

framatome

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Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

2019 - Annual Reporting of Changes and Errors in Emergency Core Cooling Systems (ECCS) Evaluation Models

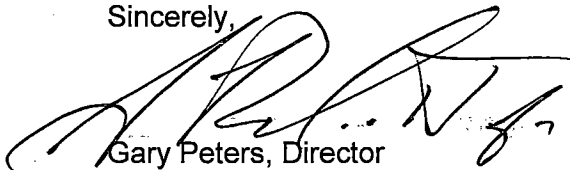
Ref. 1: Letter, Gary Peters (Framatome Inc.) to Document Control Desk (NRC), "2018 - Annual Reporting of Changes and Errors in Emergency Core Cooling Systems (ECCS) Evaluation Models," NRC:19:008, May 1, 2019.

Attached is a summary report of changes and error corrections implemented in the Framatome Inc. Emergency Core Cooling Systems (ECCS) evaluation models for the period of January 1, 2019 to December 31, 2019. Reference 1 provided reporting for the previous year.

Changes to inputs that result from fuel or plant changes, and that are treated according to the methodology, are not considered model changes and, therefore, are not reported in the attachment. Changes in peak cladding temperatures (PCTs) due to loss of coolant accident (LOCA) evaluation model changes and errors are reported on a plant specific basis by Framatome to the affected licensees. The licensees have the obligation under 10 CFR 50.46 to report the nature of changes and errors affecting PCT. The report in this letter is provided for information only.

If you have any questions related to this information, please contact Mr. Alan Meginnis, Product Licensing Manager, by telephone at (509) 375-8266, or by e-mail at Alan.Meginnis@framatome.com.

Sincerely,



Gary Peters, Director
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cc: J. G. Rowley
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Attachments:

1. Attachment A - Listing of Framatome LOCA Evaluation Models
2. Attachment B - Annual Reporting of Framatome LOCA Evaluation Model Changes and Error Corrections (January 1, 2019- December 31, 2019)

Attachment A

Listing of Framatome LOCA Evaluation Models

EXEM BWR-2000 Large and Small Break LOCA Evaluation Model

This model is applicable to jet-pump boiling water reactors for both large and small break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2361PA, Revision 0.

AURORA-B Large and Small Break LOCA Evaluation Model

This model is applicable to jet-pump boiling water reactors for both large and small break LOCA analyses. The NRC approved topical report for this evaluation model is ANP-10332P-A, Revision 0.

CRAFT2 PWR Large Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for large break LOCA analyses of zircaloy clad fuel. The NRC approved topical report for this evaluation model is BAW-10104PA, Revision 5.

CRAFT2 PWR Small Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for small break LOCA analyses of zircaloy clad fuel. The NRC approved topical report for this evaluation model is BAW-10154PA, Revision 0.

RELAP5/MOD2-B&W Once Through Steam Generator Large and Small Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for large and small break LOCA analyses of zircaloy or M5[®] clad fuel. The NRC approved topical report for this evaluation model is BAW-10192PA, Revision 0 as modified to address fuel thermal-conductivity degradation with burnup as described in BAW-10192PA Revision 0 Supplement 1 PA Revision 0. The NRC has approved this evaluation model for M5[®] clad fuel in BAW-10227PA, Revision 0.

SEM/PWR-98 PWR Large Break LOCA Evaluation Model

This model is applicable to Westinghouse designed 3 and 4 loop pressurized water reactors and Combustion Engineering designed pressurized water reactors for large break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2087PA, Revision 0.

S-RELAP5 PWR Small Break LOCA Evaluation Model

This model is applicable to Westinghouse designed 2, 3, and 4 loop pressurized water reactors and Combustion Engineering designed pressurized water reactors for small break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2328PA, Revision 0 and Supplement 1 PA Revision 0.

Realistic PWR Large Break LOCA Model

This model is applicable to Westinghouse designed 3 and 4 loop pressurized water reactors and Combustion Engineering 2x4 designed pressurized water reactors for large break LOCA analyses. The NRC approved topical reports for this evaluation model are EMF-2103PA, Revision 0 and EMF-2103PA, Revision 3.

Attachment B

Annual Reporting of Framatome LOCA Evaluation Model Changes and Error Corrections (January 1, 2019 - December 31, 2019)

EXEM BWR-2000 Large and Small Break LOCA Evaluation Model

This model is applicable to jet-pump boiling water reactors for both large and small break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2361PA, Revision 0.

There were two evaluation model error corrections made during the reporting period.

1. RODEX4 Incorrectly Calculating PCMI Interaction.

A coding issue was found in the interpolation process in the RODEX4 Pellet-Cladding Mechanical Interaction (PCMI) routines. The PCT impact of this issue ranged from -5°F to +1°F.

2. Input Automation Code Applied Incorrect Fuel Rod Geometry Values.

AUTOHUP is an automation code used in the LOCA heatup analysis process and prepares much of the input for the RODEX2 calculations. It was discovered that some of the RODEX2 inputs associated with the fuel rod geometry were not being appropriately prepared in the automation process using AUTOHUP. The PCT impact of this issue ranged from -9°F to +2°F.

AURORA-B Large and Small Break LOCA Evaluation Model

This model is applicable to jet-pump boiling water reactors for both large and small break LOCA analyses. The NRC approved topical report for this evaluation model is ANP-10332P-A, Revision 0.

There were no evaluation model error corrections made during the reporting period.

CRAFT2 PWR Large Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for large break LOCA analyses of zircaloy clad fuel. The NRC approved topical report for this evaluation model is BAW-10104PA, Revision 5.

