UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 132

TO FACILITY OPERATING LICENSE NO. DPR-61

CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

DOCKET NO. 50-213

1.0 INTRODUCTION

Pursuant to 10 CFR 50.90 and 50.91, Connecticut Yankee Atomic Power Company (CYAPCO or licensee) proposed to amend Operating License No. DPR-61 for the Haddam Neck Plant. By letter dated August 25, 1990, and supplemented by letter dated August 30, 1990, CYAPCO proposed to change the Technical Specifications (TS) by providing a clarification on the definition of Operability of the automatic auxiliary feedwater (AFW) initiation system for Cycle 16 operation only. CYAPCO requested that this license amendment be processed on an emergency basis in accordance with 10 CFR 50.91 since an increase in the power level of the Haddam Neck Plant above ten percent up to the full licensed power level is prohibited until this amendment is issued. In addition, CYAPCO requested that the NRC issue a Temporary Waiver of Compliance from the subject TS until the proposed license amendment is issued. By letter dated August 30, 1990, the NRC granted the Temporary Waiver of Compliance.

The NRC staff's safety evaluation of the auxiliary feedwater automatic initiation system Technical Specification (TS) change request is presented in the following three sections:

Section 1.1 - Plant Systems Branch

Section 1.2 - Reactor Systems Branch

Section 1.3 - Human Factors Branch

1.1 Plant Systems Branch Evaluation

1.1.1 Introduction

The auxiliary feedwater system (AFW) for the Haddam Neck Plant consists of two turbine-driven pumps and one motor driven pump with associated piping and controls. Each turbine driven pump normally provides feedwater to a common header which is cross-connected so that one pump is able to provide flow to any or all of the four steam generators should such need arise. The motor driven (MD) pump may be utilized to supply feedwater to the steam generators any time a sufficient steam supply is not available for operation of the turbines for the turbine driven (TD) pumps. However, only the TD pumps are safety-related and are depended on for mitigation of accidents and transients. The MD pump is not safety-related nor automatically initiated, thus cannot be relied upon to mitigate transients and accidents.

The licensee, Connecticut Yankee Atomic Power Company (CYAPCO), uncovered two problems with automatic initiation of the turbine driven pumps for which the plant requires relief in order to operate during Cycle 16 with power in excess of 10%.

1.1.2 Evaluation

The licensee conducted tests which show that sudden full-opening of the steam inlet valves to the turbines of the TD pumps causes turbine overspeed and pump trip. In order to prevent overspeed, the licensee has adjusted the inlet valve to open partially. This partial opening, however, does not permit the turbine to develop the speed to provide the flow required to mitigate the worst transient for which it has been designed - loss of feedwater (LOFW). In order to provide sufficient flow, operator action is required within a 4 minute time frame to further open the steam inlet.

This safety evaluation does not address the acceptability of the time frame in which to allow operator action nor with the affect of such action on the frequency of loss-of-coolant or other accidents nor on the frequency of resultant core damage; these issues are addressed in Sections 1.2 and 1.3.

As discussed above, the steam admittance valve to the AFW turbines should not be allowed to open fully on automatic initiation because the turbines will trip on overspeed. In order to prevent this, the licensee has adjusted the valves to allow incomplete opening on AFW initiation. This is accomplished by using control air to limit the valve opening. Any event requiring AFW operation but which results in loss of control air could result in turbine overspeed and pump trip. The Haddam Neck control air system has not been designed in accordance with safety-related criteria and, thus, is susceptible to failure in a seismic event or because of damage by tornados. The licensee stated that any failure resulting in slow loss of control air such as a small break or compressor loss would not result in a sufficiently rapid loss of air so as to cause a complete, rapid opening of the steam admission valves to the AFW pump turbines and turbine overspeed and trip.

