ENCLOSURE 1

SUPPLEMENTAL SAFETY EVALUATION REPORT
CESSAR SYSTEM 80
CONFIRMATORY ISSUE NO.1

5 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.4 Component and Subsystem Design

5.4.3 Shutdown Cooling (Residual Heat Removal System)

5.4.3.1 Compliance of Auxiliary Pressurizer Spray System Design with Branch Technical Position RSB 5-1

1.0 INTRODUCTION

The CESSAR-F was designed without power operated relief valves (PORVs) on the pressurizer. The plant design relies on the auxiliary pressurizer spray (APS) system as a means of rapidly depressurizing the primary coolant system for plant shutdown. Also, in the original plant design basis, the APS system was relied on for the steam generator tube rupture (SGTR) accident mitigation. Since the APS system performs safety related functions, CE had stated in its original submittals that the APS system had been designed to safety grade requirements.

On September 12, 1985, a CESSAR-F leading plant, Palo Verde Unit 1, conducted a loss-of-load test. The test resulted in an event involving an unexpected plant trip and safety injection actuation. During this event, the volume control tank (VCT) emptied and the charging pumps became bound on VCT hydrogen cover gas. Consequently, the pumps were tripped and the water supply to the APS system became unavailable.

Subsequent to the above event, the staff, in a letter to CE dated October 29, 1985 (Ref. 1), requested CE to provide the following information: (1) address need for a safety-grade APS system and supporting systems (i.e., from its water source through the spray nozzles) considering the safety related functions to be served; and (2) propose any changes in the CESSAR-F design and/or interface requirements as a result of the above.

In response to the staff request, CE in a letter dated February 6, 1987 (Ref. 2), proposed design modifications for the APS system to improve the reliability of the reactor coolant depressurization system. This enhancement is needed for compliance with Branch Technical Position (BTP) RSB 5-1 for Class 2 plants. In letters dated September 18, 1987 (Ref. 3) and December 7, 1988 (Ref. 4) CE also provided the results of reanalysis of the SGTR accidents. In this reanalysis, the APS system was assumed inoperable and the safety grade gas vent system from the pressurizer was used for accident mitigation. The results of the reanalysis showed that the radiological consequences were within the limits of 10 CFR 100 guidelines.

12. The switch over from the VCT to an alternate suction source on low-low level shall be interlocked to prevent the possibility of a charging pump taking a suction on an isolated or partially closed section of pipe. Closure of CH-501 and 501X would be delayed until either CH-536 (or 514) or CH-327X reached full open position. Automatic closure of CH-501 and 501X would not occur except on low-low VCT level.

The proposed modification items 1 and 2 would enhance the reliability of the VCT level transmitters which are relied upon for switchover between water sources for the APS system. Items 3, 4 and 5 would provide redundant isolation of the VCT outlet to prevent hydrogen gas binding of the charging pumps. Items 6, 7, 8, 9 and 10 would provide redundant flow paths between the refueling water storage tank (RWST) and the suction of the charging pumps. Item 11 would reduce the likelihood of hydrogen explosion in case there is hydrogen gas trapped inside the charging pumps. Item 12 would protect the charging pumps from the potential loss of suction during the switchover of water sources.

Although the modified APS system does not meet safety grade standards, the reliability of the APS system has been significantly enhanced with those proposed modifications. Therefore, the staff's conclusions regarding compliance with BTP RSB 5-1 as a Class 2 plant remain valid. However, CESSAR-F will not be forward referenceable with respect to the APS system design. This is because the modified design of APS system for CESSAR-F does not meet the requirements of BTP RSB 5-1 for Class 1 plants. Also, with the proposed enhancements, the reliability of the APS system has been significantly improved, and therefore, the staff conclusion stated in NUREG-1044, "Evaluation of the Need for a Rapid Depressurization Capability for Combustion Engineering Plants", remains valid for CESSAR 80 design.

2.2 Reanalysis of Steam Generator Tube Rupture (SGTR) Accident

In letters dated September 18, 1987 and December 7, 1988, CE provided the results of a revised SGTR analysis for CESSAR-F. The APS system was assumed inoperable in this analysis and the safety grade reactor coolant gas vent system (RCGVS) was credited for reactor coolant system depressurization during the mitigation of a SGTR event.

