MONTICELLO NUCLEAR GENERATING PLANT LICENSE AMENDMENT REQUEST TO SUPPORT 24-MONTH FUEL CYCLES

METHODOLOGY SUMMARY AND COMPLIANCE WITH GENERIC LETTER 91-04

1.0 SUMMARY

This proposed license amendment involves revisions to the Monticello Nuclear Generating Plant Technical Specifications (TS) and Surveillance Requirements (SR) to change the operating cycle length to 24 months. Nuclear Management Company, LLC (NMC) plans to implement longer fuel cycles for the Monticello Nuclear Generating Plant during Operating Cycle 23. Cycle 23 is currently scheduled to begin in the spring of 2005. This license amendment request is submitted in support of the 24-month fuel cycle conversion. This request demonstrates that the proposed change will not adversely impact safety. This request is being submitted to the Nuclear Regulatory Commission (NRC) as a Cost Beneficial Licensing Action, and is similar to amendments issued for a number of other nuclear plants.

The proposed TS changes were evaluated in accordance with the guidance provided in NRC Generic Letter (GL) 91-04, “Changes in Technical Specification Surveillance Intervals to Accommodate a 24 Month Fuel Cycle” (Reference 1).

Historical surveillance test data and associated maintenance records were reviewed in evaluating the effect of the proposed change on safety. The licensing basis was reviewed for each revision to assure it was not invalidated. NMC has concluded that based upon the results of these reviews there is no adverse effect on plant safety due to revising the TS, or increasing the Surveillance Requirement (SR) intervals to 24 months, and the continued application of TS SR 4.0.B.

2.0 METHODOLOGY

The NRC provided generic guidance for evaluating a 24-month surveillance test interval for TS SRs and specified the evaluation steps needed to justify a 24-month surveillance interval in Generic Letter (GL) 91-04. The following discussion defines each step outlined by the NRC and provides a description of the methodology used by the NMC staff to complete the evaluation for each specific TS SR line item. This methodology is similar to the methodology used to justify extensions for a 24-month fuel cycle at the Southern Nuclear Operating Company Hatch Nuclear Plant. The NRC approved the Hatch methodology in a Safety Evaluation and license amendment dated July 12, 2002 (Accession No. ML022040085) (Reference 2).

A. Non-Instrumentation Changes

GL 91-04 identifies three steps to evaluate non-instrumentation changes:

Step 1:

…licensees should evaluate the effect on safety of the change in surveillance intervals to accommodate a 24-month fuel cycle. This evaluation should support a conclusion that the effect on safety is small.

NMC Evaluation

Each TS SR interval being changed was evaluated with respect to its effect on plant safety. The following information provides a description of the purpose of surveillance testing and a general description of the methodology utilized to justify the conclusion that extending the testing interval will have a minimal effect on safety.

The purpose of surveillance testing is to verify through the performance of the specified SRs that the tested TS Function/Feature will perform as assumed in the associated safety analysis. By periodically testing the TS Function/Feature the availability of the associated Function/Feature is confirmed. As such, with the extension of Monticello's operating cycle surveillance test interval (a reduction in Frequency) a longer period of time will exist between performances of a surveillance test.

Each associated non-instrumentation SR was evaluated to demonstrate that the potential impact on availability, if any, is small as a result of the change to a 24-month Frequency. A program plan defining the scope of the analysis to be performed (e.g., failure history analysis) and the methods for performing the analysis was developed. This process included:

- Identifying the 18-month surveillances in the TS.
- Determining the plant tests that verified the operation of the equipment associated with the surveillance.
- Collecting the test history associated with the Function.
- Evaluating the test history results.

The evaluations were based upon the fact that the Function/Feature is typically tested on a more frequent basis during the operating cycle by other plant programs (e.g., pump flow rate tested quarterly), or is designed to be single failure proof, or is highly reliable.

Justifications for extending the Instrument Functional Tests are provided based upon more frequent testing of system components and the high reliability of system design.

