U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
REGION IV

Report No. 99900401/78-04 Program No. 51100

Company: Combustion Engineering, Inc.
1000 Prospect Hill Road
Windsor, Connecticut 06095

Inspection Conducted: November 13-17, 1978

Inspectors: _____ 11-28-78
D. G. Anderson, Principal Inspector, Vendor Inspection Branch — Date

Other Personnel: _____ 11-28-78
B. W. Sheron, Nuclear Engineer, DSS/NRR — Date

_____ 11-28-78
G. N. Lauben, Nuclear Engineer, DSS/NRR — Date

_____ 11-28-78
P. E. Norian, Section Leader, DSS/NRR — Date

Approved by: _____ 11-28-78
C. J. Hale, Chief, Vendor Program Evaluation Section, Vendor Inspection Branch — Date

Summary

Special Inspection conducted on November 13-17, 1978 (99900401/78-04)

Areas Inspected: 10 CFR 50, Appendix B, and Topical Report CENPD-210-A as applied to the establishment and implementation of procedures to control

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the development and revision of safety analysis computer codes. The inspection involved thirty (30) inspector hours on site by one (1) USNRC Region IV inspector.

Results: In the area inspected one deviation and one unresolved item were identified as follows:

Deviation: 10 CFR 50, Appendix B, Criterion V, procedures do not exist for the evaluation and reporting of significant changes in the evaluation model as referenced in Criterion II.b. of 10 CFR 50, Appendix K. (See Notice of Deviation, Enclosure.)

Unresolved Item: Verification had not been completed on two (2) calculations which resulted in input to the CESSAR System 80 FSAR (See Details Section paragraph C.2.b.).

DETAILS SECTION

(Prepared by D. G. Anderson)

A. Persons Contacted

*W. C. Coppersmith, Manager, Design Transients Safety Analysis
F. L. Carpentino, Section Manager, ECCS Analysis Group
*J. Goldberg, Supervisor, Standard Plant Licensing
*F. G. Harvey, Engineering Quality Assurance Auditor
*C. L. Kling, Acting Supervisor, CESEC Development Group
J. Longo, Jr., Manager, ECCS Analysis Group
H. T. Melcher, Engineering Specialist
*R. R. Mills, Supervisor, Project and Generic Licensing
*J. C. Packard, Supervisor, Group Quality Systems

*Denotes those present at the exit meeting.

B. Introduction

This report covers a special inspection conducted to examine the establishment and implementation of procedures controlling safety analysis computer code development. The objectives of this inspection were:

1. To determine that adequate procedures to minimize the potential for analysis errors to go undetected have been established for control of the development and revision of these codes.

2. To determine that these procedures were fully implemented during the development and revision of selected codes.

C. Control of Safety Analysis Computer Codes

1. Establishment of Procedures

a. Inspection

(1) The Combustion Engineering, Inc., Topical Report CENPD-210-A, requires in Section 17.3, Design Control, that "The QADM procedures implement design quality assurance requirements . . . provide specific requirements for all safety related work accomplished . . . provide design controls to applicable activities such as; reactor physics, seismic, stress, thermal, hydraulic, radiation and accident analysis . . . contains an identification system for analyses and/or calculations

prepared for each NSSS project within the section. This indicates how calculation sheets will be completed. Methods of analyses in the form of computer programs are controlled by the procedure. The computer programs that are used for safety-related analyses are certified for accuracy, method, and internal consistency prior to verification of the analysis in which it is used."

These commitments are implemented by the following Combustion Engineering, Inc., procedures:

QADP 5.2, Design Analysis
QADP 5.4, Design Verification

(2) An examination of procedure QADP 5.2 revealed that there are detailed requirements for the preparation, review, and verification of analyses and computer codes. Requirements for documentation of this verification are also included in the procedure. Changes to analyses or computer programs shall comply with the requirements for initial preparation of the analyses or computer programs. A Computer Code Certificate is the permanent file identification for computer codes that have been certified by Combustion Engineering, Inc.

(3) An examination of procedure QADP 5.4 revealed that Combustion Engineering, Inc., utilizes three distinct methods of design verification: Design Reviews, Alternate Calculations/Analyses, and Testing. A list of qualified reviewers is maintained by each Supervisor/Manager and independent review of analyses/calculations is conducted by reviewers selected from this list.

b. Findings

QADP 5.2 and QADP 5.4, which are procedures used to implement CENPD-210-A, appear to meet the requirements of ANSI N45.2.11 as appropriate to verification, and documentation of this verification, as applied to Safety Analysis Computer Codes. During the examination of these implementing procedures and the documentation generated as a result of following the procedures, the following items were identified and management of Combustion Engineering, Inc., indicated that they would consider further action, as appropriate. Any action taken by Combustion Engineering, Inc., will be examined during a future inspection.

In addition to the items listed below, one (1) deviation from commitment was identified (See Notice of Deviation, Enclosure). No unresolved items were identified in this area of the inspection.

