VIPRE-D/BWU Application to North Anna Power Station Units 1 and 2.

Information Meeting with NRC

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Dominion Attendees

- Cary B. LaRoe - Supervisor, Nuclear Safety Analysis
- Dr. Sama Bilbao y León - Nuclear Safety Analysis Engineer
- Kurt F. Flaig - Lead Core T/H Engineer
- Tom E. Shaub - North Anna Licensing Lead

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Outline

- Licensing Actions Required for North Anna
- Application of Virginia Power Statistical DNBR Evaluation Methodology
- Schedule for LAR
- Discussion on NRC RAIs on DOM-NAF-2

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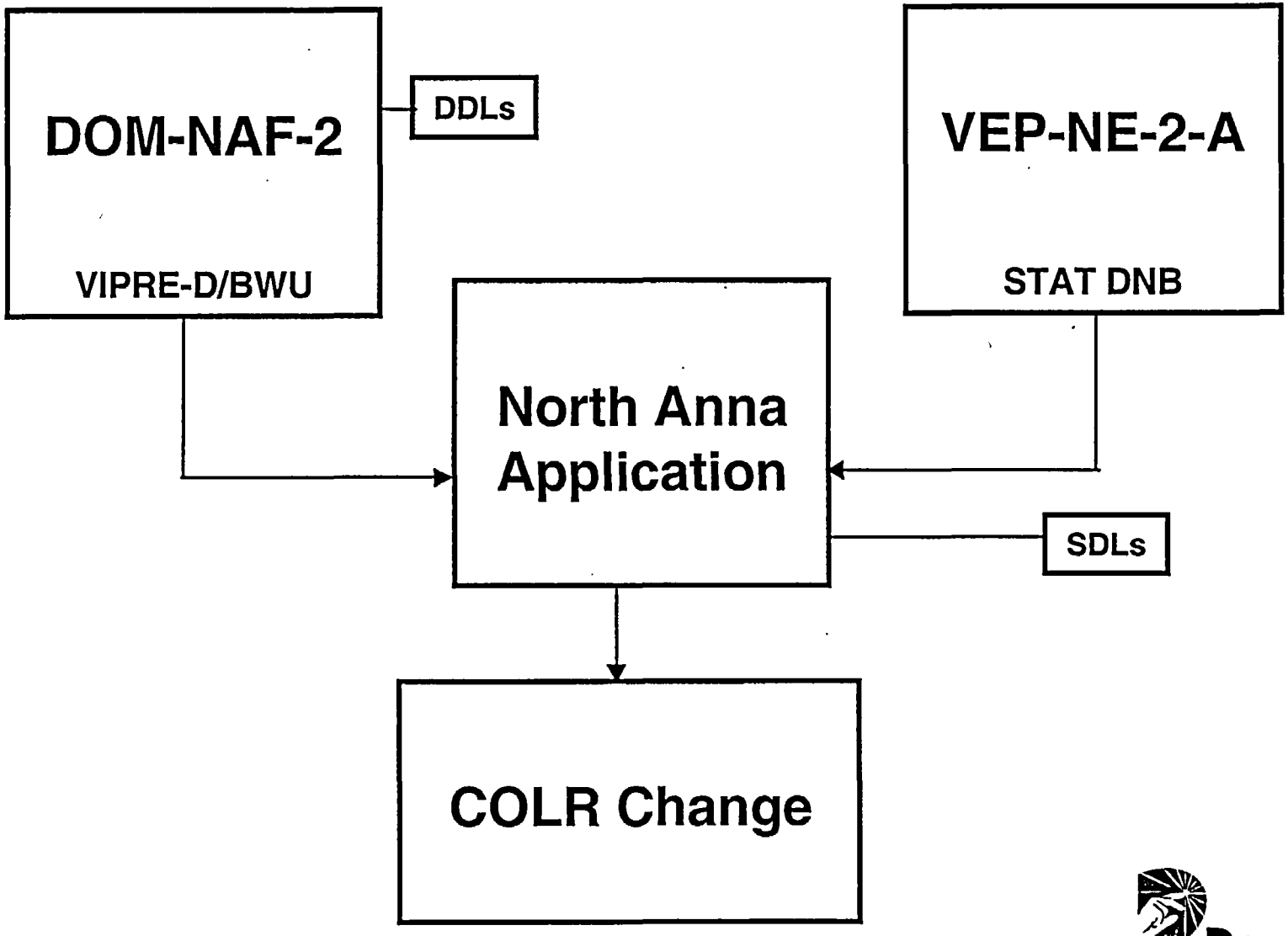
I. Licensing Actions Required



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Licensing Actions Required

The following items are required prior to the first use of the VIPRE-D/BWU code/correlation set for AREVA AMBW fuel in North Anna cores with the VEP-NE-2-A Statistical DNBR Evaluation Methodology

1. Review and approval of VIPRE Topical Report DOM-NAF-2 including Appendix A (ongoing)
2. Review and approval of a plant specific application submittal including Statistical Design Limits (SDLs)
3. Review and approval of a LAR to add Topical Report DOM-NAF-2, including Appendix A, to the Technical Specification 5.6.5.b list of USNRC approved methodologies used to determine core operating limits.