In the event of AFW pump turbine overspeed and trip it would be necessary to restart the turbine manually. As a mitigating action, the licensee has agreed to have an operator dispatched to the local control station for AFW pump turbine initiation whenever the AFW system is initiated automatically. The licensee committed to implement a design change to resolve this issue during the Cycle 16 refueling outage. Therefore, permission to operate while relying on control air for automatic initiation of the AFW system would extend only through Cycle 16.

The licensee has added the following note to item 3, Auxiliary Feedwater, under the heading "Functional Limit" in TS Tables 3.3-2, 3.3-3 and 4.3-2.

> For Cycle 16 operation only, OPERABILITY of automatic initiation of auxiliary feedwater (AFW) is defined as including (1) credit for operator action to adjust AFW to full required flow following automatic initiation and (2) reliance on the control air system to ensure successful automatic AFW initiation. Modifications will be implemented by the end of the Cycle 16 refueling outage, prior to startup for Cycle 17, to remove reliance on operator action and the control air system for successful automatic initiation of AFW.

The staff finds this acceptable, based on the discussion above.

1.1.3 Conclusions

The Plant Systems Branch staff finds the licensee's proposal to require operator action and the use of the control air system to operate the auxiliary feedwater system throughout Cycle 16 acceptable. The licensee has added a note to TS Tables 3.3-2, 3.3-3, and 4.3-2 to indicate that operability of automatic initiation of the AFW system requires operator action and the control air system. The staff finds the TS to be acceptable. As stated in the TS notes, these modifications shall apply only throughout Cycle 16 operation prior to startup for Cycle 17.

1.2 Reactor Systems Branch Evaluation

1.2.1 Introduction

The auxiliary feedwater (AFW) system design of Haddam Neck Plant incorporates two turbine driven AFW pumps. AFW flow is controlled by the steam admission valves to the turbines and by the feedwater bypass control valves on the pump discharge. An automatic initiation system for AFW flow was installed per the staff requirements after the Three Mile Island accident. Rapidly, fully opening the steam admission valve will result in a turbine overspeed trip. Thus, the automatic initiation system was designed to only partially open the steam admission valves. The AFW flow rate associated with the partially open steam admission valves was estimated to be sufficient for a design basis loss of feedwater transient.

During the Cycle 15 refueling outage, Connecticut Yankee Atomic Power Company (CYAPCO), the licensee for the Haddam Neck Plant, identified two issues regarding the automatic initiation of AFW flow. These two issues led the licensee to conclude that it is now not in conformance with its previous commitments on automatic initiation of AFW flow. These issues are as follows:

1) the recently identified nonconservatisms in the calculation of delivered AFW flow have resulted in a reduction in the projected flow. This has resulted in the determination that the calculated flow rate achieved by automatic initiation of AFW alone is not sufficient to assure that the acceptance criteria of the design basis loss of feedwater transient are met and 2) the recent testing confirmed that if there were a rapid depressurization of the control air system, the Terry turbines on the AFW pumps would trip on overspeed following their startup. This leads to a conclusion that the safety grade automatic AFW initiation system would be relying on a non-safety grade control air system to perform its safety related function.

By letter dated August 25, 1990, supplemented by a letter dated August 29, 1990 and information telecopied to the staff on September 7, 1990, the licensee submitted a request for emergency changes to the Technical Specifications (TS) related to the operability of the automatic AFW initiation system. The proposed TS changes would redefine the operability of the automatic AFW initiation by permitting operator actions to adjust AFW to full required flow following automatic initiation of the AFW system and reliance on the control air system to ensure successful automatic AFW initiation. The licensee has requested that the proposed changes of TS would be effective during Cycle 16 operation only. Modifications will be implemented by the end of the Cycle 16 refueling outage, prior to startup for Cycle 17, to remove reliance on operator actions and the control air system for successful automatic initiation of AFW flow.

