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HDI PNP 2024-003

10 CFR 50.90

May 24, 2024

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

Palisades Nuclear Plant  
NRC Docket No. 50-255  
Renewed Facility Operating License No. DPR-20

Subject: License Amendment Request to Approve the Biasi Critical Heat Flux (CHF)  
Correlation for Use with the Palisades Main Steam Line Break (MSLB) Analysis

In accordance with Title 10 of the Code of Federal Regulation (10 CFR) Section 50.90, *Application for amendment of license, construction permit, or early site permit*, 10 CFR 50.90, Holtec Decommissioning International, LLC (HDI) on behalf of Holtec Palisades, LLC (Holtec Palisades), hereby requests an amendment to the Palisades Nuclear Plant (PNP) license to approve use of the Framatome Inc. Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," (Reference 2) for application of the Biasi Critical Heat Flux (CHF) correlation in the Post-Scram Main Steam Line Break (MSLB) Analysis at PNP. Application of the Biasi CHF correlation methodology for use with Palisades High Thermal Performance (HTP) fuel is evaluated as acceptable in Technical Report ANP-4083P, Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel," which is provided in Attachment 2 to the Enclosure. This change to the PNP Power Operations Licensing Basis (POLB) will be incorporated into the PNP Core Operating Limits Report (COLR) by adding Reference 2 and ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel." Additionally, Chapter 14.14, "Steam Line Rupture Incident," of the PNP power operations Updated Final Safety Analysis Report (UFSAR) will be revised to reflect this change.

To support the Palisades restart project as described in Reference 3, HDI is requesting approval of this amendment by June 30, 2025, an effective date coincident with the date PNP transitions to a POLB per Reference 4, and an implementation period prior to the start of the next fuel cycle, PNP fuel cycle 29. The requested approval date will allow PNP safety analysis evaluation (using Reference 2) to be completed prior to PNP transitioning to a POLB and the period between the effective and implementation dates will allow for implementation of POLB documents prior to the start of PNP fuel cycle 29.

The Enclosure to this letter provides a detailed description and evaluation of the proposed changes. Enclosure Attachment 1 contains an affidavit supporting withholding of the proprietary information from Public Disclosure. Enclosure Attachment 2 is a technical evaluation justifying the applicability of the Biasi Critical Heat Flux Correlation for PNP fuel and contains information considered proprietary to Framatome, Inc. On behalf of Framatome, Inc., HDI requests that the

NRC withhold this information in accordance with 10 CFR Section 2.390, *Public inspections, exemptions, requests for withholding*, 10 CFR 2.390. Enclosure Attachment 3 contains the non-proprietary version of the technical evaluation justifying the applicability of the Biasi Critical Heat Flux Correlation for PNP fuel.

The proposed changes have been evaluated in accordance with 10 CFR Section 50.91, *Notice for public comment; State consultation*, paragraph (a), *Notice for public comment*, subparagraph (1), 10 CFR 50.91(a)(1), using the standards in 10 CFR Section 50.92, *Issuance of amendment*, paragraph (c), 10 CFR 50.92(c), and it has been determined that the changes involve no significant hazards consideration. The basis for this determination is included in Enclosure 1.

In accordance with 10 CFR Section 50.91, *State consultation*, paragraph (b), 10 CFR 50.91(b), HDI is notifying the State of Michigan of this proposed license amendment by transmitting a copy of this letter, with its enclosure, to the designated State of Michigan official.

If you have any questions regarding this submittal, please contact Jim Miksa, Regulatory Assurance Manager, at (269) 764-2945.

This letter contains one new regulatory commitment, as noted in Enclosure Attachment 4, and no revisions to existing regulatory commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 24, 2024.

Respectfully,

Jean A.  
Fleming

Digitally signed by Jean A. Fleming  
DN: cn=Jean A. Fleming, c=US,  
o=Holtec Decommissioning  
International, LLC, ou=Regulatory and  
Environmental Affairs,  
email=J.Fleming@Holtec.com  
Date: 2024.05.24 10:48:49 -0400

Jean A. Fleming  
Vice President of Licensing and Regulatory Affairs  
Holtec International

