FULL LENGTH CEA POSITION (Continued)

LIMITING CONDITION FOR OPERATION (Continued)

b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours.

g. With more than one full length CEA inoperable or misaligned from any other CEA in its group by 15 inches (indicated position) or more, be in HOT STANDBY within 6 hours.

h. With one full-length CEA inoperable due to causes other than addressed by ACTION a above, and inserted beyond the long term steady state insertion limits but within its above specified alignment requirements, operation in MODES 1 and 2 may continue pursuant to the requirements of Specification 3.1.3.6.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each full length CEA shall be determined to be within 7.5 inches (indicated position) of all other CEAs in its group at least once per 12 hours except during time intervals when the Deviation Circuit and/or CEA Block Circuit are inoperable, then verify the individual CEA positions at least once per 4 hours.

4.1.3.1.2 Each full length CEA not fully inserted shall be determined to be OPERABLE by inserting it at least 7.5 inches at least once per ~~31~~ 92 days.

4.1.3.1.3 The CEA Block Circuit shall be demonstrated OPERABLE at least once per ~~31~~ 92 days by a functional test which verifies that the circuit prevents any CEA from being misaligned from all other CEAs in its group by more than 7.5 inches (indicated position).

4.1.3.1.4 The CEA Block Circuit shall be demonstrated OPERABLE by a functional test which verifies that the circuit maintains the CEA group overlap and sequencing requirements of Specification 3.1.3.6 and that the circuit prevents the regulating CEAs from being inserted beyond the Power Dependent Insertion Limit of Figure 3.1-2:

*a. Prior to each entry into MODE 2 from MODE 3, except that such verification need not be performed more often than once per 92 ~~31~~ days, and

b. At least once per 6 months.

*The licensee shall be excepted from compliance during the startup test program for an entry into MODE 2 from MODE 3 made in association with a measurement of power defect.

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ACTION: (Continued)

h. With one full-length CEA inoperable due to causes other than addressed by ACTION a., above, but within its above specified alignment requirements and either fully withdrawn or within the Long Term Steady State Insertion Limits if in full-length CEA group 5, operation in MODES 1 and 2 may continue.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each full-length CEA shall be determined to be within 7.0 inches (indicated position) of all other CEAs in its group at least once per 12 hours except during time intervals when the Deviation Circuit and/or CEA Block Circuit are inoperable, then verify the individual CEA positions at least once per 4 hours.

4.1.3.1.2 Each full-length CEA not fully inserted in the core shall be determined to be OPERABLE by movement of at least 7.0 inches in any one direction at least once per ~~31~~ 92 days.

4.1.3.1.3 The CEA Block Circuit shall be demonstrated OPERABLE at least once per ~~31~~ 92 days by a functional test which verifies that the circuit prevents any CEA from being misaligned from all other CEAs in its group by more than 7.0 inches (indicated position).

4.1.3.1.4 The CEA Block Circuit shall be demonstrated OPERABLE by a functional test which verifies that the circuit maintains the CEA group overlap and sequencing requirements of Specification 3.1.3.6 and that the circuit prevents the regulating CEAs from being inserted beyond the Power Dependent Insertion Limit of Figure 3.1-2:

*a. Prior to each entry into MODE 2 from MODE 3, except that such verification need not be performed more often than once per ~~31~~ 92 days, and

b. At least once per 6 months.

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*The licensee shall be excepted from compliance during the initial startup test program for an entry into MODE 2 from MODE 3 made in association with a measurement of power defect.

ATTACHMENT 2

SAFETY ANALYSIS

Introduction

The proposed change to the St. Lucie Units 1 and 2 Technical Specifications modifies the requirement to determine Control Element Assembly (CEA) operability at least once per 31 days by inserting each CEA which is not already fully inserted into the core, at least 7.5 inches (Unit 1) or 7.0 inches (Unit 2). The proposed change will allow for the extension of the surveillance interval for these requirements from once per 31 days to once per 92 days. It is also proposed that the surveillance interval for the performance of the functional test of the CEA block circuit, which is performed as a part of the CEA movement test, be performed on a quarterly basis, rather than the existing monthly basis.

