



Contract 2005431.17

Calculation 17 Pages
Appendix A-2 Pages
Appendix B-88 Pages
Appendix C-25 Pages

Calculation Number V-PENG-CALC-007

Revision 01

Title RSB 5-1 Shutdown Cooling Analysis for 102% Stretch Power Using DESCENT Code
Palo Verde Nuclear Generating Units 1, 2, & 3

Author Kathryn M. Leroux

Kathryn M. Leroux

Date 12/1/95

Calculation contains safety related design information:

Yes X No

VERIFICATION STATUS: COMPLETE

The Safety-Related design information contained in this document has been verified to be correct by means of Design Review using Checklist(s) 2 of QAM-101.

R. M. Orsulak

B. M. Orsulak

12-01-95

Independent Reviewer: Name/Signature/Date

Approved by F. P. Ferraraccio (Supervisor)

F. P. Ferraraccio

Date 12/1/95

Distribution F. P. Ferraraccio, W. J. Palo, C. A. Nielsen, PENG File, E. Jageler

Summary Purpose:

The purpose of this calculation is to analyze the shutdown cooling system operation following a natural circulation cooldown.

Method and Results of Review:

The method used to verify this calculation was an independent review. The DESCENT computer code input data for each case were reviewed and confirmed to be accurate and appropriate for use in this analysis. Input data were also compared to code output listings to confirm acceptable results. All assumptions were also reviewed and confirmed to be appropriate. No assumptions were identified requiring further validation. The conclusions reached in this analysis were determined to be technically reasonable and acceptable.

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PDR

ABB Combustion Engineering Nuclear Operations

Record of Revision

<u>Revision</u>	<u>Date</u>	<u>Author</u>	<u>Reviewer</u>	<u>Approval</u>	<u>Extent of Revision</u>
01	12/01/95	K. M. Leroux	R. Orsulak	F. Ferraraccio	pp.1, 2, 5, 6, 11
00	10/27/95	K. M. Leroux	W. Palo	F. Ferraraccio	Original Issue

Replace pages 1, 2, 5, 6, and 11 of Revision 00 with pages 1, 2, 5,6 and 11 of Revision 01.

- 3.4 ABB/CE Software Verification and Validation Report Number CODES-FS-C-008, Rev. 02, "Verification of DESCENT V1M0 on the Hewlett-Packard (HP)9000/700 Series Workstations", dated 11/22/93. (See Appendix A) | Rev. 01
- 3.5 00000-PE-CV31/2-00, Computer Code Description and Verification Report for DESCENT, 2/24/78, Version 2, Rev. 00.
- 3.6 ABB/CE Calculation K-FS-C-051, Rev. 00, "Verification of Computer Code DESCENT, Version 3," dated 8/18/88.
- 3.7 APS Memo, Hamid Mortazavi to Bill Palo, "PVNGS Shutdown Cooling Analysis," dated 11/12/92 (see Appendix A).
- 3.8 Bechtel Calculation 13-NC-SP-005, Rev. 0, "Reactor Core and Spent Fuel Pool Decay Heat Loads," dated 5/8/86.
- 3.9 ABB/CE Calculation V-PEC-067, Rev. 00, "DESCENT (Shutdown Cooling) Code Input Parameters for System 80 Plants," dated 5/6/77.
- 3.10 ABB/CE Calculation SP-PEC-139, Rev. 00, "CESSAR-FSAR Shutdown Cooling System Performance (One & Two Train Cooldown)," dated 3/3/78.
- 3.11 a. NUREG-75-087, Rev. 1, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, Section 5.4.7, "Residual Heat Removal (RHR) System".
- b. Branch Technical Position RSB 5-1, "Design Requirements of the Residual Heat Removal System," attached to SRP Section 5.4.7.
- 3.12 NUREG-1287, Technical Specifications - Palo Verde Nuclear Generating Station, Unit No. 3, Docket No. STN-50-530, Appendix "A" to License No. NPF-74.
- 3.13 APS Palo Verde Nuclear Generating Station, Auxiliary Feedwater System Design Basis Manual, Rev. 0, dated 4/12/91.
- 3.14 ABB/CE Calculation V-MECH-CALC-007, Rev. 00, "Effects of NCW/EW Temperature on SCS Performance, Palo Verde Nuclear Generating Station, Units 1, 2, & 3," dated 4/20/93.

