New Hampshire Yankee
April 12, 1991

ENCLOSURE 1 TO NYN-91059

Figure 1

REACTIVITY CONTROL SYSTEMS

MOVABLE CONTROL ASSEMBLIES

ROD DROP TIME

LIMITING CONDITION FOR OPERATION

3.1.3.4 The individual full-length (shutdown and control) rod drop time from the fully withdrawn position shall be less than or equal to 2.2 seconds from beginning of decay of stationary gripper coil voltage to dashpot entry with:

mechanical

a. T_{avg} for each loop greater than or equal to 551°F, and

b. All reactor coolant pumps operating.

APPLICABILITY: MODES 1 and 2.

ACTION:

With the drop time of any full-length rod determined to exceed the above limit, restore the rod drop time to within the above limit prior to proceeding to MODE 1 or 2.

SURVEILLANCE REQUIREMENTS

4.1.3.4 The rod drop time of full-length rods shall be demonstrated through measurement prior to reactor criticality:

a. For all rods following each removal of the reactor vessel head,

b. For specifically affected individual rods following any maintenance on or modification to the Control Rod Drive System that could affect the drop time of those specific rods, and

c. At least once per 18 months.

Figure 2

REACTIVITY CONTROL SYSTEMS

MOVABLE CONTROL ASSEMBLIES

SHUTDOWN ROD INSERTION LIMIT

LIMITING CONDITION FOR OPERATION

3.1.3.5 All shutdown rods shall be fully withdrawn. (#)

APPLICABILITY: MODES 1* and 2* **.

ACTION:

With a maximum of one shutdown rod not fully withdrawn, except for surveillance testing pursuant to Specification 4.1.3.1.2, within 1 hour either:

a. Fully withdraw (#) the rod, or

b. Declare the rod to be inoperable and apply Specification 3.1.3.1.

SURVEILLANCE REQUIREMENTS

4.1.3.5 Each shutdown rod shall be determined to be fully withdrawn: (#)

a. Within 15 minutes prior to withdrawal of any rods in Control Bank A, B, C, or D during an approach to reactor criticality, and

b. At least once per 12 hours thereafter.

*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

**With k_{eff} greater than or equal to 1.

- The fully withdrawn position is defined as the interval within 225 to the mechanical fully withdrawn position, inclusive.

