



**William R. Gideon**  
Vice President  
Brunswick Nuclear Plant  
P.O. Box 10429  
Southport, NC 28461

o: 910.832.3698

**Enclosure 1 Contains Proprietary Information  
Withhold in Accordance with 10 CFR 2.390**

May 14, 2019

Serial: RA-19-0225

10 CFR 50.90

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

**Subject:** Brunswick Steam Electric Plant, Unit Nos. 1 and 2  
Renewed Facility Operating License Nos. DPR-71 and DPR-62  
Docket Nos. 50-325 and 50-324  
Supplement to Request for License Amendment Regarding Application of  
Advanced Framatome Methodologies

**Reference:** Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory  
Commission Document Control Desk, *Request for License Amendment  
Regarding Application of Advanced Framatome Methodologies*, dated  
October 11, 2018, ADAMS Accession Number ML18284A395.

Ladies and Gentlemen:

By letter dated October 11, 2018 (i.e., Reference), Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed license amendment revises Technical Specification 5.6.5.b to allow application of Advanced Framatome Methodologies for determining core operating limits in support of loading Framatome fuel type ATRIUM 11.

Framatome has identified an issue related to automated input generation which impacts the AURORA-B Loss of Coolant Accident (LOCA), Anticipated Operational Occurrence (AOO), and Control Rod Drop Accident (CRDA) analyses submitted with the Advanced Framatome Methodologies LAR. Enclosure 1 contains a report that describes the identified issue, evaluates the impact on the LAR analyses, and describes the plans to address each of the three impacted areas.

Enclosure 1 contains information considered proprietary to Framatome. The proprietary information in this report has been denoted by brackets. As owner of the proprietary information, Framatome has executed the affidavit contained in Enclosure 3 which identifies the information as proprietary, is customarily held in confidence, and should be withheld from public disclosure in accordance with 10 CFR 2.390. Enclosure 2 provides a non-proprietary version of this report.

No new regulatory commitments are contained in this letter.

Please refer any questions regarding this submittal to Mr. Jerry Pierce, Manager – Nuclear Support Services, at (910) 832-7931.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on May 14, 2019.

Sincerely,



William R. Gideon

SBY/sby

Enclosures:

- 1: ANP-3772P, *CR Supplement Report on Brunswick LAR Analyses*, Revision 0  
**[Proprietary Information – Withhold from Public Disclosure in Accordance with 10 CFR 2.390]**
- 2: ANP-3772NP, *CR Supplement Report on Brunswick LAR Analyses*, Revision 0
- 3: Affidavit for ANP-3772P, *CR Supplement Report on Brunswick LAR Analyses*, Revision 0

cc (with all Enclosures):

U. S. Nuclear Regulatory Commission, Region II  
ATTN: Ms. Catherine Haney, Regional Administrator  
245 Peachtree Center Ave, NE, Suite 1200  
Atlanta, GA 30303-1257

U. S. Nuclear Regulatory Commission  
ATTN: Mr. Gale Smith, NRC Senior Resident Inspector  
8470 River Road  
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission  
ATTN: Mr. Andrew Hon  
11555 Rockville Pike  
Rockville, MD 20852-2738

U.S. Nuclear Regulatory Commission  
ATTN: Mr. Dennis J. Galvin  
11555 Rockville Pike  
Rockville, MD 20852-2738

cc (with Enclosures 2 and 3 only):

Chair - North Carolina Utilities Commission (**Electronic Copy Only**)  
4325 Mail Service Center  
Raleigh, NC 27699-4300  
swatson@ncuc.net

Mr. W. Lee Cox, III, Section Chief (**Electronic Copy Only**)  
Radiation Protection Section  
North Carolina Department of Health and Human Services  
1645 Mail Service Center  
Raleigh, NC 27699-1645  
lee.cox@dhhs.nc.gov

*ANP-3772NP, CR Supplement Report on Brunswick LAR  
Analyses, Revision 0*



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# CR Supplement Report on Brunswick LAR Analyses

ANP-3772NP  
Revision 0

May 2019

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**Nature of Changes**

Item	Section(s) or Page(s)	Description and Justification
1	All	Initial Issue

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**Nomenclature**

<b>Acronym</b>	<b>Definition</b>
AOO	Anticipated Operational Occurrence
CR	Condition Report
CRDA	Control Rod Drop Accident
ECCS	Emergency Core Cooling System
LAR	License Amendment Request
LHGR	Linear Heat Generation Rate
LOCA	Loss of Coolant Accident
LUT	Look Up Table
MCPR	Minimum Critical Power Ratio
PCMI	Pellet-Clad Mechanical Interaction
RDIV	Recirculation Discharge Isolation Valve

