Dynamic Rod Worth Measurement

Fuel Engineering

Background

Dynamic rod worth measurement (DRWM™) is a technology designed to accurately and quickly measure control rod worths in order to accelerate return to power after refueling. In over 95 startups since 1996, PWR nuclear plant operators have typically saved 10 hours of critical path time during low-power physics testing (LPPT) by using Westinghouse DRWM instead of less sophisticated techniques. LPPT is on the critical path for most operating plants because measuring control rod worths requires a substantial amount of time and saving time during critical-path refueling operations enhances plant availability. This translates into real-time savings, real-dollar savings, and tens of thousands of additional megawatt-hours generated.

Westinghouse

Benefits

DRWM is a fast way to measure control rod worths.

- DRWM saves an average of about 10 hours of critical path time compared to conventional rod-swap techniques.
- DRWM makes changes in the LPPT program itself, saving another 5 hours.
- DRWM reduces the time the plant starts to go critical until the time the plant is turned over to operations to 8 hours.
- DRWM provides savings from reduced personnel effort and water processing.
- DRWM is as accurate as the rod-swap technique.
- DRWM's automated data reduction eliminates the error precursors associated with manual data reduction.

Description

DRWM offers the only way to perform fast and accurate rod-worth verification during LPPTs.

DRWM is an NRC-approved method to quickly measure rod worths. To perform the measurement, groups of control rods are individually inserted and removed from the core in a continuous motion at the maximum rod-stepping speed. This requires approximately 7 minutes per group. After each group is removed from the core, it is necessary to allow the flux to recover to the initial starting level. This requires about 6 minutes. During the time required for flux recovery, data processing is performed by the Westinghouse advanced digital reactivity computer (ADRC) to obtain the total rod worth and the integral rod worth as a function of group position. A group of rods can be measured in less than 15 minutes. The nine groups in a large four-loop PWR can be measured in about 2 hours.

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For more information, call your local Westinghouse Electric Company sales representative.

The ADRC and its supporting software have been specifically designed to support data acquisition and analysis with DRWM. The menu-driven system minimizes training and set-up time. Since the software runs on an IBM-compatible desktop computer, the ADRC can act as a fully functional PC when not in DRWM service.

For the initial application of the DRWM technique, Westinghouse provides:

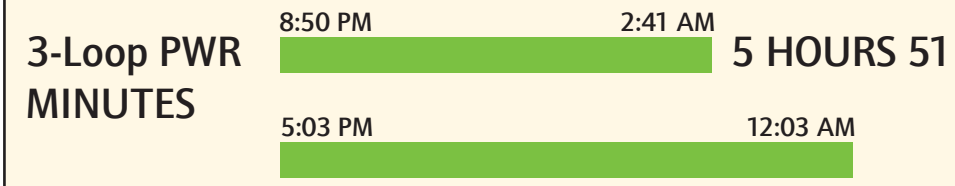
- A sample procedure for performing the test
- Aid to operators in preparing a test procedure specifically for their plant
- Westinghouse personnel to assist plant personnel during the actual test performance
- Training in both LPPT with DRWM and in the calibration and use of ADRC

The necessary corrections to the point-kinetics model in the reactivity computer to account for dynamic and static spatial effects are provided along with a set of pre-test predictions for rod worths. A post-test evaluation of the results is also provided. The ADRC required to perform the test can either be rented or purchased.

For subsequent cycles, plant operators or Westinghouse can perform the measurement. The analytical information is obtained from Westinghouse or the data can be generated by the plant operator through a technology transfer.

Actual Elapsed Time for LPPT with DRWM

Approach to Initial Criticality to "Results Verified and Cleared for Power Operation"



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