- References:
1. Framatome ANP, Inc. letter to U.S. Nuclear Regulatory Commission, "Publication of EMF-2310(P)(A), Revision 1, *SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors*," dated June 17, 2004 (ADAMS Accession No. ML041810031)
  2. Framatome ANP, Inc. letter to U.S. Nuclear Regulatory Commission, "Approved EMF-2310, Revision 1, Supplement 2P-A, Revision 0, *SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors*," dated April 10, 2023. (ADAMS Accession Number ML23109A086)
  3. Holtec Decommissioning International, LLC letter to U.S. Nuclear Regulatory Commission, "Notification of Changes in Accordance with 10 CFR 50.82(a)(7)" dated April 9, 2024 (ADAMS Accession No. ML24100A689)
  4. Holtec Decommissioning International, LLC letter to U.S. Nuclear Regulatory Commission, "License Amendment Request to Revise Renewed Facility Operating License and Permanently Defueled Technical Specifications to Support Resumption of Power Operations" dated December 14, 2023 (ADAMS Accession No. ML23348A148)

Enclosure: Description and Evaluation of Proposed Changes

Enclosure Attachments

1. Affidavit from Framatome Supporting Holtec Decommissioning International, LLC's Application to Withhold Certain Information from Public Disclosure
2. ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024 (Proprietary Version of Document Withhold under 10 CFR 2.390)
3. ANP-4083NP Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024 (Non-Proprietary Version of Document)
4. List of Regulatory Commitments

cc: NRC Region III Regional Administrator  
NRC Decommissioning Inspector – PNP  
NRC Project Manager PNP  
Designated Michigan State Official

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**Enclosure**

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**Description and Evaluation of Proposed Changes**

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## EVALUATION OF THE PROPOSED CHANGES

### 1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, “*Application for amendment of license, construction permit, or early site permit*,” Holtec Decommissioning International, LLC (HDI) on behalf of Holtec Palisades, LLC (Holtec Palisades), hereby requests an amendment to the Palisades Nuclear Plant (PNP) license to approve use of the Framatome Inc. Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0, “SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors,” (Reference 6) for application of the Biasi Critical Heat Flux (CHF) correlation in the Post-Scram Main Steam Line Break (MSLB) Analysis at PNP. Application of the Biasi CHF correlation methodology for use with Palisades High Thermal Performance (HTP) fuel is evaluated as acceptable in Technical Report ANP-4083P, Revision 0, “Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel” and is provided as Attachment 2 to this Enclosure. The Biasi CHF correlation methodology supplements Framatome Topical Report EMF-2310 Revision 1, (Reference 1) that is referenced in the PNP Updated Final Safety Analysis Report (UFSAR) Revision 35, Chapter 14.14, “Steam Line Rupture Incident” (Reference 7). Reference 6 was approved by the U.S. Nuclear Regulatory Commission (NRC) for application of the Biasi CHF correlation methodology to fuel types, similar to but different from PNP, at other U.S. Nuclear plants. The requested changes involve no significant hazards consideration.

To support the Palisades restart project as described in Reference 4, HDI is requesting approval of this amendment by June 30, 2025, an effective date coincident with the date PNP transitions to a PNP Power Operations Licensing Basis (POLB) per Reference 5, and an implementation period prior to the start of the next fuel cycle, PNP fuel cycle 29. The requested approval date will allow PNP safety analysis evaluation using Reference 6 to be completed prior to the PNP transitioning to a POLB and the period between the effective and implementation dates will allow for implementation of POLB documents prior to the start of PNP fuel cycle 29.

### 2.0 DETAILED DESCRIPTION

#### 2.1 Reason for Proposed Change

Framatome performed the PNP MSLB analysis in accordance with their non-LOCA Transient / Steam Line Break methodology (Reference 1). In 2018, Framatome notified PNP of a deviation that the Modified Barnett CHF correlation and associated limit non-conservatively predicted Departure from Nucleate boiling (DNB) for some PNP MSLB cases analyzed. The deviation determination concluded that a deviation did exist but there was no defect, no safety concern, and no operability impact to Palisades.

In December of 2018, PNP and Framatome finalized a plan to reanalyze the PNP MSLB to resolve the identified deviation. The plan relied on utilizing two additional CHF correlations not previously applied to the PNP MSLB analysis. The first of these correlations was the HTP CHF correlation (Reference 2) that is referenced for other PNP UFSAR Revision 35, Chapter 14 events. The second of these correlations was the Biasi CHF correlation. The Biasi CHF correlation is an approved correlation described in Reference 1, however there is no correlation limit listed for PNP in Reference 1. Further, neither Biasi, nor a limit for its use, appeared in the PNP UFSAR Revision 35.

In September of 2019, the PNP MSLB analysis revision had been completed by Framatome however, it had not been fully incorporated into the Palisades licensing basis by June of 2022 when Entergy Nuclear Operations, Inc. notified the NRC that it had permanently ceased operations and permanently removed fuel from the reactor vessel at PNP (Reference 3).