## 1.0 INTRODUCTION/SUMMARY OF CR-2019-827 AND CR-2019-934

Framatome Condition Report CR-2019-827 identified an issue with shifted fixed format RODEX4 input values written by AUTOSR5BDK for the AURORA-B LOCA, AOO and CRDA methods. [

]

Following this discovery, as part of an extent of condition review for CR-2019-827, all RODEX4 inputs written by AUTOSR5BDK were reviewed in detail to ensure that this issue was fully understood. This extent of condition review resulted in child CR-2019-934, [

]

The impact of these CRs is evaluated for LOCA in Section 2.0, AOO in Section 3.0 and CRDA in Section 4.0.

## 2.0 EVALUATION OF CR-2019-827 AND CR-2019-934 ON LOCA

The correction of the [ ] in the RODEX4 calculations impacts the LOCA results documented in ANP-3674P, Revision 1 (Reference 1), which was included in the Brunswick License Amendment Request (Reference 6). Therefore, a new revision of the LOCA report will be issued that incorporates the RODEX4 input corrections identified in the CRs. The PCT is estimated to increase to mid-1900 °F.

The LOCA report will also be updated to reference the approved LOCA topical report in ANP-10332PA (Reference 2) rather than the draft safety evaluation (Reference 3) and incorporate wording changes in response to the NRC LAR review.

The updated LOCA report will be provided by Duke Energy as a supplement to the Brunswick License Amendment Request (Reference 6).

### 3.0 EVALUATION OF CR-2019-827 AND CR-2019-934 ON AOO

The methodology demonstration for the AURORA-B AOO methodology is documented in ANP-3702P (Reference 4), which was included in the Brunswick License Amendment Request (Reference 6). As previously indicated the AUTOSR5BDK generated RODEX input was not properly aligned [ ] The subsequent correction of the input and reanalysis confirms that there are small changes in numerical results. These CRs only impact the demonstration calculations and the AOO analyses will be performed in full for the actual cycle specific licensing. The demonstration report will not be revised and re-submitted, since the small magnitude of the correction does not affect the representative nature of the report.

A corrected version of the AUTOSR5BDK code was used to regenerate the RODEX4 input and the calculations were performed. The results presented in Tables 3.1 through 3.7 of ANP-3702P are the results of the AURORA-B statistical evaluation. Instead of rerunning these statistical cases, only the nominal cases were rerun with the errors corrected. This provides a more direct comparison of results without introducing additional statistical variations. Table 3.1 provides the results from the nominal AOO cases both with and without the correction to the RODEX4 input. As indicated, the error correction results in a slight reduction in  $\Delta\text{MCPR}$  for all cases. Table 3.2 provides the results from the nominal overpressurization cases both with and without the correction. In some cases, correcting the error results in a very small increase in peak pressures. In all cases, any increase in peak pressure is much smaller than the available margin.

**Table 3.1 Nominal Transient Results**

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**State Point  
Power / Flow  
(% of rated)**

**Original  
ATRIUM 11  
 $\Delta$ MCPR**

**Corrected  
ATRIUM 11  
 $\Delta$ MCPR**

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**Table 3.2 ASME and ATWS Overpressurization Analysis Results**

Event	Original Analysis		Revised Analysis	
	Maximum Vessel Pressure Lower Plenum (psig)	Maximum Dome Pressure (psig)	Maximum Vessel Pressure Lower Plenum (psig)	Maximum Dome Pressure (psig)



#### 4.0 EVALUATION OF CR-2019-827 AND CR-2019-934 ON CRDA

The methodology demonstration for the AURORA-B CRDA methodology is documented in ANP-3714P, Revision 0 (Reference 5), which was included in the Brunswick License Amendment Request (Reference 6). As previously indicated the AUTOSR5BDK generated RODEX input was not properly aligned [

] The subsequent correction of the input and reanalysis confirms that there are small changes in numerical results. Only CR-2019-827 impacted the CRDA analysis. CR-2019-934 did not impact the results because the alpha-numeric values were provided in the correct column such that [ ] were modeled in the RODEX4 calculations for the CRDA methods demonstration. These CRs only impact the demonstration calculations and the CRDA analyses will be performed in full for the actual cycle specific licensing. The demonstration report will not be revised and re-submitted, since the small magnitude of the correction does not affect the representative nature of the report.