Figure 3

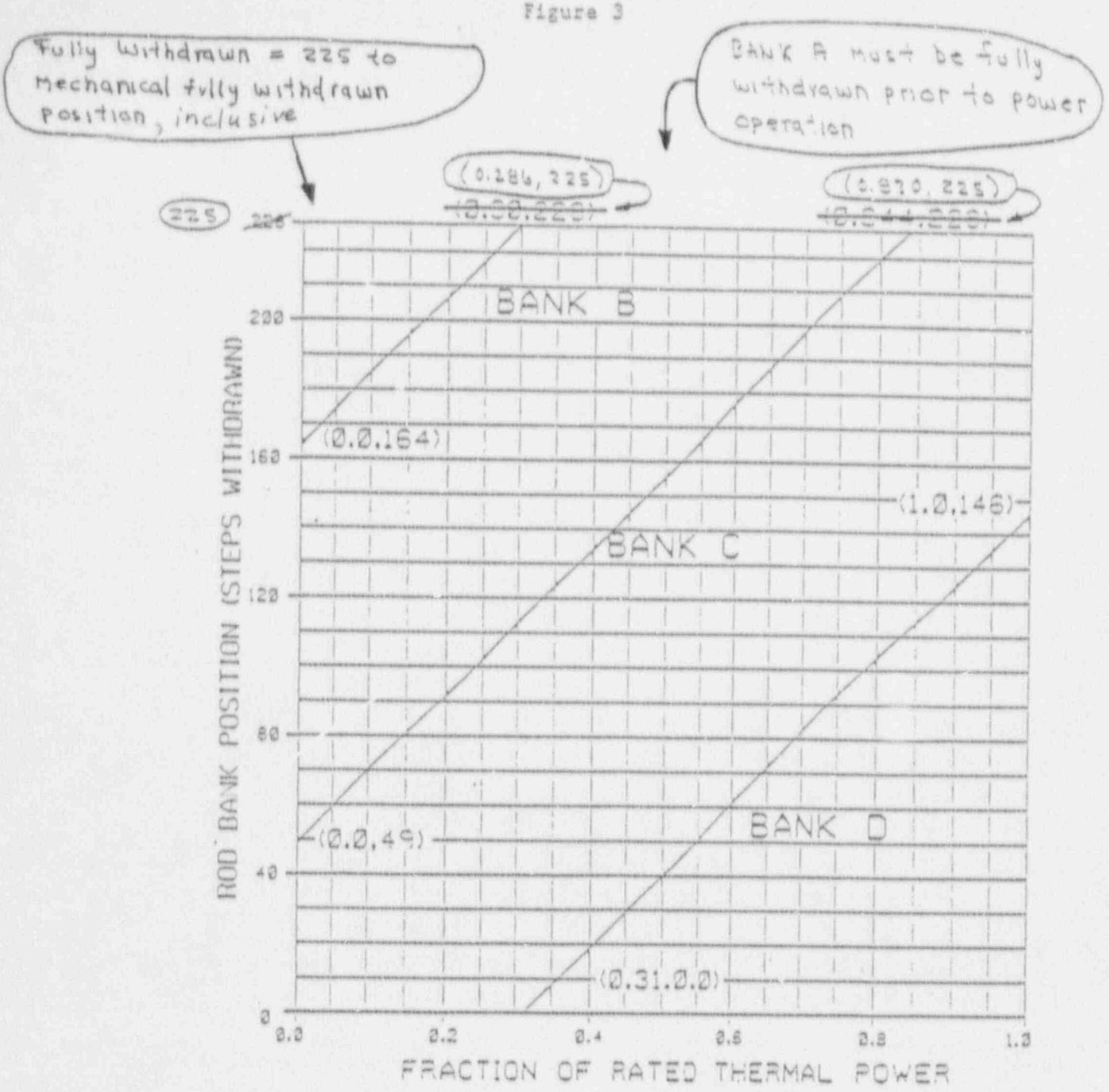

FIGURE 3.1-1

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER
FOUR-LOOP OPERATION

Figure 4

REACTIVITY CONTROL SYSTEMS

BASES

3/4.1.3 MOVABLE CONTROL ASSEMBLIES (Continued)

The maximum rod drop time restriction is consistant with the assumed rod drop time used in the safety analyses. Measurement with T_{avg} greater than or equal to 551°F and ~~with~~ all reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a Reactor trip at operating conditions.

Control rod positions and OPERABILITY of the rod position indicators are required to be verified on a nominal basis of once per 12 hours with more frequent verifications required if an automatic monitoring channel is inoperable. These verification frequencies are adequate for assuring that the applicable LCOs are satisfied.

For Specification 3.1.3.1 ACTIONS b. and c., it is incumbent upon the plant to verify the trippability of the inoperable control rod(s). Trippability is defined in Attachment C to a letter dated December 21, 1984, from E. P. Rahe (Westinghouse) to C. O. Thomas (NRC). This may be by verification of a control system failure, usually electrical in nature, or that the failure is associated with the control rod stepping mechanism. In the event the plant is unable to verify the rod(s) trippability, it must be assumed to be untrippable and thus falls under the requirements of ACTION a. Assuming a controlled shutdown from 100% RATED THERMAL POWER, this allows approximately 4 hours for this verification.

rods at their individual mechanical fully withdrawn position,

FP

The fully withdrawn position of shutdown and control banks can be varied between 225 and the mechanical fully withdrawn position (up to 232 steps), inclusive. An engineering evaluation was performed to allow operation to the 232 step maximum. The 225 to 232 step interval allows axial repositioning to minimize RCCA wear

ENCLOSURE 2 TO NYN-91059

RCCA Repositioning Program Engineering Evaluation and
Significant Hazards Consideration Evaluation

The RCCA repositioning program proposed by NHY would allow the axial repositioning of control rod and shutdown rod banks between 225 and 232 steps withdrawn, inclusive, during power operation. Although the mechanical limit is 230 steps during cold conditions, it is expected that the mechanical limit for certain rods may reach a limit of 231 steps due to thermal expansion during hot conditions. The actual mechanical limit for each rod will be determined in conjunction with the required rod drop tests of Technical Specification (TS) 3.1.3.4. The 225 to 232 step range envelopes all possible mechanical fully withdrawn positions. All banks, except for Control Bank D, are currently required to be in a 'parked' position of 228 steps during certain levels of power operation. Axial repositioning will reduce the rate of fretting wear, extend the life of the RCCAs and, therefore, postpone the replacement of RCCAs.

