

Prairie Island Safety Analysis Transition To Westinghouse

Meeting Objectives

1. Inform NRC of plans and schedules
2. Obtain feedback from the NRC

Overview

Transferring non-LOCA safety analysis scope from NMC to Westinghouse approved methods for Prairie Island.

Technical Specification reference additions and other changes consistent with Westinghouse methods will be needed.

Generally, the change is with approved methods. A few clarifications will be discussed.

Plan to change methods for both units in September 2003 with the Prairie Island Unit 2 Cycle 22 refueling outage.

Plan to have submittal to NRC in February 2003.

Prairie Island Safety Analysis Transition To Westinghouse

Meeting Agenda

Introduction / Meeting Agenda – Jack Leveille

Meeting Objectives – Cliff Bonneau

Safety Analysis Transition Program Scope – Lamar Brown

Schedule – Jack Leveille

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

Overview

FSAR CHAPTERS 3 and 14

Fuel Analysis

Core Physics

Thermal/Hydraulics

Fuel Rod Design

FSAR CHAPTER 14

**Most FSAR Chapter 14 events will be reanalyzed by
Westinghouse**

**Replacement steam generator design characteristics will be
incorporated**

Non-LOCA Analysis

LOCA Analysis

Radiological Analysis

FSAR CHAPTER 14 AND APPENDICES I AND K

Containment Integrity Analysis

Outside Containment Analysis

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

Fuel Analysis

CORE PHYSICS (FSAR Chapters 3 and 14)

Nominal parameters will be calculated: power distributions, reactivity coefficients, rod worths, boron concentrations

Core physics data to be used in safety analysis will be calculated: nominal parameters plus event specific parameters (ejected rod worths, steamline break peaking factors, etc.)

Power history data will be calculated for input to fuel rod design

Approved Codes/Methodology Topicals

- 1. PHOENIX-P, WCAP-11596-P-A**
- 2. ANC, WCAP-10965-P-A**

THERMAL/HYDRAULICS (FSAR Chapters 3 and 14)

The Revised Thermal Design Procedure will be implemented

Core limit lines and axial offset limit lines will be calculated assuming implementation of Relaxed Axial Offset Control strategy

Confirmation will be provided that DNBR limits are met

Approved Codes/Methodology Topicals

- 1. Revised Thermal Design Procedure, WCAP-11397-P-A**
- 2. VIPRE, WCAP-14565-P-A**

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

Fuel Analysis

FUEL ROD DESIGN (FSAR Chapter 3)

No change to current Westinghouse methodology as applied to Prairie Island

PAD will continue to be used to verify that all fuel rod design criteria are met

Fuel rod temperatures will be calculated for input to LOCA and non-LOCA analyses

Approved Codes/Methodology Topicals

1. PAD, WCAP-10851-P-A, Rev 1

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Safety Analysis Transition Program Scope

NON-LOCA Analysis

<u>EVENT</u>	<u>APPROVED CODES/METHODOLOGY</u>
RCCA Bank Withdrawal from Subcritical, FSAR 14.4.1	TWINKLE / FACTRAN / VIPRE-01
RCCA Bank Withdrawal at Power, FSAR 14.4.2	RETRAN-02 RTDP
RCCA Misalignment, FSAR 14.4.3 (Statically Misaligned RCCA and Dropped RCCA(s))	Statically Misaligned RCCA – ANC / VIPRE-01 Dropped RCCA(s) – Generic 2-loop WOG Statepoints (LOFTRAN), WCAP-11394-P-A methodology
Boron Dilution, FSAR 14.4.4	Reactor Critical – RETRAN (reactivity insertion bounded by RWAP) Reactor Subcritical – NMC methods retained
Startup of an Inactive Loop, FSAR 14.4.5	Operation with a loop out of service precluded by Tech Specs. FSAR will be revised to reflect this. No analysis.
Feedwater Malfunction, FSAR 14.4.6	RETRAN-02 RTDP

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Safety Analysis Transition Program Scope