The proposed change modifies Technical Specification Surveillance Requirements (SRs) 4.1.3.1.2, 4.1.3.1.3 and 4.1.3.1.4 for St. Lucie Unit 1 and 4.1.3.1.2, 4.1.3.1.3 and 4.1.3.1.4 for St. Lucie Unit 2.

Increasing this surveillance requirement interval to once per 92 days will provide the following benefits:

1. reduction of the probability of a unit trip or dropped or slipped CEA which results from intermittent or sustained Control Element Drive Mechanism (CEDM) or CEDM control circuit failure,

2. reduction of the frequency of flux perturbations in the core while conducting this surveillance testing, and

3. reduction of the frequency of false alarms and other testing indications that distract the control room operators with the resultant increase of potential operator errors.

Background Discussion

The Full Length CEA (FLCEA) SR, in which each CEA is moved a short distance in the core and back to its starting position, is one of several surveillance tests designed to verify the ability of each CEA to insert on a reactor trip. This SR is the only one of this type performed during power operation to demonstrate this capability (although normal maneuvering and any trips that might occur also do this). The intent of the SR is to demonstrate that the CEA can move freely within a very small range (7.5 inches on Unit 1 and 7.0 inches on Unit 2). The Surveillance test does not, however, verify freedom of movement beyond that range.

A major concern with performance of the subject SR is that it creates the potential for dropped CEAs. Of the 15 plants with a C-E designed Nuclear Steam Supply System (NSSS),

13 have magnetic jack CEDMs, including both St. Lucie units. In the 108 reactor years of commercial operation on these units (as of February 1989), there have been 40 reported occurrences of dropped or slipped CEAs during conduct of this SR. Of these 40 occurrences, two have resulted in reactor trips.

Detection of Stuck CEAs

A search of reported events, including the Licensee Event Report (LER) data collected from NUREG-0020, "Licensed Operating Reactors Status Summary Report," revealed no occurrences of the subject surveillances detecting stuck CEAs to date.

In the combined operating experience of pressurized water reactors with magnetic jack type CEDMs, there have been 13 reported instances of CEAs which could not be fully inserted by gravity (Only events occurring during commercial operation at PWRs with magnetic jack type CEDMS are included). Of these 13, six were discovered on reactor trips, and in only one case, as discussed below, did the CEA stick fully out of the core.

Startup testing and maneuvering have detected a number of occurrences of stuck CEAs. These tests include 1) fully withdrawing all CEAs (demonstrating no mechanical binding), 2) CEA drop tests (demonstrating the CEAs will fully insert within a specified time), and 3) CEA worth tests which involve fully inserting and withdrawing individual CEAs or CEA groups. In a few instances, stuck CEAs have been identified following a trip. In all but one case the CEAs stuck in the lower 1/3 of the core, usually within the area of the dashpot, i.e., the lower 12 inches of the fuel assembly guide tube. In this event, the CEA was subsequently manually driven in by the CEDM, and no further problem was experienced.

Startup testing has detected about 60 percent of the stuck CEAs reported. The remaining 40 percent of stuck CEAs occurred on trip, and generally occurred in the last foot of travel. Full CEA insertion was inhibited by debris which had collected within the dashpot region of the fuel assembly. This type event does not cause a significant reduction in negative reactivity insertion. A CEA which has inserted at least 90% of its negative reactivity is considered to have performed its function and is not a failure to scram.

The probability of a functional failure of the CEA causing a rod to become stuck is very small. This conclusion is based on operating experience, the conservatism in design, the quality assurance program used during the manufacturing process by the NSSS vendor, Combustion Engineering, and the fact that a full size CEA/CEDM combination has been successfully tested under simulated reactor conditions for a length of travel and number of trips considerably greater than what is expected to occur during the design life of the CEA/CEDM.

Exercising individual CEAs verifies that they continue to be operable. The most probable causes of CEA sticking are evaluated and discussed as follows:

1. CEA cladding failure.
   Fretting/wear of the CEA cladding due to contact with the guide tube from flow-induced vibration has resulted in the separation of a control rod from its control

cluster assembly at a non-CE designed plant. A portion of the rod (spring) became jammed in the guide tube and caused the CEA to stick partially out of the core. This type of event has not occurred at any Combustion Engineering plant and, due to the reasons stated above (operating experience, the conservatism in design, the quality assurance program used during the manufacturing process by the NSSS vendor, Combustion Engineering, and the fact that a full size CEA/CEDM combination has been successfully tested under simulated reactor conditions for a length of travel and number of trips considerably greater than what is expected to occur during the design life of the CEA/CEDM), the probability of functional failure of this type is very low. In addition, because of the Combustion Engineering design, it is likely that other surveillances (e.g., azimuthal tilt) would detect the broken CEA.