With PNP now proceeding down a regulatory path to resume power operations (Reference 4), as requested by HDI, Framatome issued Technical Report ANP-4083P, Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel," provided in Attachment 2. Attachment 2 was developed because PNP was not included in the Framatome Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0 (Reference 6) describing the design limit for the Biasi CHF correlation that is used for predicting the CHF performance of the HTP grids. PNP was not included because at the time EMF-2310, Revision 1, Supplement 2P-A, Revision 0 was published, PNP had permanently ceased operation. Attachment 2 serves as the technical basis for this proposed amendment. This proposed amendment is necessary to incorporate the Biasi CHF correlation used in the most recent PNP MSLB analysis into the PNP Licensing Basis.

## 2.2 Description of Proposed Change

This change to the PNP POLB will be incorporated into the Core Operating Limits Report (COLR) by adding Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0. Additionally, Chapter 14.14, "Steam Line Rupture Incident," of the PNP power operations Updated Final Safety Analysis Report will be revised to reflect the addition of EMF-2310, Revision 1, Supplement 2P-A and ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel."

As required by PNP Technical Specification 5.6.5, "Core Operating Limits Report (COLR)," item b. (5.6.5.b). "The analytical methods used to determine the core operating limits shall be those approved by the NRC, specifically those described in the latest approved revision of the following documents:

"EMF-2310 (P)(A), Revision 0, Framatome ANP, Inc., May 2001, SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors."

Application of Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," is considered a revision to EMF-2310 (P)(A), Revision 0, which requires NRC approval for use at PNP to determine PNP core operating limits for cycle 29.

The Palisades Core Operating Limits Report (COLR) Revision 20, section 3.0, "Analytical Methods" will be revised as follows:

Revision 20 text:

6. EMF-2310 (P)(A), Revision 1, Framatome ANP, Inc, May 2004, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors."  
(LCOs 3.1.6, 3.2.1, 3.2.2, & 3.2.4)



Proposed Revision 21 text:

- 6A. EMF-2310 (P)(A), Revision 1, Framatome ANP, Inc, May 2004, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors."  
(LCOs 3.1.6, 3.2.1, 3.2.2, & 3.2.4)
- 6B. EMF-2310(P)(A), Revision 1, Supplement 2P-A, Revision 0, Framatome Inc, March 2023, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors.", as supplemented by ANP-4083P, Revision 0, January 2024, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel."  
(LCOs 3.1.6, 3.2.1, 3.2.2, & 3.2.4)

Additionally, PNP Power Operations UFSAR Chapter 14.14, "Steam Line Rupture Incident," will be revised to add a discussion on the Biasi Critical Heat Flux correlation use and reference to:

EMF-2310(P)(A), Revision 1, Supplement 2P-A, Revision 0, Framatome Inc, March 2023, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors."

And

ANP-4083P Revision 0, Framatome Inc, January 2024 "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel."

And

Reference to this license amendment and associated NRC Safety Evaluation.

### **3.0 TECHNICAL EVALUATION**

#### **3.1 Accident and Transient Analyses Applicable to the Proposed Change**

The PNP Post-Scram Main Steam Line Break (MSLB) Design Basis Accident (DBA) analysis is applicable to the proposed change.

#### **3.2 Evaluation of the Proposed Change**

The Biasi CHF correlation was evaluated for application to PNP as described in Attachment 2. The evaluation concluded that the Reference 6 methodology is appropriate for use in predicting DNB for Post-Scram MSLB Analysis with Palisades Combustion Engineering (CE) 15 x 15 HTP fuel.

This conclusion is based on the following reasoning:

- Reference 6 has been approved for use in similar plants for the same intended application. Those plants are: Calvert Cliffs Units 1&2 (CE 14x14), Millstone Unit 2 (CE 14x14), St Lucie Unit 1 (CE 14x14) and St Lucie Unit 2 (CE 16x16).
- CHF test data for the HTP DNB correlation (currently a part of Palisades licensing basis) was used in the Reference 6 design limit development.
- All Limitations and Conditions specified in the Reference 6 SER, with the exception of the guide tube outer diameter range, are applicable to the Palisades plant. PNP 15x15



fuel does not have guide tubes and includes guide bars on the fuel assembly periphery which is a non-limiting location for DNB.

- CE 15 x 15 HTP fuel meets all applicable requirements imposed by the SER of Reference 6.

The Biasi CHF correlation design limit was utilized in the PNP Post-SCRAM MSLB analysis following the methodology described in References 1 and 6.

