

# Byron Thermal Power Measurement

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B-21

## Ultrasonic Feedwater Flow Measurement Overview

- Ultrasonic feedwater flow instruments evaluated for use at Braidwood and Byron Stations in 1998
- Ultrasonic measurement of feedwater flow selected for Braidwood and Byron Stations in 1999
  - Initial testing conducted in late 1998, early 1999
- Ultrasonic feedwater flow instruments implemented at Braidwood in June 1999
- Ultrasonic feedwater flow instruments implemented at Byron Station in May 2000

## Byron Station Ultrasonic Flow Measurement Evaluation

- In May and June 1999 Braidwood and Byron used ultrasonic flow instruments to determine feedwater flow venturi correction factors
  - Byron Station - approximate 2% correction factor
  - Braidwood Station - approximate 1% correction factor using identical techniques
- Byron Station reviewed results and secondary plant parameters, with Corporate support
- Issues associated with secondary plant parameters and Braidwood/Byron correction factor difference needed further evaluation

## Byron Station Ultrasonic Flow Instrument Validation

June 1999-May 2000

- Dual instrument test at Byron with ultrasonic flow instruments
- Additional validation testing at Braidwood to compare data acquisition
- Ultrasonic flow instrument vendor (AMAG) review of Byron installation
- Industry benchmarking comparison of correction factors
  - Industry +/-3%, average ~ 1.7%
- Independent testing of AMAG technology at Alden Labs
- Internal Exelon Design Engineering review
  - Review of secondary plant parameters, fuel utilization and heat rates
  - Implementation procedures
- Byron implementation of ultrasonic flow instruments in May 2000
  - Correction factors of 1.7% (Unit 1) and 1.6% (Unit 2)

## Power Uprate Implementation

- 5% Power Uprate on Byron Units 1 & 2 in May 2001
  - Design utilized 1998 calorimetric data
  - Units 1 and 2 power increases not fully achieved
- 5% Power Uprate on Braidwood Unit 1 in Oct 2001
  - Expected power level achieved
- Difference in power level achieved between Braidwood and Byron Units 1 captured in Corrective Action Program
- 5% Power Uprate on Braidwood Unit 2 in April 2002
  - Expected power level achieved

## Review of Correction Factor Differences

- Exelon Independent Review in February 2002 concluded additional detailed evaluation needed
  - Correction factor reset to 0% as result of review
- Additional review of core burn-up and fuel depletion
  - Evaluated by Corporate Nuclear Fuel Management and Westinghouse
  - Correction factors reinstalled following results of the evaluation
- Thorough review of Byron ultrasonic flow measurement implementation
  - Electronics, dimensions, installation, data gathering, redundant flow meter, procedures, calorimetric
  - Concluded ultrasonic instruments measured flow per design and implemented properly

## Byron Apparent Cause Evaluation

- Apparent Cause Evaluation (ACE) completed in Oct 2002
  - Apparent cause of the unit differences indeterminate
- Byron Station evaluated issue in aggregate
  - Acknowledged dissenting view of ACE evaluator
- Byron Station concluded ultrasonic feedwater flow measurement instrumentation is within expected tolerance
  - Based on multiple validation reviews by vendor and Corporate Exelon expert
- Exelon Nuclear Fuel Management review concluded Byron core burn-up was within expected uncertainty analysis
- ACE concluded Byron was operating within licensed power limits
- Corrective actions require ongoing monitoring and trending of ultrasonic feedwater flow measurement