U.S. NUCLEAR REGULATORY COMMISSION

REGION I

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| Licensee: | Niagara Mohawk Power Corporation |
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# EXECUTIVE SUMMARY

This inspection involved a review of Nine Mile Point Unit 1 implementation of 10 CFR 50.65, the maintenance rule. The report covers a one week on site inspection by regional and NRR inspectors during the week of October 7, 1996.

MAINTENANCE

Overall, the team judged the maintenance rule program for Nine Mile Point Unit 1 to be weak.

There was a general problem of not documenting the methods, processes and results of maintenance rule implementation. Also, there was a lack of documented justification when not following the NUMARC 93-01 guidance.

Eleven risk significant systems and some functions of three other risk significant systems did not have any availability criteria or justification of their absence. RPS did not have acceptable reliability performance criteria for one function or any availability criteria for two other functions. The use of MPFFs as a surrogate of reliability to evaluate performance, without specific justification, is not adequate and did not meet the intent of the rule. These represented an apparent violation of 10 CFR 50.65(a)(2).

The approach to scoping SSCs based upon their functions appeared reasonable. However, documentation for justifying or supporting scoping decisions was weak or absent. The NMPC scoping effort failed to identify six non-risk significant systems that should have been included in the maintenance rule program. In addition, a number of SSCs were identified by the expert panel on August 13, 1996 to be included in the scope, but as of October 11, 1996 had not been incorporated into the program. These actions represented an apparent violation of 10 CFR 50.65(b).

The expert panel had performed many of its functions in an acceptable manner, and the selection of individuals currently or previously SRO licensed or certified to be expert panel members was considered to be a positive attribute. However, in several areas, the effectiveness of the expert panel was diminished, including weak documentation of risk significance decisions, the absence of guidance for the risk significance determination process, and missing reviews of systems being placed in (a)(1) and the goals for such systems. This represented an unresolved item.

The PRA level of detail, data, truncation limits, and quality were acceptable to perform risk ranking. Except for the diesel driven fire pump, the risk ranking was appropriate. A followup item has been established to review the basis for the fire pump risk ranking.

The approach taken by NMPC to balance reliability and unavailability would not accomplish the objective of preventing failures of SSCs while minimizing unavailability and is considered to be a followup item to review the actual balancing once it is performed.

Executive Summary

The NMPC procedures provide sufficient controls for evaluation and management of on-line maintenance. Performance criteria for monitoring structures were acceptable. Industry operating experience had been used in setting goals and criteria.

The corrective actions established for two (a)(1) systems were appropriate and had been based on good root cause evaluations. However, the goals and monitoring for these systems were weak and lacked direct measures to judge the effectiveness of the corrective actions, and thus, represented an apparent violation of 10 CFR 50.65(a)(1).

Monitoring and trending of performance had problems that severely limited effectiveness, including untimely cause determinations after exceeding performance criteria, incorrect MPFF determinations, in part, due to to weak guidance, limitations in the DER process and data, and the ineffective performance criteria (as previously noted). These problems represented an apparent violation of 10 CFR 50.65(a)(2).

Engineers, engineering managers, and licensed operators were knowledgeable of the maintenance rule and their responsibilities within the maintenance rule program.

## Report Details

## II. MAINTENANCE

### M1 CONDUCT OF MAINTENANCE (62706)

The primary focus of the inspection was to verify that the Niagara Mohawk Power Corporation (NMPC) had implemented a maintenance monitoring program, which satisfied the requirements of the maintenance rule (10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.") The inspection was performed by a team of five inspectors, which included regional and headquarters inspectors.

### M1.1 SSCs Included Within the Scope of the Rule

a. Inspection Scope

The team reviewed the scoping documentation to determine if the appropriate SSCs were included within their maintenance rule program in accordance with 10 CFR 50.65(b). The team used Inspection Procedure 62706, NUMARC 93-01 and Regulatory Guide 1.160 as references during the inspection.

b. Observations and Findings

NMPC used the system engineers and maintenance rule expert panel to identify the functions of the structures, systems, and components (SSCs) and determine whether the functions were within the scope of the rule. For each SSC, a list of functions were developed and the function individually evaluated for inclusion in the rule. Attachment 1, "Integrated Scoping Matrix," to procedure N1-MRM-REL-0104 contained the results of their scoping determination. A total of 296 functions were identified in the matrix, of which 187 functions were within the scope of the rule. The Integrated Scoping Matrix contained a column for references or notes which had no information in it. The facility indicated that this information would be added to the matrix in about a month. The team found that lack of documentation was a common problem during the inspection.

The team reviewed reference material associated with the facility and selected an independent sample of SSCs and their functions that the team believed to be within scope of the maintenance rule. During the onsite review the team used this scoping sample to help determine if the facility had adequately identified the SSC functions included within scope. The team also reviewed SSC functions that were omitted by the facility from the scope to determine the appropriateness of their actions. Based upon the team's review the following discrepancies were noted.

The control rod position indication system (RPIS) was not included in scope or listed in the Integrated Scoping Matrix. The team noted that determining whether any control rod had not inserted to or beyond position 04 was an EOP (emergency operating procedures) entry condition. Therefore, the team determined that this function should have been included in scope and listed in the Integrated Scoping Matrix. On October 9, 1996, the facility issued Deviation/Event Report (DER) 1-96-2542 to include the "all rods in" function of the RPIS to be in scope of the rule.

The communications system included four functions:

- COMM-F1, Telephone-Provide reliable communications via conventional telephone lines within the plant and with various offsite organizations.
- COMM-F2, Gai-tronics-Provide reliable communications for personnel onsite.
- COMM-F3, Maintenance-Provide reliable communications within the plant between patched areas via use of headsets.
- COMM-F4, Radios-Provide reliable communications via radios and repeaters between onsite personnel and when necessary, key offsite agencies.