The RCCA repositioning program has been evaluated with respect to its effect on reactor physics, transient analysis (non-LOCA), LOCA analysis, mechanical analysis and fuel management. These evaluations are discussed below:

Reactor Physics Considerations

The change in power distribution(s) and shutdown margin which would be expected from the implementation of the RCCA repositioning program has been evaluated. The RCCA repositioning program would allow the axial repositioning of both control and shutdown banks between 225 and 232 steps withdrawn, inclusive. The program would replace the stationary parked position of 228 steps withdrawn, which is required by the Technical Specifications. Since rods would be allowed to be inserted further into the core, there could be an impact on axial and radial power distribution profiles as well as temperature dependent available shutdown margins.

The 228th step withdrawn position is actually 1.48" above the top of the active fuel region. If rods were repositioned to the 225 step position, they would be approximately .4" inserted into the active core region. It has been determined that repositioning banks at the 225th step will have an insignificant effect on both axial and radial power distributions, critical boron concentrations and temperature dependent shutdown margins during Seabrook Station Cycle 1 and future cycles as discussed in the conclusion below.

Transient Analysis Considerations

As discussed above, there is no measurable change in axial or radial power distributions due to rod insertion at 225 steps consistent with the proposed axial repositioning program. Since there is no change in power distributions with insertion at 225 steps, there will be no power distribution related effect on the accident analyses.

The RCCA repositioning program also allows for the rods to be withdrawn to 232 steps, four steps higher than the current Technical Specification limit. Withdrawing rods further out of the core translates into a longer time for insertion into the core. Technical Specification 3.1.3.4 states that for Modes 1 and 2:

> *The individual full-length (shutdown and control) rod drop time from the fully withdrawn position shall be less than or equal to 2.2 seconds from beginning of decay of stationary gripper coil voltage to dashpot entry with:*
>
> *a. T_{avg} for each loop greater than or equal to 551°F, and*
>
> *b. All reactor coolant pumps operating.*

Rod drop times have been determined by NHY prior to full power operation. The maximum rod drop time for the required conditions was determined to be 1.45 seconds. It has been estimated that the additional drop time related to the extra four steps withdrawn (232 - 228) will be .048 seconds. The total time of 1.498 seconds is still well within the 2.2 seconds requirement and, therefore, does not result in a reduction in the margin of safety assumed in the FSAR. It is, therefore, concluded that the implementation of the RCCA repositioning program will have no adverse implications on the FSAR Chapter 15 non-LOCA related analyses.

LOCA Considerations

The impact of the RCCA repositioning program on the following areas has been evaluated:

Large and Small Break LOCA Analyses
Hot Leg Switchover Calculation
Post-LOCA Long-Term Core Cooling

As discussed above, there is no impact on either the radial or axial power distributions from the implementation of the proposed repositioning program. Since there is no change related to these parameters, it has been determined that there is no adverse effect on Small Break LOCA events. The RCCA repositioning program also does not affect Large Break LOCA analysis since rod insertion is not credited during such an event.

As discussed above, there is no impact on critical boron concentrations from the implementation of the RCCA repositioning program. Therefore, there will be no impact on the Hot Leg Switchover Calculation and Post-LOCA Long-Term Core Cooling potential. Overall, the implementation of the RCCA repositioning program will have no adverse implications on the FSAR Chapter 15 LOCA related analyses.

Mechanical Considerations

The mechanical impact of implementation of the RCCA repositioning program has been evaluated. This evaluation focused on the following areas:

RCCA Tip Characteristics
LOCA Hydraulic Forces
Mechanical Integrity

The evaluation for RCCA Tip Characteristics consisted of determining whether repositioning rods from 225 to 232 steps combined with the characteristics of the RCCA tips (geometry, material composition, etc.) would reduce the likelihood that the rods would perform their function during design basis events. It was determined that withdrawing the rods out to the 232th step (or its mechanical limit) still ensures that the tips of the RCCAs remain engaged in the guide thimbles, thus ensuring that alignment between the RCCA fingers and the guide thimbles is always maintained. The repositioning of the RCCAs within the 225th and 232th step range could position the tips so as to accumulate a higher integrated flux and, therefore, a higher rate of embrittlement than would result at the 228th step position. The overall potential increase in integrated flux is determined to be insignificant. In addition, as discussed above, inserting the RCCAs to the 225th step has no impact on axial power shapes. This leads to the conclusion that repositioning the RCCAs to the 225th step will not lead to a significant increase in integrated exposure or embrittlement. There is, therefore, no adverse impact on the RCCA tips resulting from the proposed repositioning program.

