
DPC-NE-2005 Appendices for Robinson and Harris Nuclear Plants

November 12, 2014

NRC Offices

Outline

- Background
- Review of Previous Appendix Submittals
- Outline of new Appendices
- Preliminary Statistical Core Design (SCD)
Results for Harris and Robinson
- Summary

DPC-NE-2005 Background

Duke developed a Statistical Core Design (SCD) methodology for DNBR analyses in PWRs

- Approach for calculating the Statistical Design Limit (SDL) is similar to other approved methods
- Key difference is a thermal-hydraulic computer code, VIPRE-01, is used directly to calculate the coefficient of variation for all state points and cases
- Methodology was submitted in September 1992 and approved in February 1995
- Topical structure based on the methodology (main body of report) with separate Appendices for each plant application

DPC-NE-2005 Background - Continued

Process was also defined in the Methodology section for submitting new Appendices to address:

- Different plants
- New fuel designs
- New Critical Heat Flux (CHF) correlations

New Appendix format to include:

1. Identification of plant, fuel type, CHF correlation
2. Description of model
3. List of key parameters, uncertainties and distributions
4. List of State points analyzed
5. The Statistical Design Limit (SDL) licensed for the application

DPC-NE-2005 Appendices

Original report contained two appendices for then current Duke plants:

- **Appendix A**
 - Oconee Nuclear Station
 - Mark-B10 fuel
 - BWC CHF correlation
- **Appendix B**
 - McGuire and Catawba Nuclear Stations
 - Mark-BW17 fuel
 - BWCMV CHF correlation

DPC-NE-2005 Appendices - Continued

Subsequent Appendices were submitted for CHF correlation changes and fuel transitions:

- **Appendix C**

- McGuire and Catawba Nuclear Stations
- Mark-BW17 fuel
- BWU-Z CHF correlation

Submitted April 1996, approved November 1996

- **Appendix D**

- Oconee Nuclear Station
- Mark-B11 fuel
- BWU-Z CHF correlation

Submitted April 1997, approved November 1998

DPC-NE-2005 Appendices - Continued

- **Appendix E**

- McGuire and Catawba Nuclear Stations
 - Advanced Mark-BW and Mark-BW/MOX1 fuel
 - BWU-Z/MSM CHF correlation
- Submitted September 2001, approved September 2002

- **Appendix F**

- Oconee Nuclear Station
 - Mark-B HTP fuel
 - BHTP CHF correlation
- Submitted September 2007, approved September 2008

- **Appendix G**

- McGuire and Catawba Nuclear Stations
 - RFA fuel
 - WRB-2M CHF correlation
- Submitted via DPC-NE-2009 in July 1998, approved December 2002.
Included in DPC-NE-2005 in December 2008.

New SCD Appendices for DPC-NE-2005

To date, submittals have been for the same plants as the Rev 0 with difference fuel designs or CHF correlations

- Method is generic for any PWR as originally licensed

New submittal will be for two new additional plants

- Separate Appendix for Robinson (H) and Harris (I) Nuclear Plants
- VIPRE-01 model structure the same as existing approved 14 channel model (DPC-NE-3000) with necessary fuel geometry updates
 - Two fuel designs , Advanced W 15x15 HTP @ RNP and Advanced W 17x17 HTP @ HNP

RNP 14 Channel Model



HNP 14 Channel Model

New SCD Appendices for DPC-NE-2005 - Continued

New submittal changes also include:

- HTP CHF correlation
 - Used for both fuel designs
 - Data validation in VIPRE-01 code demonstrated
- Plant specific parameter uncertainties

Format of new appendices same as the last
chronologically submitted, Appendix F

- Sections as defined in Methodology main body
- No Transition or Mixed Core section since no fuel design transition occurring

Preliminary DNB Statistical Core Design (SCD) Results for Robinson and Harris

Calculations applying the Duke methodology with the indicated models completed

- Specific Plant uncertainties and state points applied
- Results anticipated to be similar to Oconee Appendix F
 - Similar fuel design

Preliminary SDL results for both Robinson and Harris plants as expected

<u>Plant</u>	<u>SDL</u>	<u>Appendix</u>
Oconee	1.34	F
Robinson	1.35	H
Harris	1.34	I

Summary

Duke Energy Thermal-Hydraulic Statistical Core Design Methodology as per DPC-NE-2005 has been applied to the Robinson and Harris Nuclear Plants

- Methodology applied as described in report Main Body for each plant

Required Duke SCD Appendices completed as Appendix H (Robinson) and Appendix I (Harris)

- Statistical Design Limit (SDL) calculated for each plant based on resident fuel design, plant uncertainties
- Submittal planned for December 2014