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Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Crutchfield:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
NUREG 0737, Item II.K.3.18
Modification to ADS Logic

The purpose of this letter is to inform you of the results of the Oyster Creek risk assessment and thermal-hydraulic analyses that were completed in response to this item.

INTRODUCTION

NUREG-0737, Item II.K.3.18 states that the Automatic Depressurization System (ADS) actuation logic should be modified to eliminate the need for manual actuation to assure adequate core cooling. The ADS reduces the reactor pressure so that flow from the Core Spray System enters the reactor vessel in time to cool the core and prevent excessive fuel cladding temperatures. After a two minute time delay, the electromatic relief valves (EMRVs) automatically open when all of the following conditions are met:

1. High drywell pressure

2. Triple low water level

3. Pressure sensed at the core spray booster pump discharge.

The BWR Owners Group (BWROG) performed a generic study of alternatives to the present ADS actuation logic: the current design and seven logic modifications. The NRC staff evaluated the BWROG study and concluded that the acceptable options are:

1. Elimination of the high drywell pressure permissive and addition of a manual inhibit switch.

2. Bypass of the high drywell pressure permissive after a sustained low water level and addition of a manual inhibit switch.

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RISK ASSESSMENT METHODS

The following events were evaluated using PRA techniques in order to calculate the frequency of severe core damage based on a failure of ADS initiation for transients or accidents not resulting in a drywell pressure increase:

1. Inadvertent opening of one relief valve (IORV)

2. LOCA Above Core Outside Containment (LACOC)

3. LOCA Below Core Outside Containment (LBCOC).

Event Sequence Diagrams (ESD's) were developed for each initiating event; these are the basic models for illustrating the possible courses which can be taken after an initiating event has occurred. Each event sequence is comprised of a combination of successes and failures of various systems, subsystems, and components which lead to a safe plant condition or to an expected core damaged state. Event trees were developed for each ESD to calculate the event sequence frequencies. The following values were used for initiating event frequencies in this analysis:

IORV	1.53E-2/year
LACOC	6.49E-2/year
LBCOC	3.39E-3/year

The approach to determining IORV initiating event frequency involved all information available, including industry experience, Oyster Creek experience and expert judgment to develop the Oyster Creek specific predictions. LOCA initiating event frequencies were derived from the Reactor Safety Study. The frequency for each accident sequence is determined by calculating the product of the initiating event frequency and the conditional probability of each branch in that sequence. The frequency of core damage due to the given initiating event is calculated by summing the frequencies for those sequences which result in a core damage state.

THERMAL-HYDRAULIC ANALYSIS METHODS

A series of analyses were performed using the RETRAN 02-3A computer code to evaluate the transient plant response for breaks outside containment. Three piping systems were chosen for break locations:

RETRAN CASES	CORRESPONDING PRA INITIATING EVENTS
. Main Steam	IORV
. Isolation condenser (break located in condensate piping)	LACOC
. Cleanup	LBCOC

For each of the breaks analyzed, a loss of offsite power was imposed in addition to the break. Under this condition, the recirculation pumps, the main condenser and the feedwater system would be unavailable. In addition, the failure of one Isolation Condenser was assumed and no operator action was allowed.

All but one of the cases (0.2 ft^2 LOCA in cleanup system) showed that one Isolation Condenser can depressurize the reactor vessel to the Core Spray injection pressure without the maximum cladding temperature exceeding 800°F as calculated by RETRAN. The 0.2 ft^2 cleanup system case resulted in a maximum cladding temperature of less than 800°F when two Isolation Condensers were available.

SUMMARY OF RESULTS

The three initiating events considered in the risk assessment were evaluated over a range of ADS failure frequencies (from 1E-3 failures/demand to a value of 1.0 failure/demand, which represents total unavailability of the ADS function). These are failures to manually initiate ADS, since automatic actuation is not called for in these events due to the absence of a high drywell pressure.

. Inadvertent Opening of One Relief Valve (IORV) was well below the Safety Goal criteria for all ADS failure frequencies. For the case in which ADS function is completely failed, the IORV core damage frequency from the event tree quantification is 1.05E-8/year.

. In the LOCA Above Core Outside Containment (LACOC) ESD, failure of the Automatic Depressurization System transfers to the Isolation Condenser block. This model with one isolation condenser and the ADS function failed resulted in core damage frequency of 9.32E-8/year.

. The LOCA Below Core Outside Containment (LBCOC) ESD included two independent success paths which would lead to a stable condition.

The first path requires ADS. The other path involves two additional event blocks, Isolation Condenser Actuation (IC) and Relief Valves to Depressurize (RV). RETRAN computer runs show that two isolation condensers are needed for this type of LOCA to prevent excessive fuel cladding temperatures. For the case of ADS failed, both isolation condensers required for system success, and a relief valve manual operating failure rate of 0.1 per demand, the core damage frequency is 3.15E-6/year.

If either of the two NRC approved design options were installed, then ADS would be automatically called on to operate for the three initiating events in this report. A representative value of 1E-3/demand has been selected for ADS failure frequency (specific Oyster Creek ADS reliability for such a modified system has not been determined). The following table shows the estimated reduction in core damage frequency when the proposed ADS logic modification is compared to the risk assessments results which take no credit for ADS actuation:

	IORV	LACOC	LBCOC
Results of risk analysis (ADS Failure Freq. = 1.0)	1.05E-8	9.32E-8	3.15E-6
Proposed ADS logic modification (ADS Failure Freq. = 1E-3)	3.65E-9	9.30E-8	3.14E-8
Reduction in core damage freq.	6.85E-9	2.00E-10	3.12E-6

Therefore, the proposed ADS logic modification could reduce the core damage frequency by 3.13E-6/year.

The two LOCA initiating events would result in increased core damage frequencies if credit were not allowed for operation of the Isolation Condensers:

1. LOCA Above Core Outside Containment (LACOC) - core damage frequency is 3.13E-6 with ADS failed and no Isolation Condensers.

   The original LACOC model was revised to show the effect of an additional safety feature (Isolation Condenser Actuation) to perform the depressurization function. One of the two isolation condensers is required for success to provide natural circulation cooling and depressurization of the reactor vessel Failure of the isolation condensers is assumed to result in core damage since ADS and feedwater have already failed.

2. LOCA Below Core Outside Containment (LBCOC) - core damage frequency is 2.91E-5 with ADS failed and no Isolation Condensers.

As in the revised LACOC model, failure of ADS lead to the IC event block, which serves as a backup, standby means of decay heat removal. Failure of the Isolation Condenser results in a core damage state. Success of event IC, together with the core fuel remaining coolable, results in the core spray injection function. In a small break LOCA outside containment, the water that would normally be pumped from the torus to the reactor vessel will now be discharged through the pipe break to the reactor building. The relief valves are required to depressurize the system and control the water inventory loss. Manual opening of relief valves to terminate inventory loss from the pipe break is not required until after Core Spray injection has been established.

Based on the results of the risk analysis which shows a core damage frequency of 3.25E-6/year, and the plant transient response for various breaks outside containment, we feel that no ADS logic modifications are necessary for Oyster Creek.

However, for certain plant transient conditions, the Oyster Creek Emergency Operating Procedures (EOPs) requires that automatic initiation of ADS be prevented by manually resetting the timer every one minute. Installation of an ADS manual inhibit switch is planned during the Cycle 11 refueling outage.

If you have any questions, please contact Mr. Drew Holland of my staff at (609)971-4643.

Very truly yours

Peter B. Fiedler
Vice President and Director
Oyster Creek

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