The team noted that effective and reliable communications systems are essential for mitigating accidents and transients, and while not explicitly called out in the EOPs, were implicitly necessary to complete many of the actions required by EOPs. The facility indicated they had not included any of these functions within scope because there were several alternate methods of communication and the EOPs did not specifically mandate any one method. The team indicated that redundancy was not a valid basis for excluding SSCs from the scope of the rule. The team judged that the communication function should have been included within scope.

The main generator and auxiliaries system function, GEN-F3, is to supply hydrogen to the main generator to keep it cool. The team noted that loss of this function could cause a main generator failure, which could cause a reactor trip. The facility acknowledged that while loss of this function could cause a scram, immediate operator actions to reduce power could prevent the scram. The team noted that immediate operator actions are not a valid basis for excluding SSCs from the rule and the function should have been included in scope.

The team noted that the instrument air system includes a safety related function to isolate the safety related portions of instrument air from the nonsafety related portions. This function was not included in the Integrated Scoping Matrix but should have been. On October 10, 1996, the facility issued DER 1-96-2568 to include the instrument air isolation function in scope.

The plant lighting system function, PLS-F01, is to provide emergency lighting in the event of loss of normal lighting. The team noted that plant lighting was necessary to mitigate accidents and transients, and while not explicitly called out in the EOPs were implicitly necessary to complete many of the actions required by the EOPs. The facility indicated that this function was not included in the scope of the rule because the plant has a number of alternative methods available to provide emergency lighting. As noted for the communications system, redundancy is not an appropriate basis for excluding an SSC from the scope of the rule. The team judged that the emergency lighting system function should have been in scope.

EOP-5, "Secondary Containment Control," specifies that reactor building sumps and drains be monitored and operated to control water levels in the reactor building. The team noted that some of the equipment associated with this function was not included in the Integrated Scoping Matrix, and should have been included in the scope of the rule.

The team discussed with the facility the justifications for not placing the SSCs and associated functions identified above in the scope of the rule. In addition to the above actions taken to add certain SSCs within scope, the facility issued DER 1-96-2574 on October 10th to re-evaluate whether communications (COMM F1, -F2,-F3,-F4), emergency lighting PLS-F01), generator hydrogen cooling (GEN-F3), and reactor building floor drains should be within the scope of the rule.

Notes from an expert panel meeting on August 13, 1996, were reviewed by the team. The expert panel determined that a number of additional functions regarding annunciators should be added to the Integrated Scoping Matrix and included within the scope of the rule. The expert panel notes did not indicate that the functions were added as a result of new information. Some of the functions recommended for addition to the scope of the rule included:

> Function ANN-F1, Provide operations personnel with audible and visual indication of abnormal plant conditions. This function is used in the EOPs.
>
> Function ANN-F2, Provide separation between safety related 125 V DC busses and the nonsafety related annunciator system. This function is safety related.
>
> Function CW-F2, Maintain forebay level for miscellaneous systems (gates, screens, and rakes). Both safety related and nonsafety related equipment are included in this function. The function came under the scope of the rule because the equipment is either safety related, nonsafety-related whose failure could fail a safety function, or nonsafety-related whose failure could cause a scram or safety system actuation.

The facility had included the notes from the expert panel's August 13th meeting in a "maintenance rule change control form," dated September 15, 1996. These changes had not been incorporated into the facility's maintenance rule procedures.

c. Conclusions

The approach to scoping SSCs on the basis of the functions they perform appeared to a reasonable method for implementing the rule. Documentation for justifying or supporting scoping decisions was weak. The bases for the scoping determinations was not included in the Integrated Scoping Matrix. In addition, the facility procedures had not been updated to include the scoping decisions made by the expert panel on August 13, 1996.

10 CFR 50.65(b) establishes the scoping criteria for selection of SSCs to be included within the maintenance rule program. 10 CFR 50.65(c) requires that licensees implement the maintenance rule no later than July 10, 1996. As of October 11, 1996, the facility had not included a number of systems and components within the scope as required. These include the following SSCs identified by the team:

- control rod position indication system
- communications system
- emergency lighting
- generator hydrogen cooling
- instrument air system (isolation function)
- reactor building sumps and drains

In addition, the following SSCs had been identified by the facility to be in scope, but there was no justification why the systems were not in scope on July 10, 1996.

annunciator system
circulating water system

Failure to include these SSCs within the scope of the maintenance rule program is an apparent violation of 10 CFR 50.65(b) (EEI 50-220/96-12-01).

## M1.2 Safety (Risk) Determination, Risk Ranking, and Expert Panel

a. Inspection Scope

Paragraph (a)(1) of the rule requires that goals be commensurate with safety. Additionally, implementation of the rule using the guidance contained in NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," requires that safety be taken into account when setting performance criteria and monitoring under Paragraph (a)(2) of the rule. This safety consideration would be used to determine if the SSC should be monitored at the system, train or plant level. The team reviewed the methods and calculations that NMPC had established for making these safety determinations. The team also reviewed the safety determinations that were made for the specific SSCs reviewed during this inspection.

NUMARC 93-01 recommends the use of an expert panel to establish risk significance of SSCs by combining probabilistic risk assessment (PRA) insights with operations and maintenance experience, and to compensate for the limitations of PRA modeling and importance measures. NMPC used an expert panel to establish risk significance and other maintenance rule related functions. The team reviewed the procedures for controlling the expert panel activities and recent expert panel meeting notes. The team also reviewed other expert panel documentation and discussed their decisions with panel members.

b. Observations and Findings on Expert Panel

Procedure NIP-REL-01, "Maintenance Rule," Revision 00, provided guidance and expectations for the expert panel, and described it as a committee of station personnel assigned to provide oversight and consistency for maintenance rule implementation. The expert panel meetings are held as necessary, and meeting quorums consist of a chairperson and one member each from operations, technical support (system engineering), maintenance, and engineering (fuels and analysis/PRA). Members must be qualified as a Technical Reviewer (QTR) and Applicability Reviewer/Safety Evaluator (QARSE). Although not specified by NIP-REL-01, all members of the expert panel with the exception of the chairpersons (maintenance rule coordinator) and the engineering members were current or previous SRO licensed or certified individuals. The chairperson is a non-voting panel member.

