Nine Mile Point 2 Instability Event Briefing

Presentation to USNRC
Mike May, Exelon Corp.

August 15, 2003

Agenda

- Event Description
- NMP-2 Design
- Event Analysis

Event Description

- At 05:50:36 on July 24, 2003 while operating at 100% power / 94% core flow, the loss of a power supply causes an unexpected plant transient
  - Recirculation pumps auto-downshift from high to low speed
  - Reactor power lowered to 45% and flow to 35%
  - After ~3 minutes, operators manually tripped one of two feed pumps due to rising water level
  - Reactor Recirculation flow control valve run-back occurred
  - Reactor power lowered to 35% and flow to 28%

Event Description

- After ~7 minutes, decreasing feedwater temperature raised power to ~45% and 28% flow prior to scram
- At 05:57:13-17 OPRM Pre-trip Alarmed
- At 05:57:17 OPRM Channel 4 PBA Tripped
- At 05:57:19 OPRM Channel 1 PBA Tripped (Reactor scram)

NMP-2 Design

- BWR-5 3467 MW_{th} (104.3% Uprate)
- Currently in Cycle 9 started in spring 2002
- Full core GE-11 fuel
- 24 month cycles
- OPRMs enabled since BOC-8 in 2000
- Cycle 9 OPRM PBA Amplitude Setpoint calculated with plant specific DIVOM
- Cycle 9 OPRM PBA Amplitude Setpoint at 1.12 @ 14 counts

Event Analysis

- The rapid flow reduction and accompanying feedwater temperature transient led to power and flow conditions in the upper left corner of the power/flow map which are typically susceptible to coupled neutronic thermal-hydraulic oscillations.
- The MCPR immediately prior to oscillations was calculated at greater than 1.8. Based on bounding analysis, the transient MCPR was never less than 1.3 and there was significant margin to the 1.06 SLMCPR during the event.

Event Analysis

- Based on a preliminary plant data analysis, a core-wide mode instability event occurred
- The instability event lasted for about 40 seconds and terminated by the PBDA in a reactor scram
- The plant data indicates that several OPRM cells reached the PBDA confirmation count trip setpoint (14) and that the relative amplitude of the leading OPRM cells reached the PBDA amplitude trip setpoint (1.12) immediately before the scram
- Further analysis of the event is in progress

Stability Option III DIVOM Part 21 Closure Plan

Presentation to USNRC

Mike May, Exelon Corp.

August 15, 2003

Agenda

- Background
- BWROG Decisions
- Proposed Closure Plan
- Open Discussion - NRC Feedback

Background

- Current D&S methodology defines cycle-specific calculation to ensure MCPR safety limit protection
- Current reload method relies on generic DIVOM curve (fractional change in CPR vs. oscillation magnitude)
- June 2001: GE reported that generic DIVOM curve may be non-conservative, resulted in Part 21 notification
- BWROG D&S Committee re-formed to develop new generic DIVOM correlation

Background

- Concluded that generic DIVOM approach not viable for Option III plants (good correlation of DIVOM with plant parameters not achieved)
- Pursued generic setpoint approach that uses TRACG event simulation to demonstrate MCPR SL protection
- Pursued new stability limit instead of MCPR SL to increase long-term viability and range of applicability
  - Analysis successfully identified key PCT parameters
  - Appears technically feasible, but wide margins not demonstrated
  - To proceed, need to better quantify uncertainties in analysis and the acceptance criteria

BWROG Decisions

- Not pursue generic setpoints with new stability limit
  - Large work scope / scope uncertainty
  - High cost / cost uncertainty
  - Long schedule (years to accomplish)
  - Recognized that separating departure from nucleate boiling from fuel damage would be major shift in philosophy for fuel protection

- Use next best alternative:
  - Plant-specific DIVOM

Plant-Specific DIVOM *- proposed approach*

- Methodology described in NEDO-32465-A:
  - Establish initial MCPR prior to oscillation (IMCPR)
  - Calculate hot channel oscillation magnitude (HCOM)
  - Use fractional change in CPR vs. oscillation magnitude (DIVOM)
- Follow process in NEDO-32465-A to develop plant-specific DIVOM
- No change to NEDO-32465-A and no planned generic submittals

Plant-Specific DIVOM - advantages/disadvantages

- Plant/cycle specific DIVOM is technically appropriate
  - Addresses changes in core loading, fuel designs, and operating strategies not accounted for by generic DIVOM
  - Follows NRC approved methodology (NEDO-32465-A)
  - Consistent with interim approach
- Advantages
  - Closes Part 21 on setpoint methodology
  - Allows for relatively quick OPRM arming of Option III plants
  - Reduces BWROG and NRC resource requirements
- Disadvantages
  - Requires plant-specific analysis (TRACG or equivalent)
  - Setpoints may be too low for some plants (unnecessary scrams)

Proposed Closure Plan

- Develop technical procedure for plant-specific DIVOM
  - Provide consistency with NEDO-32465-A approach
  - Provide consistency for all fuel vendors
- Continue to work with non-GE fuel vendors to perform plant-specific DIVOM analyses
- Plant implementation
  - Select plant-specific DIVOM or DSS-CD
  - MELLLA+ plants use DSS-CD
  - Develop schedule
  - Interim stability protection used until LTS implemented

NRC Comments and Feedback