Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

SEP 0 1 2005

10 CFR 50.4

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - UNRESOLVED ITEM 05000390/2005002-05, FAILURE TO IMPLEMENT AND MAINTAIN SHUTDOWN PROCEDURES RESULTING IN PRESSURIZER PORV ACTUATIONS

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley authority	)	

The purpose of this letter is to provide information for NRC consideration in its preliminary significance determination for the subject unresolved item from Inspection Report 2005-002 dated April 29, 2005.

This issue was the subject of a telephone conference with TVA's and NRC's risk analysts on August 16, 2005, where TVA discussed its initial risk insights.

TVA's Probabilistic Safety Analysis (PSA) contractor, ABS Consulting, has completed an event tree model for defining core damage sequences resulting from the subject issue. Those results show that the potential core damage scenarios are very low frequency and total to about 3.5 E-08 per year (Delta CDF). This result would characterize the issue well into the green finding category.

IE01

Based on this very low risk result, TVA is providing a summary of the evaluation for NRC's consideration in dispositioning the subject finding.

There are no regulatory commitments associated with this submittal. Should you have any questions on the enclosed information, please contact me at (423) 365-1824.

Sincerely,

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Enclosure
cc: See Page 3

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Enclosure

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Enclosure
ABS Consulting Report Dated August 30, 2005

Potential Scenarios Leading from Challenges to the PORVs During RHR Cooling

Introduction

During the cool down of Watts Bar Nuclear Unit 1 for refueling shutdown in February of 2005, the pressurizer PORVs were challenged at least four times. The analysis in this report defines the core damage scenarios that could have resulted from these challenges. An event tree model was developed based on the procedures that the operators are required to follow (Reference 1). The results show that the potential core damage scenarios are very low frequency and total to about 3.5E-08 per year. The scenarios were developed to a level where the frequencies are low enough and not developed further. Most of these scenarios can be developed further with other modes of cooling and makeup.

Initial Conditions

The scenarios were defined using an event tree. The following conditions existed when the PORVs were challenged:

1. Closed loop RHR cooling at approximately 312 psi and approximately 140 deg F. (subcooled conditions).

2. One PORV was blocked, the second PORV and RHR suction relief valve were available for overpressure protection (COMS).

3. Secondary cooling was stopped but steam generators still carried substantial inventory.

4. RCP No. 2 still in operation.

5. Charging in progress with bypass letdown at approximately ~165 gpm.

6. Initial containment breeches had just started – not equipment hatch, ice condenser, or personnel air lock.

7. Work was in progress to get off bypass letdown and go back on the main letdown valve 62-93.

Assumptions for the Event Tree Model

The following logic is used to develop the scenarios:

1. Challenge to the PORV results in lifting of the valve. If the valve reseats after pressure relief, it is a success.

2. If the PORV fails to open, the RHR relief valve will open. If the valve reseats after pressure relief, it is a success.

3. If neither valve opens to relieve pressure, it is assumed that there will be a break somewhere in the RHR system; the pump seals may fail or there may be leaks in the heat exchanger. No credit was taken for the operator action to shut off the charging pumps or increasing letdown per the procedures.

4. If the PORV lifts, there are sufficient indications in the control room to inform the operator (RCS APPROACHING COPS SETPOINT and COPS PORV ACTUATE alarms). If the RHR relief valve lifts (RHR SUCT FCV-74-1, 2, 8, 9 OPEN & HI PRESS alarm), the operators will know about the loss of coolant as the RCS level drops. The procedures guide the operators to isolate the leak by blocking the stuck open PORV or securing RHR.

5. If a leaking PORV is blocked and the second PORV is successfully unblocked, RHR and charging can continue. If the leaking PORV cannot be blocked, charging system can be used to makeup the lost coolant. However, since the RCS was subcooled at the time of the events, the leak would not continue for very long.

6. If RHR is successfully isolated to stop a leaking RHR valve or other leaks, the operators are instructed to return to secondary cooling. If secondary cooling cannot be restored, then the operators are instructed to return to RHR with makeup for lost coolant using the charging system.

7. If the leak cannot be isolated and makeup is required, eventually, makeup to the RWST will be required. This may be at the end of 15 to 20 hours. This long time window essentially implies that operator error rate to carry out these actions is negligibly small. If equipment failures are encountered, they can be recovered, repairs can be made. If primary water is exhausted, fire water can be used with boron added to the tanks.

8. The time window to return to secondary cooling is in excess of 4 to 5 hours due to the inventory in the steam generators. This long time window essentially implies that operator error rate to carry out these actions is negligibly small. If equipment failures are encountered, they can be recovered, repairs can be made.

