WESTINGHOUSE CLASS 3

WCAP-11718

EVALUATION OF THE MARGIN TO STEAM GENERATOR OVERFILL FOR MILLSTONE UNIT 3

P. H. Huang

JANUARY 1988

Nuclear Safety Department

Westinghouse Electric Corporation
Nuclear Energy Systems
P.O. Box 355
Pittsburgh, Pennsylvania 15230

TABLE OF CONTENTS

Evaluation of the Margin to Steam Generator Overfill for Millstone 3

I. Introduction/Background

One of the requirements for plant specific information listed in the NRC safety evaluations for WCAP 10698, "SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill", is an assessment of the individual plant relative to the reference plant analyzed in WCAP 10698 to demonstrate margin to steam generator overfill for a design basis SGTR.

This report provides a survey of the Millstone 3 primary and balance of plant system designs relative to the reference plant. [

]a,c An assessment is then performed to evaluate the effects of the system differences on the margin to overfill. The evaluations are based on the following assumptions:

[ ]a,c

II. Comparisons for Millstone 3 and the Reference Plant

A. Design Basis SGTR Analysis for the Reference Plant

The design basis SGTR analysis for the reference plant was performed using the LOFTTR1 program. The analysis was performed for a double-ended rupture of one steam generator tube using conservative parameters and assumptions with respect to overfill. It was assumed that a loss of offsite power occurred at the time of reactor trip, and the highest worth rod was assumed to be stuck at reactor trip.

The major operator actions for SGTR recovery which are included in the E-3 guideline of the WOG ERGs were explicitly modelled in the analysis. The operator actions modelled include identification and isolation of the ruptured steam generator, cooldown of the RCS to establish subcooling margin, depressurization of the RCS to restore inventory, and termination of SI to stop primary to secondary leakage.

1. Identify and Isolate the Rupture Steam Generator:
   Recovery actions of a tube rupture begin by isolating steam flow from the ruptured steam generator and throttling the auxiliary feedwater flow to the ruptured steam generator. The ruptured steam generator is assumed to be identified and isolated when the narrow range level reaches [ ]a,c or at [ ] minute after initiation of the SGTR, whichever is longer.

2. Cooldown of the RCS to Establish Subcooling Margin:
   After isolation of the ruptured steam generator, there is a [ ]a,c minute operator action time imposed prior to cooldown. The RCS is cooled by dumping steam from the PORV on one intact steam generator to the atmosphere. The cooldown is continued until RCS subcooling at the ruptured steam generator pressure is 20 F plus an allowance for subcooling uncertainty.

3. Depressurize the RCS to Restore Inventory:
   After the RCS cooldown is completed, a [ ]a,c minute operator action time is imposed prior to depressurization. The RCS is depressurized to assure adequate coolant inventory prior to terminating SI flow. With the RCPs stopped, normal pressurizer spray is not available and thus the RCS is depressurized by opening a pressurizer PORV. The depressurization is continued until any of the following conditions are satisfied: RCS pressure is less than the ruptured steam generator pressure and the pressurizer level is greater than the level uncertainty, or pressurizer level is greater than 80% minus level uncertainty, or RCS subcooling is less than the subcooling uncertainty.

4. Terminate SI to Stop Primary to Secondary Leakage:
   After the RCS depressurization is completed, an operator action time of [ ]a,c minute is imposed prior to SI termination. The SI flow is terminated when the RCS pressure increases, minimum AFW flow is available or at least one intact steam generator level is in the narrow range, RCS subcooling is greater than the subcooling uncertainty, and the pressurizer level is greater than the level uncertainty.

B. Comparisons of the Plant Systems and Equipment Used for SGTR Recovery

The major RCS and SG parameters, and systems/equipment used for SGTR recovery for Millstone 3 (NEU) and the reference plant are compared in Table 1.

RCS parameters

[ ] a,c

SG parameters

[ ] a,c

SI System

[ ] a,c

AFW System

[ ] a,c

SG PORV capacity

[ ]a,c

Przr PORV capacity

[ ]a,c

Table 1
Comparison of the major RCS and SG parameters, and systems/equipment used for SGTR Recovery for Millstone 3 (NEU) and the reference plant.

	Millstone 3 (NEU)	Reference Plant of WCAP 10698

[ ]a,c

C. Comparisons of the Emergency Operating Procedures, Operator Action Times and the Worst Single Failure

Emergency Operating Procedure

[ ]a,c

Operator Action Times

[ ]a,c

Worst Single Failure Assumption

[ ]a,c

TABLE 2

OPERATOR ACTION TIMES FOR DESIGN BASIS SGTR ANALYSIS

Action	[a,c]
Identify and isolate ruptured SG	
Operator action time to initiate cooldown	
Cooldown	
Operator action time to initiate depressurization	
Depressurization	
Operator action time to initiate SI termination	
SI termination and pressure equalization	

* These times are dependent upon the plant design and parameters and the equipment used to perform the operations, and therefore are calculated with the LOFTTR1 analysis program.

D. Comparisons of SGTR Transient and Margin to Overfill for Millstone 3 and the Reference Plant

The SGTR transient for Millstone 3 is expected to be different from the transient for the reference plant. [

]a,c The following are the evaluations of the effects of the system designs on the transient recovery times and margin to overfill for each of the four major recovery periods.

1. Time to isolation of the ruptured SG

[ ]a,c

2. Time to complete cooldown

[ ]a,c

3. Time to complete depressurization

[ ]a,c

4. Time to terminate the primary to secondary leakage

[ ]a,c

5. Comparison of Margin to Overfill for Millstone 3 and the Reference Plant

Based on the above evaluation, the time at which safety injection flow is terminated for Millstone 3 is expected to be approximately the same as the reference plant. However, the time at which primary to secondary leakage is terminated for Millstone 3 could be significantly longer than for the reference plant.

The following system responses/parameters will increase the margin to overfill for Millstone 3:

[ ]a,c

The following system responses/parameters will decrease the margin to overfill for Millstone 3:

[ ]a,c

Overall, the margin to overfill for the Millstone 3 is expected to be greater than for the reference plant since the break flow rate for Millstone 3 is expected to be lower than the break flow rate for the reference plant. However, it is not possible to quantify the difference without an explict analysis since there are negatives as well as positives in the above comparisons.

E. Evaluation of Margin to Overfill for the Millstone 3

The margin to overfill for the Millstone 3 has also been estimated based on the [ ]a,c with some simple assumptions on [ ]a,c The results indicated that margin to overfill can not be demonstrated since overly conservative assumptions were necessary when hand calculation were used. Those assumptions include the following:

[ ]a,c

It is expected that a significant increase in margin to SG overfill could be demonstrated such that margin to overfill would be demonstrated if a detailed analysis utilizing the computer program and methodology described in WCAP 10698 is performed.

III. REFERENCES

1. Lewis, Huang, Behnke, Fittante, Gelman, "SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill," WCAP-10698-P-A, August 1987. [PROPRIETARY]

2. Lewis, Huang, Rubin, "Evaluation of Offsite Radiation Doses for a Steam Generator Tube Rupture Accident," Supplement 1 to WCAP-10698-P-A, March 1986. [PROPRIETARY]

3. J. A. Camp, Letter from NEU to Westinghouse Concerning Plant Specific Information for Millstone 3 for the Evaluation of Margin to Overfill, January 7, 1988.

4. E-3 Procedure for Millstone 3