Items for consideration by Combustion Engineering, Inc., Management:

(1) There does not appear to be any central index to define what constitutes the code design file, or a project design file.

(2) Procedures do not address how modifications to NRC-approved codes are reported to NRC.

(3) The "ECCS Licensing Analysis Verification Checklist" was found in the system 80 CEFLASH calculation input file, but not in other files. We encourage the use of such a checklist for all calculations and its inclusion in the design files.

(4) There appears to be no information in the ECCS code files regarding verification by comparison to test data. Such comparisons are available through programs such as the standard problem program. We believe this form of verification to be applicable to parts of evaluation model codes and should be included in the code verification files.

(5) On the ECCS Licensing Analysis Verification Checklist, item 25 was checked "yes," indicating experimental data was employed. No evidence of how the experimental data was employed was found.

(6) Procedures do not address how errors identified in codes are dispositioned.

(7) A chronological listing of development, review, approval, and changes to codes had not been documented.

(8) Procedures do not address the process to be followed when existing codes are used in applications other than those for which the code was originally developed.

(9) Procedures do not address how documentation is maintained for the following items:

(a) Comparison of Codes with previous results.

(b) Review of Computer Code Quality Assurance Folders.

(c) Changes to Computer Codes.

(10) Departmental level procedures do not exist which address code development, review, approval, and control of computer codes.

(11) CESSAR/FSAR/System 80 LOCA Analyses were submitted to NRC prior to the completion of independent review of the analyses. QA review and verification of all documents should be completed prior to submittal to NRC.

(12) Procedures do not address how individual codes are to be used in an overall analysis model or package. Also, there are no requirements for assuring that integral results developed from more than one code are independently reviewed.

2. Implementation of Procedures

a. Inspection

The development and revision of the following computer programs was evaluated for meeting the requirements of QADP 5.2 and QADP 5.4 related to development, verification, and control of:

STRIKIN II: A Cylindrical Geometry Fuel Rod Heat Transfer Program. The STRIKIN II code is a Fortran IV digital program which is used to calculate the core hot spot transient clad temperature during the blowdown, refill, and reflood portions of the loss-of-coolant accident.

CESEC: Digital Simulation of a Combustion Engineering Nuclear Steam Supply System. Simulates doppler and moderator reactivity feedback, point kinetics neutron behavior, boron and CEA reactivity effects, multi-node average and hot channel reactor core thermal hydraulics, reactor coolant pressurization and mass transport, reactor coolant system safety valves, steam generation, steam generator water level, main steam bypass system, safety and turbine valves, as well as alarm, control, protection and Engineered Safety Feature Systems.

The inspector examined the documentation contained in the Quality Assurance Folder on these two (2) computer codes which consisted of fourteen (14) computer code Topical Reports, thirty-one (31) copies of interoffice correspondence twenty-four (24) calculations, seven (7) computer code certificates, ten (10) lists of qualified reviewers, six (6) analysis cover sheets, one (1) ECCS licensing analysis checklist, one (1) listing of the STRIKIN II code version 77036, and two (2) film cassettes of computer code verification runs.

b. Findings

In this area of the inspection, no deviations were identified. The following finding has been identified as an unresolved item and will be forwarded to NRC/NRR for resolution:

During a review of one verification of two (2) calculations that resulted in input to the CESSAR System 80 FSAR, sections 6.2.1.5 and 6.3.3., the inspector noted that the verification process had not been completed even though the FSAR has been submitted to NRR/NRC for docketing. Upon discussion of this item with Combustion Engineering representatives, it was noted that design input for these calculations had not as yet been received and therefore the calculations could not be completed and consequently could not be verified. 10 CFR 50.b.(4) requires that for Final Safety Analysis Reports that "A final analysis and evaluation of the design and performance of structures, systems and components with the objective stated in (a)(4)* of this section and taking into account any pertinent information developed since the submittal of the preliminary safety analysis report."

*(a)(4) refers to preparation of preliminary analyses.

The inference above to "final analysis" indicates that information should not be submitted to NRR/NRC which is "preliminary" in nature.

As noted before, this item will be forwarded to NRR/NRC for resolution of what constitutes "final analysis" for purposes of FSAR submittals.

D. Exit Meeting

An exit meeting was conducted with Combustion Engineering management personnel at the conclusion of the inspection. Those individuals indicated by an asterisk in Section A of the Details Section of this report were in attendance. In addition, the following were present:

J. M. Cicerchia, Licensing Engineer
E. P. Flynn, Director, Plant Apparatus and Engineering Quality Assurance
C. W. Hoffman, Director, Group Quality Assurance
G. J. Huba, Manager, Engineering Quality Assurance

The inspector discussed the special nature of this inspection, scope, and findings identified during the inspection. Management representatives of Combustion Engineering acknowledged the statements by the inspector with respect to the one (1) deviation presented.