

April 9, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Analysis
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

SUBJECT: COMMENTS ON AP600 EMERGENCY RESPONSE GUIDELINES (ERGs) PASSIVE
SAFETY SYSTEM TERMINATION GUIDANCE

Dear Mr. Liparulo:

The Nuclear Regulatory Commission (NRC) Reactor Systems Branch, with assistance from a contractor from Brookhaven National Laboratory, has reviewed the AP600 ERGs to determine if they provide clear guidance on the termination of passive safety systems by the plant operators. Based on this review, the staff has generated comments that may require the ERGs to be corrected and revised. These comments are attached as an enclosure to this letter. Westinghouse is requested to review these comments and arrange for a meeting or telephone conference to discuss what actions are necessary for resolution. We also request that these comments be included in the open item tracking system so that the status and disposition of these items can be tracked.

If you have any questions regarding this matter, you can contact me at (301) 415-1141.

Sincerely,

original signed by:

William C. Huffman, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

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Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

cc: Mr. B. A. McIntyre
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
P.O. Box 355
Pittsburgh, PA 15230

Mr. Ronald Simard, Director
Advanced Reactor Programs
Nuclear Energy Institute
1776 Eye Street, N.W.
Suite 300
Washington, DC 20006-3706

Ms. Cindy L. Haag
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15230

Ms. Lynn Connor
Doc-Search Associates
Post Office Box 34
Cabin John, MD 20818

Mr. M. D. Beaumont
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
One Montrose Metro
11921 Rockville Pike
Suite 350
Rockville, MD 20852

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

Mr. Sterling Franks
U.S. Department of Energy
NE-50
19901 Germantown Road
Germantown, MD 20874

Mr. Robert H. Buchholz
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Mr. S. M. Modro
Nuclear Systems Analysis Technologies
Lockheed Idaho Technologies Company
Post Office Box 1625
Idaho Falls, ID 83415

Barton Z. Cowan, Esq.
Eckert Seamans Cherin & Mellott
600 Grant Street 42nd Floor
Pittsburgh, PA 15219

Mr. Frank A. Ross
U.S. Department of Energy, NE-42
Office of LWR Safety and Technology
19901 Germantown Road
Germantown, MD 20874

Mr. Ed Rodwell, Manager
PWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94303

Mr. Charles Thompson, Nuclear Engineer
AP600 Certification
NE-50
19901 Germantown Road
Germantown, MD 20874

Staff Comments on
AP600 Emergency Response Guidelines
Termination Criteria

Introduction

The AP600 Emergency Response Guidelines (ERGs) were reviewed to determine if they provide sufficiently clear guidance concerning the termination by the operators of the passive safety systems.

The original version, Rev. 0, of these ERGs was reviewed before Rev. 2 was received. Then after Rev. 2 was received and inserted into the ERG Volumes, the review was rechecked against Rev. 2. Some changes to the findings resulted from the Rev. 2 changes.

The AP600 passive safety systems considered for this review task are:

- Core Makeup Tanks (CMT)
- Passive RHR System (PRHR)
- Automatic RCS Depressurization (ADS)
- Accumulators
- Passive Containment Cooling (PCS)
- In Containment RWST (IRWST)

It should be noted that the work for this portion of the review of the ERGs was not global and was limited in scope to that described above.

Comments

AE-0. "Reactor Trip or Safety Injection"

- #1 Step 25 This step requires the operator to check if the passive safety systems should be terminated. The operator checks the following CSFs: RCS subcooling, RCS heat sink, RCS pressure, & pressurizer level against criteria. If the criteria are satisfied, the operator leaves this guideline and transfers to AES-1.1, "Passive Safety Systems Termination." In general, for these critical safety functions (CSFs), the availability/status of the non-safety systems do not appear to be verified. In one case (RCS heat sink) there is a check of the non-safety systems, by checking total feed flow to SGs or narrow range SG level in one SG. However, there is also an "or" for PRHR operating. The RCS decay heat removal portion of Step 25 is thus worded such that it can be satisfied with only PRHR operating. (Perhaps the "or" was intended to be an "and.") Yet the purpose of the step is partially to determine if PRHR should be terminated. Thus, depending on the philosophy of when/whether to check for the availability of non-safety backup systems, the

Enclosure

transition to AES 1.1, Passive Safety Systems Termination, may be premature. Note: the steps after Step 25 and 26 would not be performed, including:

- Step 27 Initiate monitoring of CSF status trees
- Step 30 Check if ADS should be actuated
- Step 36 Check if PRHR should be isolated (checks for SFW operation and NR level in at least one SG)
- Step 37 A return to Step 12.
- Transfers to other event based procedures in several steps.