1.2.2 Evaluation

Following a loss of feedwater event, both of the turbine driven AFW pumps will receive a signal for automatic initiation. Total AFW flow from two pumps will satisfy the design basis flow requirement. However, if a single failure is assumed on one pump, the remaining pump will deliver AFW flow slightly under the required flow rate. In this case, operator actions inside the control room are needed to adjust AFW flow to the required AFW flow rate. The licensee asserted that these operator actions could be accomplished within four minutes. Since a loss of feedwater event will cause a reactor trip very quickly, the operator would enter the emergency operating procedures (EOPs) E-0, "Reactor Trip or Safety Injection," and on the fourth step of E-0, transfer to ES-0.1, "Reactor Trip Response," or transfer to FR-H.1, "Response to Loss of Secondary Heat Sink." For both ES-0.1 and FR-H.1, one of the first steps is to verify adequate AFW flow and to take steps to manually achieve the required flow. Therefore, taking manual control of the AFW system is covered in training and practiced routinely on the simulator. The licensee has performed a walkdown under this scenario following EOP steps and the required operator actions were accomplished in less than 3.5 minutes. In the design basis loss of feedwater analysis, there is a four minute time delay assumed for AFW flow delivered to the steam generators following the initiation of the loss of feedwater event. This conservative assumption in the existing FSAR is now supporting the operator action time required for AFW flow adjustment. Also, the licensee stated that, by a best estimate analysis, approximately 15 minutes are available for the required operator actions and the acceptance criteria for the transient are still met.

During the NRC staff review, a concern was raised that failure of the operator to increase AFW flow within the required time may cause the pressurizer to fill and result in the PORV opening with liquid relief. This is a contributor to the frequency of a small break LOCA. In response to the staff concern, the licensee has estimated that the small break LOCA probability will be increased by approximately nine percent. The staff judges that this increase in the calculated small break LOCA probability at Haddam Neck Plant is acceptable for one cycle. In addition, as a compensatory measure, the licensee has agreed to dispatch an operator to the AFW pump room whenever AFW is automatically initiated to ensure that local control of the AFW system is available if required.

The licensee stated that while the control air is a non-safety grade system, operating experience indicates that the system is highly reliable. However, a rapid depressurization of control air could result from a break of a major pipe in the system. The air line tubing is comprised primarily of copper tubing or stainless steel tubing, both of which are relatively ductile materials. The staff agrees with the licensee's assessment that a catastrophic failure of the tubing is not likely to occur during one fuel cycle. Also, a walkdown performed by the licensee has demonstrated that the operator actions needed to establish the AFW flow following tripping of turbine driven AFW pumps due to control air system failure could be accomplished within 15 minutes. Thus, in the best estimate scenario, the pressurizer will not be filled and result in the PORV opening with liquid relief.

1.2.3 Conclusions

Based on the NRC Reactor System Branch staff evaluation in Section 1.2.2 above, the staff concludes that the licensee proposed Technical Specification Tables 3.3-2, 3.3-3, and 4.3-2 are acceptable only during Cycle 16 operation. The staff requires that plant modifications be implemented by the end of the Cycle 16 refueling outage to remove reliance on operator actions and control air system for successful automatic initiation of AFW flow.

1.3 Human Factors Assessment Branch Evaluation

1.3.1 Introduction

The revised AFW design basis analysis assumes that required AFW flow would not be achieved until four (4) minutes following a loss of feedwater event. The analysis assumes that within four minutes, required AFW flow would be provided by automatic AFW initiation followed by operator action to take manual control of the AFW system at the main control board to increase flow, as necessary. To support their position that operators could adjust AFW flow manually within the analyzed time, the licensee stated that operators are currently instructed in applicable Emergency Operating Procedures (EOP) to verify and, if necessary, to achieve the required AFW flow. The licensee further stated that taking manual control of AFW and accomplishing the actions to increase flow are covered in operator training and practiced routinely on the simulator. To verify that operator actions and response times assumed in the design basis analysis are achievable, the licensee performed a walk-through of the new AFW initiation process. In addition, the licensee performed a walk-through of the back-up operator response to an event requiring operator actions to take control of the Terry Turbine locally because of an overspeed trip. The licensee also performed an AFW initiation event analysis with best estimate assumptions using guidance provided in ANSI/ANS 58.8, "Time Response Design Criteria for Nuclear Safety Related Operator Actions."

