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Gentlemen:

DOCKETS 50-266 AND 50-301
ECCS EVALUATION MODEL CHANGES, 10 CFR 50.46
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

As required by Title 10 of the Code of Federal Regulations Part 50.46 (a) (3) (ii), Wisconsin Electric Power Company (Licensee) is submitting this annual report of changes to, and errors discovered in the emergency core cooling system (ECCS) evaluation models for Point Beach Nuclear Plant, Units 1 and 2. This letter provides a summary of ECCS evaluation model changes and errors identified since the last annual report dated March 30, 1994 (letter NPL 94-0118). Model changes include changes to the small break and large break loss of coolant accident (LOCA) models. A summary of the changes is provided below with additional details and a summary sheet of peak cladding temperature (PCT) margin in the attachments.

Small Break LOCA Evaluation Model

A substantial PCT penalty has been assessed for a 10 CFR 50.59 analysis of the impact of loss of auxiliary feedwater. The Analysis of Record assumes actuation of the turbine driven auxiliary feedwater pump after an undervoltage signal from the 4 KV buses. This actuation signal is not safety grade. A conservative estimate of 213°F PCT penalty has been assessed for a small break LOCA with no auxiliary feedwater for the duration of time that the break will remove the energy previously removed via auxiliary feedwater. Since this estimate assumes no auxiliary feedwater, the 1989 auxiliary feedwater enthalpy delay issue is no longer valid and the 25°F PCT penalty has been removed from the margin utilization sheets.

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Mixture velocity in various boiling heat transfer regime correlations were modified to properly account for drift and slip effects calculated in NOTRUMP. Also, a minor typographical error was corrected in the Westinghouse Transition Boiling Correlation. These errors were assessed a PCT benefit of 6°F.

An error in the steam line isolation logic results in a PCT penalty of 18°F. The isolation function was triggered at a later time than when the appropriate signal was generated.

Deficiencies in the detail used for axial nodalization of the fuel rod in the SBLOCTA code, which is a part of NOTRUMP, was assessed a PCT penalty of 7°F. Related issues with nodalization and fluid conservation equations were corrected. Also, a revised model for calculating transient fuel rod internal pressure was implemented in the SBLOCTA code.

Other minor errors in the small break LOCA evaluation model which are not assessed a PCT penalty or benefit include: core node zirc oxide initialization error; pressure search convergence criteria in NOTRUMP; friction value input corrections; automatic containment spray actuation during SBLOCA; and safety injection in the broken loop. Additional details for these errors are contained in the attachments.

Large Break LOCA Evaluation Model

The WCOBRA/TRAC UPI code versions were combined into one UPI version to reduce the number of codes to maintain. The combined codes include the Appendix K blowdown and reflood and the superbounded version. In addition, several errors were found in preparation and review of the WCOBRA/TRAC best estimate code. A net PCT benefit of 34°F was assessed from the 1993 10 CFR 50.46 report for the code version merging and error corrections. Details of the code version combination and error corrections are listed in Attachment 1.

An assessment was conducted on the effect of revised steam generator tube plugging (SGTP) margin on the analyses of record. The assessment analyzed a SGTP increase from 20% to 25%. The effect on PCT was conservatively estimated at +2°F for every 1% increase in SGTP for a total penalty of 10°F.

The current cumulative change in PCT for small break LOCA analysis is 207°F for a total PCT of 1049°F (Attachment 2). The cumulative change in PCT for the large break LOCA is -24°F (Attachment 3). There is no plan for reanalysis of the ECCS models at this time due to the significant PCT margins to the licensing limit. However, any future reanalysis of the ECCS models will include consideration of the above estimates.

Please contact us if you have any questions about this information.

Sincerely,

Gary M. Kaiser
Manager
Industry and Regulatory Services

BH/cms

Attachments

cc: NRC Resident Inspector
NRC Regional Administrator, Region III

ECCS EVALUATION MODEL CHANGES AND ERRORS

- WCOBRA/TRAC UPI CODE VERSION COMBINATION AND ERROR CORRECTIONS

Near the end of 1993, a decision was made to combine the three UPI versions of WCOBRA/TRAC (Appendix K blowdown and reflood, and superbounded version) into one UPI version to reduce the number of codes to be maintained. To combine the codes, some updates were included to provide flags and input options to switch on various Appendix K models. In performing the code combination, several updates that were in the superbounded version were introduced into the Appendix K version (a decision had been made previously to not include these changes in the Appendix K version because they were not considered code errors which would affect code results). In addition, several undefined variables were identified and corrected. A user convenience update was added to have the code automatically stop at the end-of-blowdown conditions. This effort was completed in 1994.

In addition, several errors were found during preparation and review of the best estimate WCOBRA/TRAC code in 1994 which also apply to the UPI version. These corrections were also made in 1994. A summary of the corrections follows:

- Corrections to add additional variables to the restart file, to reduce small differences which occur when a restarted case is compared to a non-restarted case.
- Correction to lateral velocity for convection of axial momentum.
- Correction to intercell drag force logic.
- Corrections to two minor errors in 1-D components.
- Correction to rod gap pressure calculation.
- Correction of a typo in the 1979 decay heat table. No effect on Appendix K results.
- Correction of an error in the condensation model which was discovered earlier, but was not corrected properly.
- Correction of a minor error in the 1-D/3-D junction.
- Correction of an error in the Zirlo reaction rate constant. Too high a reaction rate was being calculated. Does not affect Appendix K results.
- Correction of some errors in coding logic which improperly calculated the location of the zirc-oxide interface, and the momentum area following burst.