A corrected version of the AUTOSR5BDK code was used to regenerate the RODEX4 input and the calculations were performed. A combination of numerical results and graphical results are presented in ANP-3714P. Numerical results relating to rod failures and potential release fractions were based on hypothetical rod failures and are not impacted by the CR.

ANP-3714P numerical results are reported in Table 3.7, Table 3.8, and Table 7.1 which are impacted. Graphical representations of results are provided in Figure 4.1 and Figure 4.3 of the report which will have a minor change in appearance.

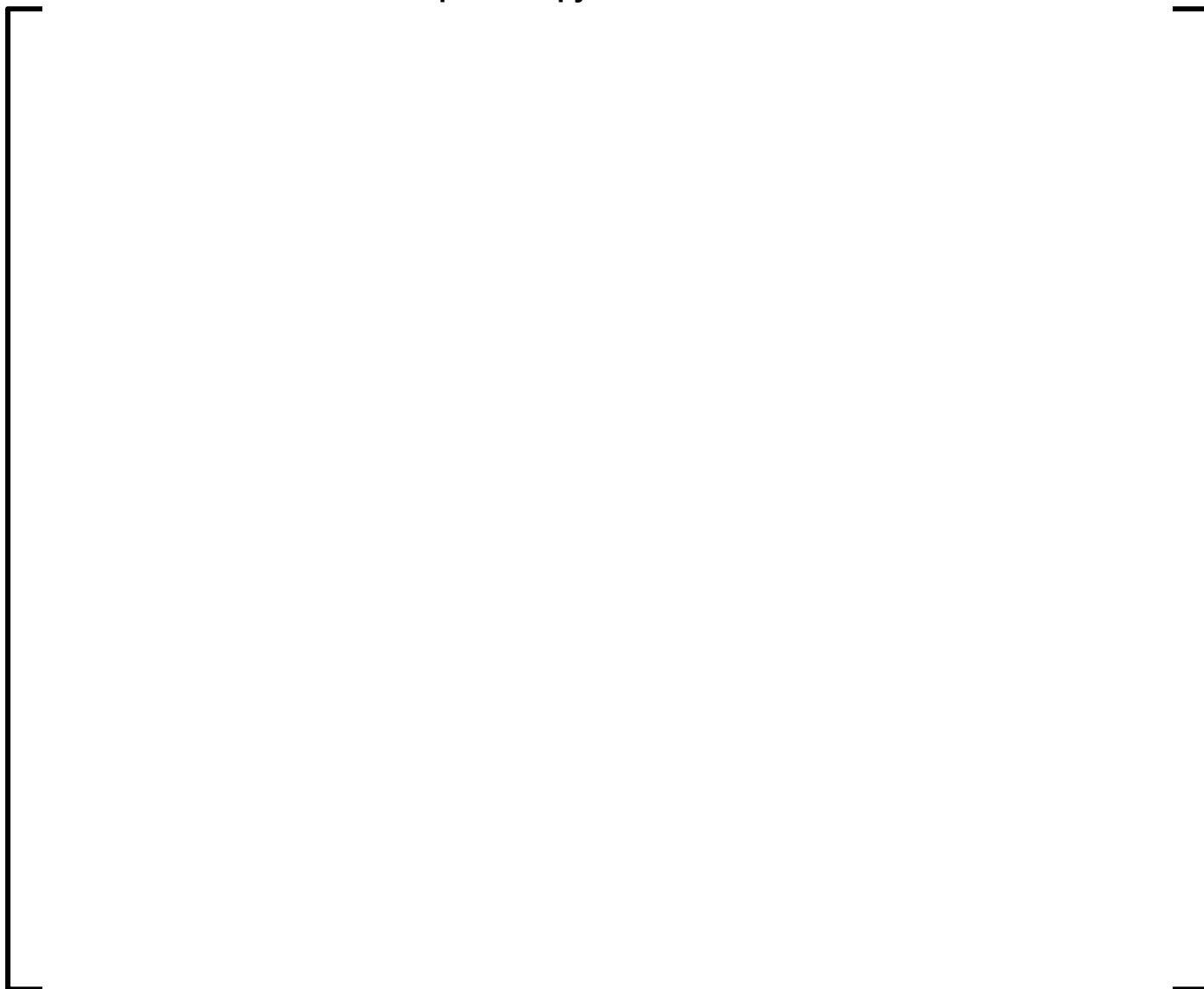
In all cases significant margin remains to all failure thresholds.