The docketed results of the licensee's walk-through times of required operator actions, and the analysis of an AFW initiation event, were submitted for staff review on September 19, 1990. The licensee performed walk-throughs and analyses for two cases. Case 1 involved operator action in the control room to adjust AFW flow to greater than 320 gpm (as required by procedure) to demonstrate that operator actions can achieve the required design basis AFW flow in the time required. Case 2 involved the back-up operator response to an AFW Terry Turbine overspeed trip requiring local manual actions to start an AFW turbine- driven pump to supply the required AFW flow.

Following are summaries of walk-throughs:

Case 1 - Simulating a loss of feedwater, a normal shift complement of operators responded to the event using plant emergency operating procedures. Operators were required to read all steps of the procedures, simulate all required actions, and were instructed not to rush through the procedures. In addition, operators were not allowed to take action to restore the required AFW flow until the procedural step was reached that addresses establishing AFW flow. Normally, operators are allowed to proceed to a subsequent instruction in a procedure before a required task is fully completed, provided that there is assurance that the task is progressing satisfactorily (reference CYAPCO procedure ACP 1.2-6.15 "Emergency Operating Procedures User's Guide"). Timing was stopped when operators reached the point where the simulated AFW flow reached 320 gpm. The total time to complete this simulation was three (3) minutes and 24 seconds. The design basis analysis time to reach the required AFW flow is four (4) minutes.

Case 2 - Simulating a loss of feedwater event, a normal shift complement of operators complied with the committed action of paging an Auxiliary Operator to proceed to the Terry Turbine Room after recognizing that the event had occurred. Timing of this event included a 30 second delay between the event initiation and operator recognition that automatic AFW initiation had occurred. For worst case purposes, the Auxiliary Operator was assumed to be in the Screen House. Upon arrival at the Terry Turbine Room, the Auxiliary Operator was advised that both turbines had tripped on overspeed. Timing was stopped after the Auxiliary Operator had simulated taking local control of a Terry Turbine using the appropriate procedures in place and coordinating with control room operators to establish the required 320 gpm. The total time required to complete this simulation was four (4) minutes and 38 seconds. The design basis analysis time to reach the required AFW flow does not apply to this case.

The licensee's ANSI/ANS 58.8 analysis assumed that for the two cases considered, plant systems parameters were at realistic operating conditions rather than at the design basis analysis conditions. Essentially this difference changed the time allowed to establish greater than 320 gpm AFW flow from four minutes per the design basis analysis to fifteen minutes using best estimate conditions. A summary of the licensee's ANSI/ANS 58.8 analysis is as follows:

Case 1: Loss of feedwater event with control room operators adjusting AFW flow to the required amount, included the following elements:

Event initiation - Both main feed pumps trip.

Event alarm - Reactor trip due to low steam generator level coincident with steam flow/feed flow mismatch (seven seconds after event initiation).

Operator actions alarm (indications to operator that AFW is needed) - Heat sink critical safety function in a red path condition (critical safety function in jeopardy - immediate operator action required).

Time margin -- time interval between event alarm and when operator is ready to take action (five minutes).

Time margin complete -- Earliest time after the event initiation that the operator can be credited with taking action (five minutes and seven seconds for this event).

Complete operator action/safety function - Time operator action and safety function must be completed to ensure design criteria are not exceeded (AFW flow greater than 320 gpm) (fifteen minutes).

Latest time to initiate operator action - Time required to complete safety function minus time required to complete manipulations to establish required AFW flow.