NIP-REL-01 describes the expert panel functions, which include:

- review changes within the maintenance rule program
- review Individual Plant Examination (IPE) updates
- review goal setting activities, including (a)(1) corrective action plans

- review placement and removal of SSCs from monitoring condition (a)(1)

- review periodic assessment results and resolutions

The team verified that appropriate procedural controls were in place to inform the panel of plant modifications and changes to the IPE that had the potential to affect the maintenance rule program.

Based on discussions with the panel and the results of the process, the panel's ranking of SSCs appeared to be thorough and met the intent of NUMARC 93-01. However, no procedural guidance existed to control the risk significance classification process. The team learned that the process had been described in detail in a procedure but the procedure had been discarded.

The team reviewed decisions made by the expert panel regarding scoping and risk significance. The panel determined that thirteen system functions evaluated by PRA as potentially risk significant were not risk significant. Additionally, the panel determined that eleven system functions not modeled by PRA and four system functions modeled but not considered potentially risk significant by PRA were risk significant. The only documentation available for these decisions were the expert panel's voting sheets, which did not always provide sufficient justification for the decisions. After discussions with the team, NMPC acknowledged the weakness in documentation and issued DER 1-96-2571. The team discussed with panel members the basis for decisions on thirteen functions that the panel determined not to be risk significant. The panel members provided an adequate bases for twelve of the thirteen decisions. The team found the reasons for not classifying the diesel driven fire pump (Function FDP-F2) risk significant to be inappropriate. This issue is discussed below.

The team determined that the panel did not review the containment nitrogen system (CTN-F17) or the reactor recirculation system (RR-F2) functions when these systems were placed in (a)(1) from (a)(2). The containment nitrogen system was placed in (a)(1) on April 9, 1996 and the reactor recirculation system was placed in (a)(1) on July 1, 1996. The panel's default regarding review of these activities had little consequence to placing these two systems in (a)(1), as the placements were appropriate and were not delayed or deferred. Nonetheless, the absence of the panel reviews limited the effectiveness of the panel and was not in accordance with NMPC expectations as described in panel guidance documents. The facility issued DER 1-96-2428, dated October 3, and DER 1 96-2519, dated October 8 to address these problems.

As noted in section M1.6, the panel had not reviewed the goals established for (a)(1) systems, despite NMPC guidance that the panel was expected to perform such reviews.

c. Conclusions on Expert Panel

The expert panel had performed many of its functions in an acceptable manner, and the selection of individuals currently or previously SRO licensed or certified to be expert panel members was considered to be a positive attribute. However, in several areas, the effectiveness of the expert panel was diminished, including weak documentation of risk significance decisions, the absence of guidance for the risk significance determination process, and missing reviews of systems being placed in (a)(1) and the goals for such systems. As noted in section M1.6, the (a)(1) goals were weak and the expert panel had missed an opportunity to improve the goals because the panel never reviewed the goals. The team concluded that the above areas of ineffectiveness represented an unresolved item (URI 50-220/96-12-02).

b. Observations and Findings on Risk Ranking

A plant specific PRA was used to rank SSCs with regard to risk significance. NMPC followed NUMARC 93-01 recommendations in providing their expert panel with information on three importance measures; risk reduction worth (RRW), risk achievement worth (RAW), and core damage frequency contribution (CDF). Information was developed for each system function that defined its value of RAW, RRW, and inclusion in the top 90% of the CDF sequences. The information was quantified from the Nine Mile Point Unit 1 individual plant examination (IPE) for internal events and from the IPE for external events (IPEEE). NMPC also presented these importance measures for the large early release frequency (LERF) sequences.

The IPE for ranking SSCs used the plant operating history to quantify initiating events. Twenty-three initiating events were quantified in the IPE. These included seven loss-of-coolant accidents (LOCA), eight plant specific support system failures, and eight generic transients. Each initiating event was included in an appropriate class of initiating events, and each class of initiating events was modeled with an event tree. The team noted that NMPC is not tracking the accuracy of the initiating event frequency to confirm the IPE assumptions. The team was informed that initiating event frequency would be updated if the IPE was revised.

The IPE modeled recirculation pump seal LOCAs as a result of loss of seal cooling during transient and accident sequences. This is of interest since the plant design includes isolation condensers, which do not inject to the reactor vessel. The IPE modeled support system dependencies in two large support system fault trees. Common cause failures were modeled within systems.

Because of changes to procedures, plant modifications, and equipment aging, only more recent plant specific data were used to quantify failures of mitigating system components. Generic failure data that had been updated by Bayesian analysis with plant specific data were used for hardware failures and maintenance unavailabilities. To quantify failures of standby components to operate on demand, plant data from August 1988 through June 1992 were used. To quantify the failures of operating components, plant data from June 1984 through October 1991 were used. The team noted that NMPC provided failure and common cause data for a general category of low pressure centrifugal pumps. This was based upon plant data for all of the low pressure centrifugal pumps.

NMPC quantified the core damage accident sequences using the large event tree/small fault tree technique. A truncation value of 1E-11 was used for quantification of all initial events. The team found this truncation level to be adequate. The overall CDF reported in the IPE was 5.5E-6 per reactor year. The low CDF is due to the low contribution of transient events, 8E-7 per reactor year. (The average transient CDF for boiling water reactors is an order of magnitude higher.) Station blackout contributes 64%, transients 14%, LOCAs 13% and anticipated transients without scram (ATWS) 10%.

As a sensitivity study, NMPC re-quantified the Level 1 IPE model assuming no human errors. Changes in the top event importance ranking for the perfect operator model were then compared to the baseline model. The importance of some equipment oriented top events, such as vapor suppression vacuum breakers, the condensate storage tank and high pressure injection, were reduced as operator actions in aligning containment spray and depressurizing the reactor were assumed more reliable. However, equipment such as the reactor vessel level instrumentation increases in importance, because its failure would lead to an undesirable level when operators lower water level while mitigating an ATWS.