There were no evaluation model changes or error corrections made during the reporting period.

CRAFT2 PWR Small Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for small break LOCA analyses of zircaloy clad fuel. The NRC approved topical report for this evaluation model is BAW-10154PA, Revision 0.

There were no evaluation model changes or error corrections made during the reporting period.

RELAP5/MOD2-B&W Once Through Steam Generator Large and Small Break LOCA Evaluation Model

This model is applicable to all B&W designed pressurized water reactors for large and small break LOCA analyses of zircaloy or M5[®] clad fuel. The NRC approved topical report for this evaluation model is BAW-10192PA, Revision 0 as modified to address fuel thermal-conductivity degradation (TCD) with burnup as described in BAW-10192PA Supplement 1 Revision 0. NRC-approved fuel codes are used to supply the fuel rod steady-state conditions at the beginning of the small or large break LOCA transient. These codes are approved for use with M5[®] cladding via the safety evaluation report on BAW-10227PA. The NRC has approved BAW-10192PA, Revision 0 evaluation model for M5[®] clad fuel in BAW-10227PA, Revision 0. Note that the NRC has approved Revision 1 of the M5[®] topical report, but it is not applicable to the evaluation model.

There were two generic evaluation model changes or error corrections made during the reporting period.

1. The EM model error correction for M5[®] cladding properties

Two documentation errors from circa 2000 topical reports related to M5 cladding were discovered in 2019. These errors were discovered and reported to the utilities using the BWNT LOCA EM for licensing applications. One error was related to the clad outside emissivity used in the LOCA analyses and the other error did not report updated cladding thermal expansion models from 2001 in the M5 cladding topical report BAW-10227PA. The 10 CFR 50.46 report identified the incorrect descriptions in the M5 topical versus what was modeled in the demonstration cases and also the models used for current B&W plant LBLOCA and SBLOCA analyses. Since the models used for current LBLOCA and SBLOCA licensing basis are consistent with the updated descriptions provided from this 50.46 report, there are no changes to the current PCT reported 10 CFR 50.46 PCTs for all B&W plant LOCA analyses. The documentation corrections to the circa 2000 EM was estimated to be 0 °F for acceptable SBLOCA and LBLOCA models.

2. The EM model error correction for the SBLOCA LOCA holes and slots between the core and core baffle region

The EM incorrectly documented the modeling approach used for the junctions modeling the baffle plate holes and slots between the core and core baffle region in SBLOCA applications. The EM documentation described the modeling approach as different than the LBLOCA methods but all SBLOCA 177 FA analyses have applied it consistent with the LBLOCA modeling. The SBLOCA results are not sensitive to how these junctions are modeled but the documentation is not consistent and it was reported under 10 CFR 50.46 in 2019. This issue does not impact LBLOCA results and it does not change the current LOCA AOR SBLOCA licensing basis results because the analyses used the appropriate junction modeling option. However, the EM documentation error correction change reported a 10 CFR 50.46 SBLOCA PCT impact of 0°F to address the incorrect EM documentation.

SEM/PWR-98 PWR Large Break LOCA Evaluation Model

This model is applicable to Westinghouse designed 3 and 4 loop pressurized water reactors and Combustion Engineering designed pressurized water reactors for large break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2087PA, Revision 0.

There were no evaluation model changes or error corrections made during the reporting period.

S-RELAP5 PWR Small Break LOCA Evaluation Model

This model is applicable to Westinghouse designed 2, 3, and 4 loop pressurized water reactors and Combustion Engineering designed pressurized water reactors for small break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2328PA, Revision 0 and EMF-2328PA Revision 0, Supplement 1PA Revision 0.

There were no evaluation model changes or error corrections made during the reporting period.

Realistic PWR Large Break LOCA Model (EMF-2103PA Revision 3)

This model is applicable to Westinghouse designed 3 and 4 loop pressurized water reactors and Combustion Engineering 2x4 designed pressurized water reactors for large break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2103PA, Revision 3.

There were two evaluation model error corrections made during the reporting period.

1. Rod pressure not reset after rupture in S-RELAP5 LOCA calculations

After S-RELAP5 calculates that a fuel rod ruptures, the rod internal pressure in the COPERNIC fuel rod model was not reset to system pressure. The 10 CFR 50.46 reportable impact of this error is estimated as 0°F for all plants.

2. Use of oxide in S-RELAP5 Cathcart-Pawel equation for zirconium metal reacted

When calculating metal-water reaction, the Cathcart-Pawel correlation for the rate of oxide thickness was used instead of the Cathcart-Pawel correlation for the rate of total oxygen consumed. The 10 CFR 50.46 reportable impact of this error is estimated as 0°F for all plants.

Realistic PWR Large Break LOCA Model (EMF-2103PA Revision 0)

This model is applicable to Westinghouse designed 3 and 4 loop pressurized water reactors and Combustion Engineering 2x4 designed pressurized water reactors for large break LOCA analyses. The NRC approved topical report for this evaluation model is EMF-2103PA, Revision 0.

There was one evaluation model error correction made during the reporting period.

1. Use of oxide in S-RELAP5 Cathcart-Pawel equation for zirconium metal reacted

When calculating metal-water reaction, the Cathcart-Pawel correlation for the rate of oxide thickness was used instead of the Cathcart-Pawel correlation for the rate of total oxygen consumed. The 10 CFR 50.46 reportable impact of this error is estimated as 0°F for all plants.