NON-LOCA Analysis

<u>EVENT</u>	<u>APPROVED CODES/METHODOLOGY</u>
Excessive Load Increase, FSAR 14.4.7	RETRAN-02, or evaluation vs. core thermal limits
Loss of Flow, FSAR 14.4.8.1	RETRAN-02 / VIPRE-01 RTDP
Locked Rotor, FSAR 14.4.8.2	RETRAN-02 / VIPRE-01 RTDP (rods in DNB analysis)
Loss of Load / Turbine Trip, FSAR 14.4.9	RETRAN-02 RTDP (DNB analysis)
Loss of Normal Feedwater and Loss of AC Power, FSAR 14.4.10, 14.4.11	RETRAN-02
Steam Line Break (core response), FSAR 14.5.5	RETRAN-02 / VIPRE-01 / ANC
RCCA Ejection, FSAR 14.5.6	TWINKLE / FACTRAN
ATWS, FSAR 14.8	RETRAN-02 (validation of Diverse Scram System)

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Safety Analysis Transition Program Scope

NON-LOCA Analysis

Approved Code Topicals

1. TWINKLE *WCAP-7979-P-A, TWINKLE – A Multidimensional Neutron Kinetics Computer Code, January 1975.*
2. FACTRAN *WCAP-7908-A, FACTRAN – A FORTRAN IV Code for Thermal Transients in a UO₂ Fuel Rod, December 1989.*
3. RETRAN-02 *WCAP-14882-P-A, RETRAN-02 Modeling and Qualification for Westinghouse Pressurized Water Reactor Non-LOCA Safety Analyses, April 1999.*
4. LOFTRAN *WCAP-7907-P-A, LOFTRAN Code Description, April 1984.*
5. ANC *WCAP-10965-P-A, ANC: Westinghouse Advanced Nodal Computer Code, September 1986.*
6. VIPRE-01 *WCAP-14565-P-A, VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis, October 1999.*

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Safety Analysis Transition Program Scope

NON-LOCA Analysis

Approved Methodology Topicals

1. Reload *WCAP-9272-P-A, Westinghouse Reload Safety Evaluation Methodology, July 1985.*
2. DNB *WCAP-11397-P-A, Revised Thermal Design Procedure, April 1989.*
3. Overpower ΔT and *WCAP-8745-P-A, Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Setpoints* *Overtemperature ΔT Trip Functions, September 1986.*
4. Dropped Rod *WCAP-11394-P-A, Methodology for the Analysis of the Dropped Rod Event, January 1990.*
5. Rod Ejection *WCAP-7588, Rev. 1-A, An Evaluation of the Rod Ejection Accident in Westinghouse Pressurized Water Reactors, January 1975.*
6. Boron Dilution *NSPNAD-8102-PA, Revision 7, Prairie Island Nuclear Power Plant Reload Safety Evaluation Methods For Application to PI Units, (Appendix G), July 1999.*
7. Pressurizer Safety *WCAP-12910, Rev. 1-A, Pressurizer Safety Valve Modeling Valve Set Pressure Shift, Westinghouse Owners Group, May 1993.*
8. Steam Line Break *WCAP-9226-P-A, Revision 1, Reactor Core Response to Excessive Secondary Steam Releases, February 1998.*

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

LOCA Analysis

No change to current Westinghouse methodology as applied to Prairie Island

LARGE BREAK ANALYSIS (FSAR Chapter 14.6)

The SECY Upper Plenum Injection methodology using WCOBRA/TRAC will continue to be employed

Appendix K and Superbounded cases will be run for the limiting break using replacement steam generator data

Approved Codes/Methodology Topicals

- 1. WCOBRA/TRAC, WCAP-10924-P-A**

SMALL BREAK ANALYSIS (FSAR Chapter 14.7)

NOTRUMP will continue to be employed

A complete break spectrum will be analyzed using replacement steam generator data

Approved Codes/Methodology Topicals

- 1. NOTRUMP, WCAP-10054-P-A**
- 2. Small Break Evaluation Methodology, WCAP-10079-P-A**

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

LOCA Analysis

POST-LOCA ANALYSES (FSAR Chapter 14.10)

Subcriticality will continue to be verified using current methods

Boron buildup will continue to be analyzed using current methods

LOCA HYDRAULIC FORCES (FSAR Chapter 3.6)

MULTIFLEX will continue to be employed

The LOCA forces determined for Unit 2 for the 25% SGTP program will be re-validated

The impact of the replacement steam generator will be evaluated for Unit 1

Approved Codes/Methodology Topicals

1. MULTIFLEX, WCAP-8708-P-A

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Safety Analysis Transition Program Scope

Radiological Analysis

Fauske and Associates (Westinghouse subsidiary) has performed dose analysis using the Alternate Source Term Methodology under a separate program and a report will be submitted separately by NMC

The Alternate Source Term Methodology will be implemented when approved.