2. Bowed CEA.
Due to the reasons stated above, the probability for CEA functional failure from this cause is very low.

3. Fuel rod failure.
Since the minimum clearance between a fuel rod and a guide tube in the fuel assembly is at least 1/8 inches, and because the guide tube has about 10 times the resistance to lateral deflection than that of a fuel rod, the probability for CEA functional failure from this cause is very low.

4. Bent CEA extension shaft.
It would take considerable force to bend a CEA extension shaft. Since there is no mechanism which would cause a bending of the CEA extension shaft during operation, this would most likely occur during refueling (e.g., misaligned shafts bent when installing reactor vessel head). CEA extension shafts bent to the extent that would cause a CEA to stick would also prevent installation of the CEDM and therefore would be detected prior to reactor startup.

5. Debris contained in the coolant or dropped into the CEA guide tube during maintenance or refueling.
This is the most probable cause for a stuck CEA during plant operation. However, CEA guide tubes are designed with small diameter flow holes, with axes perpendicular to the direction of reactor coolant flow, which inhibit debris entrance. Additionally, strict materials controls are in place during refueling outages which restrict the dropping of materials into the reactor coolant system.

To date, no Combustion Engineering-designed CEAs have experienced the failures of types 1, 2 or 3 as discussed above. One instance of a bent CEA extension shaft has been experienced, but was detected prior to plant startup after refueling. Two instances of debris blockage have occurred; the first event was discovered during rod drop time testing, and the second, which occurred at St. Lucie Unit 1 in January of 1979, was discovered after a reactor trip. It has been postulated that debris blockage caused the CEAs to stick 8" above the bottom of the core within the dashpot region of the fuel assembly. These types of failures would not have been detected by the subject surveillance. No further instances of CEA debris blockage have been experienced at either St. Lucie Unit.

Proposed Change Discussion

FLCEA Surveillance Extension

The question of whether or not the proposed surveillance interval extension is acceptable hinges upon its effect on the Reactor Protective System (RPS) mechanical portion of the Anticipated Transient Without Scram (ATWS) event tree. For PWRs, the failure of two or more CEAs to fully insert upon demand has been quantified as being 5.43 E-6 (Seabrook Station Probabilistic Safety Analysis, PLG-0300, Revision 2, December 1983, Page D.6-35, Docket Number 50-443). The subject surveillance is intended to detect the most serious type of stuck CEA, one which is stuck fully out. Based on operating experience, the FLCEA surveillance has been ineffective in detecting the expected causes of stuck CEAs. As there has been only one such occurrence (of a single CEA being stuck fully out) in the available data, and that occurrence was not detected by the subject surveillance, it is reasonable to infer that the contribution of this surveillance to a reduction in plant risk is very much smaller than that reported for RPS mechanical risk. Therefore, the extension of this surveillance interval will result in an insignificant contribution to the risk of core melt.

Surveillance Requirement 4.1.3.1.2 also verifies that each CEA can move freely, and verifies the operability of the CEDMs and the reed switch position indicators over a limited portion of CEA travel (7.5 inches on Unit 1, 7.0 inches on Unit 2). As stated earlier, if a CEA is found to be immovable, it must be determined if the CEA is mechanically bound, frictionally bound, untrippable, or immovable due to some other cause. Operating experience to date verifies that frictional and/or mechanical binding, as discussed in the preceding section, are not probable events at Combustion Engineering plants. There have been cases of the FLCEA surveillance detecting inoperable CEDMs and/or reed switches; however, neither of these pose a safety concern.

CEA Block Circuit Surveillance Extension

Surveillance Requirements 4.1.3.1.3 and 4.1.3.1.4.a, addressing the verification of the CEA Block Circuit, ensure that 1) the block circuit prevents any CEA from being misaligned from all other CEAs in its group by more than 7.5 inches on Unit 1 and 7.0 inches on Unit 2, 2) the circuit maintains group overlap and sequencing requirements, and 3) the circuit prevents regulating CEAs from being inserted beyond the Power Dependent Insertion limit.

