COMBUSTION ENGINEERING

March 18, 1988
LD-88-019

Docket No. STN 50-470F

Mr. Guy S. Vissing, Project Manager
Standardization and Non-Power
Reactor Project Directorate
Office of Nuclear Reactor Regulation
Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Response to NRC Request for Additional Information Concerning Chapter 1, CESSAR-DC, Chemical and Volume Control System

Reference: Letter, G. S. Vissing (NRC) to A. E. Scherer (C-E), dated December 17, 1987

Dear Mr. Vissing:

The reference letter requested that Combustion Engineering provide additional information on the Chemical and Volume Control System (CVCS) for the System 80+™ Standard Design.

Enclosure (1) to this letter provides our responses to your specific questions in a direct question and response format. We are also providing our proposed revision to the Combustion Engineering Standard Safety Analysis Report - Design Certification (CESSAR-DC) as Enclosure (2).

Should you have any questions, please feel free to contact me or Dr. M. D. Green of my staff at (203) 285-5204.

Very truly yours,

COMBUSTION ENGINEERING, INC.

A. E. Scherer
Director
Nuclear Licensing

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AES:ss
Enclosures: As Stated

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Response to NRC Request for Additional Information Concerning Chapter 1, CVCS, CESSAR-DC

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The reference letter requested that Combustion Engineering provide additional information on the Chemical and Volume Control System (CVCS) for the System 80+™ Standard Design.

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Question 281-1

In section 1.1.1 (Page 1.1-2), it states that the System 80+ Chemical and Volume Control System has been reclassified as a non-safety grade system. Provide the basis for this reclassification.

Response 281-1

The System 80+™ Chemical and Volume Control System (CVCS) will no longer be required to perform any accident mitigation or safe-shutdown functions. This design change reduces the interaction between safety-related and control systems and greatly simplifies the CVCS. This change is based on the operating experience of C-E designed Nuclear Steam Supply Systems and is consistent with the EPRI Requirements Document.

This simplification does not compromise the "defense-in-depth" provided by the system as the means of maintaining reactor coolant system inventory, primary water chemistry, and of controlling Reactor Coolant System (RCS) pressure and boron concentration during normal operation and normal shutdowns. System reliability and availability will be enhanced through design improvements to the CVCS, judicious location of components for better service life and improved capabilities, and selected application of redundancy, diversity, and safety class requirements. The CVCS will be described in further detail in CESSAR-DC Section 9.3.4.

In designing the CVCS as non-safety grade, the following safety functions performed by the current System 80® design have been transferred to other dedicated safety systems. Boration and Makeup for Design Basis events will be provided by the Safety Injection System. Pressure control will be provided by the Safety Depressurization and Vent System. The Safety Injection System and the Safety Depressurization and Vent System will be described in further detail in CESSAR-DC Sections 6.3 and 5.4.12, respectively. All portions of the CVCS outside of containment have been designed as non-nuclear safety, however, portions of the CVCS which are inside the containment will retain their safety class designation to ensure the integrity of the reactor coolant pressure boundary.

Question 281-2

Table 1.2-2 indicates the matrix of CESSAR-DC/BOP interface sections for systems designated as performing a safety function. This table lists the CVCS which is inconsistent with Section 1.1.1 which states that the System 80+ CVCS no longer performs any safety function.

Response 281-2

The CVCS does not perform any accident mitigation or safe shutdown functions and will be eliminated from Table 1.2-2 in a future revision to CESSAR-DC. The two systems which now perform the accident mitigation and safe shutdown functions (previously performed by the CVCS) were identified in the response to Question 281-1. Of these, the Safety Injection System is already in Table 1.2-2. The Safety Depressurization and Vent System is new and will be added to Table 1.2-2 in a future amendment.

Question 281-3

Section 1.1.3.2-3 (Page 1.1-4) indicates the specific systems safety functions of System 80+ design including the CVCS. This again is inconsistent with Section 1.1.1 which states that the CVCS no longer performs any safety functions. The System 80+ Design Verification kickoff meeting with the NRC staff on November 19, 1987, also indicated no safety functions for the CVCS.

Response 281-3

The CVCS does not perform accident mitigation or safe shutdown functions as indicated in the response to Question 281-1. Mention of the CVCS will be removed from CESSAR-DC Section 1.1.3.2-3 in a future revision to CESSAR-DC.

Question 281-4

Section 1.1-3 (Page 1.1-5) lists containment spray as a CESSAR-DC system with a specific safety function. However, the containment spray system is not discussed in Section 1.2.4 as an Engineered Safety Feature.

Response 281-4

The Containment Spray System for System 80+™ is an independent safety system. It is designed to maintain the containment pressure and temperature within the design limits in the unlikely event of design bases mass-energy releases to the containment atmosphere.

The Containment Spray System is a fully redundant two-train system. Two containment spray pumps supply water through two heat exchangers to the upper region of the containment. Spray headers are used to provide a relatively uniform distribution of spray over the cross sectional area of the containment. The In-Containment Refueling Water Storage Tank (IRWST) is used as the water source for the spray system. The Containment Spray Pumps can be manually aligned and used as Residual Heat Removal (RHR) pumps during shutdown cooling system operation. Likewise, the RHR pumps can be manually aligned to perform the spray function of the containment spray pumps.

