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Docket No.: 50-302

JUL 7 1975

Florida Power Corporation
ATTN: Mr. J. T. Rodgers
Assistant Vice President
& Nuclear Project Manager
P. O. Box 14042
St. Petersburg, Florida 33733

Gentlemen:

B&W Topical Report No. 10103 is presently scheduled to be submitted on July 9, 1975 for our review in support of your application to construct and operate the Crystal River, Unit 3 facility. To complete the review of your application with regard to compliance with 10 CFR 50.46, certain material in addition to that submitted in the referenced topical report is needed.

Attachment 1 to this letter is an overall requirements statement delineating all information necessary for the staff to complete its review of ECCS capability on each and every application docket. Each NSSS vendor (including B&W) has already been provided with all the attached information except the first two pages.

We urge you to evaluate these requirements and be assured that your submittals on the Crystal River, Unit 3 docket include all the required information outlined in Attachment 1. Please advise this office within 10 days of your schedule for submitting additional information as required.

Sincerely,

Original Signed by

POOR ORIGINAL

A. Schwencer, Chief
Light Water Reactors Branch 2-3
Division of Reactor Licensing

Attachment 1
Required Information

cc: See next page

OFFICE	x7886/LWR2-3	C-LWR2-3:RL				
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w/o enclosure
cc: Mr. S. A. Brandimore
Vice President General Counsel
Florida Power Corporation
P. O. Box 14042
St. Petersburg, Florida 33733

bccs: J. R. Buchanan, ORNL w/o encl.
T. B. Abernathy, DTIE w/o encl.

OFFICE ➤						
SURNAME ➤						
DATE ➤						

Attachment 1

REQUIRED INFORMATION

1. Break Spectrum and Partial Loop Operation

The information provided for each plant shall comply with the provisions of the attached memorandum entitled, "Minimum Requirements for ECCS Break Spectrum Submittals."

2. Potential Boron Precipitation (PWR's Only)

The ECCS system in each plant should be evaluated by the applicant (or licensee) to show that significant changes in chemical concentrations will not occur during the long term after a loss-of-coolant accident (LOCA) and these potential changes have been specifically addressed by appropriate operating procedures. Accordingly, the applicant should review the system capabilities and operating procedures to assure that boron precipitation would not compromise long-term core cooling capability following a LOCA. This review should consider all aspects of the specific plant design, including component qualification in the LOCA environment in addition to a detailed review of operating procedures. The applicant should examine the vulnerability of the specific plant design to single failures that would result in any significant boron precipitation.

3. Single Failure Analysis

A single failure evaluation of the ECCS should be provided by the applicant (or licensee) for his specific plant design, as required by Appendix K to 10 CFR 50, Section I.D.1. In performing this evaluation, the effects of a single failure or operator error that causes any manually controlled, electrically-operated valve to move to a position that could adversely affect the ECCS must be considered. Therefore, if this consideration has not been specifically reported in the past, the applicants upcoming submittal must address this consideration. Include a list of all of the ECCS valves that are currently required by the plant Technical Specifications to have power disconnected, and any proposed plant modifications and changes to the Technical Specifications that might be required in order to protect against any loss of safety function caused by this type of failure. A copy of Branch Technical Position EICSB 18 from the U.S. Nuclear Regulatory Commission's Standard Review Plan is attached to provide you with guidance.

The single failure evaluation should include the potential for passive failures of fluid systems during long term cooling following a LOCA as well as single failures of active components. For PWR plants, the single failure analysis is to consider the potential boron concentra-problem as an integral part of long term cooling.

4. Submerged Valves

The applicant should review the specific equipment arrangement within his plant to determine if any valve motors within containment will become submerged following a LOCA. The review should include all valve motors that may become submerged, not only those in the safety injection system. Valves in other systems may be needed to limit boric acid concentration in the reactor vessel during long term cooling or may be required for containment isolation.

The applicant (or licensee) is to provide he following information, for each plant:

(1) Whether or not any valve motors will be submerged following a LOCA in the plant being reviewed.

(2) If any valve motors will be flooded in their plant, the applicant (or licensee) is to:

(a) Identify the valves that will be submerged.

(b) Evaluate the potential consequences of flooding of the valves for both the short term and long term ECCS functions and containment isolation. The long term should consider the potential problem of excessive concentrations of boric acid in PWR's.

(c) Propose a interim solution while necessary modifications are being designed and implemented. (currently operating plants only).

(d) Propose design changes to solve the potential flooding problem.

5. Containment Pressure (PWR's Only)

The containment pressure used to evaluate the performance capability of the ECCS shall be calculated in accordance with the provisions of Branch Technical Position CSB 6-1, which is enclosed.