## **4.0 REGULATORY EVALUATION**

### **4.1 Applicable Regulatory Requirements**

#### 10 CFR 50, Appendix A, General Design Criteria for Nuclear Power Plants

The General Design Criteria establish minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location to plants for which construction permits have been issued by the Commission. The PNP design and licensing basis and its relationship to the General Design Criteria are described in the UFSAR, Revision 35 and other plant-specific licensing basis documents. UFSAR Revision 35 will be reinstated as described in Reference 5 as part of PNP's return to a POLB. This will include reinstatement of Chapter 14.14, "Steam Line Rupture Incident," accident analysis. Changes made to the UFSAR after Revision 35 related to this amendment will be evaluated as required by 10 CFR 50.59.

### **4.2 Precedent**

Reference 6, approved by NRC Staff in March of 2023, provided a design limit for the Biasi CHF correlation suitable for application to HTP spacer grids for specific nuclear power plants which are similar power plants to PNP. The Biasi correlation is approved for use in Post-Scram Main Steam Line Break (MSLB) analysis as part of the methodology described in Reference 1.

### **4.3 No Significant Hazards Consideration Determination**

The proposed license amendment will revise the approved Critical Heat Flux (CHF) correlations for the Palisades Main Steam Line Break (MSLB) Chapter 14.14, "Steam Line Rupture Incident," accident analysis consistent with EMF-2310(P)(A), Revision 1, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," dated June 17, 2004, EMF-2310, Revision 1, Supplement 2P-A, Revision 0, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," dated April 10, 2023 and ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024.

In accordance with 10 CFR 50.92, *Issuance of amendment*, Holtec Decommissioning International (HDI) has reviewed the proposed changes and concludes that the changes do not involve a significant hazards consideration since the proposed changes satisfy the criteria in 10 CFR 50.92(c). These criteria require that operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

The discussion below addresses each 10 CFR 50.92(c) no significant hazards consideration criterion and demonstrates that the proposed amendment does not constitute a significant hazard.

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

There are no design changes associated with the proposed change. All design, material, and construction standards that were applicable prior to this amendment request will continue to be applicable.

The proposed change will not affect accident initiators or precursors or alter the design, conditions, and configuration of the facility, or the manner in which the plant is operated and maintained, with respect to such initiators or precursors.

The NRC staff reviewed EMF-2310, Revision 1, Supplement 2P-A, Revision 0, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," dated April 10, 2023 and found it to be appropriately conservative for a distinct group of reactors utilizing Framatome fuel and methodology. The proposed change, supported by ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024, extends the applicability of the Biasi CHF correlation to Palisades 15x15 High Thermal Performance (HTP) fuel.

Accident analysis acceptance criteria will continue to be met with the proposed change. The proposed change will not affect the source term, containment isolation, or radiological release assumptions used in evaluating the radiological consequences of any accident previously evaluated. The proposed change will not alter any assumptions or change any mitigation actions in the radiological consequence evaluations in the Updated Final Safety Analysis Report (UFSAR). Consequently, the applicable radiological dose acceptance criteria will continue to be met.

Therefore, it is concluded that the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

There are no proposed design changes nor are there any changes in the method by which any safety-related plant structures, systems, and components perform their specified safety functions. The proposed change will not affect the normal method of plant operation or change any operating parameters. No equipment performance requirements will be affected. The proposed change will not alter any assumptions made in the safety analyses.

The proposed change does not involve a physical modification of the plant.

No new accident scenarios, transient precursors, failure mechanisms, or limiting single failures will be introduced as a result of this proposed change. There will be no adverse effect or challenges imposed on any safety-related system as a result of this proposed change.

Therefore, it is concluded that the proposed amendment does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

Margin of safety is associated with confidence in the ability of the fission product barriers (i.e., fuel cladding, reactor coolant system pressure boundary, and containment structure) to limit the level of radiation dose to the public. The proposed amendment would modify the PNP licensing basis by adding an approved CHF correlation for use in the accident analyses for the Design Basis Accident (DBA) described in Chapter 14.14, "Steam Line Rupture Incident," of the reinstated UFSAR. Margin of safety will be unaffected by the proposed change since the MSLB analysis results in no fuel failures predicted.

There will be no effect on plant systems necessary to perform protection functions.

No instrument setpoints or system response times are affected and none of the acceptance criteria for any accident analysis will be changed.

Consequently, the proposed change will have no impact on the radiological consequences of a design basis accident.