The hydraulic forces resulting from a LOCA will challenge the mechanical integrity of the RCCAs. These forces are applied to the RCCAs through openings in the guide thimbles within the fuel assemblies and through openings in the guide tubes in the upper internals. In the upper internals, a series of horizontal card type structures provide lateral support for the RCCA fingers at regular intervals along the length of the guide tube. Fuel assembly guide thimbles provide lateral support within the core region. Since the span lengths between lateral support locations will not be changed due to repositioning, forces and stresses will not be increased significantly. There is, therefore, no adverse impact due to LOCA hydraulic forces experienced with the implementation of the RCCA repositioning program.

The question of mechanical integrity relates to whether the RCCAs will remain structurally intact during a design basis event. The RCCAs remain positively inserted in the guide thimbles by a safe margin even at the maximum fully withdrawn position of 232 steps. The RCCAs and protective guide tubes (and thimbles) are subjected to the same mechanical stresses in any position from Step 225 to Step 232 due to the fixed lateral support locations in both the upper internals and the fuel assemblies. There is, therefore, no reason to believe that the RCCAs cannot perform their intended function during a design basis event.

Overall, implementation of the RCCA repositioning program will have no adverse impact on the mechanical integrity on the control and shutdown rods and they will be able to perform their necessary function.

Fuel Management Considerations

Members of the Yankee Atomic Electric Company Fuel Management Department (FMD) have attended workshops related to RCCA fretting wear in the recent past. Other plants in the industry have experienced significant RCCA fretting wear. All indications show that Seabrook's RCCAs are susceptible to such fretting wear. With this industry experience in mind, the FMD has advised NHY of the following two points.

First, FMD advised that the proposed axial repositioning program be implemented as soon as possible or Seabrook may be at risk of potential damage to RCCA fingers. Second, FMD advised that the RCCA repositioning program should be initially set up to avoid the current fully withdrawn position of 228 steps until operating time at the other positions in the 225 to 232 step range approximates that of the 228 step position. This would allow for an even distribution of fretting wear within that range.

Engineering Evaluation Conclusion

The conclusion of the above evaluations is that the implementation of the proposed RCCA Repositioning Program is acceptable and should be expeditiously implemented.

This Engineering Evaluation applies to core designs where the positioning of the 225 to 232 step range relative to the top of the active core height is the same as Core 1. Step 225 is currently positioned approximately .4" into the active core region. This evaluation is applicable to Core 2, since this criteria is met. The fuel vendor will be informed that the RCCA repositioning program should be accounted for in subsequent nuclear designs and safety analyses for the plant.

Significant Hazards Consideration

NHY has evaluated the proposed Technical Specification changes utilizing the criteria specified in 10CFR50.92 and has determined that the proposed changes do not involve a Significant Hazards Consideration pursuant thereto.

This evaluation is discussed below and is supported by the Engineering Evaluation discussed above:

a. *Do the changes involve a significant increase in the probability or consequences of an accident previously evaluated?*

No. Several areas have been evaluated to ensure that the probability or consequences of an accident will not increase as a result of the proposed changes. Allowing previously parked control and shutdown banks to have a variable fully withdrawn position between 225 and 232 steps, inclusive, versus the current position of 228 steps will have an insignificant effect on the various areas evaluated. The areas covered by the evaluations include all of the FSAR Chapter 15 accidents (both non-LOCA and LOCA transients), rod drop time requirements, Minimum Departure From Nucleate Boiling Ratio (MDNBR) requirements and mechanical integrity requirements. The evaluation performed for these areas indicates that variable repositioning between the 225 to 232 step range will not significantly increase the probability or consequence of a previously analyzed accident.

b. *Do the changes create the possibility of a new or different kind of accident from any accident previously evaluated?*

No. The only effect on plant operation, is allowing the control and shutdown banks to be withdrawn an additional four steps from 228 to 232 steps. Banks positions below 228 steps are within the current system's approved operability range for controlled startups and shutdowns. The system is designed to allow withdrawal out to 230 steps (during cold conditions) as stated in the Rod Control Systems Vendor Manual or 231 steps during hot conditions. The actual mechanical fully withdrawn limits for each rod will be determined during the first reload following the implementation of the proposed TS changes and subsequent reloads, if necessary. Evaluations have determined that a new or different kind of accident will not result from the proposed changes.

c. *Do the changes involve a significant reduction in the margin of safety?*

No. The margin(s) of safety potentially affected by the proposed changes are related to MDNBR requirements for most non-LOCA related transient events, and potential fuel failures with the resulting mass/energy releases during LOCA and Rod Ejection events. Evaluations have demonstrated that the margin of safety has not been reduced by the proposed changes to the Technical Specifications.