DOCKET NO. 50-245

# MILLSTONE NUCLEAR POWER STATION, UNIT NO. 1

## SUMMARY REPORT

## STARTUP PHYSICS TESTING PROGRAM FOR CYCLE 7



SEPTEMBER, 1979

SUMMARY REPORT

Cycle 7 Physics Startup Testing

Millstone Unit 1

1. Cold Control Rod Drive Testing

At the completion of the fuel shuffle and the reactor core verification, each control rod was friction and function tested and timed with a stopwatch. No abnormalities were noted.

2. Hot Control Rod Drive and Scram Time Test

After the reactor achieved hot operating conditions, each control rod was scrammed and timed using the Brush recorder. The following results were obtained:

Table 1

| % Scram Insertion | Tech. Spec. Time (sec.) | Actual Time (sec.) |
|---|---|---|
| 5 | 0.375 | 0.317 |
| 20 | 0.900 | 0.694 |
| 50 | 2.00 | 1.408 |
| 90 | 3.50 | 2.528 |

The average scram insertion time for 5%, 20%, 50%, and 90% for the three fastest control rods in a two-by-two array were also compared to the technical specification limits. Initially, all but one two-by-two array were within the technical specification limits for all insertion times. The two-by-two array which failed the 5% insertion time was retested when control rod was rescrammed, which resulted in satisfactory times for the three fastest control rods in a two-by-two array for all insertion times.

All control rods scrammed to 90% insertion in less than 7.00 seconds and are considered operable.

3. Shutdown Margin Test

The Shutdown Margin Test was performed using the In-Sequence Critical Data Method. The results indicated that the reactor core had a shutdown margin at BOC 7 of 1.79% ΔK/K with the strongest rod withdrawn. The technical specification limit is 0.47% ΔK/K.

4. Non-Voided Critical Eigenvalue Comparison for a Fixed-Control Rod Pattern

The expected critical control rod pattern was compared to the actual control rod pattern. The actual control rod pattern required to bring the reactor critical required 44 additional notches be withdrawn from the core as compared to the predicted critical control rod pattern. These additional notches are not considered an abnormality.

5. Power Distribution Comparison at a Given Control Rod Pattern and Power Level at 100% Rated Power

At 100% power, the following parameters were compared to the predicted values:

| Relative Axial Power Shape node | As Found | Predicted |
|---|---|---|
| 1 | 0.59 | 0.36 |
| 2 | 1.01 | 0.64 |
| 3 | 1.17 | 0.85 |

| | | |
|---|---|---|
| 4 | 1.21 | 1.14 |
| 5 | 1.20 | 1.18 |
| 6 | 1.20 | 1.20 |
| 7 | 1.14 | 1.21 |
| 8 | 1.14 | 1.20 |
| 9 | 1.09 | 1.19 |
| 10 | 1.02 | 1.15 |
| 11 | 0.82 | 0.96 |
| 12 | 0.40 | 0.55 |

| | | |
|---|---|---|
| Notches in the Core | 682 | 550 |
| Maximum Linear Heat Generation Rate, KW/FT | 9.49 | 9.36 |
| Maximum Average Planar Linear Heat Generation Rate Ratio | 0.792 | 0.78 |
| Minimum Critical Power Ratio | 1.5661 | 1.59 |

The actual number of notches in the core was well within the $\pm$1% $\Delta$K anomaly curve.

6. TIP Reproducibility and TIP Symmetry Test at 100% Rated Power

The TIP uncertainty test was performed at 100% power when xenon had stabilized. The results indicated the following uncertainties:

Total TIP Uncertainty - 3.95%
TIP Random Noise Uncertainty - 1.48%
TIP Geometric Uncertainty - 4.22%

Symmetric pairs of LPRM's were observed for symmetry. No abnormal conditions exist in the reactor core with the present 100% power control rod pattern.

7. Reactor Core Verification

At the completion of the fuel shuffle, the reactor core was verified. The verification was recorded on video tape and Core 7 was reconstructed by QC by viewing these recordings. Throughout the verification, no loading errors were found.