Therefore, it is concluded that the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above, HDI concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of "no significant hazards consideration" is justified.

#### **4.4 Conclusion**

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

## 5.0 ENVIRONMENTAL EVALUATION

The proposed license amendment would revise the approved CHF correlations for the Palisades Chapter 14.14, "Steam Line Rupture Incident," accident analysis.

This amendment request meets the eligibility criteria for categorical exclusion from environmental review set forth in 10 CFR 51.22, *Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review*, paragraph (c)(9). The 10 CFR 51.22(c)(9) criteria are met as follows:

- (i) The amendment involves no significant hazard consideration.

As documented in Section 4.3, No Significant Hazards Consideration Determination, of this license amendment request, an evaluation was completed to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment." The Significant Hazards Consideration determined that (1) the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) the proposed amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of "no significant hazards consideration" is justified.

- (ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

The proposed change is unrelated to any aspects of plant construction or operation that would introduce any changes to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents) or affect any plant radiological or non-radiological effluent release quantities. The proposed change does not adversely impact any functions associated with containing, controlling, channeling, monitoring, or processing radioactive or non-radioactive materials, nor does it diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation. The types and quantities of expected plant effluents are not changed. No effluent release path is associated with this amendment. Neither radioactive nor nonradioactive material effluents are affected by this activity. Furthermore, the proposed change does not diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation. Therefore, it is concluded that the proposed amendment does not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

- (iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed change does not affect plant radiation zones described in the UFSAR and controls under 10 CFR Part 20 preclude a significant increase in occupational radiation exposure. The proposed change does not adversely impact radiologically controlled zones. Plant radiation zones, radiation controls established to satisfy 10 CFR Part 20

requirements, and expected amounts and types of radioactive materials are not affected by the proposed amendment. Therefore, individual and cumulative radiation exposures are not significantly affected by this change. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above, HDI concludes that the proposed amendment meets the eligibility criteria for categorical exclusion as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

## 6.0 REFERENCES

1. Framatome ANP, Inc. letter to U.S. Nuclear Regulatory Commission, "Publication of EMF-2310(P)(A), Revision 1, *SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors*," dated June 17, 2004 (ADAMS Accession No. ML041810031)
2. EMF-92-153(P)(A) and Supplement 1, HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel, Siemens Power Corporation, March 1994.
3. Entergy Nuclear Operations, Inc. letter to U.S. Nuclear Regulatory Commission, "Certifications of Permanent Cessation of Power Operations and Permanent Removal of Fuel from the Reactor Vessel," dated June 13, 2022 (ADAMS Accession No. ML22164A067)
4. Holtec Decommissioning International, LLC letter to U.S. Nuclear Regulatory Commission, "Notification of Changes in Accordance with 10 CFR 50.82(a)(7)," dated April 9, 2024 (ADAMS Accession No. ML24100A689)
5. Holtec Decommissioning International, LLC letter to U.S. Nuclear Regulatory Commission, "License Amendment Request to Revise Renewed Facility Operating License and Permanently Defueled Technical Specifications to Support Resumption of Power Operations," dated December 14, 2023 (ADAMS Accession No. ML23348A148)
6. Framatome ANP, Inc. letter to U.S. Nuclear Regulatory Commission, "Approved EMF-2310, Revision 1, Supplement 2P-A, Revision 0, *SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors*," dated April 10, 2023. (ADAMS Accession Number ML23109A086)
7. Entergy Nuclear Operations, Inc. letter to U.S. Nuclear Regulatory Commission, "Final Safety Analysis Report Update – Revision 35," dated April 14, 2021, (ADAMS Accession No. ML21125A285)

## 7.0 ATTACHMENTS

1. Affidavit from Framatome Supporting Holtec Decommissioning International, LLC's Application to Withhold Certain Information from Public Disclosure
2. ANP-4083P Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024 (Proprietary Version of Document)
3. ANP-4083NP Revision 0, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel", January 2024 (Non-Proprietary Version of Document)
4. Regulatory Commitment

**Attachment 1 to Enclosure**

**HDI PNP 2024-003**

**Affidavit from Framatome Supporting Holtec Decommissioning International, LLC's  
Application to Withhold Certain Information from Public Disclosure**

3 Pages Follow



## A F F I D A V I T

1. My name is Morris Byram. I am Manager, Licensing & Regulatory Affairs for Framatome Inc. (Framatome) 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 ANP-4083P, Revision 1, "Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel," dated May 2024, 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 this Document is considered proprietary for the reasons set forth in paragraph 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 has 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.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: (5/23/2024)