9. The procedures define alternate cooling methods when RHR and secondary cooling are both unavailable. These have not been included in this analysis.

10. When the accident scenarios defined are sufficiently low in frequency (~< 1.0E-8), the scenario is not developed any further.

11. During the outage, multiple crews are available for recovery actions when necessary equipment is not available or fails when needed. The Technical

Support Center can be manned quickly and emergency instructions are available to the operators to interpret the emergency procedures or to take steps beyond the emergency procedures.

12. The event tree model developed based on these assumptions was quantified with data from the Watts Bar PSA (Reference 2) as far as possible. The data from the power PSA is considered to be conservative for this use, specially the human error rates.

13. Not considered in the model is gravity feed if secondary cooling and charging both fail. With the subcooled conditions, an open PORV will essentially drop the RCS pressure to ambient conditions making gravity feed possible.

Figure 1 shows the Event Tree model that was used to quantify the sequences.

Data Used For the Event Tree Top Events

Table 1 provides the data that was used to calculate the values for the top event. The major equipment is indicated in the table. The actual value used in the event trees is somewhat higher accounting for some passive components in the system that are not explicitly evaluated.

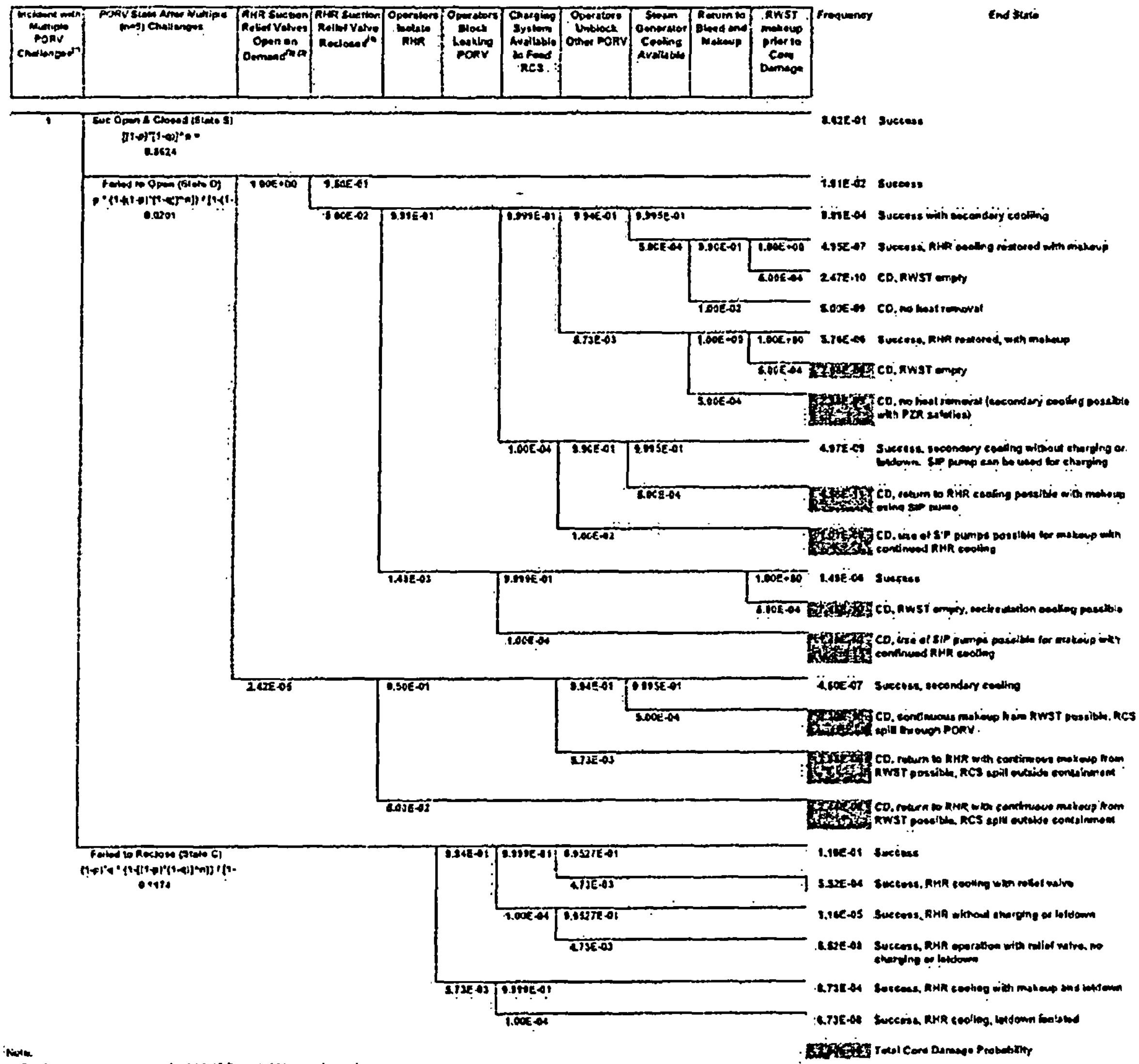
References

1. Watts Bar Nuclear Plant Abnormal Operating Instruction, AOI-14, Loss of RHR Shutdown Cooling, Revision 29.

2. Watts Bar Nuclear Plant Probabilistic Risk Assessment, 2001.

3. N-1363, EG&G Idaho, Inc., "Data Summaries of Licensee Event Reports of Valves at U.S. Commercial Nuclear Power Plants: January 1, 1976, to December 31, 1978," U.S. Nuclear Regulatory Commission, NUREG/CR-1363, May 1980.

4. U.S. Nuclear Regulatory Commission, "Reactor Safety Study, An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," October 1975, WASH-1400 (NUREG 75/014)



Note.
(1) The following are parameters for PORV fails probability per demand

n	5	n is the number of open (and reseat) challegnes
p	4.27E-03	p is the probability PORV failure to open per challenge
q	2.50E-02	q is the probability PORV failure to reseat per demand

(2) For top event heading, the upper branch is success branch, i.e., the description in heading is true.