The team noted that NMPC had not made an update to the SSC risk ranking that reflected SSCs at their "allowed" unavailability or their maintenance preventable functional failure (MPFF) limits for reliability. This could impact the present risk ranking. The team considered this a weakness.

Function FDP-F2 for fire protection was determined to be non-risk significant by the expert panel. This function is to provide water from either the electric or diesel fire water pump as a backup water source for the reactor, emergency condensers, diesel generator, spent fuel pool, or emergency service water. The IPE identified the diesel engine driven fire water pump as one of the top four systems important to safety. This function met all three of the importance criteria (RRW, RAW, and the top 90% sequences) for both core damage frequency and large early release frequency. The expert panel took credit for cross-connections to the Unit 2 fire water system and to the city water supply. These water supplies were not modeled in the IPE. The team noted that there were no engineering evaluations available to support use of these two sources, e.g., although possibly available to provide water, the volume and pressure of water from these sources were undetermined. Based upon the information presented, the team found the reasons for not classifying the diesel driven fire pump to be risk significant to be inadequate.

The other systems identified as important to safety by the IPE were within risk significant functions. These include emergency AC and DC power and relief valve reclosure. Additionally, one of the human reliability analysis actions identified as important to safety by the IPE related to a maintenance function. It concerned calibration of the core spray injection permissive instruments. This is also included in a risk significant function.

c. Conclusions for Risk Ranking

The team concluded that the PRA level of detail, data, truncation limits and quality were adequate to perform risk ranking. Not updating the SSC risk ranking to determine the potential impact of the performance criteria was considered a weakness.

The team concluded that the risk ranking of all SSC functions except one appeared appropriate. The downgrading of the risk ranking of the diesel engine fire water pump to non-risk significant was done with an insufficient basis and represented an inspector followup item (IFI 50-220/96-12-03) pending engineering evaluation to provide a basis.

**M1.3 (a)(3) Periodic Evaluations**

a. Inspection Scope

Section (a)(3) of the rule requires that performance and condition monitoring activities and associated goals and preventive maintenance activities be evaluated taking into account, where practical, industry-wide operating experience. This evaluation is required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The team reviewed the procedural guidelines for these evaluations, as at the time of this inspection, NMPC had not performed the first periodic evaluation. NMPC had established plans and procedures for these evaluations.

b. Observations and Findings

NMPC planned to complete the first evaluation in July 1997. The procedural requirements in S-MRM-REL-010, "Maintenance Rule," to complete the periodic evaluation were consistent with the guidance in NUMARC 93-01 but the detailed implementation aspects of the periodic evaluation were not fully developed.

c. Conclusions

The plans and procedures for performing the periodic evaluations appeared to meet the requirements of the rule. However, since a periodic evaluation has not been completed, this item will be considered to be an inspector follow up item until the NRC completes a review of a Nine Mile Point Unit 1 periodic evaluation. (See the inspector follow item described below.)

### M1.4 (a)(3) Balancing Reliability and Unavailability

a. Inspection Scope

Paragraph (a)(3) of the rule requires that adjustments be made where necessary to assure that the objective of preventing failures through the performance of preventive maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The team reviewed the facility's plans to conduct this evaluation as required by the rule.

b. Observations and Findings

The NMPC approach for optimizing availability and reliability is based on quarterly assessments of equipment performance. Unavailability data is gathered from shift operator logs, the equipment status log, the mark-up log and the daily operating reports; reliability data is based on functional failures (FF) and/or maintenance preventable functional failures (MPFF) gathered from the DER database, DER records, licensee event reports (LER), work orders, the Nuclear Plant Reliability Database, and lost electrical generation reports. The maintenance rule quarterly performance reports have not addressed an evaluation of the balance between availability and reliability. The team noted that using MPFFs without information on demand and run time did not measure or adequately represent reliability.

c. Conclusions

The team concluded that the approach to balancing reliability and unavailability would not accomplish the objective of preventing failures of SSCs while also minimizing unavailability as required by the rule. This issue will be reviewed after the facility performs the first periodic assessment of the maintenance rule program (IFI 50-220/96-12-04).

### M1.5 (a)(3) Plant Safety Assessments Before Taking Equipment Out of Service

a. Inspection Scope

Paragraph (a)(3) of the rule states that the total impact on plant safety should be taken into account before taking equipment out of service for monitoring or preventive maintenance. The team reviewed the applicable procedures and related documentation for controlling work activities while at power, and discussed the process with appropriate facility personnel. The team also reviewed the process used for shutdown risk management. Licensed operator knowledge of the general requirements of the maintenance rule and their particular duties and responsibilities under the rule was assessed.

b. Observations and Findings

Procedures GAP-PSH-03, "Control of On-Line Work Activities," and N1-ODP-PSH-0301, "Review of Weekly Work Schedules," prescribes the administrative controls for evaluating and managing risk for the removal of SSCs from service for testing, maintenance, monitoring, inspection and design activities at Nine Mile Point Unit 1. When these activities are scheduled, the key plant safety functions are evaluated to prevent compromise of safety.

Work activities are planned on a 13 week rolling schedule based upon system windows. System windows were organized such that the work load was distributed among the 13 weeks, while maintaining availability of the key plant safety functions. The 13 week rolling schedule received risk analysis to eliminate peaks in the relative risk caused by the combination of activities planned during the week. The team reviewed the analysis for seven of the 13 work weeks and reports for two of the weeks. The reports made recommendations for combinations of equipment out of service.

The team reviewed the work week planning and analysis for the week of October 7, 1996. This week received a PRA evaluation because of emergent work. Relative risk peaks were analyzed on a daily basis for unavailable equipment. Initiating events of concern each day were identified and recommendations made for independent confirmation of separation of certain work activities. The analysis also identified equipment and operator actions with increased importance because of the work scheduled for the day. The team recognized the value of these clearly articulated reports to the plant staff.

