Background
The BEACON™ Core Monitoring System is an advanced core monitoring and support package that uses current instrumentation in conjunction with a three dimensional (3-D) nodal analytical methodology for online measurement and analysis of 3-D power distributions. The system performs core monitoring, measurement data reduction, analysis, and follow and prediction.

Description
The BEACON system can obtain core maps “on the fly” without waiting for equilibrium Xe conditions. This technique enhances accuracy during the initial ascent to full power, shortening it by up to 24 hours. This feature is also invaluable if a tilt (> 2%) in the core power distribution is detected on the initial ascent to power, because the plant can ascend without waiting for equilibrium conditions to take maps at reduced power.

The BEACON system incorporates the Westinghouse single-point incore/excore calibration technique. Quarterly incore/excore calibrations can be done without spending 12 hours at reduced power.

The BEACON system can also be very accurate (< 100 pcm) for predicting expected critical positions (ECPs) and shutdown margin (SDM) on the initial ascent to power or after a trip/forced outage. Utilities with the BEACON system estimate that its more accurate ECP prediction saves substantial time. Accurate knowledge of SDM helps the utility keep from over-borating the reactor coolant system, so that less dilution has to occur for the return to power after an outage, thereby reducing replacement power costs.

The BEACON system provides continuous core Xe distribution information, which enhances operator understanding and planning of control rod insertion withdrawal movements necessary to dampen oscillations during load follow or load change.

Benefits
- Can increase capacity factors by saving time on initial ascent to power
- Helps reduce the time at reduced power by 24 hours through the single-point excore calibration feature
- Can save many days of delay in the ascent to power in the event of a tilt in core power distribution
- Helps reduce operation and maintenance costs by more accurately predicting critical positions and by not delaying return to power after an outage due to excessive boration

Experience
In February of 1994, Westinghouse received U.S. Nuclear Regulatory Commission (NRC) approval of the BEACON system. The NRC concluded that the BEACON system provides the capability for accurate, continuous core monitoring in existing pressurized water reactors using currently available instrumentation.
The BEACON system has successfully been in operation since 1990 and is currently being used by over 50 nuclear power plants in eight countries around the world. The BEACON system has well over 400 reactor years of operational experience.

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