The more frequent testing may include the performance of Sensor Checks that verify that the instrument loop (i.e., transmitter and indication) is functional, and the system parameters (e.g., pump flow, system pressure, etc.) are within expected values. More frequent testing also includes Channel Functional Tests that verify the operation of circuits associated with alarms, interlocks, displays, trip functions, time delays and channel failure trips. Where a Sensor Check or Channel Functional Test is not required normally the circuit is simple and these checks will not provide any additional assurances the components are functional. Several cases (e.g., switches) determined that the more frequent testing may not verify the operation of the circuits directly associated with the switch, but may verify the operation of other circuits associated with the Function with which the switch is associated. Most cases determined that the same circuit (with the exception of the open loop associated with the switch) is used for manual operation of a pump and for pump automatic start functions. In these cases the Sensor Checks and Instrument Functional Tests will also test most of the circuit associated with the initiation, with the exception of the switch itself and the wire to connect the switch to the circuit.

Although no credit is taken for inservice pump or valve testing, this additional testing will also verify that the power and control circuits and relays and contacts associated with these circuits are operational. Inservice programs test components based upon performance-oriented schedules. The Maintenance Rule (MR) also supports testing based upon the safety significance of components and their availability or performance. Decreased component performance requires increased testing. Some system components may not be tested more frequently based upon the impact on plant operation [e.g., emergency core cooling system (ECCS) injection valves]. Performance of these components is tracked on the basis of system availability and increased failures or maintenance will be identified and corrected as a part of the plant's maintenance program.

Additionally, as stated by the NRC in the Safety Evaluation issued for the Peach Bottom Atomic Power Station Units 2 and 3 surveillance interval extension from 18 to 24 months (Reference 3), industry reliability studies for boiling water reactors (BWRs), prepared by the BWR Owners Group (Reference 4), show that overall safety system reliability is not dominated by logic system reliability, but by mechanical component reliability (e.g., pumps and valves) that are consequently tested on a more frequent basis, usually by the Inservice Testing Program. Since the probability of a relay or contact failure is small relative to the probability of mechanical component failure, increasing the Instrument Functional Test interval represents no significant change in overall safety system unavailability.

Step 2:

Licensees should confirm that historical maintenance and surveillance data do not invalidate this conclusion.

NMC Evaluation

The surveillance test history of the affected TS SRs was evaluated. This evaluation consisted of a review of surveillance test results and associated maintenance records. Only SR test failures were evaluated because failures detected by other plant activities, such as preventive maintenance tasks or surveillance tests performed at shorter intervals than 24 months were assumed to continue to detect failures. This review of surveillance test history validated the conclusion that the impact, if any, on system availability will be small as a result of the change to a 24-month testing frequency.

Step 3:

…licensees should confirm that the performance of surveillance at the bounding surveillance interval limit provided to accommodate a 24-month fuel cycle would not invalidate any assumption in the plant licensing basis.

NMC Evaluation

The evaluation of each TS SR determined the impact of the changes against the assumptions in the Monticello licensing basis. NMC concluded that these changes have no impact on the plant-licensing basis, although in some cases the change does require a change to licensing-basis information provided in the Monticello Updated Safety Analysis Report (USAR). Appropriate USAR changes will be incorporated and docketed under the 10 CFR 50.59 and 10 CFR 50.71(e) processes.

The Maintenance Rule (MR) Program trends failures that affect the safety functions of equipment. Any degradation in performance due to the extension of surveillance or maintenance activities will be captured under the existing MR Program.

B. <u>Instrumentation (Channel Calibration Changes):</u>

GL 91-04 identifies 7 steps for the evaluation of instrumentation changes.

<u>Step 1:</u>

Confirm that instrument drift as determined by as-found and as-left calibration data from surveillance and maintenance records has not, except on rare occasions, exceeded acceptable limits for a calibration interval.

<u>NMC Evaluation</u>

The effect of longer calibration intervals on the TS instrumentation was evaluated by performing a review of the surveillance test history for the affected instrumentation, including, where necessary, an instrument drift study. The failure history evaluation and drift study demonstrates that, except on rare occasions, instrument drift has not exceeded the current allowable limits.