6. Low ECCS Reflood Rate (Westinghouse NSSS Only)

Plants that have a Westinghouse nuclear steam supply shall perform their ECCS analyses utilizing the proper version of the evaluation model, as defined below:

(1) The December 25, 1974 version of the Westinghouse evaluation model, i.e., the version without the modifications described in WCAP-8471 is acceptable for previously analyzed plants for which the peak clad temperature turnaround was identified prior to the reflood rate decreasing below 1.1 inches per second or for which the reflood rate was identified to remain above 1.0 inch per second; conditions for which the December 25, 1974 and March 15, 1975 versions would be equivalent.

(2) The March 15, 1975 version of the Westinghouse evaluation model is an acceptable model to be used for all previously analyzed plants for which the peak clad temperature turnaround was identified to occur after the reflood rate decreased below 1.1 inches per second, and for which steam cooling conditions (reflood rate less than 1 inch per second) exist prior to the time of peak clad temperature turnaround. The March 15, 1975 version will be used for all future plant analyses.

APR 25 1975

MINIMUM REQUIREMENTS FOR ECCS BREAK SPECTRUM SUBMITTALS

I. INTRODUCTION

The following outline shall be used as a guideline in the evaluation of LOCA break spectrum submittals. These guidelines have been formulated for contemporary reactor designs only and must be re-assessed when new reactor concepts are submitted.

The current ECCS Acceptance Criteria requires that ECCS cooling performance be calculated in accordance with an acceptable evaluation model and for a number of postulated loss-of-coolant accidents of different sizes, locations and other properties sufficient to provide assurance that the entire spectrum of postulated loss-of-coolant accidents is covered. In addition, the calculation is to be conducted with at least three values of a discharge coefficient (C_D) applied to the postulated break area, these values spanning the range from 0.6 to 1.0.

Sections IIA and IIIA define the acceptable break spectrum for most operating plants which have received Safety Orders. Sections IIB and IIIB define the break spectrum requirements for most CP and OL case work (exceptions noted later). Sections IIC and IIIC provide an outline of the minimum requirements for an acceptable complete break spectrum. Such a complete break spectrum could be appropriately referenced by some plants. Sections IIID and IIIE provide the exceptions to certain plant types noted above.

A plant due to reload a portion of its core will have previously submitted all or part of a break spectrum analysis (either by reference or by specific calculations). If it is the intention of the Licensee to replace expended fuel with new fuel of the same design (no mechanical design differences which could affect thermal and hydraulic performance), and if the Licensee intends to operate the reloaded core in compliance with previously approved Technical Specifications, no additional calculations are required. If the reload core design has changed, the Licensee shall adopt either of Sections IIA or IIC, or of Sections IIIA or IIIC of this document, as appropriate to the plant type (BWR or PWR). The criterion for establishing whether paragraph A or C shall be satisfied will be determined on the basis of whether the Licensee can demonstrate that the shape of the PCT versus break size curve has not been modified as a consequence of changes to the reload core design. When the reload is supplied by a source other than the NSSS supplier, the break spectrum analyses specified by Sections IIC or IIIC shall be submitted as a minimum (as appropriate to the plant type, BWR or PWR). Additional sensitivity studies may be required to assess the sensitivity of fuel changes in such areas as single failures and reactor coolant pump performance.

II. PRESSURIZED WATER REACTORS

A. Operating Reactor Reanalyses (Plants for which Safety Orders were issued)

If calculational changes* were made to the LBM** to make it wholly in

* Calculational changes/Model changes--those revisions made to calculational techniques or fixed parameters used for the referenced complete spectrum.

** LBM--Large Break Model; SBM--Small Break Model conformance with 10CFR50, Appendix K, the following minimum number of break sizes should be reanalyzed. Each sensitivity study performed during the development of the ECCS evaluation model shall be individually verified as remaining applicable, or shall be repeated. A plant may reference a break spectrum analysis conducted on another plant if it is the same configuratio and core design.

1. If the largest break size results in the highest PCT:

   a. Reanalyze the limiting break.

   b. Reanalyze two smaller breaks in the large break region.

2. If the largest break size does not result in the highest PCT:

   a. Reanalyze the limiting break.

   b. Reanalyze a break larger and a break smaller than the limiting break. If the limiting break is outside the range of Moody multipliers of 0.6 to 1.0 (i.e., less than 0.6), then the limiting break plus two larger breaks must be analyzed.

If calculational changes have been made to the SBM to make it wholly in conformance with 10CFR50, Appendix K, the analysis of the worst small break (SBM) as previously determined from paragraph C below should be repeated.

