COMBUSTION ENGINEERING

September 9, 1988
LD-88-089

Docket No. STN 50-470F
(Project No. 675)

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 4, Reactor Systems Branch

References: Letter, G. S. Vissing (NRC) to A. E. Scherer (C-E), dated June 28, 1988

Dear Mr. Vissing:

The reference letter requested that Combustion Engineering provide additional information concerning CESSAR-DC, Chapter 4. The enclosure to this letter provides our responses.

Should you have any questions, please feel free to contact me or Mr. S. E. Ritterbusch of my staff at (203) 285-5206.

Very truly yours,

COMBUSTION ENGINEERING, INC.

A. E. Scherer
Director
Nuclear Licensing

AES:dmb

Enclosure: As Stated

cc: Mr. Frank Ross (DOE - Germantown)

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RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

CONCERNING CHAPTER 4

REACTOR SYSTEMS BRANCH

Question 440.1

The use of the VISIONS code in the analysis of load follow transients appears to be a change from previously approved methodology. Has VISIONS been submitted and reviewed by NRC? How has it been qualified for use in safety and analyses?

Response 440.1

The VISIONS code has not been submitted for review by NRC because it is not used in the safety analysis. The calculations of core power distributions used for the final safety analysis in CESSAR-DC were made with the NRC-approved DIT/ROCS/MC, HERMITE, and QUIX computer codes described in Section 4.3.3.1 of CESSAR-DC.

VISIONS is a three-dimensional nodal core simulator with the capability to generate realistic core power distributions during operational transients. Except for differences in user edit options, VISIONS is identical to C-E's FLAIR code, which has been used for more than a decade as a design scoping tool and core operation simulator. Because VISIONS is a fast running code, it is used as a supplemental scoping tool for simulating representative core operating performance and strategies for control of core power distribution. The calculations of representative load follow transients illustrated in CESSAR-DC Section 4.3.2.2.3 were performed using VISIONS in place of the QUIX code which was utilized for this purpose in CESSAR-F. The VISIONS code was used for these cases because it has the capability to provide more information on core power distribution than the one-dimensional QUIX code.

The VISIONS model input is based on cycle specific ROCS and MC analysis, and is adjusted to provide close agreement at all times in cycle with reference ROCS/MC three-dimensional power distribution calculations. The predictive accuracy of the VISIONS model for core power distributions is verified every cycle by benchmarking extensively against ROCS, and against measured power distributions at plant sites during power ascension testing and operations (CESSAR-DC, Section 4.3, Reference 2).

Question 440.2

Verification of the adequacy of the CEAs to meet the required 4.0 second 90% insertion scram time has been determined by testing in the C-E TF-2 flow test facility. In view of the recently observed longer scram times in ANO-2 when testing the simultaneous tripping of all CEAs compared to individual CEAs, describe how this testing was performed and any anticipated changes to the test procedure.

Response 440.2

The CEA scram time testing described in Appendix 4B of CESSAR-DC was performed using a single control element drive mechanism (CEDM) and 12-element CEA in the TF-2 hot loop test facility. The electrical and mechanical functioning of the tested individual CEDM/CEA is identical to that used in the System 80+™ reactor design. The test included the effect of electrical circuit delay for the CEA trip as well as the effects of mechanical and hydraulic forces on the CEA. A 12-element CEA was chosen for testing because it has the lowest weight-per-rod of all CEA types described in Section 4.2, resulting in the longest scram time.

The scram time test results for the individual 12-element CEA were used to develop the acceptance curve for scram time which is applied in the safety analysis. A substantial amount of margin was provided in the scram time acceptance curve in order to conservatively allow for additional system delays and plant-specific deviations from the TF-2 test conditions. As is shown in Figure 4B-1 of CESSAR-DC, the scram time acceptance curve value to 90% insertion is 4.0 seconds, compared to the TF-2 test measured value of 3.1 seconds. Post-core hot functional tests have further shown measured scram times in System 80® plants (utilizing the same 12-element CEA design) to be conservative relative to the TF-2 test. For PVNGS-1, the longest individual CEA scram time measurements were below 2.9 seconds to 90% insertion. The post-core hot functional test results, therefore, confirm that the margin in the scram time acceptance value to 90% insertion is large relative to any additional system delay, including that observed in ANO-2 when testing simultaneous vs. individual tripping of all CEAs.

On the basis of the conservative margin demonstrated for the scram time acceptance curve, the test procedure in CESSAR-DC is considered to be fully adequate, and no change is needed as a consequence of the test observations in ANO-2.