Monticello had been pursuing the replacement of some older model transmitters with newer qualified transmitters. Several of the Rosemount transmitters used in the late1980's were replaced due to an industry-identified potential for failure. A generic Rosemount failure mode was identified, during 1986 and 1987, based upon the failure of five Rosemount model 1153 HD5PC differential pressure transmitters at Northeast Utilities', Millstone Nuclear Power Station, Unit 3. These failures were documented in NRC Information Notice No. 89-42, "Failure of Rosemount Models 1153 and 1154 Transmitters" (Reference 5) and NRC Bulletin No. 90-01, "Loss of Fill-oil in Transmitters Manufactured by Rosemount" (Reference 6).

During power operation, the Millstone operators noted that the signal from the Rosemount 1153 transmitters were deviating from redundant channel signals and that the transmitters were indicating reduced levels of process noise. Further investigation by the NRC and Rosemount lead to identification of the root cause as oil loss from the Rosemount sealed sensing module. NRC Bulletin No. 90-01 (Reference 6) and Bulletin No. 90-01, Supplement 1 (Reference 7) defined specific replacement and testing criteria for any suspected transmitters. Additionally Supplement 1 defined a maturity period after which the probability of failure due to oil loss is greatly reduced and monitoring the transmitters may be performed at longer intervals (not exceeding 24 months).

For Monticello, all affected Rosemount transmitters have been replaced or have successfully exceeded the maturity time. There are no ongoing actions or enhanced surveillance monitoring programs for these transmitters.

Step 2:

Confirm that the values of drift for each instrument type (make, model, and range) and application have been determined with a high probability and a high degree of confidence. Provide a summary of the methodology and assumptions used to determine the rate of instrument drift with time based upon historical plant calibration data.

NMC Evaluation

NMC has performed drift evaluations, based upon a Monticello specific Drift Analysis (Instrumentation and Controls) (Enclosure 4) using Microsoft® Excel Spreadsheets based upon EPRI TR-103335, "Guidelines for Instrument Calibration Extension/Reduction Programs," Rev. 1, (Reference 8). Quattro-Pro®, Lotus 1-2-3® and MathCad® applications were used to verify the analysis.

The Monticello drift analysis utilizes the as-found/as-left (AFAL) analysis methodology to statistically determine drift for current calibration intervals. Using recommendations from the EPRI TR-103335 and NRC review comments to the TR, the time dependence of the current drift was evaluated, where possible, and conservative assumptions were made in extrapolating current drift values to new drift values to be used for 24-month fuel cycles. Table 1 of this Enclosure provides a Summary of Drift Evaluations for the Monticello Two Year Fuel Cycle Extensions. Enclosure 2 of this submittal lists the specific NRC comments on the EPRI TR-103335 and shows how each comment was considered in the development of the Monticello drift methodology and the 24-Month Fuel Cycle Extension Project.

The AFAL methodology utilizes historical data obtained from surveillance tests. The raw data is conditioned prior to use for the drift calculation. The conditioning consists of eliminating tests or individual data points that do not reflect actual drift. The removed data is generally limited to data associated or affected by:

- Instrument failures,
- Procedural problems that affect the calibration data,

- M&TE problems that affect the calibration data, or
- Human performance problems that affect the calibration data.

Historical data obtained from surveillance tests also provided statistical outliers that in limited cases did not meet the above criteria and were removed from the sample set. The values that were removed were well outside the expected performance conditions and in most cases, resulted in equipment replacement or repair during the next calibration. The Monticello trending program, in the future, will require a prompt analysis of any instrument performance substantially outside of expected conditions. This performance will then result in timely replacement of the instrument or an evaluation of the impact of the instrument's performance on the assumptions and values used in the drift or setpoint analysis. These actions will effectively identify failures and potential failures of the instrumentation.

Calibration data conditioned as described above was added to spreadsheets. The spreadsheets were used to calculate the difference between the current as-found value and the previous as-left value. This difference is the drift and can be expressed in units, percent of span, or percent of setting.

The spreadsheet for each calibration point is used to determine the following:

- Tolerance Interval Factor (95%/95% for this analysis - meaning that the results have a 95% confidence (γ) that at least 95% of the population will lie between the stated interval (P) for a sample size (n).),
- Standard Deviation,
- Mean.