B. New CP and OL Case Work

A complete break spectrum should be provided in accordance with paragraph C below, except for the following:

1. If a new plant is of the same general design as the plant used as a basis for a referenced complete spectrum analysis, but operating parameters have changed which would increase PCT or metal-water reaction, or approved calculational changes resulting in more than 20°F change in PCT have been made to the ECCS model used for the referenced complete spectrum, the analyses of paragraph A above should be provided plus a minimum of three small breaks (SBM), one of which is the transition break.* The shape of the break spectrum in the referenced analysis should be justified as remaining applicable, including the sensitivity studies used as a basis for the ECCS evaluation model.

2. If a new plant (configuration and core design) is applicable to all generic studies because it is the same with respect to the generic plant design and parameters used as a basis for a referenced complete spectrum defined in paragraph C, and no calculational changes resulting in more than 20°F change in PCT were made to the ECCS model used for the referenced complete spectrum, then no new spectrum analyses are required. The new plant may instead reference the applicable analysis.

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* Transition Break (TB)--that break size which is analyzed with both the LBM and SBM.

C. Minimum Requirements for a Complete Break Spectrum

Since it is expected that applicants will prefer to reference an applicable complete break spectrum previously conducted on another plant, this paragraph defines the minimum number of breaks required for an acceptable complete break spectrum analysis, assuming the cold leg pump discharge is established as the worst break location. The worst single failure and worst-case reactor coolant pump status (running or tripped) shall be established utilizing appropriate sensitivity studies. These studies should show that the worst single failure has been justified as a function of break size. Each sensitivity study published during the development of the ECCS evaluation model shall be individually justified as remaining applicable, or shall be repeated. Also, a proposal for partial loop operation shall be supported by identifying and analyzing the worst break size and location (i.e., idle loop versus operating loop). In addition, sufficient justification shall be provided to conclude that the shape of the PCT versus Break Size curve would not be significantly altered by the partial loop configuration. Unless this information is provided, plant Technical Specifications shall not permit operation with one or more idle reactor coolant pumps

It must be demonstrated that the containment design used for the break spectrum analysis is appropriate for the specific plant analyzed. It should be noted that this analysis is to be performed with an approved evaluation model wholly in conformance with the current ECCS Acceptance Criteria.

1. LBM--Cold Leg-Reactor Coolant Pump Discharge

    a. Three guillotine type breaks spanning at least the range of Moody multipliers between 0.6 and 1.0.

    b. One split type break equivalent in size to twice the pipe cross-sectional area.

    c. Two intermediate split type breaks.

    d. The large-break/small-break transition split.

2. LBM--Cold Leg-Reactor Coolant Pump Suction

    Analyze the largest break size from part 1 above. If the analyses in part 1 above should indicate that the worst cold leg break is an intermediate break size, then the largest break in the pump suction should be analyzed with an explanation of why the same trend would not apply.

3. LBM--Hot Leg Piping

    Analyze the largest rupture in the hot leg piping.

4. SB[illegible]--Splits

Analyze five different small break sizes. One of these breaks must include the transition split break. The CFT line break must be analyzed for B&W plants. This break may also be one of the five small breaks.

III. BOILING WATER REACTORS

The generic model developed by General Electric for BWRs proposed that split and guillotine type breaks are equivalent in determining blowdown phenomena. The staff concluded this was acceptable and that the break area may be considered at the vessel nozzle with a zero loss coefficient using a two phase critical flow model. Changes in the break area are equivalent to changes in the Moody multiplier.

The minimum number of breaks required for a complete break spectrum analysis, assuming a suction side recirculation line break is the design basis accident (DBA) and the worst single failure has been established utilizing appropriate sensitivity studies, are shown in paragraph C below. Also, a proposal for partial loop operation shall be supported by identifying and analyzing the worst break size and location (i.e., idle loop versus operating loop). In addition, sufficient justification shall be provided to conclude that the shape of the PCT versus Break Size curve would not be significantly altered by the partial loop configuration. Unless this information is provided, plant Technical Specifications shall not permit operation with one or more idle reactor coolant pumps.

A. BWR2, BWR3, and BWR4 Reanalysis (Plants for which Safety Orders were issued)

If the referenced lead plant analysis is in accordance with Section III, paragraph C below, the following minimum number of break sizes should be reanalyzed. It is to be noted that the lead plant analysis is to be performed with an approved evaluation model wholly in conformance with the current ECCS Acceptance Criteria. A plant may reference a break spectrum analysis conducted on another plant if it is the same configuration and core design.

Each sensitivity study published during the development of the ECCS evaluation model shall be individually justified as remaining applicable, or shall be repeated.