**BYRAM Morris** Digitally signed by BYRAM Morris  
Date: 2024.05.23 11:16:42 -07'00'

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(NAME)

morris.byram@framatome.com

**HDI PNP 2024-003**

**Enclosure Attachment 2**

**ANP-4083P Revision 0,  
“Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel”,  
January 2024  
(Proprietary Version of Document Withhold under 10 CFR 2.390)**

14 Pages Follow

**HDI PNP 2024-003**

**Enclosure Attachment 3**

**ANP-4083NP Revision 0,  
“Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel”,  
January 2024  
(Non-Proprietary Version of Document)**

14 Pages Follow

# **Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel**

ANP-4083NP  
Revision 1

## **Technical Report**

May 2024

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### Nature of Changes

Revision	Section(s) or Page(s)	Description and Justification
1	Section 1	Addition of supporting text.
1	Section 2	Addition of Table 2-1, Table 2-2, Figure 2-1, and supporting text to provide additional information.

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## Nomenclature

### Acronym

### Definition

CHF	Critical Heat Flux
MSLB	Main Steam Line Break
HTP	High Thermal Performance
CE	Combustion Engineering
DNB	Departure from Nucleate Boiling
MDNBR	Minimum Departure from Nucleate Boiling Ratio
SER	Safety Evaluation Report
GB	Guide Bar

## 1.0 INTRODUCTION

The purpose of this document is to extend the applicability of the HTP design limit of the Biasi CHF correlation for use in safety analyses of Palisades HTP CE 15 x 15 fuel. The Biasi correlation is approved for use in Post-Scram Main Steam Line Break (MSLB) Analysis, as described in Reference 1. While all regulatory requirements associated with Reference 1 are not explicitly discussed in this document, they have been addressed and are extended to apply to Palisades CE 15 x 15 design as was done for the CE 14 x14 and CE 16 x 16 designs in the approved topical report supplement (Reference 1). This design limit has been validated for other types of HTP fuel using design-specific CHF data in Reference 1. **Because Reference 1 was developed to be generically applicable to HTP fuel, the calculation and evaluation of the Biasi design limit is not impacted by the proposed extension of applicability to the Palisades CE 15 x 15 design. Thus, the conclusions of the NRC's technical evaluation (SER Section 3 of Reference 1) should remain unchanged. The only exception is the inclusion of the design-specific MDNBR correction factor (SER Section 3.2.5.2 of Reference 1), as detailed in Section 2.0.**

## 2.0 APPLICABILITY OF THE BIASI CORRELATION TO PALISADES

Framatome intends to apply the Biasi CHF correlation, as described in Supplement 2 to EMF-2310(P)(A) (Reference 1), for transient analyses with boundary conditions outside the range of applicability of the HTP correlation (Reference 2) (e.g., Post-Scram MSLB). Per the SER of Reference 1, Section 4, “Any application to a new fuel type or new mixing vane spacer type, any decrease in the design limits, or any expansion of the application domain would require NRC review and approval.” Though this is an application to a new fuel type, this is a unique situation for the following reasons.

Palisades is not included in the “Range of Application of Supported Plants” (Reference 1, Table 2-3); however, this was simply an administrative exclusion, since Palisades was not operating and was thought to be permanently shut down when the topical supplement was written. Had it been operational, it would have been included in the list of CE plants implementing the methodology of Reference 1.

The applicability of the Biasi correlation to Palisades was further confirmed by Framatome through the following justifications:

- The CHF test data used to develop the Biasi design limit is the same HTP test data used to support applicability of the HTP correlation (Reference 2), which is included in the licensing basis for Palisades (Reference 3).
- The intended application ranges for Palisades are bounded by the applicability ranges defined in Table 2-1 and Table 2-2 of Reference 1.



Note that the guide tube outer diameter range of applicability (Table 2-2 of Reference 1) cannot be applied to CE 15 x 15 fuel, since the fuel does not have guide tubes. Instead, CE 15 x 15 fuel has guide bars. These guide bars (GB) are trapezoidal in shape and are located on the assembly periphery. Though this shape is atypical, the shape of the guide bar does not impact the ability of the Biasi correlation to predict DNB in these locations. The GB-adjacent channels have values for heated perimeter, wetted perimeter and area that are within the range of the geometric parameters supported by the data used in the validation of the HTP and Biasi CHF correlations. Additionally, these guide bars are located on the fuel assembly periphery, which is a nonlimiting location for DNB. For these reasons, the guide bars do not challenge the Biasi correlation's ability to accurately predict DNB based on local conditions.