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- VEP-NE-2-A
  - Virginia Power Statistical DNBR Evaluation Methodology
  - Method approved by NRC in May 1987
  - Implemented at North Anna (approved by NRC on June 1989)
    - Westinghouse NAIF Fuel
    - COBRA/WRB-1
  - Now implemented again at North Anna
    - Framatome/AREVA Advanced Mark-BW Fuel
    - VIPRE-D/BWU

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Methodology Summary
  - ➔ Selection of key parameters to evaluate statistically
    - Pressurizer Pressure
    - Inlet Temperature
    - Thermal Power
    - Vessel Mass Flow Rate
    - Nuclear Enthalpy Rise
    - Hot Channel Engineering Factors
    - Bypass Flow
  - ➔ Evaluation of parameter uncertainties and distributions

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Methodology Summary (cont.)
  - → Selection of Nominal Statepoints
  - → Monte Carlo Simulation
    - 2,000 random cases around each nominal statepoint
    - Executed with VIPRE-D/BWU
    - Distribution of DNBR results
  - → Statistical convolution including
    - Correlation Uncertainty
    - Code Uncertainty
    - Model Uncertainty
  - → 95/95 Pin Peak SDL
  - → 99.9% Full Core DNB Probability Summation SDL

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Compliance with VEP-NE-2-A SER
  - → Justification of the selection of Nominal Statepoints
  - → Justification of the distribution, mean and standard deviation for all the statistically treated parameters
  - → Justification of Model Uncertainty
  - → Justification of the 95/95 DNBR limit and the normality of the M/P distribution, its mean and standard deviation for the BWU CHF Correlations
    - UNLESS there is an approved Topical Report documenting them → DOM-NAF-2, Appendix A

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Deterministic Design Limits for VIPRE-D/BWU
  - ➔ Provided in DOM-NAF-2, Appendix A

VIPRE-D/BWU-Z	
DNBR limit below 700 psia	1.59
DNBR limit 700 – 2,400 psia	1.20
VIPRE-D/BWU-ZM	
DNBR limit below 594 psia	1.59
DNBR limit at or above 594 psia	1.18
VIPRE-D/BWU-N	
DNBR limit below 1200 psia	1.39
DNBR limit at or above 1200 psia	1.22

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Statistical DNBR Design Limits for North Anna cores containing AREVA AMBW with VIPRE-D/BWU
  - ➔ Design Basis Limit for Fission Products Barrier (DBLFPB)
  - ➔ To be submitted in June 2005 for NRC review and approval

CHF CORRELATION	STATISTICAL DNBR LIMIT
BWU-Z	1.34
BWU-ZM	1.34
BWU-N	1.38

Dominion

II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Safety Analysis Limits for North Anna cores containing AREVA AMBW with VIPRE-D/BWU
  - ➔ Selected by Dominion to provide retained margin

DETERMINISTIC DNB APPLICATIONS				
DNB CORRELATION	PRESSURE	DDL	SAL_{DET}	RETAINED MARGIN [%]
BWU-Z/ZM	< 700 psia	1.59	1.85	14.0
	700 – 2,400 psia	1.20	1.60	25.0
BWU-N	< 1200 psia	1.39	1.60	13.1
	≥ 1200 psia	1.22	1.60	23.7

Dominion

II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Safety Analysis Limits for North Anna cores containing AREVA AMBW with VIPRE-D/BWU

STATISTICAL DNB APPLICATIONS			
DNB CORRELATION	SDL	SAL_{STAT}	RETAINED MARGIN [%]
BWU-Z/ZM	1.34	1.60	16.2
BWU-N	1.38	1.60	13.7

Dominion

II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- North Anna Transition Core Penalties
  - ➔ Applicable to mixed cores containing Westinghouse and AREVA fuel assemblies
  - ➔ SAL selected to allow for these penalties

	FIRST CORE (N2C17 & N1C18)	SECOND CORE (N2C18 & N1C19)
BWU-Z/ZM	19.8%	12.8%
BWU-N	0.7%	0.7%

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II. Application of Virginia Power Statistical DNBR Evaluation Methodology

- Verification of Existing Reactor Core Safety Limits, Protection Setpoints and Chapter 15 Events
  - → 173 Statepoints from UFSAR Chapter 15
    - Reactor Core Safety Limits
    - Axial Offset Envelopes
    - Rod Withdrawal at Power
    - Rod Withdrawal from Subcritical
    - Control Rod Misalignment
    - Loss of Flow Accident
    - Locked Rotor
    - Main Steam Line Break
    - Rod Withdrawal from Subcritical

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III. License Amendment Request

- Inclusion of Topical Report DOM-NAF-2, including Appendix A, to the Technical Specification 5.6.5.b list of USNRC approved methodologies used to determine core operating limits (i.e. the reference list of the North Anna Core Operating Limits Report (COLR)).
  - ➔ Allow the use of the VIPRE-D/BWU code to perform licensing calculations of AREVA AMBW fuel in North Anna cores, using the deterministic design limits (DDLs) qualified in Appendix A of Topical Report DOM-NAF-2.

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III. License Amendment Request

- Schedule
  - North Anna Unit 2 Cycle 18 - Fall '05 (2nd Transition Core)
  - North Anna Unit 1 Cycle 19 - Spring '06 (2nd Transition Core)
  - North Anna Unit 2 Cycle 19 - Spring '07 (Full AMBW Core)
  - North Anna Unit 1 Cycle 20 - Fall '07 (Full AMBW Core)

  - Six months lead time required to incorporate into Reload Analysis Methodology
  - NRC approval required in Fall '06 to support N2C19 in Spring '07

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