CEN-339-NP-A

# CPC/CEAC SOFTWARE MODIFICATIONS FOR THE CPC IMPROVEMENT PROGRAM RELOAD DATA BLOCK



COMBUSTION ENGINEERING

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# CPC/CEAC SOFTWARE MODIFICATIONS FOR THE CPC IMPROVEMENT PROGRAM RELOAD DATA BLOCK

OCTOBER 1987

COMBUSTION ENGINEERING

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 12, 1986

Mr. A. E. Scherer, Director
Nuclear Licensing
Combustion Engineering, Inc.
1000 Prospect Hill Road
Windsor, Connecticut 06095

Dear Mr. Scherer:

SUBJECT: ACCEPTANCE FOR REFERENCING OF LICENSING TOPICAL REPORT CEN-330-P REV 00-P, "CPC/CEAC SOFTWARE MODIFICATIONS FOR THE CPC IMPROVEMENT PROGRAM RELOAD DATA BLOCK"

The Nuclear Regulatory Commission (NRC) staff has completed its review of the Topical Report CEN-330-P, REV 00-P.

We find the report to be acceptable for referencing in license applications to the extent specified and under the limitations delineated in the report and the associated NRC evaluation, which is enclosed. The evaluation defines the basis for acceptance of the report.

We do not intend to repeat our review of the matters described in the report and found acceptable when the report appears as a reference in license applications, except to assure that the material presented is applicable to the specific plant involved. Our acceptance applies only to the matters described in the report.

In accordance with procedures established in NUREG-0390, it is requested that CE publish an accepted version of this report within three months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed evaluation after the title page. The accepted version shall include an -A (designating accepted) following the report identification symbol.

Should our criteria or regulations change such that our conclusions as to the acceptability of the report are invalidated, CE and/or the applicants referencing the topical report will be expected to revise and resubmit their respective documentation, or submit justification for the continued effective applicability of the topical report without revision of their respective documentation.

Sincerely,

Dennis M. Crutchfield

Dennis M. Crutchfield, Assistant Director
Division of PWR Licensing-B
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

# SAFETY EVALUATION OF TOPICAL REPORT CEN-330-P REVISION 00-P "CPC/CEAC SOFTWARE MODIFICATIONS FOR THE CPC IMPROVEMENT PROGRAM RELOAD DATA BLOCK"

## 1. INTRODUCTION

By letter from A. E. Scherer to George W. Knighton dated May 21, 1986, Combustion Engineering (CE) submitted proprietary and non-proprietary versions of CEN-330, Revision 00, entitled "CPC/CEAC Software Modifications for the CPC Improvement Program Reload Data Block", dated May 1986 for NRC review. These documents were submitted by CE on behalf of the Core Protection Calculator (CPC) Oversight Committee consisting of Arizona Nuclear Power Project, Arkansas Power and Light Company, Louisiana Power and Light Company and Southern California Edison, with CE acting as technical consultant. This committee has developed the CPC Improvement Program primarily to implement CPC modifications and methodology improvements so as to reduce future reload efforts and, possibly, the need for NRC reload reviews, by attempting to avoid future software changes.

One phase of the CPC Improvement Program is the Reload Data Block (RDB) Constants Program, a proprietary concept which is owned and has been held in confidence by CE. Report CEN-330-P, Revision 00-P, describes the RDB feature and provides a description of the variables which will be included in the RDB. It should be noted that the actual values assigned to each of these RDB variables are not given in this report since the report is directed primarily at the RDB concept and the selection of appropriate reload dependent variables rather than on their actual numerical values. The numerical values will be developed and supplied by CE and are expected to change infrequently.

COMBUSTION ENGINEERING

August 19 , 1987
LD-87-045

Mr. Ashok C. Thadani
Assistant Director for Systems
c/o Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Reload Data Block Constants

References: (A) CEN-330-P, Rev. 00-P, "CPC/CEAC Software Modifications for the CPC Improvement Program Reload Data Block", May 1986.

(B) Letter, D. M. Crutchfield (NRC) to A. E. Scherer (C-E), August 12, 1986

Dear Mr. Thadani:

The purpose of this letter is to document our intended changes to the Reference (A) Reload Data Block constants list.