Figure 1. Event Tree for PORV Challenges

Table 1. Data Used for Top Event Evaluation	
Top Event	**Data***
PORV fails to open, fails to reseat.	PLG-0500 (based on N-1363), 4.27E-03 for fail to open; 2.50E-02 for fail to reseat
RHR suction Relief valves open and reclose	PLG-0500 (based on WASH-1400. 5th and 95th values used as 20th and 80th, stretching the distribution and resulting in a higher mean) 2.42E-05 for fail to open and 5.00E-02 for fail to reseat
Operators isolate RHR	HER from WBN PRA for block a PORV (HAPI1) + Common cause failure of two MOVs to close 1.43E-3 + 1.17E-02*4.3E-03 = 1.48E-3
	5.0E-2 used after break in RHR system
Operators block leaking PORV	HER from WBN PRA for block a PORV (HAPI1) + failure of MOVs to close 1.43E-3 + 4.3E-03 = 5.73E-3
Charging system available	Two motor driven pumps available for charging, one in operation (3.36E-5 per hour) and one in standby (1.85E-3) + Common cause failure of pumps to run (1.25E-2) ~=1.0E-5 over 24 hours
Operators unblock second PORV	HER from WBN PRA for block a PORV (HAPI1) + failure of MOVs to close 1.43E-3 + 4.3E-03 = 5.73E-3
	1.0E-2 used after failure of charging
	4.3E-3 used when used with action to block leaking PORV
RWST makeup prior to core damage	HER considered negligibly small since action taken after 15 to 20 hours of injection. Two primary water pumps available in standby. 3.35E-5 fail to run CCF 1.0E-2 3,29E-3 fail to start CCF 7.03e-2 ~=2.6E-4 over 24 hours Other sources not considered in value
Steam generator cooling available	Two motor driven AFW pumps available, 3.42E-5 fail to run CCF 6.77E-3 3.29E-3 fail to start CCF 3.28E-1 one electric MFW pump available 3.3E-5 fail to run 3.5E-5 fail to start ~=5.0E-6 over 24 hours

Table 1. Data Used for Top Event Evaluation	
Top Event	**Data***
Return to bleed and makeup	Restore RHR (PORV did not lift and second PORV cannot be unblocked, no leak in RHR system) Two RHR pumps available and letdown line valves have a bypass valve each. 8.67E-5 fail to run CCF 6.0E-3 2.39E-3 fail to start CCF 5.0E-2 4.3E-3 MOV fails to open CCF β 1.21E-3 CCF γ 0.285 CCF δ 0.856 Failure to restore ~=2.0E-4
	Restore RHR (leaking PORV blocked and second PORV cannot be unblocked) HER from WBN PRA for block a PORV (HAPI1) + failure of one MOVs to open 1.43E-3 4.3E-3 MOV fails to open = 5.73E-3
*All data from WBN PRA except RHR relief valves fail to reseat.	