The analysis with the 1994 WCOBRA/TRAC UPI Code Updates includes the code update effects previously reported as a 76°F benefit. Input deck modifications were included in this analysis to bring it in line with current methodology, in addition to the new code updates, yielding a net 42°F penalty when compared to the 1993 10 CFR 50.46 Report. The total benefit for this reporting period is 34°F.

· BOILING HEAT TRANSFER CORRELATION ERRORS

This closely related set of errors deals with how the mixture velocity is defined for use in various boiling heat transfer regime correlations. The previous definition for mixture velocity did not properly account for drift and slip effects calculated in NOTRUMP. This error particularly affected NOTRUMP calculations of heat transfer coefficient when using the Westinghouse Transition Boiling Correlation and the Dougall-Rohsenow Saturated Film Boiling Correlation.

In addition, a minor typographical error was also corrected in the Westinghouse Transition Boiling Correlation.

Representative plant calculations for this issue resulted in an estimated PCT effect of -6°F.

· STEAM LINE ISOLATION LOGIC ERRORS

This error was the result of incorrect logic which always led to the isolation functions occurring at a slightly later time than when the appropriate signal was generated.

Representative plant calculations for this issue resulted in an estimated PCT effect of +18°F.

· CORE NODE ZIRC OXIDE INITIALIZATION ERROR

NOTRUMP models two regions for each core node analogous to the two (mixture and vapor) regions in adjoining fluid nodes. During the course of a transient, NOTRUMP tracks region specific qualities for each core node. Erroneous logic caused incorrect initialization of the region specific, fuel cladding zirc oxide thickness at times prior to the actual creation of the relevant region during the core boiloff transient.

Representative plant calculations led to an estimated generic PCT effect of 0°F for this effect.

· PRESSURE SEARCH CONVERGENCE CRITERIA IN NOTRUMP

The convergence criteria used during the pressure search in NOTRUMP have been found to not be adequately restrictive to ensure a sufficiently accurate value for Fluid Node pressure when conditions approach the boundary between subcooled and saturated in some cases. The resulting effects on predicted pressure were more pronounced at pressures below those normally seen during standard Evaluation Model calculations. The previously hardwired convergence criteria values have been made user controlled, appropriate values have been determined, and these will be implemented in all future analyses.

The nature of this error led to an estimated generic PCT effect of 0°F for existing analyses.

· FRICTION VALUE INPUT CORRECTIONS

The SPADES code is used to generate input decks for the small break analysis code, NOTRUMP. An error was found in the code which involved the values assigned to some of the friction factor input. The erroneous values had no impact on transient calculations and were corrected in order to maintain the consistency of the SPADES code with the relevant documentation.

Representative plant calculations indicate no effect on PCT.

· AUTOMATIC CONTAINMENT SPRAY ACTUATION DURING SBLOCA

Automatic containment spray actuation during a small break LOCA had not previously been addressed in the Westinghouse small break LOCA evaluation model. The containment pressure transient is not modeled because the small break PCT is not directly sensitive to this effect. While investigating this issue, however, Westinghouse concluded that containment spray actuation early in the small break transient is possible for a variety of containment types. Containment spray actuation could result in draindown of the RWST prior to conclusion of the small break transient. Switching to cold leg recirculation during the transient may reduce or briefly interrupt the modeled ECCS injection flow in some plants and elevate the enthalpy of ECCS injection water. Furthermore, an alternate single failure scenario could result in earlier draindown for the RWST and subsequent switchover to cold leg recirculation.

Plant specific evaluations of affected plants currently indicate no PCT effect due to SI interruption or reduction following switchover to cold leg recirculation.

· SBLOCTA REVISIONS AND AXIAL NODALIZATION ERRORS

Reference: Letter NTD-NRC-94-4343, "Interim Report of an Evaluation of a Deviation or Failure to Comply Pursuant to 10CFR21.21(a)(2) - Closeout 94-002", NJ Liparulo (W), November 15, 1994.

Westinghouse has completed an evaluation of issues concerning the SBLOCTA code which is a part of both the NOTRUMP and WFLASH SBLOCA ECCS Evaluation Models. The potential issue originally identified was a deficiency in the amount of detail used for the axial nodalization of the fuel rod, as it affected the solution of the channel fluid equations. Further investigation identified several additional related issues associated with nodalization and the overall solution of the fluid conservation equations which have subsequently been corrected. As a separate, but related issue, a revised model for calculating transient fuel rod internal pressure was implemented in the SBLOCTA code. The NRC was informed of these modeling changes, which were summarized in the closeout notification of the reference.

Analysis of the issues relate to portions of the SBLOCTA code and its associated input methodology for Point Beach yielded a cumulative PCT penalty of 7°F.