4.0 METHOD OF ANALYSIS

Shutdown Cooling System performance was modeled parametrically in a series of DESCENT cases for the cooldown parameters presented in Table 4.1. The QA verified code DESCENT (Reference 3.4) was used, with inputs as given in Section 5 below. The Essential Water (EW) temperature and Reactor Coolant flow through the shutdown cooling system (hereafter referred to as shutdown cooling flow) are varied parametrically to produce a matrix of cases. EW temperature ranges from 125°F to 143.4°F, and shutdown cooling flow ranged from 3400 gpm to 5000 gpm. Input parameters were selected to be consistent with the references in Section 3.0.

Table 1: SUMMARY OF COOLDOWN SCENARIOS

13.3 hrs Decay Heat, 12,600 gpm EW Flow,
1 LPSI Pump in Service

EW Temperature (°F)→ SDC Flow (gpm) ↓	125	132	143.4
3400	Case 1	Case 5	(Case not run)
4000	Case 2	Case 6	Case 9
4500	Case 3	Case 7	Case 10
5000	Case 4	Case 8	Case 11

5.29 RATEMIN

RATEMIN = 0.

The value of 0. indicates RATEMIN is not in effect.

5.30 CARD6

CARD6 = 0

Since this analysis uses DESCENT (Reference 3.4) it is necessary to provide an input for CARD6 which will identify if a sixth input card is desired to define specific heat exchanger variables. The value of 0 indicates the option for Card 6 variables is not desired. Further explanation of the Card 6 variable is provided on page 10 of Reference 3.6.

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ENCLOSURE 2

AFFIDAVIT PURSUANT

TO 10 CFR 2.790

I, I.C. Rickard, depose and say that I am the Director, Operations Licensing, of Combustion Engineering, Inc., duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.790 of the Commission's regulations and in conjunction with the application of Arizona Public Services for withholding this information.

The information for which proprietary treatment is sought is contained in the following document:

CEN-385-P, "RSB 5-1 Natural Circulation Cooldown Analysis At Up-rated Power Conditions (3876 Mwt Core Power) For Palo Verde Nuclear Generating Station Units 1, 2 and 3", November 1995

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Combustion Engineering in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.



1. The information sought to be withheld from public disclosure, is owned and has been held in confidence by Combustion Engineering. It consists of information regarding the application of the LTC computer code and methodology for analysis of plant natural circulation cooldown.
2. The information consists of test data or other similar data concerning a process, method or component, the application of which results in substantial competitive advantage to Combustion Engineering.
3. The information is of a type customarily held in confidence by Combustion Engineering and not customarily disclosed to the public. Combustion Engineering has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The details of the aforementioned system were provided to the Nuclear Regulatory Commission via letter DP-537 from F. M. Stern to Frank Schroeder dated December 2, 1974. This system was applied in determining that the subject document herein is proprietary.
4. The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.790 with the understanding that it is to be received in confidence by the Commission.
5. The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.
6. Public disclosure of the information is likely to cause substantial harm to the competitive position of Combustion Engineering because:
 - a. A similar product is manufactured and sold by major pressurized water reactor competitors of Combustion Engineering.

- b. Development of this information by Combustion Engineering required tens of thousands of dollars and hundred of manhours of effort. A competitor would have to undergo similar expense in generating equivalent information.
- c. In order to acquire such information, a competitor would also require considerable time and inconvenience for development of a computer code application and methodology for analysis of plant natural circulation cooldown.
- d. The information consists of the application of the LTC computer code and methodology for analysis of plant natural circulation cooldown; the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Combustion Engineering, take marketing or other actions to improve their product's position or impair the position of Combustion Engineering's product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.
- e. In pricing Combustion Engineering's products and services, significant research, development, engineering, analytical, manufacturing, licensing, quality assurance and other costs and expenses must be included. The ability of Combustion Engineering's competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.
- f. Use of the information by competitors in the international marketplace would increase their ability to market nuclear steam supply systems by reducing the costs associated with their technology development. In addition, disclosure would



have an adverse economic impact on Combustion
Engineering's potential for obtaining or maintaining foreign
licensees.

Further the deponent sayeth not.



I.C. Rickard, Director
Operations Licensing

Sworn to before me
this 4th day of January, 1996



Notary Public
My commission expires: 8/31/99

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