On each St. Lucie unit, there are two different mechanisms for determining CEA position. The Digital Data Processor provides CEA position information based on the number of pulses generated by the Coil Power Programmer on Unit 1 and by the subgroup logic of the Control ElementDrive Mechanism Control System on Unit 2. The CEA Position Display on Unit 1, and the Analog Display System on Unit 2, are graphic displays of CEA position based on input generated by the reed switch position transmitter on each CEA. CEA position is verified every 12 hours using both the reed switch position indication and the pulse count position indication in accordance with Surveillance Requirements 4.1.3.1.1 and 4.1.3.6. Therefore, should there be a problem with the CEA block circuit which allowed one CEA to become misaligned from the other CEAS in its group, or which allowed the regulating CEAs to be inserted beyond the Power- Dependent Insertion Limit, the maximum amount of time which could pass before this discrepancy was noted would be 12 hours.

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 Commission'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; (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 below:

(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 intent of the Control Element Assembly (CEA) movement testing surveillance is the detection of CEAs which are stuck fully out of the core, and to demonstrate that the CEA can move freely within a small range of movement. The current Combustion Engineering Standard Technical Specification and the St. Lucie Technical Specification 31 day surveillance interval frequency was based on engineering judgement. Operating experience has demonstrated that this surveillance is not a principal method for detecting stuck CEAs. For example, startup testing, which includes CEA drop testing and CEA worth testing, have detected a number of stuck CEAs. Additionally, in a few instances, stuck CEAs have been identified following a trip, and have generally occurred in the last foot of travel. The St. Lucie Units 1 and 2 Updated Final Safety Analysis Report (UFSAR) Chapter 15 Accident Analyses assume the most reactive CEA is stuck in the fully withdrawn position on a reactor trip; therefore, this amendment does not involve a significant increase in the consequences of accidents previously analyzed. As discussed above, other more effective means of detecting stuck CEAs in normal use make operation with an undetected stuck CEA improbable. Therefore, this amendment does not involve a significant increase in the probability of accidents previously analyzed.

Increasing the surveillance test interval of the CEA movement test will decrease the probability of dropping a CEA. Dropped CEAs cause unnecessary flux perturbations in the core, and can result in a reactor trip.

The block circuit test frequency was originally established to be the same as the CEA movement test. The individual CEA block circuit surveillance is not directly connected with any analyzed event, but rather serves as backup to other surveillances and operator action. The CEA group block circuit surveillance applies during initial CEA withdrawal during reactor startup, and is bounded by the CEA Misoperation event previously analyzed.

(2) Operation of the facility in accordance with the proposed amendment will 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 extended test intervals. A single CEA stuck in the fully withdrawn position and CEA misoperation events have been previously analyzed in the St. Lucie Units 1 and 2 UFSAR Chapter 15 Accident Analyses. Additionally, the change does not result in any physical change to the plant or method of operating the plant from that allowed by the technical specifications.

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

The St. Lucie Units 1 and 2 UFSAR Chapter 15 accident analyses assume the most reactive control element assembly is stuck in the fully withdrawn position on a reactor trip; therefore, this proposed change does not alter the margin of safety with respect to limiting positive reactivity additions during a postulated Main Steam Line Break at Hot Zero Power, End of Cycle. Additionally, Shutdown Margin requirements per the St. Lucie Units 1 and 2 Technical Specifications assume the hypothetical worst case stuck CEA.

The Technical Specification Action Statements applicable to misaligned or inoperable CEAs include requirements to align the Operable CEAs in a given group with an inoperable CEA. Conformance with these alignment requirements brings the core, within a short period of time, to a configuration consistent with that assumed in establishing Limiting Conditions for Operation (LCO) limits and Limiting Safety System Settings (LSSS) setpoints.

Even should a CEA misalignment or CEA block circuit failure occur during the proposed 92 day surveillance frequency for testing, other independent means of detecting misaligned CEAs exist, enabling control room operators to implement the Technical Specification ACTIONS as required.

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 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, and therefore does not involve a significant hazards consideration.