Reference (A) described CPC/CEAC software modifications for the CPC Improvement Program Reload Data Block (RDB). Reference (A) was submitted for NRC review in May 1986 and was approved by Reference (B). In September, 1986, several changes to the list of constants included in Reference (A) were identified and discussed with the NRC staff. During these discussions, it was agreed that the proposed changes would provide greater flexibility in the generic application of the RDB, were relatively minor, and would not impact the safety function of the Core Protection Calculator System (CPCS). The final details of the intended changes to the RDB were discussed with Mr. L. I. Kopp of your staff earlier this month. It was again agreed that the changes were minor and that no additional NRC review would be necessary. Based on this agreement, the changes are being incorporated into the approved version of Reference (A) and will be published as CEN-330-P-A. The changes are described below and are summarized in the attached Table 1.

Five constants were added to the RDB constants list in order to make the software applicable to more than one plant having the CPCS: one was added for the scaling of reactor coolant pump speed signals, four were added for the scaling and biasing of reactor coolant system pressure signals.

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## 2.0 EVALUATION

The staff has had several discussions in the past with the CPC Oversight Committee and has previously indicated that the RDB concept appeared acceptable. Based on a review of the constants of the CPC software routines TRIPSEQ, FLOW, UPDATE, POWER, STATIC and CEAC which have been assigned to the RDB, the staff agrees that the selected set is limited to potentially cycle-dependent parameters. The staff also finds that any safety limits which may be affected by the RDB constants remain adequately controlled by Technical Specifications. In addition, the staff has previously approved the quality assurance procedures described in CEN-323, Revision 00, "Reload Data Block Constant Installation Guidelines" for generating and updating RDB constants. These procedures incorporate automated reasonability checks on the numerical values of the constants which, once loaded, will not be accessible for change by the plant operator. These numerical values, as with other CPC variables, will be developed by CE using approved analytical methods. Based on the above, the staff finds the selection of RDB constants listed in CEN-330-P, Revision 00-P acceptable.

## 3.0 CONCLUSION

The list of RDB constants described in CEN-330-P, Revision 00-P, has been reviewed by the staff and found to be acceptable. Therefore, the report is acceptable for referencing in licensing applications. Any additions to the list of RDB constants presented in this report will require review and approval by the NRC.

Two constants were deleted because they contained information that was redundant with other constants that were already in the RDB.

A pointer array was added to the RDB for the purpose of adding flexibility in the selection of variables for inclusion in the tripped CPC channel snapshot. The pointer array defines the point ID numbers of 30 of the 115 variables in the snapshot.

Should you have any questions on the contents of this letter, please feel free to contact me or Mr. L. E. Philpot of my staff at (203) 285-5210.

Very truly yours,

COMBUSTION ENGINEERING, INC.

A. E. Scherer
Director
Nuclear Licensing

AES/nl
Attachment: Table 1
cc: L. Kopp (NRC)
M. W. Hodges (NRC)

Table 1. Changes to the RDB Constants List

| Name | Add/ Delete | Definition | Program, Page No.* |
|---|---|---|---|
| | | | FLOW p. 10 |
| | | | UPDATE p. 11 |
| | | | UPDATE p. 11 |
| | | | UPDATE p. 11 |
| | | | STATIC p. 15 |
| | | | Utility Program, Add after p. 17 |

* Page numbers refer to CEN-330-P, Rev. 00-P.

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# 1.0 INTRODUCTION

## 1.1 REPORT SCOPE

The Core Protection Calculator System (CPCS) is designed to provide low DNBR and high Local Power Density (LPD) trips to (1) ensure that the specified acceptable fuel design limits on departure from nucleate boiling and centerline fuel melting are not exceeded during Anticipated Operational Occurrences (AOOs) and (2) assist the Engineered Safety Features System in limiting the consequences of certain postulated accidents.

The COLSS/CPC Oversight Committee, consisting of Arizona Nuclear Power Project, Arkansas Power and Light Company, Louisiana Power and Light Company and Southern California Edison, with Combustion Engineering as its technical consultant, has developed the CPC Improvement Program (CIP), a program of CPC Modifications and Methodology Improvements scheduled to be implemented in 1986 and 1987. An initial presentation of concepts was provided on November 8, 1984, the schedule for implementation of the program was presented to the NRC on March 8, 1985 and a detailed presentation of the portions of the program scheduled for implementation in early 1986 was provided on April 18, 1985 (Reference 3.6) and upgraded for the complete program in November 1985.