#### 4.1 *Prompt and Total Enthalpy Results*

The tabulation of prompt enthalpy results are presented in Table 3.7 and the Total Enthalpy in Table 3.8 of ANP-3714P. The cases for the Brunswick LAR CRDA were rerun and the corrected results are provided in Table 4.1 for prompt enthalpy and Table

4.3 for total enthalpy. The prompt enthalpy decreased with the exception of two values, the maximum of which increased by 0.4 cal/gr. The change in the prompt enthalpy results are provided in Table 4.2. For the total enthalpy, the results varied more showing both increases and decreases. The largest increase is 3.64 cal/g as shown in Table 4.4.

**Table 4.1 Prompt Enthalpy Results Corrected Table 3.7**





**Table 4.2 Original and Corrected Prompt Enthalpy**

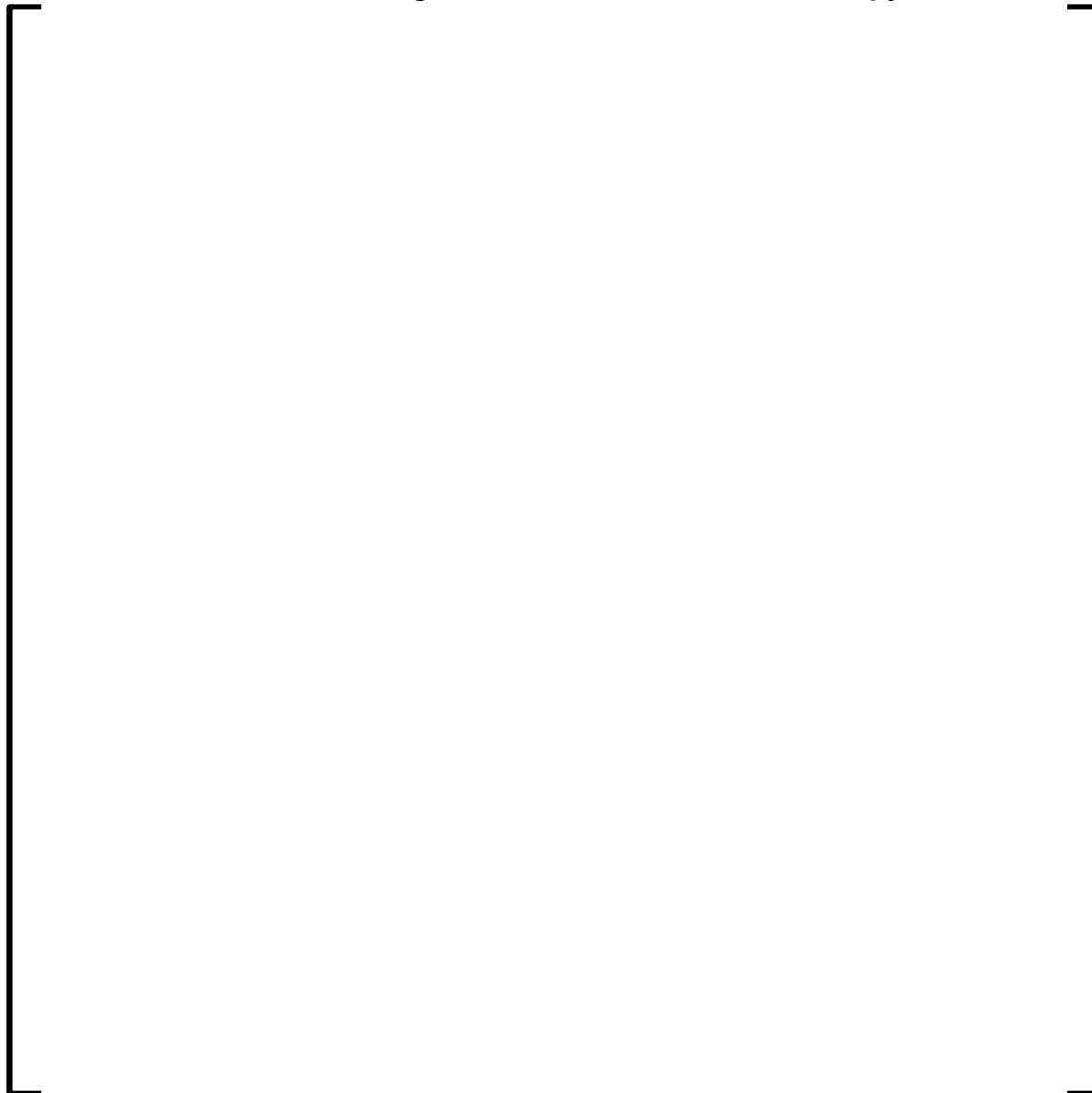
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**Table 4.3 Total Enthalpy Results Corrected Table 3.8**

