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LTR-NRC-10-71

November 17, 2010

**Subject:** Clarification on the Use of Dynamic Rod Worth Measurement (DRWM) in Initial Plant Start-up Applications Pertaining to WCAP-13360-P-A, Revision 1 (Non-Proprietary)

Enclosed is a copy of the non-proprietary version of the "Clarification on the Use of Dynamic Rod Worth Measurement (DRWM) in Initial Plant Start-up Applications Pertaining to WCAP-13360-P-A, Revision 1." This clarification is submitted for NRC review and approval. Upon acceptance of this clarification by the NRC, Westinghouse will incorporate this submittal and the NRC's acceptance into WCAP-13360-P-A, Revision 2 to capture this review. Westinghouse requests that this be approved by March/April 2011 if feasible to support a new plant start-up scheduling.

Very truly yours,

A handwritten signature in black ink, appearing to read "J. A. Gresham for." The signature is written in a cursive style.

J. A. Gresham, Manager  
Regulatory Compliance and Plant Licensing

**Enclosures**

cc: A. Attard  
A. Mendiola

TOTO  
NRR

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**Clarification on the Use of Dynamic Rod Worth  
Measurement (DRWM) in Initial Plant Start-up Applications  
Pertaining to WCAP-13360-P-A, Revision 1 (Non-Proprietary)**

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Dynamic Rod Worth Measurement (DRWM) has proven to be an accurate and safe physics testing method with over 200 applications around the world. With the advent of the nuclear renaissance, it is desired to use this accurate and proven methodology for initial plant start-ups. This application would be limited to Westinghouse-designed Nuclear Steam Supply System (NSSS) with Westinghouse licensed fuel products and would include the additional requirements noted here-in. This clarification request is to request U.S. Nuclear Regulatory Commission (NRC) approval to use DRWM on initial plant start-ups.

By letter dated January 5, 1996, the NRC approved the use of the Dynamic Rod Worth Measurement (DRWM) technique at Westinghouse Pressurized Water Reactors. The NRC made the following conclusions about the DRWM technique:

*"Based on our review as outlined in the evaluation in Section 2.0 above, we conclude that the dynamic rod worth measurement technique is acceptable for measurement of rod worth at the beginning of reload cycles for two, three, and four loop Westinghouse cores. This acceptance is based on using the technique as outlined in Attachment B of Reference 4 and applying the evaluation criteria and remedial actions also outlined in this attachment. It is also limited to use with the rod patterns and rod worths bounded by those used in the sensitivity studies."*

The aforementioned Attachment B describes the actions to be taken upon failure of the individual bank worth review criteria. Failure of these criteria indicates a possible inconsistency in the core power distribution caused by differences between the design and the as built core, or a core anomaly (dropped rod, misloading, etc.). For this reason, a power distribution measurement (full core flux map) is required prior to exceeding 5% power when the measurement difference is confirmed. This is consistent with the misload analysis in place for Westinghouse plants at the time of the approval.

Westinghouse plans to meet the intent of WCAP-13360-P-A, Revision 1 (henceforth referred to as WCAP-13360-P-A) for initial plant start-ups in the following manner. An outline of the approach that will be taken by Westinghouse is provided at the end of this document.

It should be noted that throughout WCAP-13360-P-A, Westinghouse did not stipulate that this methodology was limited to reload applications only. The NRC stipulated this requirement in their approval, which Westinghouse accepted at that time, since initial plant start-ups were not envisioned when the topical report was initially approved. The one item in WCAP-13360-P-A where Westinghouse referred to previous cycles is in Section 3.3, page 3-4. Since Westinghouse calculates the dynamic spatial factors for the banks each cycle, for each plant, there is no reliance on previous cycle data to determine sensitivity correlations.

#### **CHANGE TO REVIEW CRITERIA**

Because of the lack of fuel burnup and fission product distribution changes, the measurements performed on a clean core are expected to be much more accurate than those of a reload core. For that reason, Westinghouse has historically tightened the review criteria on individual bank worths to 10% or 75 pcm. The review criteria specified in the topical report is 15% or 100 pcm. This change to the review and criteria is specific to the initial plant start-up applications only and is based on prior initial plant start-up experience.

#### **REPLACEMENT OF 5% FLUX MAP**

In the event of a review criterion failure, WCAP-13360-P-A states that a power distribution measurement (full core flux map) is required prior to exceeding 5% power in order to determine the cause of the failure. When WCAP-13360-P-A was written, it was applicable only for plants equipped with a moveable incore detector system; however, many of the Westinghouse NSSS plants that will be going through initial start-ups will have a fixed incore detector system. Fixed incore detector systems lack the ability to perform a power distribution measurement below ~20% power.

For the initial plant start-up, any bank that is confirmed to fail the individual bank worth review criteria will be re-measured by either Boron Dilution or the Rod Swap methodology. Both of these methods are approved for first cores and within the licensing basis for these new units coming on-line. In the unlikely case that the results from the subsequent measurement using either of these other two methods fails the bank worth criteria, then the data will be reviewed considering other measurement information to determine a possible cause (e.g., unlatched Rod Control Cluster Assembly, misloaded assembly). The core design analyst will evaluate the magnitude of the failure and provide a safety assessment to allow power ascension to ~25% Rated Thermal Power (RTP) to perform a fixed incore detector based power distribution measurement. Note that Regulatory Guide 1.68 Revision 2 specifically recognizes that initial flux maps can be taken above 5% power, depending on the sensitivity of the incore instrumentation.

<b>Reload Core Review Criteria and Resolution</b>	<b>Initial Core Review Criteria and Resolution</b>
Individual Bank Worth Review Criteria	Individual Bank Worth Review Criteria
<ul style="list-style-type: none"> <li>• Within 15% or 100 pcm</li> </ul>	<ul style="list-style-type: none"> <li>• Within 10% or 75 pcm</li> </ul>
If the individual bank worth fails	If the individual bank worth fails
<ul style="list-style-type: none"> <li>• Investigate the failure by re-measurement with DRWM</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate the failure by re-measurement with DRWM</li> </ul>
If the individual bank worth fails the investigation/re-measurement	If the individual bank worth fails the investigation/re-measurement
<ul style="list-style-type: none"> <li>• Measure the bank by dilution or swap</li> </ul>	<ul style="list-style-type: none"> <li>• Measure the bank by dilution or swap</li> </ul>
If any of the failures cannot be resolved by re-measurement	If any of the failures cannot be resolved by re-measurement
<ul style="list-style-type: none"> <li>• Review data in detail to see if there is a probable cause (e.g., unlatched RCCA, misloaded assembly).</li> </ul>	<ul style="list-style-type: none"> <li>• Review data in detail to see if there is a probable cause (e.g., unlatched RCCA, misloaded assembly).</li> </ul>
<ul style="list-style-type: none"> <li>• Perform a full core flux map prior to exceeding 5% power</li> </ul>	<ul style="list-style-type: none"> <li>• The core design analyst will evaluate the magnitude of the failure and provide a safety assessment to allow power ascension to ~25% RTP to perform a fixed incore detector based power distribution measurement.</li> </ul>