NMPC procedures provide a path to have situation specific PRAs completed when the work control coordinator deems it appropriate. Although not specified by procedure, the work control coordinator is to request a PRA for cases when maintenance is to be performed in a week different than normally scheduled. After discussions with the team, the maintenance rule coordinator (MRC) initiated DER C-96-2570 to enhance the administrative procedures for on-line maintenance with respect to requesting situation specific PRAs and the use of insights obtained.

Administrative procedures direct the time spent in limiting conditions for operations (LCOs) to be minimized and do not allow the voluntary entry into technical specification 3.0.3. The station shift supervisor (SSS) is responsible for maximizing the availability of risk significant SSCs when work is preformed. The SSS is also responsible for evaluating the impact of unplanned outages, and determining the need to expedite the return of equipment to improve plant safety. Operators interviewed by the team were aware of their responsibilities for evaluating unplanned outages.

Shutdown risk is administratively controlled through procedure NIP-OUT-01, "Shutdown Safety," and N1-OGD-11, "Shutdown Operations Protection Guidelines." During shutdown, key safety functions are maintained consistent with established criteria or contingency plans are developed. The criteria are based on an N+1 philosophy of having one more system available than the minimum required. During each shift an outage safety assessment is completed to verify compliance with the established criteria. The team considered the controls in place for shutdown risk management to be appropriate.

The team interviewed five licensed senior reactor operator (SROs) and determined that their knowledge of the maintenance rule was appropriate. The SROs indicated that their primary maintenance rule duties were first to minimize equipment unavailability and second, to provide data for determining functional failures. The SROs were aware that the rule covered equipment beyond that controlled by technical specifications. Although they were not familiar with specifically what equipment was within scope, they could locate the list of equipment covered by the rule within the applicable procedure.

c. Conclusions

The team concluded that NMPC procedures provided sufficient controls for evaluation and management of on-line maintenance. NMPC reviewed the 13 week schedule from a PRA perspective. Peaks of relative risk were being quantified for both the rolling thirteen week schedule and for weeks with emergent work. The PSA group has been active in recommending actions to minimize the safety impact of taking equipment out of service.

The team judged that shutdown risk management was adequately controlled and monitored.

SRO knowledge of the rule and their responsibilities associated with the rule was acceptable.

**M1.6 (a)(1) Goal Setting and Monitoring and (a)(2) Preventive Maintenance**

a. Inspection Scope

The team reviewed program documents in order to evaluate the process established to set goals and monitor under (a)(1) and to verify that preventive maintenance was effective under (a)(2) of the rule. The team also discussed the program with appropriate plant personnel. The rule as implemented by NUMARC 93-01 specifies industry operating experience (IOE) to be considered, where practical, when establishing goals, and during periodic assessments. The team reviewed the following systems:

<u>(a)(1) Systems</u>

- reactor recirculation
- containment nitrogen inerting

<u>(a)(2) Systems</u>

- reactor protection
- service air
- instrument air
- emergency diesel generators (EDG)
- emergency condensers
- structures
- hydrogen/oxygen monitors
- containment vents

The team reviewed each of these systems to verify that goals or performance criteria were established in accordance with safety, that industry-wide operating experience was taken into consideration where practical, that appropriate monitoring and trending was being performed, and that corrective actions were taken when an SSC failed to meet its goal or performance criteria or experienced a maintenance preventable functional failure (MPFF). The team also reviewed performance criteria for SSCs not listed above.

b. <u>Observations and Findings on (a)(1) Goals</u>

Two SSCs had been placed into the (a)(1) category. Records indicated that the containment nitrogen system was placed in (a)(1) in April of 1996 based on unavailability of 3% exceeding the performance criterion of 2.3%, largely due to poor planning of maintenance work. The team judged that NMPC had performed an acceptable evaluation of the causes of the poor containment nitrogen availability and had identified appropriate corrective actions to address these causes.

When the reactor recirculation (RR) was placed in the (a)(1) category in July 1996, there had been a total of 17 MPFFs in the past 24 months. The (a)(2) performance criteria for the reactor recirculation system was 3 MPFFs/24 months, regardless of reactor recirculation pump train. When the performance criteria were established, based on the historical data, by August 1994 there had been sufficient MPFFs to exceed the performance criteria.

The MPFFs varied among the 5 reactor recirculation pump (RRP) trains and RRP master controller as follows:

RRP11 Train - 5 MPFFs
RRP12 Train - 1 MPFF
RRP13 Train - 2 MPFFs
RRP14 Train - 4 MPFFs
RRP15 Train - 4 MPFFs
RRP Master - 1 MPFF

The MPFFs included the following type of failures:

- trip due to failure of voltage regulator resistor - electrical
- trip due to open in the tachometer generator circuit (multiple) - electrical
- trip due to exciter brush arcing - electrical
- trip due to overheated compression connector - mechanical
- trip due to abraded exciter lead - mechanical
- runback due to a ground in DAAS during maintenance (several) - electrical
- runback due to dirty M/A station switch contacts - electrical
- power oscillations due to air leaks in Bailey positioner (several) - electrical/mechanical
- failure to start due to loose scoop tube limit switches - electrical
- failure to start due to field breaker failure - electrical
- failure to start due to repeat failure of dpsh/IA80 relay - electrical

Given the wide variety of failures and affected trains, the corrective actions appeared to be appropriate and included multiple actions to address the apparent causes.

The (a)(1) goals established for the reactor recirculation system were specified as 5 MPFFs/system/24 months through June 30, 1997. The (a)(1) goals (5 MPFFs at the system level) were similar to the (a)(2) performance criteria (3 MPFFs at the system level) and represented a relaxation of the performance criteria. There were no goals at the train or component level, and no goals focused on the identified corrective actions. The goals did not directly address the effectiveness of the corrective actions over the varied electrical and mechanical MPFFs and varied reactor recirculation pump trains. Further, there was no evidence that any additional monitoring of parameters or conditions was being performed to evaluate the effectiveness of the corrective actions. Also, there appeared to be no means to determine whether additional MPFFs at the system level represented ineffective corrective actions or additional ineffective maintenance practices not previously identified.