The results of this analysis indicated that there would be a maximum of fifteen minutes available to complete the safety function (i.e., establish required AFW flow). The analysis also established that four minutes would be required for operators to complete the actions necessary to establish required AFW flow, which means that the latest operators could initiate action without exceeding design limits would be 11 minutes into the event. Based on the above elements, the earliest operator actions could be taken in this event is adequate time for operators to establish required AFW flow and remain within best case estimate limits of fifteen minutes.

Case 2: A seismic event causing loss of offsite power, which causes auto AFW initiation and loss of control air requiring local manual actions at the AFW Terry Turbine to establish required flow, contained the same elements as in case 1.

The results of the analysis indicated that there would be 15 minutes available to complete the safety function and six (6) minutes required for completion of operator actions. This means that the latest time operator action could be initiated is nine (9) minutes (15 minus 6) after the beginning of the event. Because ANSI/ANS 58.8 does not allow credit for operator action outside the control room to be taken for at least 30 minutes into the event, the earliest time operator action could be initiated, in accordance with the Standard, is 30 minutes and two (2) seconds into the event (time margin complete element). With the best case estimate time of fifteen minutes, there would not be adequate time available, according to ANSI/ANS 58.8 guidance, for operators to locally establish AFW flow greater than 320 GPM.

1.3.2 Evaluation

The licensee has demonstrated that operator actions can be taken within sufficient time to obtain the required AFW flow following automatic system initiation during a design basis event. The licensee verified, via a walk-through, that under design basis conditions for a loss of feedwater event, a typical operating crew using existing emergency operating procedures could take manual control of the AFW system in the control room and establish the required AFW flow. An additional walk-through was performed in which an automatic AFW initiation occurred, but control room functions were assumed not available because of an AFW Terry Turbine overspeed trip. This required an auxiliary operator to be dispatched to the Terry Turbine to reset the overspeed trip mechanism, and manually start and control the AFW turbine while in communication with control room operators. Operators demonstrated that they could perform the actions required by this event within realistic operating conditions (i.e., best case estimate time limit of fifteen minutes). This event is outside the licensee's design basis analysis and therefore, the operator action times required by their design basis analysis do not apply.

The licensee also analyzed the two plant event scenarios that would require AFW initiation assuming realistic rather than design basis conditions. The analyses were done using the guidance provided in ANSI/ANS 58.8, "Time Response Design Criteria for Nuclear Safety Related Operator Actions." The licensee applied the guidance provided in ANSI/ANS 58.8 appropriately, and demonstrated that control room operators could accomplish the actions required to manually adjust AFW flow to the required levels to successfully mitigate the consequences of a loss of feedwater event, and prevent the condition from degrading into an accident condition. In the scenario requiring operator action outside the control room to manually start and control the AFW turbine, because ANSI/ANS 58.8 states that operator actions outside the control room cannot be taken for 30 minutes after the indication of an event, the analysis showed that the required AFW flow would not be achieved within the time assumed necessary to prevent the event from degrading into an accident condition.

1.3.3 Conclusions

Based on reviewing the results of the licensee's verification walk-throughs and analyses, the staff concludes that the licensee has provided reasonable assurance that the Haddam Neck Plant AFW automatic initiation system, including credit taken for operator actions, can meet the design basis analysis required flow rates within the response times necessary for a loss of feedwater event. The staff is satisfied with the licensee's statement that an event of this type is run routinely on the plant simulator for all operators, and is thoroughly covered in operator training. The staff determined that operating the AFW system in this manner provides an acceptable level of safety, does not present undue risk to public health and safety, and is an acceptable interim approach to be in effect for cycle 16 only.

2.0 EMERGENCY CIRCUMSTANCES

Pursuant to 10 CFR 50.91(a)(6), CYAPCO by letter dated August 25, 1990, requested the NRC to approve this proposed amendment under emergency circumstances. By letter dated August 30, 1990, the NRC issued a Waiver of Compliance for specification 3.3.2 Table 3.3-2 Item 3 allowing power ascension above 10% with the auxiliary feedwater automatic initiation system inoperable. In that letter the NRC informed CYAPCO the NRC would process the proposed amendment under emergency circumstances as the waiver would allow the plant to progress with power ascension until the TS could be processed.

