slow"\right) = 1 - \sum_{X=0}^{4} \frac{30!}{X!(30-X)!} 0.99865^{30-X} 0.00135^{X}$$

The results are listed in Table 2. There is no significant difference (1.93189E-6 - 1.90949E-6 =2.24E-8 much less than 1E-6) between the cumulative probabilities of detecting more than 4 "slow" rods over a normal cycle for both the current TS frequency and the proposed TS frequency.

Table 2. Calculation of the Cumulative Probabilities over A Normal Cycle

	Startup Following Refueling	Current TS Frequency (120-day Intervals)	Proposed TS Frequency (200-day Intervals)
# of tests over normal cycle	1	4	2
# of rods tested over normal cycle	145	60	30
Cumulative probability of detecting more than 4 "slow" rods	1.90887E-6	2.30207E-8	6.21276E-10
Cumulative probability of detecting more than 4 "slow" rods over normal cycle	1.90887E-6	1.93189E-6	1.90949E-6

Due to the extremely good test data for rod insertion times collected over the last 15 years, the initial technical specification frequency of 10% sampling every 120 days can be revised. Further, the 100% rod scram test done after each refueling outage as required by SR 3.1.4.1 would detect any type of new generic problem in the unlikely event one were to arise. Also, any maintenance performed on the control rod drive system which could affect scram times, must be followed by post-maintenance scram time testing as required by SR 3.1.4.3 before declaring the control rod operable. Assuming the rod insertion system functions consistent with past data extending the test interval from 120 to 200 days would have a negligible impact on the probability of exceeding the TS LCO conditions.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met.

Entergy has determined that the proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any General Design Criteria (GDC) differently than described in the SAR.

5.2 No Significant Hazards Consideration

Entergy Operations, Inc. (Entergy) is proposing that the River Bend Station (RBS) Technical Specifications (TS) be amended to increase the Control Rod Scram Time Testing frequency from 120 days of full power operation to 200 days of full power operation. This will reduce the need to schedule special down-powers for control rod scram time testing or the need to perform control rod scram time testing for each control rod sequence exchange. In general, the scram time testing process complicates the sequence exchange maneuver and adds to the probability of a reactivity related event.

Entergy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change will not adversely impact plant operation. There will be no change in the method of performing the tests. The extended test frequency will provide some positive safety benefits by reducing the complexity of half of the control rod sequence exchange maneuvers, reducing the likelihood of a reactivity or fuel related event.

   The actual rod insertion times and control rod reliability are not impacted by this proposed change; only the probability of detecting slow rods is impacted. The potential consequence of the proposed change is that one or more slow rods that would have been detected under the current 120-day frequency, may not be detected due to a reduced number of tests under the 200-day frequency.

   Historical data shows that the River Bend Station control rod insertion function is highly reliable and rod insertion tests meet the scram time limits 99.949% of the time. Statistical analysis also demonstrates that the extended frequency would have little impact on the ability to detect slow rods in the sampling tests.

There is no safety consequence resulting from "slow" rods so long as the plant does not exceed the Technical Specification 3.1.4 Limiting Condition for Operation requirement of no more than 10 slow rods in the entire core or no two OPERABLE "slow" rods occupying adjacent positions. It is highly unlikely that a combination of missed detections and known "slow" rods would lead to the requirement to take action in accordance with Technical Specification 3.1.4 as discussed in the supporting analysis. Therefore, it is highly unlikely that the reduction in test frequency would have any impact on plant operation or safety.

The plant safety analysis assumes that all 10 slow rods take 7 seconds to reach notch position 13 which is very conservative based on actual rod performance. Control rod data shows that rods that have failed the time requirements are usually only a fraction of a second slower. The low probability of MODE 1 operation with excess slow rods combined with the historically low incidence of failure, leads to the conclusion that the probability or consequences of accidents previously evaluated are not significantly increased.

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

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed change will make no change to plant configuration or test procedures. The proposed change does not impact the operation of the plant except to reduce the number of required tests and slightly increase the probability of failing to detect a slow control rod. Operating with possibly one or two undetected slow rods does not create the possibility of an accident, since sudden control rod insertion by scram is an accident mitigation action.

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

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The River Bend Station accident analyses assume a certain negative reactivity time function associated with scrams. So long as the Limiting Condition for Operation of Technical Specification 3.1.4 is met, that is, there are no more than 10 slow control rods in the entire core or two OPERABLE "slow" rods occupying adjacent locations, all accident analysis assumptions are met and there is no reduction in any margin of safety. The proposed change does not impact the Technical Specification Limiting Condition for Operation or any other allowable operating condition. The potential for an increase in the probability of being outside acceptable operating conditions due to this proposed change is insignificant. Calculations have demonstrated that the likelihood of detecting

four slow rods with proposed testing frequency over a fuel cycle is lower than that with the current testing frequency by a negligible amount. The difference is even smaller for detecting a greater number of slow rods over a cycle. Therefore, since there is no impact on allowable operating parameters and the likelihood of detecting significant numbers of slow rods is only negligibly affected, there is no significant reduction in a margin of safety.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Entergy Operations, inc. concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.3 Environmental Considerations

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 PRECEDENCE

This request is similar to one recently approved for Grand Gulf Nuclear Station (TAC# MB1304).