1. If the largest break results in the highest PCT:

   a. Reanalyze the limiting break with the appropriate referenced single failure.

   b. Reanalyze the worst small break with the appropriate referenced single failure.

   c. Reanalyze the transition break with the single failure and model that predicts the highest PCT.

2. If the largest break does not result in the highest PCT:

   a. Reanalyze the limiting break, the largest break, and a smaller break.

If calculational changes have been made to the SBM to make it wholly in conformance with 10CFR50, Appendix K, reanalyze the small break (SBM) in accordance with Section IIIC.

B. New CP and OL Case Work

A complete break spectrum should be provided in accordance with Section III, paragraph C below, except for the following:

1. If a new plant is of the same general design as the plant used as a basis for the lead plant analysis, but operating parameters have changed which would increase PCT or metal-water reaction, or approved calculational changes have been made to the ECCS model resulting in more than 20°F change in PCT, the analyses of Section III, paragraph A above should be provided plus a minimum of three small breaks (SBM), one of which is the transition break. The shape of the break spectrum in the lead plant analysis should be justified as remaining applicable, including the sensitivity studies used as a basis for the ECCS evaluation model.

2. If a new plant (configuration or core design) is applicable to all generic studies because it is the same with respect to the generic plant design and parameters used as a basis for a referenced complete spectrum defined in paragraph C, and no calculational changes resulting in more than 20°F change in PCT were made to the ECCS model used for the referenced complete spectrum, then no new spectrum analyses are required. The new plant may instead reference the applicable analysis.

C. Minimum Requirements for a Complete Break Spectrum

This paragraph defines the minimum number of breaks required for an acceptable complete spectrum analysis. This complete spectrum analysis is required for each of the lead plants of a given class (BWR2, BWR3, BWR4, BWR5, and BWR6). Each sensitivity study published during the development of the ECCS evaluation model shall be individually justified as remaining applicable, or shall be repeated.

1. Four recirculation line breaks at the worst location (pump suction or discharge), using the LBM, covering the range from the transition break (TB) to the DBA, including C_D coefficients of from 0.6 to 1.0 times the DBA.

2. Five recirculation line breaks, using the SBM, covering the range from the smallest line break to the TB.

3. The following break locations assuming the worst single failure:

   a. largest steamline break

   b. largest feedwater line break

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c. largest core spray line break

d. largest recirculation pump discharge or suction break (opposite side of worst location)

D. BWR4 with "Modified" ECCS

Same as Section IIIC.

E. BWR5

Same as Section IIIC.

F. BWR6

Same as Section IIIC.

IV. LOCA PARAMETERS OF INTEREST

A. On each plant and for each break analyzed, the following parameters (versus time unless otherwise noted) should be provided on engineering graph paper of a quality to facilitate calculations.

--Peak clad temperature (ruptured and unruptured node)

--Reactor vessel pressure

--Vessel and downcomer water level (PWR only)

--Water level inside the shroud (BWR only)

--Thermal power

--Containment pressure (PWR only)

B. For the worst break analyzed, the following additional parameters (versus time unless otherwise noted) should be provided on engineering graph paper of a quality to facilitate calculations. The worst single failure and worst-case reactor coolant pump status will have been established utilizing appropriate sensitivity studies.

--Flooding rate (PWR only)

--Core flow (inlet and outlet)

--Core inlet enthalpy (BWR only)

--Heat transfer coefficients

--MAPLHGR versus Exposure (BWR only)

--Reactor coolant temperature (PWR only)

--Mass released to containment (PWR only)

--Energy released to containment (PWR only)

--PCT versus Exposure (BWR only)

--Containment condensing heat transfer coefficient (PWR only)

--Hot spot flow (PWR only)

--Quality (hottest assembly) (PWR only)

--Hot pin internal pressure

--Hot spot pellet average temperature

--Fluid temperature (hottest assembly) (PWR only)

C. A tabulation of peak clad temperature and metal-water reaction (local and core-wide) shall be provided across the break spectrum.

D. Safety Analysis Reports (SARs) filed with the NRC shall identify on each plot the run date, version number, and version date of the computer model utilized for the LOCA analysis. Should differences exist in version number or version date from the most current code listings made available to the NRC staff, then each modification shall be identified with an assessment of impact upon PCT and metal-water reaction (local and core-wide).

E. A tabulation of times at which significant events occur shall be provided on each plant and for each break analyzed. The following events shall be included as a minimum:

--End-of-bypass (PWR only)

--Beginning of core recovery (PWR only)

--Time of rupture

--Jet pumps uncovered (BWR only)

--MCPR (BWR only)

--Time of rated spray (BWR only)

--Can quench (BWR only)

--End-of-blowdown

--Plane of interest uncovery (BWR only)