The CPC Improvement Program consists of three major areas:

- Part A - Optimization of CPC/CEAC Software for Reloads
- Part B - CEAC Desensitization to Spurious Signals
- Part C - Reload Data Block Constants

This document provides a complete description of the Reload Data Block feature, Part C.

The modifications described in this document will apply to any of Arkansas Nuclear One Unit 2 (ANO-2); Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 and 3; San Onofre Nuclear Generating Station (SONGS) Units 2 and 3; and Waterford Unit 3 which reference this document.

Subsequent to the issuance of CEN-330-P, Revision 00-P, five (5) constants and an array were added and two (2) deleted from the Reload Data Block. Pursuant to agreement with the Commission, documented in the attached correspondence, this approved version incorporates these and other editorial changes.

1.2 REPORT SUMMARY

The Reload Data Block (RDB) is a group of constants [ ]

The RDB was created in order to [ ]

This document provides a description of the RDB feature, the list of the constants in the RDB and a general description of the RDB System Loader.

The RDB related changes will be implemented in the CPC/CEAC software and the modified software will be tested in accordance with References 3.1 and 3.2.

## 2.0 DESCRIPTION

### 2.1 RDB SYSTEM DESCRIPTION

The RDB feature was developed in order to [redacted]

The entire set of RDB constants will be on a stand-alone disk and the individual constants can be changed only by changing the value on the RDB disk and reloading the system software. Updating the RDB disk will be controlled by formal procedures. These procedures and qualified software tools [redacted] will be used to ensure the quality of the updated disk. (See Reference 3.5)

In addition to the algorithm constants, the RDB disk contains an array specifying [redacted] Point IDs to be included in the CPC trip buffer report (Reference 3.3).

The RDB related changes do not modify any of the protection algorithms defined in References 3.3 and 3.4.

### 2.2 RELOAD DATA BLOCK CONSTANTS

Tables 2-1 through 2-6 show the constants of the routines TRIPSEQ, FLOW, UPDATE, POWER, STATIC and CEAC, respectively, assigned to the RDB. The assignment was based on a review of the non-addressable constants [redacted]. The number of RDB constants was constrained to maintain consistency with the current CPCS design.

## 2.3 LOADING OF THE RDB

The RDB will be loaded by the RDB System Loader, a modified version of the standard system loader. This modified loader will follow the loading of the CPC (or CEAC) software with a request for the RDB disk and will load the appropriate RDB constants into the CPC (or CEAC) memory RDB space. (See Reference 3.5.)

## 3.0 REFERENCES


3.1 "CPC/CEAC Protection Algorithm Software Change Procedure", CEN-39(A)-P-A, Rev. 3, November 1986.

3.2 "Quality Assurance of Design Manual for C-E Nuclear Power Systems."

3.3 "CPC Functional Design Requirements", CEN-305-P, Rev. 01-P, May 1986.

3.4 "CEAC Functional Design Requirements", CEN-304-P, Rev.01-P, May 1986.

3.5 "Reload Data Block Constant Installation Guidelines", CEN-323-P-A, September 1986.

3.6 "CPC Improvement Program, De ailed Presentation to the NRC", CEN-302(S)-P, April 1985.

TABLE 2-1
RDB CONSTANTS FOR TRIPSEQ

| VARIABLE NAME | VARIABLE DESCRIPTION |
|---|---|

TABLE 2-2
RDB CONSTANTS FOR FLOW

| VARIABLE NAME | VARIABLE DESCRIPTION |
|---|---|

TABLE 2-3
RDB CONSTANTS FOR UPDATE

| VARIABLE NAME | VARIABLE DESCRIPTION |
|---|---|

TABLE 2-3 (continued)

| VARIABLE NAME | VARIABLE DESCRIPTION |
| --- | --- |

TABLE 2-6

RDB CONSTANTS FOR CEAC

| VARIABLE NAME | VARIABLE DESCRIPTION |
| --- | --- |

TABLE 2-7

RDB ARRAY FOR SELECTABLE POINT ID-S IN CPC TRIP BUFFER

| CONSTANTS NAME | CONSTANTS DESCRIPTION |
|---|---|
| | |