The Haddam Neck Plant is in the process of returning to operation following the Cycle 15 refueling outage. As part of the AFW system testing performed during the preparations for and during start-up, CYAPCO has identified two issues for which CYAPCO concludes that the plant is not in conformance with the TS requirements regarding operability of the AFW automatic initiation system. CYAPCO has determined that the calculated flow rate achieved by automatic initiation of AFW alone is not sufficient to assure that the criteria of the design basis loss of feedwater analysis are met and that the safety grade automatic initiation system relies on a nonsafety grade control air system. TS Table 3.3-2 Item 3 restricts power level to below 10% when the AFW automatic initiation system is inoperable.

Emergency approval is necessary because an emergency situation exists in that failure to act in a timely way would prevent the increase in power output up to the plant's licensed power level. The emergency situation could not have been avoided. The testing of the AFW pumps which demonstrated the reliance of the AFW system on control air system was conducted on August 12, 1990. The plant went critical for the first time since the outage started on August 15, 1990 and went subcritical again on August 17, 1990 for some minor repairs. On August 18, 1990 the plant went critical and progressed to 9% power. CYAPCO held power at 9% while they were determining their course of action because of AFW automatic initiation system problems. On August 22, 1990, CYAPCO submitted a 50.72 report noting the deficiencies of the AFW automatic initiation system and declaring the system inoperable. As noted above, with the AFW automatic initiation system inoperable the plant cannot proceed above 10% power. By letter dated August 22, 1990 CYAPCO proposed to modify the TMI order to extend the TMI order for one cycle for a fully automatic and safety grade AFW automatic initiation system. The staff reviewed this request and stated this was not an appropriate avenue for redefining the operability requirement in the TS. The staff recommended that the TS be amended to redefine the operability requirements of the AFW automatic initiation system for one cycle until the system could be modified. Therefore, on August 25, 1990, pursuant to 10 CFR 50.91(a)(5) CYAPCO requested NRC emergency authorization and approval of the proposed amendment to define the operability of the AFW automatic initiation system as relying on operator action and the nonsafety control air system. Thus, the staff does not believe that the licensee has abused the emergency provisions by failing to make a timely application. Accordingly, the Commission has determined that emergency circumstances exist warranting prompt approval by the Commission, in that failure to act will limit plant output below the design output, the situation could not have been avoided and the amendment, as discussed in Section 5.0, does not involve a significant hazards consideration.

3.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92 state that the Commission may make a final determination that license amendment involves no significant hazards considerations, if operation of the facility, in accordance with the amendment would not:

(1) Involve a significant increase in the probability of consequences of any 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 or safety.

This amendment has been evaluated against the standards in 10 CFR 50.92. The does not involve a significant hazards consideration because the changes would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated.

   Although virtually all design basis accidents except large break loss of coolant accidents (LOCAs) either explicitly or implicitly rely on auxiliary feedwater (AFW) for decay heat removal, only the loss of normal feedwater (FW) accident needs to be reviewed in detail for impact since this accident is the most limiting from the standpoint of AFW system performance both in terms of timing and minimum flow requirements.

The proposed changes will not have any impact on the consequences of a loss of normal FW accident. Assuming that control air is available during system startup and that the operator manually increases flow, system performance will be within the assumptions of the loss of FW analysis. No system parameters will be affected and system response will be as previously assumed. Therefore, the proposed changes will not have any impact on consequences.

The proposed changes will have no significant impact on the probability of occurrence of any design basis accident. The proposed changes can affect only the response of AFW to a system challenge. The changes cannot have any impact on the probability of a loss of normal FW or any other accidents. However, the failure modes associated with the proposed changes will slightly increase the probability of failure of AFW. That is, wither a rapid loss of control air during system initiation or a failure of the operator to increase flow within four minutes (assuming a successful start) would result in failure of the AFW system to meet its design basis requirements.