As of the date of this inspection, the goals and corrective actions established for these systems had not been reviewed and approved by the expert panel. This review was specified in the administrative guidance for the expert panel, and such a review when performed, could potentially have addressed and corrected the above concern. Nonetheless, the tardy review by the expert panel was another area that diminished the effectiveness of the panel. The issue of the lack of the intended expert panel review of systems being recategorized as (a)(1) was discussed previously.

c. Conclusions

(a)(1) Goals

The team concluded that the corrective actions established for the (a)(1) systems were appropriate and had been based on good root cause evaluations. However, the (a)(1) goals established for the reactor recirculation system were weak and lacked direct measures to judge the effectiveness of the corrective actions. Further, the tardy review of the goals by the expert panel represented a missed opportunity to upgrade the goals and diminished the effectiveness of the panel. The team concluded that the ineffective (a)(1) goals and monitoring of reactor recirculation represented an apparent violation of 10CFR50.65(a)(1) (EEI 50-220/96-12-05).

b. Observations and Findings on (a)(2) Performance Criteria

NUMARC guidance specifies safety (risk) be taken into consideration when establishing performance criteria under (a)(2). NMPC used a process to categorize SSCs as either risk significant or non-risk significant. The guidance also specifies IOE be taken into account when establishing performance criteria for risk significant SSCs. NMPC had adequately considered IOE when setting performance criteria.

Performance criteria were established based on risk significant or non-risk significant categorizations; however, NMPC did not always follow the NUMARC guidance. In accordance with the NUMARC guidance, system or train level performance criteria are to be established for all risk-significant SSCs and those nonrisk-significant SSCs that are used in standby service. For risk-significant SSCs, the performance criteria should include both unavailability and reliability. Plant level performance criteria are established for all remaining non-risk significant, normally-operating SSCs. The plant level performance criteria established by NMPC included the following:

- 3 automatic reactor scrams per 7000 hours critical. To be changed to 0.5 scrams next year.
- 5 reportable safety system actuations
- 5% unplanned capability loss factor
- 15 MPFFs
- 1 repeat MPFF

The plant level criteria of one allowable repeat MPFF was not consistent with the NUMARC guidelines. The NUMARC guidance specifies that any repeat MPFF be considered for placement into (a)(1).

Performance criteria for risk significant and standby SSCs within the scope of the rule were availability and reliability based. Most risk significant SSCs had performance criteria that included both availability and reliability. However, the following risk significant systems did not specify availability criteria or justify exceptions to NUMARC 93-01:

- 120 Volt AC
- 600 Volt AC
- 4160 Volt AC
- 125 Volt DC
- automatic depressurization system
- ATWS system
- main steam
- primary containment structure vacuum relief
- reactor protection (also did not have acceptable reliability performance criteria)
- reactor recirculation
- reactor vessel instrumentation.

In addition, the team found that availability criteria were not specified for the following system functions:

- reactor coolant system pressure boundary function of reactor core spray
- scram function of control rod drive
- torus cooling function of containment spray.

NMPC procedure S-MRM-REL-101 specified that for risk significant SSCs availability and reliability should be the primary performance criteria. N1-MRM-REL-0104 documented the risk ranking of the systems and system functions. N1-MRM-REL-0105 documented the performance criteria. However, as noted, the SSCs described above did not have availability criteria specified to verify that the preventive maintenance was effective nor was there any documented assessments to justify exceptions. This is considered the first part of an apparent violation of 10 CFR 50.65(a)(2).

Acceptable monitoring was being performed on the service air system's five defined functions, of which two were in scope. Although this system was normally operating and non-risk significant, system level performance criteria had been established, as the plant level performance criteria would not adequately monitor the effectiveness of maintenance. In addition to the performance criteria, the system engineer monitored trends of several parameters related to compressor performance that operators recorded during their tours. The system engineer was knowledgeable of the system and the maintenance rule. No MPFFs had occurred during the evaluation period and the system had not exceeded its performance criteria.

The reactor protection system (RPS) had three functions defined, all of which were safety related and risk significant. The three functions were;

RPS-F1, initiate a reactor scram to prevent exceeding LSSS limits

RPS-F2, initiate reactor coolant and primary containment isolations

RPS-F3, initiate ECCS and ESF SSCs.

The reliability performance criterion was 0 MPFFs for each function. Unavailability performance criteria were not specified for any of the functions. The team determined that it was impractical to monitor unavailability for function RPS-F1; however, for functions RPS-F2 and RPS-F3 it appeared that unavailability could occur and be monitored.

Further, the use of 0 MPFFs as a performance criteria for RPS functions was not considered sufficient to ensure the effectiveness of preventive maintenance for this system. As noted in Regulatory Guide 1.160, Revision 1:

> "The extent of monitoring may vary from system to system depending on the system's importance to risk. Some monitoring at the component level may be necessary... For more risk significant systems, some parameter trending, beyond that already required by NRC requirements to provide early warning of degradation, may also be necessary for critical components whose unavailability causes a system train to be unavailable or whose failure is otherwise unacceptable."

The team determined that the RPS is one such system whose failure is unacceptable and should be monitored at a level below that of system/train (or channel in the case of RPS). On October 10,1996, NMPC issued DER 1-96-2573 to address this issue.

The failure to establish unavailability criteria for RPS-F2 and RPS-F3 and acceptable reliability performance criteria for RPS-F1 is the second part of the apparent violation for failure to establish performance criteria for risk significant functions.

The system engineer tracked RPS parameters that the instrumentation and control group identified as indicative of potential problems in the RPS. This parameter trending was not included as part of the maintenance rule performance (condition monitoring) criteria. No MPFFs had occurred during the evaluation period. The RPS system engineer had a workable knowledge of the system and the maintenance rule requirements.