The above paragraphs will be added to CESSAR-DC Section 1.2.4 and additional detail will be provided in a future amendment to Section 6.2.

Question 281-5

Table 1.2-1 (Sheet 4 of 8) indicates that item (a) process radiation monitor and item (i) boronometer have been deleted from System 80+, CESSAR-DC. Provide basis for these deletions.

Response 281-5

The process radiation monitor and boronometer have been relocated from the CVCS letdown line and incorporated into the process sampling system. Process radiation monitor and boronometer requirements are found in CESSAR-DC Section 9.3.2 (Entitled: "Process Sampling System"), which will be included in the next CESSAR-DC submittal.

Question 281-6

In Section 1.1.3.2 (Page 1.1-5) Containment Spray and its specific safety function is identified. Table 1.2-2 does not list containment spray within CESSAR-DC scope of design.

Response 281-6

The Containment Spray System will be in CESSAR-DC scope of design. Table 1.2-1 will be amended in a future revision to include:

Containment Spray System

1. Containment Spray Pumps
2. Containment Spray Heat Exchangers
3. Containment Spray Valves
4. Containment Spray Nozzles

Question 281-7

Table 1.3-4 indicates that the CVCS system is no longer credited for any safety function. Reconcile Section 1.1.3.2.3 (Page 1.1-4) which specifies CVCS safety functions with that indicated in Table 1.3-4.

Response 281-7

The CVCS is not credited for any accident mitigation or safe shutdown function and CESSAR-DC Section 1.1.3.2-3 will be corrected in a future revision. For further detail, see the response to Question 281-1.

PROPOSED REVISIONS TO THE

COMBUSTION ENGINEERING STANDARD SAFETY ANALYSIS REPORT

f) Provides a medium for reactivity and chemistry control.

2. RCS Support System

a) Provides support for the primary loop components and piping while allowing essentially unrestrained movement due to heatup and cooldown.

b) Withstands, within allowable stress limits, the reactor loads due to dead weight, operational thermal expansion and temperature gradients, OBE and SSE seismic effects, and postulated design basis pipe break effects.

Q/R 281-7
Q/R 281-3
Delete

c) Provides a sufficiently stiff support of the masses of the RCS components and piping to remove the dynamic response natural frequencies of the supported system from the amplified peak response range of the design basis seismic response spectra.

d) (deleted) 12

3. Chemical and Volume Control System (CVCS)

a) Provides a means of supplying makeup for RCPB leaks.

b) Provides an alternate method of reactivity addition for control and shutdown to ensure the capability to maintain safe shutdown margins.

c) (deleted) 12

d) Provides a means of chemistry control for the reactor coolant.

e) Provides a means of maintaining radioactivity levels in the reactor coolant within acceptable limits.

3 ~~4.~~ Safety Injection System (SIS)

a) Provides core cooling after a Loss of Coolant Accident (LOCA) such that requirements of 10CFR50.46 and GDC 35 are met.

b) Provides neutron absorbers after a LOCA to maintain the core subcritical.

c) Provides neutron absorbers after Secondary Line Break (SLB) to add negative reactivity to the core.

d) Provides the primary source of borated water for injection.

4 ~~5.~~ Shutdown Cooling System (SCS)

a) Assists in placing and maintaining the plant in a safe shutdown condition.

b) Aids in removal of stored energy from the recirculating containment sump water following a LOCA.

Q/R 281-7
Q/R 281-3

5 ~~8~~. Reactor System

a) Provides a method of reactivity control.

b) Provides, by means of the fuel cladding, the first boundary preventing the release of fission products from the fuel.

c) Provides a coolable geometry for the fuel.

6 ~~7~~. Fuel Handling System (FHS)

a) Provides a means of handling the fuel for removal or insertion in the reactor such that fuel clad integrity requirements are not violated.

7 ~~8~~. Reactor Protective System (RPS)

a) Automatically initiates reactor trip to assure that SAFDLs are not violated as a result of a moderate frequency incident.

b) Automatically initiates reactor trip to aid in mitigating the consequences of infrequent incidents and limiting faults.

8 ~~9~~. Engineered Safety Features Actuation System (ESFAS)

a) Automatically initiates the operation of the proper ESF systems to aid in mitigating the consequences of infrequent incidents and limiting faults.

9 ~~10~~. Safety Depressurization System

a) Provides safety grade depressurization when pressurizer sprays are unavailable.

10 ~~11~~. Emergency Feedwater System (EFWS)

a) Provides core cooling after a Loss of Feedwater Event.

11 ~~12~~. Reactor Containment

a) Prevents the release of radioactive material in the event of a breech in the Reactor Coolant Pressure Boundary. 12

12 ~~13~~. Containment Spray

a) Prevents containment overpressurization if Reactor Coolant System mass and energy are released to the containment.