In AES 1.1, "Passive Safety Systems Termination," Step 6 checks the following to see if PRHR should be isolated: (1) SFW in operation and (2) NR level in at least one SG. However, if these two criteria are not met, one still proceeds to step 7 without securing PRHR at this time. Thus, given the criteria of AE-0 Step 25, you could enter AES 1.1 without SFW. If that's the case you continue in procedure AES-1.1 with PRHR operating and no SFW. Further instructions do not appear to be given. Per the background document (knowledge section) step 6 of AES 1.1 is not a continuous action step. Thus, while the intent of AES 1.1 is to terminate the safety systems, you enter it really not ready to terminate PRHR and the procedure does nothing further to solve that problem.

AES-0.1. "Reactor Trip Response"

- #2 Page 2 of the guideline has a generic caution statement that if SI actuation occurs during this guideline - go back to AE-0.

- Step 1 Requires the operator to take various decay heat removal actions to control RCS temperature. One of these actions is to initiate PRHR. Step 1 also contains actions to terminate PRHR.
- Step 3 Requires the operator to manually actuate PRHR if SFW is not available and SG narrow range level criteria is not satisfied.

These steps do not explicitly direct the operator to another procedure (such as AE-0 or AES-1.1) for PRHR termination. The criteria in this ERG for PRHR termination are different from other ERGs. Moreover, subsequent steps in AES-0.1 do not provide PRHR termination guidance. It does not appear that the caution statement, noted above, encompasses PRHR.

- #3 Step 6 This step checks CMT status. The CMT system auto actuates at a certain pressurizer level. If PZR level is less, the operator verifies that the CMT injection valves are open. If not, the valves are manually opened. The operator is directed to continue

with Step 7 of the procedure, rather than being explicitly directed back to AE-0. This appears inconsistent with the purpose and entry conditions of the ERG.

Note: Step 7 looks at PZR pressure. If it is less than (P11) psig, SI actuation is verified or manually actuated, and the operator is directed to AE-0.

With regard to the CMT, Step 6 should probably have an independent statement to direct the operator to AE-0 instead of relying on Step 7. Procedure AES-0.1 appears to assume that CMT actuation on level (Step 6) will always occur simultaneously with a low RCS pressure actuation (Step 7) and therefore separate transfers are not necessary. That may not be true for spurious actuations.

#4 Step 14 The last step of this procedure directs the operator to AES-0.2 Natural Circulation Cooldown. AES-0.2 appears to assume PRHR and/or CMT are not actuated, but they may have been actuated in this procedure.

#5 In summary, the procedure has several steps that initiate PRHR. It does not appear that the actuation of PRHR transfers the operator to AE-0. Further, one step (Step 1) in AES-0.1 can isolate PRHR (and the termination criteria are not the same as in AES-1.1). It appears that PRHR could remain in operation as you transition out of this procedure into natural circulation cooldown which does not appear to address PRHR.

AES-0.2. "Natural Circulation Cooldown"

#6 The use of PRHR support systems (i.e., IRWST cooling) are not addressed for using PRHR in a natural circulation cooldown. The IRWST may eventually heat to saturation. It would seem that these support systems should be addressed in the ERGs.

AE-1. "Loss of Reactor or Secondary Coolant"

#7 Steps 5&6 These steps check if passive safety systems should be terminated and directs the operator to AES-1.1, "Passive Safety Systems Termination." The same comment applies as discussed for AE-0 Step 25 with respect to the "or" for PRHR and feed flow.

#9 Step 8 This step checks if passive containment cooling (PCS) should be stopped. If the containment pressure is less than the criteria, the operator is instructed to stop PCS.

The termination criteria do not consider the status/availability of other containment heat removal systems prior to stopping PCS. It is not clear if the containment pressure criterion inherently considers this.

