

February 6, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Analysis
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
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SUBJECT: COMMENTS ON COMPARISON OF AP600 EMERGENCY RESPONSE GUIDELINES (ERGs)
TO ADVERSE SYSTEM INTERACTIONS (ASI) EVALUATION REPORT

Dear Mr. Liparulo:

By letter NSD-NRC-96-4658 dated March 5, 1996, Westinghouse submitted the AP600 ASI Evaluation Report (WCAP-14477). The Nuclear Regulatory Commission (NRC) reactor systems branch, with assistance from a contractor from Brookhaven National Laboratory, has reviewed this report for consistency against the AP600 ERGs. Based on this review, the staff has generated comments that may require the ASI report and 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

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Docket No. 52-003
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Staff Comments on
Comparison Between the Adverse System Interaction Report
and Emergency Response Guidelines

Completeness and Accuracy

Some issues were noted with regard to the completeness and accuracy of the ASI report. Specific examples follow:

- (1) Not all of the SSCs noted in Section 2.1 appear in Table 2.1.
 - pH adjustment of containment recirculation does not appear on the top of the Table.
 - RCS pressure control (pressurizer spray), reactor vessel head vent, and the steam generator system are missing from the initiating system column of the Table.
- (2) In Section 3.1 a statement is made that "the ERG/FRGs are symptom-based, thus they do not allow the operator (to) make knowledge-based decisions." This is not in accordance with the current philosophy of ERGs and EOPs in the industry. In particular, one of the documents (NUREG/CR-6208) authored by and provided by WEC for the Operating Experience Review of Chapter 18, makes a strong case for operator knowledge-based reasoning (particularly situation assessment and response planning) during the execution of emergency procedures. The statement in the ASI report should be revised or removed.

This section also states that when a red path is reached in the status trees, the operators go to the FRGs. This is also true for orange paths but is not noted.
- (3) Section 3.2 states that each adverse system interaction identified in Section 2.0 is examined from the point of view of human errors of commission. However, those adverse interactions of Section 2.2.14 are not included here.
- (4) Section 3.3, Commission Error Related to Economic Consequences, concludes that such an error is "not credible" without seriously considering the possibilities and explaining why it may not be credible. The only reason given is that procedures require it. However, there have been many cases where procedures have not been followed and there are also cases where operators have been reluctant to take actions that have economic consequences (e.g. Davis Besse). The ASI report should be revised to acknowledge that such an error is possible but of low probability. It may be appropriate to discuss if the PRA accounts for such an occurrence.

Enclosure

- (5) Section 3.4 states there are six human actions impacting adverse system interactions, but then lists seven. Also the section does not give the criteria for selecting these seven from the larger number in Table 3.1.
- (6) The Table 3.1 analysis of RCP interactions (Section 2.2.1) notes that no opportunity for human error (HE) exists and that there is no LOCA-related procedure where the operators are instructed to restart RCPs if CMTs are required. This response misses an important point. There are ERGs that direct the restart of RCPs. In the TMI accident, the operators didn't know there was a LOCA and were not in a LOCA-related procedure. The ASI report should address the design features that prevent restart of the RCPs if the CMTs are actuated.

Inconsistency with the ERGs

- (7) Section 2.2.1 Reactor Coolant Pump Interactions: A potential adverse interaction noted here is similar to TMI operation of RCPs can mask the severity of an event by misguiding operators that sufficient coolant inventory is present. This section states that, "as presented in the AP600 ERGs, restart of the RCPs requires core subcooling and pressurizer level to be indicated." This is true for ERGs AES-1.2, AE-3, and AFR-I.3, but it is not true for ERGs AES-0.1, step 10, AES-0.2, step 1, or AES-1.1, step 17.
- (8) Section 2.2.2 Post-Accident Interactions Involving the Pressurizer (PZR) Heaters: This section states that AP600 addresses the potential adverse interactions during an SGTR by the tripping of the PZR heaters on an S-signal actuation. However, AE-3, for an SGTR, step 11 directs the operator to turn off the PZR heaters and does not mention at all the automatic trip.
- (9) Section 2.2.3 Chemical and Volume Control System (CVS) Makeup Pump Interactions: discusses three actions to prevent PZR overfill, including stopping the makeup pumps. AFR-I.1, Response to High Pressurizer Level, does not include any of these three steps and in fact step 2 starts a makeup pump. Other ERGs (e.g. AE-0, step 17, and AFR-H.1, step 14) do contain a step to stop makeup pumps on a high PZR level. Table 3.1 states that procedures instruct the operator to trip CVS pumps, however not all appropriate ERGs appear to do so.
- (10) Section 2.2.3 also states that during SGTR events to prevent adverse interactions, the CVS makeup line receives a signal to isolate on high SG water level. However, AE-3, for an SGTR, does not mention this isolation. Further, step 4.b says to stop the makeup pumps, and step 4.c says to operate makeup and letdown to maintain PZR level between L(05) and L(06). Table 3.1 mentions an automatic CVS pump trip on high SG level, which is not mentioned

in Section 2.2.3. Thus, it appears to be that on an SGTR with a high SG level, the automatic system will be tripping the pumps and/or isolating the makeup line, while the ERG is telling the operators to run the pump and maintain level. Table 3.1 recognizes the conflict here, but does not appear to think it a problem and still classifies this adverse interaction as a [1] or "no credible concern for human commission error." This issue/concern is not mentioned in the background material for ERG AE-3.

- (11) Section 2.2.5, Makeup Control System: This section discusses boron dilution scenarios and notes that the clean water (demin) isolation valves receive auto isolation signals on reactor trip, safeguards actuation, etc. AES-0, Reactor Trip or Safety Injection, and AES-0.1, Reactor Trip Response, do not mention or verify this isolation. This line is left out of Table 3.1 in an apparent oversight, and hence this interaction was not analyzed in Section 3.
- (12) Section 2.2.6, Letdown Line Isolations: This section discusses letdown line isolations to prevent loss of reactor coolant outside of the reactor coolant pressure boundary and outside of containment. Of particular note is the case during shutdown operations when draining water from the RCS via letdown. Here the letdown isolation on low PZR level must be blocked. The section notes that in this case there is also an isolation on low hot leg level. ERG SDG-1, Response to Loss of RCS Inventory During Shutdown, step 2 states, "Verify RCS Drain Path Isolation." Neither this step nor the rest of the ERG says anything of the PZR low level isolation being blocked. Table 3.1 incorrectly notes that LOCA-related procedures instruct the operator to open the letdown line. Also the Table does not acknowledge or analyze the potential for shutdown draining operations errors that have occurred in many operating plants.
- (13) One particular potential adverse interaction was noted in the ERGs, that was not contained in the WCAP. Instrumentation can interact with various systems in adverse ways, particularly when there are failures or inaccuracies in the instrumentation. This type of interaction can also contribute to the possibility of human errors of commission. An example noted in ERG AE-1 was in steps 5 and 6, where improper instrument readings by the operators could result in incorrect termination of the Passive Safety Systems. A discussion of the potential for this type of interaction would seem to be appropriate in the ASI report.