The reliance on control air to prevent an AFW pump turbine trip on overspeed lasts for only a very brief period of time. A loss of control air after the pump has started will not result in an overspeed trip. Similarly, a slow loss of control air, as would be expected following loss of a running compressor, will likely not result in an overspeed trip. Only a rapid loss of air would result in a trip of the pump turbine.

Even if an overspeed trip were to occur, the pump can be manually restarted by the operator locally in a very short time frame. CYAPCO has committed to dispatch an operator to the Terry turbine building in the event of an automatic AFW system initiation. This commitment provides further assurance that should an overspeed trip occur, the pump can be manually restarted quickly.

It should be stressed that manual start of the AFW pumps does not result in AFW turbine trip. Actual experience supports the conclusion that AFW pump turbines do not overspeed and trip during manual actuation.

Most failures of the control air system would result in a slow loss of air pressure and would have no impact on AFW pump startup. There are very few failure mechanisms which could result in a rapid loss of air pressure. These would include seismic or tornado induced failures.

Although the air tubing is not seismically designed, it is comprised primarily of copper tubing and in some areas stainless steel tubing, both of which are relatively ductile materials. Original plant design required the tubing to be supported for deadweight and thermal loadings, which provides for a very flexible support system capable of accommodating large deformations. Therefore, although the tubing is not seismically qualified, based on engineering judgment it is concluded that a catastrophic tube failure, and rapid loss of control air pressure, is unlikely to occur during a seismic event.

The potential for failure during a seismic event or tornado cannot be ruled out entirely. However, in letters dated September 15 and October 14, 1980, CYAPCO provided the NRC staff with justifications for continued operation until required seismic upgrades have been completed.

The Haddam Neck Probabilistic Safety Study (PSS) evaluated the probability and consequences of loss of main FW and loss of control air initiating events. The PSS also considered the dependency of control air on support systems such as AC power and service water. Although not specifically quantified, only a fraction of complete loss of air events could result in a sudden depressurization of the air system, based on the design.

The potential for AFW pump turbine trip on overspeed due to a sudden loss of control air was not included in the PSS since this issue was raised after the study was completed. However, this issue is expected to have a modest impact on the core melt frequency. The net effect of this increase, in combination with the increase in frequency due to external events, is a potential 3E-5/year increase in total core melt frequency for the nest operating cycle. Based on this, it is concluded that although this aspect of the change (reliance on control air) will result in an increase in the probability of failure of the AFW, the increase in the failure probability is acceptably low and is not significant.

Even if there is no failure in the control air system and the AFW pump starts successfully, operator action is still requires within four minutes from the time main FW is lost in order to successfully mitigate the accident without resorting to more extreme means of reactor coolant system heat removal (i.e., feed and bleed). For accidents other than a loss of normal FW, operator action would still be required to increase flow although the time frame for this action would be slightly increased, on the order of ten minutes. If the operator fails to perform this action in the required time, AFW will not satisfy its intended safety function. Since the proposed change is effectively changing an (assumed) fully automatic system response to one which requires operator action in a relatively short period of time, the probability that the system will fail its safety function is increased.

Although the probability of system failure is increased due to reliance on operator action, the increase in failure probability is not significant. One of the first actions in Emergency Operating Procedure (EOP) ES-0.1, "Reactor Trip Response," is to increase AFW flow to 320 gpm. This EOp would be entered very quickly from E-0, "Reactor Trip or Safety Injection," during any accident for which AFW flow rate would be critical because a loss of Fw event causes a reactor trip very quickly. Taking manual control of AFW and the actions which can be taken to increase flow are covered in training and practiced routinely on the plant-specific simulator. Experience has shown that these actions are taken very quickly. Therefore, although the probability of system failure is increased somewhat by reliance on short-term operator action, the increase is judged to be small.