The Excel spreadsheets were also used to perform other statistical analysis operations to identify outliers and determine normality of the data. Additional analyses were performed to verify that appropriate groupings were used and to determine if specific indications of a time drift magnitude correlation exist. The final calculation of the tolerance interval is based upon a Time Dependence Analysis (normally a binning technique) performed using Microsoft® Excel spreadsheets.

Instruments that were recently installed or where the drift analysis process could not be applied have a different methodology utilized to demonstrate that the drift was acceptable. Each instrument where the EPRI program was not utilized to evaluate the drift data, a summary of the methodology used was prepared and is contained in the specific discussion of the change included as Enclosure 5 to this submittal.

Step 3:

Confirm that the magnitude of instrument drift has been determined with a high probability and a high degree of confidence for a bounding calibration interval of 30 months for each instrument type (make, model number, and range) and application that performs a safety function. Provide a list of the channels by TS section that identifies these instrument applications.

NMC Evaluation

The methodology described in the previous section was used to determine the magnitude of instrument drift with a high degree of confidence and a high degree of probability for a bounding calibration interval of 30 months for each instrument make and model number and range. Enclosure 3 lists the associated instruments, including manufacturer and model number for each affected TS SR, where drift analyses were performed using the drift methodology provided in Enclosure 4.

Step 4:

Confirm that a comparison of the projected instrument drift errors has been made with the values of drift used in the setpoint analysis. If this results in revised setpoints to accommodate larger drift errors, provide proposed TS changes to update trip setpoints. If the drift errors result in revised safety analysis to support existing setpoints, provide a summary of the updated analysis conclusions to confirm that safety limits and safety analysis assumptions are not exceeded.

NMC Evaluation

NMC uses the setpoint methodology provided in GE NEDC-31336, “General Electric Setpoint Methodology” (Reference 9). Setpoint assessments were performed for Monticello in which the calculated 30-month drift values replaced the vendor, or assumed, drift values from each setpoint calculation. The Nominal Trip Setpoints (NTSPs) were assessed, considering the 30-month drift. Setpoint calculations will be revised to consider 30-month drift and to develop NTSPs. Plant setpoints have been revised or will be revised prior to exceeding the 22.5 months of operation (18 months + 25%) where the new NTSP is more conservative than the plant setting. An evaluation was performed with any needed NTSP changes identified and included in this License Amendment Request where the NTSP is less conservative than the plant setpoints. NTSPs were changed where it was not possible to accommodate the projected drift by adjusting plant settings (higher potential for spurious trip). There was sufficient margin within the existing safety analysis to accommodate the revision in the NTSPs without revising the safety analysis in each of these cases.

To allow for setpoint changes where the evaluation identified there was sufficient operating margin (e.g., spurious trip avoidance probability was low) the NTSPs were evaluated for adjustment.

The surveillance interval was extended to a 24-month (+ 25%) interval based upon other, more frequent testing (Quarterly Channel Functional Test, including calibration if necessary) or justification based upon information obtained from the instrument manufacturer if an instrument was not in service long enough to establish a calculated drift number.

In no case was it necessary to change the existing analytical limit or safety analysis to accommodate a larger instrument drift error.

Step 5:

Confirm that the projected instrument errors caused by drift are acceptable for control of plant parameters to effect a safe shutdown with the associated instrumentation.

NMC Evaluation

The calculated drift values were compared to drift allowances in the setpoint calculation, other uncertainty analyses and the GE design basis. An evaluation was performed, as shown in Enclosure 4, to verify the instruments could still be effectively utilized to perform a safe plant shutdown for instrument strings that provide process variable indication.

In no case was it necessary to change the existing safe shutdown analysis to account for failures or drift.

Step 6:

Confirm that all conditions and assumptions of the setpoint and safety analyses have been checked and are appropriately reflected in the acceptance criteria of plant surveillance procedures for channel checks, channel functional tests, and channel calibrations.

NMC Evaluation

In the cases where the extrapolated drift was less than the value assumed in the Monticello calculations, there was no change to plant surveillance procedures. The plant setpoint calculations will be revised to incorporate the drift values and to indicate NTSPs prior to license amendment implementation.