CE 15 x 15 fuel does have an instrument tube at the center of the assembly; however, this instrument tube shares a common outer diameter with the fuel rods. Thus, the instrument tube subchannels have identical geometry to the unit cell subchannels, and only 75% of the power compared to a unit subchannel surrounded by fuel rods. Since the instrument tube does not contribute more power to or decrease the flow area of the neighboring subchannels, the subchannels adjacent to the instrument tube are nonlimiting in comparison to typical unit subchannels. Therefore, the instrument tube will not challenge the Biasi correlation's ability to conservatively predict DNB and is not subject to the range of applicability imposed on guide tube outer diameter.

Table 2-1 compares the CE 15 x 15 fuel design to the CE 14 x 14 fuel designs for which Reference 1 was approved.

**Table 2-1 Comparison of CE Fuel Designs**

The image shows two large, empty square brackets, one on the left and one on the right, positioned vertically. These brackets are intended to indicate the location of Table 2-1, which is missing from the page.

Consistent with other plant types (as described in Section 7.5 of Reference 1) a conservative MDNBR correction factor is defined for Palisades to accommodate the geometric parameters of the fuel, such as guide bars. The applicable plant-specific value for Palisades is [ ]. The CE 15 x 15 MDNBR correction factor was calculated in a manner consistent to the other plant types (as described in RAI-4 of Reference 1). However, due to the unique geometric and modeling configurations of the CE 15 x 15 fuel design, the limiting geometry correction factor of only the unit subchannels and guide bar subchannels is used (subchannel types “C,” “D,” “E,” and “H” in Figure 2-1). The peripheral subchannels (with no guide bars) often have very limiting geometry correction factors because of the way the assembly boundary is arbitrarily modeled. In reality, due to adjacent assemblies, the peripheral subchannels with no guide bars have larger flow areas and are less susceptible to reaching DNB. The CE 15 x 15 MDNBR correction factor is therefore conservative and appropriate.

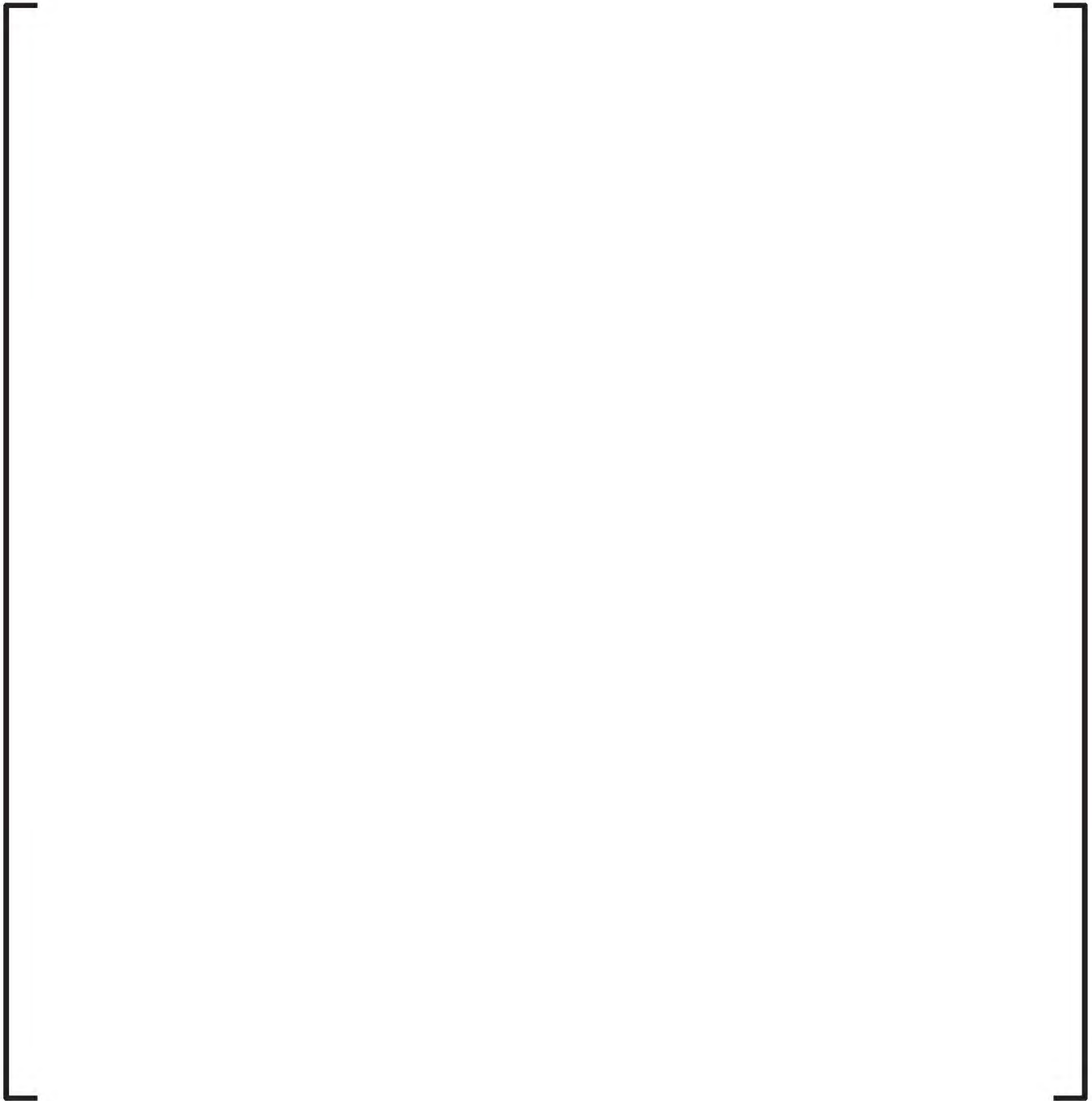
Table 2-2 compares the pertinent geometric parameters and MDNBR correction factor of the CE 15 x 15 fuel design to those of the CE 14 x 14 and CE 16 x 16 fuel designs provided in RAI 4, Table 4-1 of Reference 1.

