Operating Experience Smart Sample (OpESS) FY 2007-04
"BWR Core Power / Flow Map - supplemental inspection guidance for MC 2515D"

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SOURCE DOCUMENTS:

1) Manual Chapter (MC) - 2515D "Plant Status"- [for Control Room Walkdowns]
Note: Control room walkdown reviews are especially important during abnormal conditions (unplanned feedwater transients, etc.) or scheduled transients (e.g., downpowers, coastdowns, shutdowns, startups or other infrequently performed evolutions). The resident inspectors should transition into an appropriate inspection procedure (example IP-711111.15) whenever their effort shifts from collecting plant status information to evaluating a potential issue/finding and followup actions that will exceed about one half hour for any single issue per MC2515D.

2) Browns Ferry Inspection Report IR 2007-02, see section 4OA5.3, writeup that begins on page 32 of the report that documented this issue: BROWNS FERRY NUCLEAR PLANT - NRC INTEGRATED INSPECTION REPORT 05000259/2007002, 05000260/2007002, AND 05000296/2007002 , (ADAMS ML071210012).

CORNERSTONES: Barrier Integrity

APPLICABILITY: All commercial operating **Boiling Water Reactors (BWR)** .

OBJECTIVE: To support NRC review of licensees' activities in regards to proper monitoring of BWR operations specifically regarding monitoring and adherence to the limits of the core power-flow map.

INSPECTION GUIDANCE:

• **Manual Chapter**, MC 2515D, "Plant Status" - [for Control Room Walkdowns]

• **IP 71152 "Identification and Resolution of Problems"**

1) Review the source documents above to obtain a general understanding of the concerns related to operators failing to maintain core flow within the bounds of the Core Power/ Flow Map established by operating procedures.

2) Review the **"Background"** information in the following section for specific inspection guidance and other items to consider.

3) Periodically during BWR control room walkdowns verify that the plant is operating within the prescribed limits of the Core Power-Flow Map. The potential for deviation from these limits is likely to be highest during coastdown, and other transient conditions. If deviations are identified that indicate the licensee is exceeding the prescribed limits notify the control room supervisors promptly.

4) Inspectors should also consider reviewing the licensee corrective action program (CAP) for any previous issues involving operation outside the Core Power/ Flow Map, and corrective actions taken to prevent recurrence if issues were identified.

BACKGROUND:

Boiling Water Reactors (BWRs) that are authorized to operate in the increased core flow region do so in order to extend core life. During End of Cycle conditions (i.e., all rods out), inspectors should anticipate that operators will operate with recirculation flow right at the highest authorized increased core flow (ICF) limit for the respective power level (e.g., 105% flow at 100% power). However, during an extended reactor power coastdown, reactor coolant flow will naturally tend to increase due to reduced head loss across the reactor core as power and two phase flow decreases (e.g., 112% flow at 40% power).

The power-to-flow relationship in the ICF region during coastdown is essentially linear and can be extrapolated with great detail to determine the actual core flow limit arithmetically rather than relying solely on the power-flow map display.

It is important that operators pay strict attention to the right side boundary of the ICF region to ensure reactor operation is maintained within the analyzed core power-flow map during reactor power coastdowns. This is especially critical during and following power maneuvers to support pre-outage work.

When operating at the highest allowed core flow (i.e., right-hand edge of the ICF region), there are factors that inspectors should be aware of while monitoring unit operation using a computer generated core power-flow map that's typically displayed on the main control board or operator desk computer. These factors are:

1) If the cursor displaying the current power-flow position is wider than the line representing the right hand edge of the ICF region and the cursor is sitting on the right-hand edge, then flow may actually be slightly greater than the allowed limit.

2) If the computer only refreshes or displays the power-flow cursor position in discreet steps, then actual flow may be exceeding the allowed limit even though the cursor indication doesn't appear to be.

3) The power-flow map, including the ICF region, is part of the fuel cycle analyzed limits for power operation. Since indicated and actual core flow will oscillate somewhat, operators may be inclined to believe (erroneously) that as long as the average core flow is less than the limit then it is acceptable, when they're actually operating in an unanalyzed condition.

REPORTING INSPECTION RESULTS / TIME CHARGES / ADDITIONAL ISSUES:

Document any inspection result findings, as applicable, in an integrated inspection report (i.e., quarterly inspection report) and reference the title/ OpESS number (example: **"Review of Operating Experience Smart Sample (OpESS) FY2007-04,**."**BWR Core Power/ Flow Map - Supplemental Inspection Guidance for MC 2515D."** Otherwise, list the item as an inspection sample including the "OpESS number/ title" under the applicable inspection attachment with no findings of significance identified.

Inspection time for this OpESS is to be charged to the normal baseline procedure under which it is being reviewed such as Plant Status (PS) for control room walkdowns (along with any routine

preparation and documentation charge times). Inspectors will transition to the appropriate inspection procedure whenever their effort shifts from collecting status information to evaluating a potential inspection issue/finding per MC 2515D.