MPFFs were used for performance criteria as a measure of reliability. System engineers established the performance criteria. There was little, if any, connection to the reliability numbers used in the PRA. The number of MPFFs were used without explicitly accounting for the number of demands or running time. NUREG-1526, "Lessons Learned from Early Implementation of the Maintenance Rule at Nine Nuclear Power Plants," states that safety is adequately considered through the process of determining whether to set system or plant level performance criteria. NUMARC 93-01 states that performance criteria for risk significant SSCs should be established to assure that reliability and availability assumptions used in the PRA are maintained or adjusted when determined necessary by the utility. The team noted that the inadequacy of using MPFFs without justification was also identified in the Nuclear QA audit (#96009) dated June 18, 1996. The team did not review the facility response to this audit finding, but noted that in October 1996 the unacceptable approach had not been corrected. This issue is considered a third part of the apparent violation for performance criteria.

NUMARC 93-01, paragraph 9.3.2, "Performance Criteria for Evaluating SSCs," states that performance criteria for risk significant SSCs should be established to assure reliability and availability assumptions used in the plant-specific PRA, IPE, IPEEE, or other risk determining analysis are maintained or adjusted when determined necessary by the utility. Unavailability performance criteria are based upon NMPC and industry experience, and ranged from 0.8% to 4.6%. The system or train performance criteria included an unavailability allowance for historically very reliable systems such as the isolation condensers for the purpose of accounting for preventive maintenance unavailability. Most SSC reliability performance criteria were one MPFF per 24 months.

NMPC evaluated the allowed system and train unavailability acceptance criteria to quantify the risk impact of the performance criteria chosen. NMPC replaced the historic data used for the baseline IPE model with the performance criteria. This analysis did not include the systems with no unavailability performance criteria noted above. The CDF increased from 5.5E-6 to 8.1E-6 per reactor year (46.7% increase). NMPC considered the analysis conservative because although some systems or trains may exceed their performance criteria, the bulk of the systems will be within their acceptance criteria such that the unavailability sensitivity analysis provides a bounding condition. As noted, NMPC did not make a recalculation of SSC risk ranking with SSCs at their allowed unavailability performance criteria.

The team noted that MRM-REL-104 and MRM-REL-105 were not consistent in that not all systems and functions contained were linked to a performance criteria. For example the area radiation monitors, drywell cooling and plant annunciators were not addressed in both documents. Based upon discussions with facility personnel, NMPC had plans to link all of the functions and performance criteria but had not yet initiated the effort.

All structures within the scope of the rule were in (a)(2). Functions for each structure were identified. One structure, primary containment structures, penetrations and hatches, was identified as risk significant.

Monitoring of structures was addressed in procedure, S-MRM-REL-0102. The procedure identified those structures and substructures in the scope of the rule and the responsible groups for monitoring. Performance criteria that could measure the overall performance of a structure were not developed. Rather, the facility developed a program specifically for structures that relied exclusively on condition monitoring. For risk significant structural functions, the conditions that needed to be monitored were specified. The remaining structures were monitored by feature (e.g., reinforced concrete, masonry walls) rather than by structure. In addition, the program included reasonable condition criteria that would categorize the structures as (a)(1) prior to the collapse of the structure. The NMPC program for monitoring the condition of structures was acceptable.

The team noted that industry guidelines for monitoring structures have not yet been issued and that the NMPC monitoring will be reviewed against industry guidelines when available.

Deficient conditions identified during walkdowns were evaluated through the DER process. The DERs reviewed by the team appeared to address the problems that were described, including if the deficiency had a generic concern. No MPFFs were identified for the evaluation period for structures.

The system engineer for structures was knowledgeable of the significance of deficiencies identified in structures and the program for monitoring structures. The system engineer had a workable knowledge of how condition monitoring met the requirements of the rule, and understood how to determine whether a deficiency should be considered a MPFF.

c. Conclusions on (a)(2) Performance Criteria

The team concluded that an apparent violation (EEI 50-220/96-12-06) existed regarding (a)(2) performance criteria. First, eleven risk significant systems and some functions of three other risk significant systems did not have any availability criteria or justification of its absence. Second, RPS did not have acceptable reliability performance criteria for one function or any availability criteria for two other functions. Third, MPFFs were inappropriately used for numerous reliability performance criteria without justification.

The team concluded that the linkage of the system functions within the scope of the rule and the performance criteria was poor in some cases. This linkage was provided in facility procedure MRM-REL-104 and 105.

The procedures to support maintenance rule implementation were not complete or up to date in many instances.

The performance criteria for structures were acceptable.

b. Observations and Findings on Use of Industry-Wide Operating Experience

The maintenance rule, as implemented using the guidance in NUMARC 93-01, specifies that industry-wide operating experience be taken into consideration, where practical, when establishing goals or performance criteria. Procedure, S-MRM-REL-0101, administratively controls the completion of industry operating experience (IOE) reviews during goal setting and periodic assessment reviews. The team considered the procedure to be acceptable for implementing the rule.

Discussions with the maintenance rule coordinator and systems engineers responsible for the two systems classified (a)(1) indicated that IOE was reviewed during the goal setting process as well as during scoping. According to the system engineers, the IOE information was more beneficial in determining appropriate corrective actions than in determining the goals.

c. Conclusions on Use of Industry-Wide Operating Experience

Industry-wide operating experience had been incorporated into the maintenance program.

b. Observations and Findings on Monitoring and Trending

NUMARC guidance indicates that monitoring will be performed to determine if maintenance of (a)(1) SSCs results in acceptable performance. For (a)(2) SSCs performance is trended against the established performance criteria so that adverse trends can be identified. The objective of monitoring plant level performance criteria is to focus attention on the aggregate performance of many of the operating SSCs that are not individually risk significant.