If the Alternate Source Term Methodology is not approved for use on Prairie Island for Unit 2 Cycle 22 (August 2003), NMC methodology may be retained for Locked Rotor analysis

Methodology

- 1. Alternate Source Term Methodology, Reg Guide 1.183**

Prairie Island Safety Analysis Transition To Westinghouse

Safety Analysis Transition Program Scope

Containment Integrity Analysis

LOCA MASS & ENERGY RELEASES (FSAR Appendix K)

This data will be provided by NMC for the replacement steam generator

STEAMLINER BREAK MASS & ENERGY RELEASES (FSAR Chapter 14.5.5)

Mass & energy releases will be calculated using LOFTRAN for both Unit 1 (RSG) and Unit 2 (OSG)

Various power levels, break sizes, and single failures will be examined

As a contingency, NOTRUMP may be used to support break quality assumptions for the RSG's

Approved Codes/Methodology Topicals

- 1. Methodology for Calculation of SLB M&E's Inside Containment, WCAP-8822**

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Safety Analysis Transition Program Scope

Containment Integrity Analysis

CONTAINMENT RESPONSE (FSAR Chapter 14.5.5 and Appendix K)

Containment response for LOCA and SLB will be performed using either Gothic v. 7.0 or MAAP5

Codes/Methodology Topicals (Currently under NRC Review)

- 1. Gothic v. 7.0, NRC-02-082, Kewaunee Nuclear Power Plant Request for Use of Gothic v. 7.0 in Containment Design Basis Accident Analysis, Sept 2, 2002**
- 2. MAAP5, WCAP-15844, Rev 0, March 2002**

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Safety Analysis Transition Program Scope

Outside Containment Analysis

LONG TERM SLB OUTSIDE CONTAINMENT (FSAR APPENDIX I)

Westinghouse will calculate mass & energy releases using LOFTRAN

NMC will perform compartment calculation to determine temperature profiles for equipment qualification

Approved Codes/Methodology Topicals

- 1. SLB M&E Outside Containment Methodology, WCAP-10961, Rev 1**

SHORT TERM M&E RELEASES OUTSIDE CONTAINMENT (FSAR APPENDIX I)

Westinghouse will validate M&E releases from steamline and feedline breaks

NMC will perform compartment pressurization calculations

No NRC approval required

Methodology

- 1. Short term M&E releases outside containment, Appendix E of ANSI/ANS-58.2-1980**

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Safety Analysis Transition Program Scope

Implementation

Implementation of the Westinghouse methodology will require:

**Changes to the Technical Specifications
References to methodology topicals
Format (RAOC)**

FSAR changes

The validity of the safety analysis will be confirmed on a cycle-by-cycle basis in accordance with the methodology described in the Westinghouse Reload Methodology Topical, WCAP-9272-P-A.

Prairie Island Safety Analysis Transition To Westinghouse

NRC Involvement / Schedule

- ❖ **Change both units in September 2003 with Prairie Island Unit 2 Cycle 22**
 - **Submittal for Technical Specification Change in February 2003**
 - **Methodology references in TS (adding methodologies rather than replacing)**
 - **Changes for Relaxed Axial Offset Control**
 - **No Setpoint changes**
- ❖ **Approvals needed for other submittals**
 - **MAAP 5, or Gothic 7.0 (not on PI docket)**
 - **Alternate Source Term Methodology (ASTM)**
- ❖ **Contingencies**
 - **Locked rotor accident analysis (may need to maintain current analysis until ASTM is approved)**
 - **3-D Rod Ejection (may need approval for previously submitted Westinghouse methodology, depending on results of analysis)**
 - **Calculation of Liquid Entrainment for Replacement Steam Generators (may need to use NOTRUMP)**