Attachment 2

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Proposed Technical Specification Change (mark-up)

SURVEILLANCE REQUIREMENTS

----------NOTE----------
During single control rod scram time Surveillances, the control rod drive (CRD) pumps shall be isolated from the associated scram accumulator.

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	Verify each control rod scram time is within the limits of Table 3.1.4-1 with reactor steam dome pressure ≥ 950 psig.	Prior to exceeding 40% RTP after fuel movement within the reactor pressure vessel AND Prior to exceeding 40% RTP after each reactor shutdown ≥ 120 days
SR 3.1.4.2	Verify, for a representative sample, each tested control rod scram time is within the limits of Table 3.1.4-1 with reactor steam dome pressure ≥ 950 psig.	200 ~~120~~ days cumulative operation in MODE 1
SR 3.1.4.3	Verify each affected control rod scram time is within the limits of Table 3.1.4-1 with any reactor steam dome pressure.	Prior to declaring control rod OPERABLE after work on control rod or CRD System that could affect scram time

(continued)

Attachment 3

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Changes to Technical Specification Bases Pages

(For Information Only)

BASES (continued)

SURVEILLANCE REQUIREMENTS

The four SRs of this LCO are modified by a Note stating that during a single control rod scram time surveillance, the CRD pumps shall be isolated from the associated scram accumulator. With the CRD pump isolated (i.e., charging valve closed), the influence of the CRD pump head does not affect the single control rod scram times. During a full core scram, the CRD pump head would be seen by all control rods and would have a negligible effect on the scram insertion times.

SR 3.1.4.1

The scram reactivity used in DBA and transient analyses is based on assumed control rod scram time. Measurement of the scram times with reactor steam dome pressure ≥ 950 psig demonstrates acceptable scram times for the transients analyzed in References 3 and 4.

Scram insertion times increase with increasing reactor pressure because of the competing effects of reactor steam dome pressure and stored accumulator energy. Therefore, demonstration of adequate scram times at reactor steam dome pressure greater than 950 psig ensures that the scram times will be within the specified limits at higher pressures. Limits are specified as a function of reactor pressure to account for the sensitivity of the scram insertion times with pressure and to allow a range of pressures over which scram time testing can be performed. To ensure scram time testing is performed within a reasonable time following a refueling or after a shutdown ≥ 120 days, all control rods are required to be tested before exceeding 40% RTP. This Frequency is acceptable, considering the additional surveillances performed for control rod OPERABILITY, the frequent verification of adequate accumulator pressure, and the required testing of control rods affected by work on control rods or the CRD System.

SR 3.1.4.2

Additional testing of a sample of control rods is required to verify the continued performance of the scram function during the cycle. A representative sample contains at least 10% of the control rods. The sample remains "representative" if no more than ~~20~~% of the control rods in

7½

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.4.2 (continued)

the tested sample are determined to be "slow." If more than 20% of the sample is declared to be "slow" per the criteria in Table 3.1.4-1, additional control rods are tested until this 20% criterion (e.g., 20% of the entire sample size) is satisfied, or until the total number of "slow" control rods (throughout the core, from all surveillances) exceeds the LCO limit. For planned testing, the control rods selected for the sample should be different for each test. Data from inadvertent scrams should be used whenever possible to avoid unnecessary testing at power, even if the control rods with data were previously tested in a sample. The 120 day Frequency is based on operating experience that has shown control rod scram times do not significantly change over an operating cycle. This Frequency is also reasonable, based on the additional Surveillances done on the CRDs at more frequent intervals in accordance with LCO 3.1.3 and LCO 3.1.5, "Control Rod Scram Accumulators."

7½ 7½ 7½ 200

is intended to allow consistency with control rod sequence exchanges and

SR 3.1.4.3

When work that could affect the scram insertion time is performed on a control rod or the CRD System, testing must be done to demonstrate that each affected control rod retains adequate scram performance over the range of applicable reactor pressures from zero to the maximum permissible pressure. The scram testing must be performed once before declaring the control rod OPERABLE. The required scram time testing must demonstrate that the affected control rod is still within acceptable limits. The limits for reactor pressures < 950 psig are established based on a high probability of meeting the acceptance criteria at reactor pressures ≥ 950 psig. Limits for ≥ 950 psig are found in Table 3.1.4-1. If testing demonstrates the affected control rod does not meet these limits, but is within the 7 second limit of Table 3.1.4-1 Note 2, the control rod can be declared OPERABLE and "slow."

The 7½% of sample size criteria is intended to align with the 7½% of the total control rods allowed to have scram times that exceed the specified limit.

Specific examples of work that could affect the scram times include (but are not limited to) the following: removal of any CRD for maintenance or modification; replacement of a control rod; and maintenance or modification of a scram solenoid pilot valve, scram valve, accumulator isolation valve, or check valves in the piping required for scram.

(continued)

Attachment 4

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List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
The acceptance criteria for the sample tests of control rod insertion times will be changed from 20% to 7.5% as described in Section 2.0 "PROPOSED CHANGE".		x	Within 60 days of approval