· SAFETY INJECTION IN THE BROKEN LOOP

Reference: WCAP-10054-P, Addendum 2, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," August, 1994.

The referenced topical report presents a change to the Westinghouse SBLOCA methodology dealing with ECCS flows in the broken loop. It also presents a revised condensation model that will be used on the safety injection jet in future analysis.

This change has been shown to typically produce PCT benefits in studies presented in the reference. It is being implemented on a forward fit basis. A net PCT impact of 0°F is being assessed against the Point Beach analysis.

· STEAM GENERATOR TUBE PLUGGING MARGIN INCREASE

Westinghouse has completed a Peak Cladding Temperature (PCT) assessment for the Large Break LOCA analysis to support an increase in the available Steam Generator Tube Plugging (SGTP) margin from 20% to 25%. A sensitivity study to determine the ΔPCT-SGTP percentage relationship found a 2°F penalty for every 1% SGTP increase. For the 5% SGTP margin increase, a PCT penalty of 10°F is assessed.

· SMALL BREAK LOCA ANALYSIS FOR LOSS OF AUXILIARY FEEDWATER

There are two signals that actuate the turbine driven auxiliary feedwater pumps undervoltage of the 4 KV buses and steam generator low-low level. As a result of the review of the small break Accident Analysis Basis Document (AABD), It was determined that the LOOP assumption could not be assumed to generate an undervoltage to the 4 KV buses signal because the signal is not safety grade. The low-low steam generator level signal is not part of the small break LOCA evaluation model with NOTRUMP since it is anticipated that the alarm would be reached after PCT time of 179 seconds (~3 minutes).

For the current licensing basis small break LOCA analysis performed with the NOTRUMP Evaluation Model, the 4-inch equivalent diameter case was examined. The conservative evaluation of the effects of the loss of auxiliary feedwater to both steam generators has required the use of 213°F of peak cladding temperature margin. The conservative assumption is that the cladding temperature is calculated to increase linearly at a rate consistent with the heat up rate observed during the 4-inch break PCT transient near PCT time. The calculation is applied over the period of time necessary for the break energy flow to remove that energy which was

previously removed via auxiliary feedwater and steam generator heat trahsfer. Since the change in heat transfer from the steam generator was assumed to depend only on AFW, a conservative time delay was calculated, further insuring the conservatism in the evaluation.

The evaluation has resulted in the use of 213°F of small break LOCA margin for the PBNP Units. Since this evaluation accounts for the total loss of auxiliary feedwater, the 25°F of margin required to evaluate the auxiliary feedwater enthalpy delay issue in 1989 is no longer appropriate. The margin utilization sheet has been updated to include a ΔPCT = 213°F for the loss of auxiliary feedwater and the ΔPCT = 25°F for the auxiliary enthalpy delay issue has been removed. The resulting small break LOCA peak cladding temperature plus margin utilization is 1049°F. Substantial margin to the 10 CFR 50.46 limit of 2200°F remains.

SMALL BREAK PEAK CLAD TEMPERATURE MARGIN UTILIZATION

A. Analysis of Record (7/88)	PCT=	809 °F
B. Prior Permanent ECCS Model Assessments	ΔPCT=	8 °F
C. 10 CFR 50.59 Safety Evaluations	ΔPCT=	213 °F
D. 1994 10 CRF 50.46 Model Assessments		
1. Boiling Heat Transfer Correlation Error	ΔPCT=	-6 °F
2. Steam Line Isolation Logic Error	ΔPCT=	18 °F
3. Axial Nodalization, RIP Model Revision and SBLOCTA Error Corrections Analysis	ΔPCT=	7 °F
E. Temporary ECCS Model Issues		
1. None	ΔPCT=	0 °F
F. Other Margin Allocations		
1. None	ΔPCT=	0 °F
Licensing Basis PCT + Margin Allocations	PCT=	1049 °F

LARGE BREAK PEAK CLAD TEMPERATURE MARGIN UTILIZATION

A. Analysis of Record (2/91)	PCT=	2028 °F
1. Combined SSE and LOCA Events	ΔPCT=	10 °F
B. Prior Permanent ECCS Model Assessments	ΔPCT=	0 °F
C. 10 CFR 50.59 Safety Evaluations	ΔPCT=	0 °F
D. 1994 10 CFR 50.59 Model Assessments		
1. 1994 WCOBRA/TRAC UPI Code Updates	ΔPCT=	-34 °F
E. Temporary ECCS Model Issues		
1. None	ΔPCT=	0 °F
F. Other Margin Allocations		
1. None	ΔPCT=	0 °F
Licensing Basis PCT + Margin Allocations	PCT=	2004 °F

10 CFR 50.59 SAFETY EVALUATIONS

1. Small Break ECCS Safety Evaluations		
A. Loss of Auxiliary Feedwater	ΔPCT=	213 °F
Total 10 CFR 50.59 Small Break Assessments	PCT=	213 °F
2. Large Break ECCS Safety Evaluations		
A. None	ΔPCT=	0 °F
Total 10 CFR 50.59 Large Break Assessments	PCT=	0 °F