13 ~~14~~. Nuclear Plant Control Center

a) Provides an integrated, centralized control capability for the plant operators.

The EFWS is comprised of four pumps and associated piping and valves. Two pumps are motor driven and two are steam turbine driven. The EFWS is actuated automatically. The EFWS is discussed further in Section 10.4.

1.2.4.1.4 Safety Depressurization System

The Safety Depressurization System (SDS) is a dedicated safety system designed to perform the following functions:

1. Provide a safety grade means to depressurize the RCS in the event that pressurizer spray is unavailable during plant cooldown to cold shutdown or in the event of a steam generator tube rupture. 12

2. Provide a capability to rapidly depressurize the RCS to initiate a primary system feed and bleed for the beyond design bases event of total loss of feedwater.

The system includes the valves and piping which establishes a flow path from the pressurizer steam space to the In-containment Refueling Water Storage Tank (IRWST). It is manually actuated and controlled. The SDS is discussed further in Section 5.4.

1.2.5 INSTRUMENTATION AND CONTROL

Insert (A)
Q/R 281-4

Automatic protection systems, control systems, and interlocks are provided, along with the administrative controls of the specific site, to assure safe operation of the plant. Sufficient instrumentation and controls are supplied to provide manual operation as a normal backup control mode on all automatic systems.

A Plant Protection System (PPS) initiates a reactor trip if the reactor approaches prescribed safety limits, or provides an actuation signal to the Engineered Safety Features systems when a fluid system or containment parameter approaches a prescribed limit.

Sufficient redundancy is installed to permit periodic testing of the PPS so that removal from service of any one protection system component or portion of the system will not preclude reactor trip, or other protective action when required. Additionally, no single failure can preclude the PPS providing a reactor trip or other protective action when required.

The protection system and associated instrumentation is separated from the control systems and their associated instrumentation such that failure, or removal from service, of any control system, component or instrument channel will not inhibit the functioning of the protection system (see Chapter 7.0 for details).

Amendment No. 12
September 11, 1987

Q/R 281-4

Insert A

1.2.4.1.5 Containment Spray System

The Containment Spray System for System 80+^{TM} is an independent safety system. It is designed to maintain the containment pressure and temperature within the design limits in the unlikely event of design bases mass-energy releases to the containment atmosphere.

The Containment Spray System is a fully redundant two-train system. Two containment spray pumps supply water through two heat exchangers to the upper region of the containment. Spray headers are used to provide a relatively uniform distribution of spray over the cross sectional area of the containment. The In-Containment Refueling Water Storage Tank (IRWST) is used as the water source for the spray system. The Containment Spray Pumps can be manually aligned and used as Residual Heat Removal (RHR) pumps during shutdown cooling system operation. Likewise, the RHR pumps can be manually aligned to perform the spray function of the containment spray pumps.

The Containment Spray System is discussed further in CESSAR-DC Section 6.2.

Table 1.2-1 (Cont'd) (Sheet 7 of 8)

   c) Logarithmic and Linear Safety Channels

13. Other Protective Instrumentation

   a) Shutdown Cooling System Suction Line Isolation Valve Interlocks

   b) Safety Injection Tank Isolation Valve Interlocks

14. Advanced Control Room (Nuplex 80)

   a) Data Processing Systems

   b) Control Center Panels

   c) Solid State Plant Protection System

   d) Solid State Component Control System

15. Containment Building 12

16. Emergency Feedwater System

17. Safety Depressurization System

Q/R 281-6

18. Containment Spray System

   a) Containment spray pumps

   b) Containment Spray Heat Exchangers

   c) Containment Spray Valves

   d) Containment Spray Nozzles

TABLE 1.2-2

MATRIX OF CESSAR/BOP INTERFACE SECTIONS

Located in	CESSAR Standardized Functional Requirement Sections:	10.3 Main Steam Systems	10.4 Main Feedwater Systems	9.2.2 Component Cooling Water System	11.0 Waste Management System	8.3 Onsite Power System	8.2 Offsite Power System	6.4 Habitability Systems
	CESSAR SECTIONS SYSTEM SCOPE:							
4.2.5	Reactor							
5.1.4	Reactor Coolant System	X	X	X	X			
6.3.1	Safety Injection System			X		X	X	
7.1.3 & 7.2.3	Reactor Protection System	X				X	X	
7.1.3 & 7.3.3	Engineered Safety Features Actuation System	X	X			X	X	
9.1.4	Fuel Handling System				X		X	X
5.4.7	Shutdown Cooling System			X		X	X	X
9.3.4	Chemical & Volume Control			X	X	X	X	X
10.4.9	Emergency Feedwater System		X					
6.2	Containment							X
7.0	Control Room							
	SUPPORTING INTERFACE AREA							
3.5.3	Missile Protection							X
3.11	Environment Design							X
9.5	Fire Protection							X
5.4.12	Safety Depressurization and Vent System					X	X	

INSERT

Delete Q/R 281-2

Q/R 281-2

Amendment No. 12
September 11, 1987

Enclosure (2)
to LD-88-019
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