The accident scenario reanalyzed is the steam generator tube rupture with a loss of offsite power and single failure. This is the most limiting case of the SGTR event documented in the Section 15D of the CESSAR-F. By replacing the RCGVS for the APS system during the post-SGTR operation, the sequence of events remains unchanged. The major effect of the slower reactor coolant system depressurization which results from the use of the RCGVS rather than APS system is that there is a slight increase in primary-to-secondary leakage through the rupture during first eight (8) hours period. This additional leak flow causes a slightly increased offsite dose during the first eight hours following a SGTR event. The results of the CE analysis show that the radiological consequences of this SGTR event are still within the 10 CFR 100 limits. An independent evaluation of the CE analysis performed by the staff, provided in Enclosure 2, has found that the radiological consequences of a postulated SGTR accident for a System 80 design meet the 10 CFR 100.11 dose reference values, and therefore, are acceptable.

2.0 EVALUATION

2.1 APS System Modifications and BTP RSB 5-1 Implementation

CE, in response to Reference 1, proposed the following design modifications to the APS system (Appendix A to Reference 2):

1. Provide a separate reference leg for each of two VCT level transmitters. One reference leg shall be designed for dry calibration and one shall be designed for wet calibration.

2. Provide separate and redundant emergency power supplies for the VCT level transmitters (L-226 from Train B and L-227 from Train A). Power supply to these transmitters shall be non-interruptible, i.e., shall not be shed on SIAS, for example.

3. Add a second motor operated valve in series with the VCT outlet valve (this valve has been designated CH-501X in Figure 2).

4. Both CH-501 and CH-501X shall be capable of receiving power from an emergency 1-E supply (CH-501 from Train A and CH-501X from Train B). Power Supplies to these valves shall be non-interruptible, i.e., shall not be shed on SIAS, for example. Handswitches shall be provided in the control room for remote operability of the valves.

5. CH-501X shall close on low-low level as indicated by L-226; CH-501 shall close on low-low level as indicated by L-227.

6. CH-536 shall be capable of receiving power from an emergency 1-E supply (Train A). Power Supply to this valve shall be non-interruptible, i.e., power shall not be shed on SIAS, for example.

7. CH-536 shall open on low-low level on L-277.

8. Add a motor operated valve in parallel with CH-327 (Valve CH-327X in Figure 2). CH-327X shall be capable of receiving power from an emergency 1-E supply (Train B). Power supply shall be non-interruptible, i.e., shall not be shed on SIAS, for example. A handswitch shall be provided in the control room for remote operability of the valve.

9. CH-327X shall open on low-low level on L-226.

10. Add a check valve downstream of CH-327X and CH-327 (Valve CH-XXX on Figure 2). Piping downstream of CH-XXX shall conform to ASME Class 2, including CH-755, CH-756, and CH-757. Valves CH-755, CH-756, and CH-757 shall be normally open. (Current piping between CH-327 and CH-755, 756, 757 is ASME Safety Class 3).

11. High point vents on charging pump shall be directed to areas of the auxiliary building such that the likelihood of hydrogen explosion is minimized.

3.0 CONCLUSION

Based on the review of the CE submittals regarding the APS system design of CESSAR-F, the staff has reached the following conclusions:

1. The CE modified design of APS system of CESSAR-F does not meet safety grade standards. However, the reliability of the APS system has been significantly enhanced.

2. The modified design of APS system of CESSAR-F is not credited in the safety analyses for mitigating a SGTR accident and thus it is not required to be safety grade with respect to accident mitigation.

3. With the modified APS system, the staff's conclusions regarding CESSAR-F's compliance with BTP RSB 5-1 as a Class 2 plant remain valid.

4. The modified APS system of CESSAR-F does not meet the requirements of BTP RSB 5-1 for Class 1 plants. Therefore, CESSAR-F will not be forward referenceable with respect to the APS system design.

5. With the modifications, the reliability of APS system has been significnatly improved and therefore, the staff's conclusion stated in NUREG-1044, "Evaluation of the need for a rapid depressurization capability for combustion engineering plants", remains valid for CESSAR 80 design.

6. Based on the above conclusions, Confirmatory Issue No. 1 is closed for a Class 2 plant.

4.0 REFERENCES

1. Letter from H. Thompson, Jr., NRC, to A. Scherer, Combustion Engineering, Inc., dated October 29, 1985.

2. Letter (LD-87-009) from A. Scherer, Combustion Engineering, Inc., to F. Miraglia, NRC, dated February 6, 1987.

3. Letter (LD-87-053) from A. Scherer, Combustion Engineering, Inc., to F. Miraglia, NRC, dated September 18, 1987.

4. Letter (LD-88-150) from A. Scherer, Combustion Engineering, Inc., to G. Vissing, NRC, dated December 7, 1988.