To summarize, the need for full automatic AFW flow in four minutes following a loss of normal FW event is a worst case analysis assumption. It includes conservative initial conditions and the failure of one of the AFW pumps. If one assumes more representative operating conditions and that both AFw pumps are available, the operator would have significantly more time to ensure full AFW flow. As demonstrated on the plant-specific simulator, the typical operator manually initiates AFW in approximately 30 seconds following the reactor trip. This is an evolution that is practiced often at the simulator during operator requalification training. Therefore, if the operators have demonstrated that they obtain full AFW flow in approximately 30 seconds and analysis demonstrates that it is not needed for four minutes in the conservative case, then expecting operator action to manually adjust AFW flow after automatic initiation and within four minutes of the event is reasonable.

The AFW operating station on the main control board was evaluated in the Haddam Neck Plant Detailed Control Room Design Review (DCRDR). Although no major problems were identified, four Human Engineering Deficiencies (HEDs) were written. Two HEDs pointed out that the AFW controls and displays were not immediately adjacent to each other, although the displays could be read from the control station. The other two HEDs noted that the operator was required to add four individual flow meters to obtain a total AFW flow number, although a total AFW flow number is provided on the Safety Parameter Display System. CYAPCO has concluded that these HEDs are relatively minor and is evaluating the need for correction within the Integrated Safety Assessment Program. As an additional compensatory measure, operator training during the current operator requalification classroom sessions will emphasize this concern with the AFW system.

Proper adjustment of control air to limit the travel of the steam admission valves is established by plant procedure. Plant procedure SUR 5.1-141, "Functional Test for Auto Initiation Scheme for AFW," specifically lists as a prerequisite for proper setpoint of the control knobs to ensure that the steam admission valves open to the correct position. This is established based on Terry turbine steam inlet pressure. The adjustment knobs are on the main control board with indicators that are used to verify that the pneumatic signal is set at the appropriate value. Also, procedure SUR 5.1-141, Step 6.2.12, instructs the operator to record and verify the correctness of the turbine steam inlet pressure during actual testing and take action, if necessary, to bring it back into the proper range.

The proposed changes themselves have no impact on the performance of the AFW system. The changes only consist of reliance on control air to prevent overspeed trip and on the operator to manually increase flow. Actual system responses are not affected. Therefore, the proposed changes are concluded to not result in 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 previously evaluated.

   The proposed changes will have no impact on plant response to any transient or accident. Therefore, the proposed changes cannot create a new accident.

   The recently identified dependence of the automatic initiation of AFW on both operator action to adjust flow and the control air system has identified a new equipment failure sequence leading to a total loss of FW. However, the probability of such an equipment failure sequence (i.e., a catastrophic failure of the control air system or failure of the operators to take action) has been shown to be acceptably small. Therefore, it is concluded that the failure modes do not create a new or different type of accident from any previously evaluated.

3. Involve a significant reduction in a margin of safety.

   Since there is no impact on the consequences of any accident, there can be no impact on any of the protective boundaries. Crediting operator action to increase AFW flow within four minutes of a loss of FW event and relying on the integrity of the control air system ensure that the consequences of the design basis accident analysis are unchanged. This assures that none of the acceptance limits are exceeded and represents no significant reduction in the margin of safety.

Accordingly, the Commission has determined that this amendment involves no significant hazards considerations.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, efforts were made to contact the Connecticut State representatives. The state representative was contacted on August 31, 1990 and had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. We have determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The staff has made a final no significant hazards consideration finding with respect to this amendment. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR §51.22(c)(9). Pursuant to 10 CFR §51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

We have concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment wil' not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Letter from W.D. Romberg of Connecticut Yankee Atomic Power Company to USNRC "Proposed Changes to Technical Specifications on AFW Actuation System," August 25, 1990.

2. Letter from W.D. Romberg of Connecticut Yankee Atomic Power Company to USNRC "Request for Additional Information on AFW Actuation System," August 29, 1990.

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