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**Table 4.4 Original and Corrected Total Enthalpy**

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## 4.2 *High Temperature Results*

The high temperature results presented in Figure 4.1 of ANP-3714P were tabulated from the corrected calculations and are provided below in Figure 4.1. The margin to the failure threshold is slightly increased from that of the original reported results. It is also noted the enthalpy level is now consistent between the high and nominal burnup.



**Figure 4.1 Total Enthalpy versus High Temperature Cladding Failure Threshold (Corrected)**

## 4.3 *PCMI Failures*

Small changes to the plotted data are observed between Figure 4.3 of ANP-3714P and Figure 4.2. In general the maximum enthalpy is lower and farther from the failure threshold. However the conclusion remains unchanged in that there are no rod failures from PCMI with the applied correction.



**Figure 4.2 PCMI Cladding Failure Results for Brunswick ATRIUM 11 Equilibrium Cycle**

#### **4.4 Core Coolability**

The core coolability result provided in Section 7 of ANP-3714P show significant margin to the 230 cal/g threshold and the maximum total enthalpy case from Table 4.4 decreases with the correction. Therefore these results were not updated in the demonstration calculation.

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## 5.0 REFERENCES

1. ANP-3674(P) Revision 1, *Brunswick Units 1 and 2 LOCA Analysis for ATRIUM 11 Fuel*, Framatome, October 2018.
2. ANP-10332(P)(A) Revision 0, *AURORA-B: An Evaluation Model for Boiling Water Reactors; Application to Loss of Coolant Accident Scenarios*, Framatome, March 2019.
3. PROJECT NO.: 728/DOCKET NO. 99902041, Draft Safety Evaluation for Framatome Inc. Topical Report ANP-10332P, Revision 0, *AURORA-B: An Evaluation Model for Boiling Water Reactors; Application to Loss of Coolant Accident Scenarios*, (CAC NO. MF3829/EPID: L-2014-TOP-0004) US NRC, August 2018.
4. ANP-3702(P) Revision 0, *Brunswick ATRIUM 11 Transient Demonstration*, August 2018.
5. ANP-3714(P) Revision 0, *Brunswick ATRIUM 11 Control Rod Drop Accident Analyses with the AURORA-B CRDA Methodology*, September 2018.
6. Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory Commission Document Control Desk, *Request for License Amendment Regarding Application of Advanced Framatome Methodologies*, October 11, 2018, ADAMS Accession Number ML18284A395.

*Affidavit for ANP-3772P, CR Supplement Report on  
Brunswick LAR Analyses, Revision 0*

# AFFIDAVIT

STATE OF WASHINGTON )  
 ) ss.  
COUNTY OF BENTON )

1. My name is Alan B. Meginnis. I am Manager, Product Licensing, for Framatome Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by Framatome to determine whether certain Framatome information is proprietary. I am familiar with the policies established by Framatome to ensure the proper application of these criteria.

3. I am familiar with the Framatome information contained in the report ANP-3772P, Revision 0, "CR Supplement Report on Brunswick LAR Analyses," dated May 2019 and referred to herein as "Document." Information contained in this Document has been classified by Framatome as proprietary in accordance with the policies established by Framatome for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by Framatome and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is



requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by Framatome to determine whether information should be classified as proprietary:

- (a) The information reveals details of Framatome's research and development plans and programs or their results.
- (b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.
- (c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for Framatome.
- (d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for Framatome in product optimization or marketability.
- (e) The information is vital to a competitive advantage held by Framatome, would be helpful to competitors to Framatome, and would likely cause substantial harm to the competitive position of Framatome.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b), 6(d) and 6(e) above.

7. In accordance with Framatome's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside Framatome only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. Framatome policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

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SUBSCRIBED before me this 15<sup>th</sup>  
day of May, 2019.

Hailey M. Siekawitch

Hailey M Siekawitch  
NOTARY PUBLIC, STATE OF WASHINGTON  
MY COMMISSION EXPIRES: 9/28/2020