Cases where the extrapolated drift was greater than the value assumed in the setpoint calculation setpoint assessments were developed to calculate a new NTSP. No changes were made to the plant surveillance procedures where the existing plant setpoint is conservative to the NTSP. This license amendment request proposes revisions to Trip Settings where the existing plant setpoint is less conservative than the NTSP. The plant setpoint calculation and the associated plant surveillance procedures will be revised upon approval of this license amendment. The plant surveillance procedures were verified to appropriately reflect the assumptions and conditions of the setpoint calculations.

The assumptions in the safety and setpoint analysis were properly reflected in the acceptance criteria for plant surveillance procedures prior to the evaluation of these procedures for changes in Frequency. The review determined that the acceptance criteria do not require revision due to the change in the surveillance test Frequency for any of the associated TS functions.

Step 7:

Provide a summary description of the program for monitoring and assessing the effects of increased calibration surveillance intervals on instrument drift and its effects on safety.

NMC Evaluation

Instruments with TS calibration surveillance frequencies extended to 24 months will be monitored and trended. As-found and as-left calibration data will be recorded for each calibration activity. This data will be evaluated for trends against data collected during previous calibrations. This will identify occurrences of instruments found outside of their Allowable Value, or instruments whose performance is not as assumed in the drift or setpoint analysis.

An evaluation will be performed to determine if the assumptions made to extend the calibration frequency are still valid, to evaluate the effect on plant safety, and to evaluate instrument operability when as-found conditions are outside the Allowable Value.

The Monticello trending program will address setpoints for TS calibration surveillance frequencies extended to 24 months found to exceed the expected drift for the instruments. The Monticello trending program will require that any time a setpoint value is found to exceed the expected drift, an additional evaluation will be performed to ensure the instruments performance is still enveloped by the assumptions in the drift or setpoint analysis. The trending program will also plot setpoint or transmitter As-Found/As-Left (AFAL) values to verify that the performance of the instruments is within expected boundaries and that adverse trends (repeated directional changes in AFAL even of smaller magnitudes) are detected and evaluated.

The Maintenance Rule (MR) Program trends failures that affect the safety functions of equipment. Any degradation in performance due to the extension of surveillance or maintenance activities will be captured under the existing MR Program.

3.0 CONCLUSION

NMC evaluations to justify a change in surveillance intervals necessary to support 24-month fuel cycles have been completed. These evaluations conform with the guidance provided in GL 91-04. The specific evaluations for each Monticello TS and SR being changed are contained in Enclosure 5 for both the non-instrumentation changes and the instrumentation changes. In addition, a No Significant Hazards Consideration Determination was performed in accordance with 10 CFR 50.92 for the proposed changes to the TS, this determination is also included in Enclosure 5.

4.0 COMMITMENTS WITHIN THIS LETTER

- Monticello will implement a trending program to address setpoints for TS calibration intervals extended to 24 months. Setpoints found to exceed the expected drift for the instruments would require an additional evaluation to ensure the instrument's performance is still enveloped by the assumptions in the drift or setpoint analysis. The trending program will also plot setpoint or transmitter As-Found/As-Left (AFAL) values to verify that the performance of the instruments is within expected boundaries and that adverse trends (repeated directional changes in AFAL even of smaller magnitudes) are detected and evaluated.

5.0 REFERENCES

1. NRC Generic Letter No. 91-04, “Changes in Technical Specification Surveillance Intervals to Accommodate a 24 Month Fuel Cycle,” dated April 2, 1991.

2. NRR Safety Evaluation for Southern Nuclear Operating Company Hatch Nuclear Plant approving 24-month fuel cycle extension dated July 12, 2002.

3. NRR Safety Evaluation for Peach Bottom Atomic Power Station Units 2 and 3 License Amendments 179 and 182, respectively, Operating License DPR-44 and DPR-56, Dockets D50-277 and D50-278, dated August 2, 1993.

4. “Industry Reliability Studies for Boiling Water Reactors (BWRs),” NEDC-30936.

5. “Failure of Rosemount Models 1153 and 1154 Transmitters,” NRC Information Notice No. 89-42.