#10 General Comments on AE-1:

- (a) Unlike AE-0, this guideline does not direct the operator back to the beginning of the procedure. If the transfer to AES-1.1, "Passive Safety Systems Termination," at Steps 5 and 6 isn't satisfied, one gets to the end of AE-1 (Step 17-Evaluate Long Term Plant Status) apparently without formally satisfying the passive safety system termination criteria. Thus, the ERG does not appear to provide sufficient coverage in this case.
- (b) It is unclear why the ERG does not take advantage of the Reactor Vessel Level (hot leg level) as a parameter to assist the operators in this procedure.

AES-1.1, "Passive Safety Systems Termination"

Note that the termination criteria in AE-0 and AE-1 are not the same as in AES-1.1.

- #11 Step 3 This step directs the operator to close the CMT isolation valves, apparently relying on the termination criteria of AE-0 and AE-1. There are no checks of availability of non-safety backup systems. (see comments on AE-0, Step 25 and AE-1, Step 6).
- #12 Steps 4&22 These steps require the operator to verify CMT injection is not required. Although there is a transfer back to AE-1, there is none for AE-0, to address a premature isolation of the CMT for reasons other than a loss of coolant (Is this needed?).
- #13 Step 6 This step checks if PRHR should be isolated - requires SFW in operation and NR level in at least one SG .

Given the criteria of AE-0 Step 25, you could enter AES-1.1 without SFW. If that's the case, you continue in AES-1.1 with only PRHR operating (no SFW). Further instructions do not appear to be given. Per the background document this is not a continuous action step (i.e., it is not so noted in the knowledge section).
- #14 Step 8 This step checks if passive containment cooling should be stopped.

Termination criteria for PCS was not provided in AE-0 or AE-1, in contrast to the Entry Condition Statement of AES-1.1. The only check here is containment pressure less than the criterion. There is no check of availability of non-safety containment heat removal systems.

AES-1.2. "Post LOCA Cooldown and Depressurization"

- #15 Step 8 This step checks if ADS should be actuated. If ADS is actuated, plant conditions no longer satisfy the entry conditions to this guideline and a transfer back to AE-1 would appear to be appropriate. If not, the basis for remaining in this procedure should be discussed in the background document.
- Beginning in AE-1, it appears that the operator may or may not transition to AES-1.2. Both have steps for actuating ADS. The final end states (the last few steps) appear different. This should be clarified?
- #16 Step 9 This step checks if CMT injection should be isolated. The availability of non-safety systems to perform RCS injection does not appear to be verified prior to CMT injection termination. Note that the AE-1.2 background document states "The CMTs can be isolated if RCS inventory is being maintained by the CVS makeup pumps." This should be a step in the ERG itself, as is typically done elsewhere in the ERGs by checking SFW before securing PRHR.
- #17 Step 17 This step checks if Passive Containment Cooling should be stopped without checking for the availability of non-safety backup systems. This is the same comment as given on AE-1 Step 8.

AE-3. "Steam Generator Tube Rupture"

- Step 14 Checks for CMT isolation.
- Step 21 Checks for stopping PCS.
- Step 25 Checks to isolate SI Accumulators.
- #18 Steps 14, 21, and 25 of AE-3 all terminate use of passive safety systems without checking on the availability of a defense-in-depth or other non-safety related system which can back up the safety function of the system being secured. If a backup system is not necessary for this procedure, the background document should clarify how the safety functions provided by these systems are maintained after they are isolated.

General Comment on ADS Termination

- #19 All of the ERGs were reviewed to determine whether there was adequate guidance for terminating ADS if that should become necessary, for example due to spurious actuation of ADS. The guidelines reviewed addressed ADS only within the context of "verification of actuation/manual actuation backup." Unlike other "passive" safety systems (specifically CMT) where the background documents make reference to spurious operation, the information on ADS did not address isolation at all, let alone due to spurious operation. It may eventually be addressed in the more detailed EOP, to be developed by a COL

after design certification, for ERG AE-1, "Loss of Reactor or Secondary Coolant," step 11, Initiate Evaluation of Plant Status. In the Westinghouse response to NRC's comment #48 on the Adverse Systems Interaction document, Westinghouse mentions several actions associated with both the EOPs and with operator response to spurious ADS actuations. However, these activities do not appear to be outlined in the ERGs, such that a COL could use them to develop appropriate EOPs.