**Table 2-2 MDNBR Correction Factors**



Figure 2-1 is a scaled down assembly example of the subchannels for the CE 15 x 15 fuel design similar to that provided in the SER of Reference 1, Section 3.2.5.2 for the CE 14 x 14 and CE 16 x 16 fuel designs.

**Figure 2-1 CE 15 x 15 Subchannels**



### **3.0 CONCLUSION**

Reference 1 has been approved for use in similar plants for the intended application of DNB prediction during a Post-Scram MSLB event. The technical basis for the original topical report supplement utilizes the same CHF data used in the development of the HTP correlation, which is also included in the licensing basis for Palisades. All Limitations and Conditions specified in the Reference 1 SER, with the exception of the guide tube outer diameter range, are applicable to the Palisades plant. CE 15 x 15 HTP fuel meets all applicable requirements imposed by the SER of Reference 1. Based on these justifications, the Reference 1 methodology is appropriate for use in predicting DNB for Post-Scram MSLB Analysis with Palisades CE 15 x 15 HTP fuel.

#### **4.0 REFERENCES**

1. EMF-2310(P)(A) Revision 1 Supplement 2P-A Revision 0, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," March 2023.
2. EMF-92-153(P)(A), Revision 1, "HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel," January 2005.
3. "Palisades Nuclear Plant Core Operating Limits Report, Revision 20." Docket 50-255, Renewed Facility Operating License No. DPR-20.

**HDI PNP 2024-003**  
**Enclosure Attachment 4**  
**List of Regulatory Commitments**

1 Page Follows

## Regulatory Commitments

This table identifies actions discussed in this letter for which, upon approval, Holtec Decommissioning International, LLC (“HDI”), Holtec Palisades, LLC (“Holtec Palisades”), or Palisades Energy, LLC (“OPCO”) commits to perform. Any other actions discussed in this submittal are described for the U.S. Nuclear Regulatory Commission’s (“NRC”) information and are **not** commitments.

Commitments	Type (Check One)		Scheduled Completion Date  (If Required)
	One- Time Action	Continuing Compliance	
<p>HDI will include in the Updated Final Safety Analysis Report Chapter 14.14 “Steam Line Rupture Incident,” a discussion on the Biasi Critical Heat Flux correlation use and will include reference to:</p> <p>Topical Report EMF-2310, Revision 1, Supplement 2P-A, Revision 0, <i>SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors</i>,</p> <p>Technical Report 2. ANP-4083P Revision 0, “Applicability of Biasi Critical Heat Flux Correlation to Palisades Fuel”, January 2024,</p> <p>and,</p> <p>The NRC issued License Amendment with the associated NRC Safety Evaluation.</p>	<p><b>X</b></p>		<p>On the effective date of the Palisades Power Operations Technical Specifications (HDI PNP 2024-003, Enclosure Reference 5) issued amendment which is coincident with the date that Palisades transitions from a decommissioning licensing basis to a power operations licensing basis.</p>