6. “Loss of Fill-Oil in Transmitters Manufactured by Rosemount,” NRC Bulletin No. 90-01, March 9, 1990.

7. “Loss of Fill-Oil in Transmitters Manufactured by Rosemount,” NRC Bulletin No. 90-01, Supplement 1, December 22, 1992.

8. “Statistical Analysis of Instrument Calibration Data, guidelines for Instrument Calibration Extension/Reduction Programs,” EPRI TR-103335, Revision 1, October 1998.

9. “General Electric Instrument Setpoint Methodology,” NEDC 31336.

Table 1
Summary of Drift Evaluations

Calc No.	Device	Assumptions For Extrapolation
CA-03-019	Rosemount 1153DB4RC Level & Flow Transmitters	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. The worst-case data point for drift, as determined by a comparison of the value, is applied across the entire instrument span.
CA-03-054	Agastat ETR14D3 Time Delay Relays	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. This analysis was performed with a total of 29 analyzed drift values. These relays were replaced in 1994 and only a limited number of calibrations have been performed on them. The total population consisted of 30 data points, one of which was judged to be erroneous and removed from the final set. In most cases, a data set is considered statistically invalid unless 30 data values are used. A review of the data within the final data set shows the data to be relatively consistent, and the Chi-Squared results show that the data is likely from a normal distribution. This is evidence that the data distribution is likely to be reasonablely accurate as analyzed. Additionally, the method of determining the analyzed drift values for 29 data values uses a high Tolerance Interval Factor (TIF) for 95/95 confidence providing the required conservatism for use in setpoint calculations. Therefore, although this study only analyzes 29 drift data points, the results are conservative for the application.

Table 1 (Continued)

CA-03-055	Barksdale B2T-A12SS Pressure Switches	The drift is conservatively treated as strongly time dependent although time dependent drift behavior was not indicated. (Enclosure 3)
CA-03-057	Fenwal 01-1700200-090 Temperature Switches	The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3)
CA-03-058	GE 12NGV15A21 Undervoltage Relays	The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3)
CA-03-061	GE TFJ Electrical Protection Assembly Timing Function	The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3)
CA-03-065	ITE 27H211B0175 Undervoltage Relays	The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3)
CA-03-068	Rosemount 1151DP4E22 Level Transmitters	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. The drift data for the calibration point closest to the trip point is used to most accurately predict the instrument performance near the span point of intrest. The use of a Tolerance Interval Factor for a 95/95 confidence level provides the required conservatism for use in the setpoint calculation for this application.

Table 1 (Continued)

CA-03-069	Rosemount 1151GP9A22 Pressure Transmitters	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. The worst-case data point for drift, as determined by a comparison of the value, is applied across the entire instrument span.
CA-03-072	Rosemount 510DU Trip Units	This data did not contain enough time diversity to perform a valid time dependency test. The drift interval plot prediction line is essentially flat. Although time dependent drift behavior was not indicated, the drift is conservatively treated as moderately time dependent. (Enclosure 3)
CA-03-073	Rosemount 1153DB7 Differential Pressure Transmitters	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. The worst-case data point for drift, as determined by a comparison of the value, is applied across the entire instrument span.
CA-03-074	Rosemount 1153GB9A Pressure Transmitters	1. The drift is conservatively treated as moderately time dependent although time dependent drift behavior was not indicated. (Enclosure 3) 2. The worst-case data point for drift, as determined by a comparison of the value, is applied across the entire instrument span.

Table 1 (Continued)

CA-97-110	Rosemount 710DU0TR Trip Units	The total population consisted of 12 data points. These trip units were installed in 1998 and only a limited number of surveillances have been performed on them. Evaluation of the available drift data shows that the drift as determined from the as-found/as-left calibration data has been within the vendor specified drift values. Additionally, three of the four trip units have not required adjustments in any of the three surveillances performed. The fourth trip unit required adjustments during the first two surveillances performed. A requirement to evaluate the performance of this trip unit following the next scheduled surveillance has been entered into the corrective action program. The stability of the trip units demonstrates that the proposed increase in the calibration interval will have little or no effect on drift data for these instruments. (Enclosure 3)