The system engineers are responsible for trending and evaluating SSC performance trended at the train or system level, and the maintenance rule assistant coordinator is responsible for SSCs trended at the plant level. The team reviewed the quarterly report that trended performance. The quarterly report appeared to be a good method for disseminating SSC performance information to management.

The team identified that additional MPFFs (DERs 1-95-250 and 1-94-1633) should have been included in the assessment of reactor recirculation system performance, an (a)(1) system. The team noted that S-MRM-REL-0103 example 4a of non-MPFFs was confusing and was the reason why one MPFF was classified as a non-MPFF.

The team determined that the MPFF DER data base was not useable as a tool to monitor against the MPFF plant level limit. The output of the DER data base provided a different listing of DERs than maintained by the system engineers. The facility issued DER C-96-2506 on October 7, 1996 to resolve this problem.

The team noted that three of the plant level performance criteria had been exceeded. Two were exceeded when the rule came into effect approximately three months ago and the unplanned capability loss factor was recently exceeded. NMPC had not yet taken action to assess the cause of exceeding the performance criteria. The NMPC administrative procedures provide no guidance as to the timeliness for the cause determination when performance criteria are exceeded. The facility issued DER 1-96-2550, dated October 9, 1996 to address exceeding the plant level performance criteria of unplanned capability loss factor.

c. Conclusions for Monitoring and Trending

The team concluded that a number of problems severely limited the effectiveness of the monitoring and trending of performance. These problems included:

- untimely cause determinations after exceeding performance criteria
- incorrect MPFF determinations based, in part, on weak guidance
- difficulties with the DER process and data
- ineffective performance criteria (as noted previously)

The ineffective monitoring and untimely evaluation of (a)(2) systems represent an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-220/96-12-07).

b. Observations and Findings on Equipment Corrective Actions

The team reviewed the equipment corrective actions taken for a sample of systems reviewed in this inspection. The system engineers responsible for establishing corrective actions were interviewed. Corrective actions are normally developed out of the NMPC DER process. The corrective actions were considered by the team to be appropriate for the identified equipment problems.

c. Conclusions on Equipment Corrective Actions

The team concluded that in general, equipment corrective actions were appropriate.

## M3 STAFF KNOWLEDGE AND PERFORMANCE

### M3.1 Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

The team interviewed engineers and engineering managers to assess their understanding of the maintenance rule and associated responsibilities. Also, the team interviewed licensed reactor and senior reactor operators to determine if they understood the general requirements of the rule and their particular duties and responsibilities for its implementation.

b. Observations and Findings

The system engineers were very knowledgeable of their systems and were familiar with related industry operating experience. System engineers and managers were familiar with the maintenance rule requirements.

The team interviewed licensed operators and noted that they were familiar with the maintenance rule and their role in its implementation. The operators indicated that their primary duties included review of maintenance plans and schedules, and timely removal and restoration of equipment to maximize its availability. The team found the operators had a working level knowledge of which systems were within the scope of the maintenance rule.

c. Conclusions

All engineers, engineering managers, and licensed operators were knowledgeable of their assigned systems and demonstrated sufficient knowledge to adequately implement their responsibilities under the maintenance rule.

## V. MANAGEMENT MEETINGS

## X1 EXIT MEETING SUMMARY

The team discussed the progress of the inspection with NMPC representatives on a daily basis and presented the inspection results to members of management at the conclusion of the inspection on October 11, 1996. NMPC management acknowledged the findings presented.

The team asked whether any materials examined during the inspection should be considered proprietary. NMPC indicated that none of the materials provided to the team were proprietary information.

## PARTIAL LIST OF PERSONS CONTACTED

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## LIST OF INSPECTION PROCEDURES USED

IP 62706 Maintenance Rule

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

50-220/96-12-01 (EEI) Failure to include a number of SSCs within the scope of the rule.

50-220/96-12-02 (URI) The expert panel's ineffectiveness, including untimely reviews associated with (a)(1) systems.

50-220/96-12-03 (IFI) Engineering evaluation to provide a basis for the risk ranking downgrade of the diesel fire pump.

50-220/96-12-04 (IFI) Review of balancing of reliability and unavailability after it is completed.

50-220/96-12-05 (EEI) Ineffective goals and monitoring established for the (a)(1) systems (Containment nitrogen and reactor recirculation).

50-220/96-12-06 (EEI) Unacceptable performance criteria specified to verify that preventive maintenance was effective.

50-220/96-12-07 (EEI) Ineffective monitoring and untimely evaluation of (a)(2) systems.

## LIST OF ACRONYMS USED

| | |
|---|---|
| ADS | Automatic Depressurization System |
| BOP | Balance of Plant |
| CDF | Core Damage Frequency |
| CFR | Code of Federal Regulations |
| CRD | Control Rod Drive |
| CS | Core Spray |
| DER | Deviation/Event Report |
| EDG | Emergency Diesel Generators |
| EHC | Electrohydraulic Control |
| ESW | Emergency Service Water |
| FF | Functional Failure |
| FW | Feedwater |
| IFI | Inspection Followup Item |
| IPE | Individual Plant Evaluation |
| IPEEE | Individual Plant Evaluation for External Events. |
| ISEG | Independent Safety Engineering Group |
| kV | Kilovolts |
| LERF | Large Early Release Fraction |
| LCO | Limiting Condition for Operation |
| MPFF | Maintenance Preventable Functional Failure |
| MS | Main Steam |
| MSRV | Main Safety Relief Valve |
| NMPC | Niagara Mohawk Power Corporation |
| NOV | Notice of Violation |
| NRR | Nuclear Reactor Regulation |
| PCIS | Primary Containment Isolation System |
| PRA | Probabilistic Risk Assessment |
| PSA | Probabilistic Safety Assessment |
| QA | Quality Assurance |
| RAW | Risk Achievement Worth |
| RHR | Residual Heat Removal |
| RPS | Reactor Protection System |
| RRW | Risk Reduction Worth |
| RPIS | Rod Position Indication System |
| SRV | Safety Relief Valve |
| SSC | Structures, Systems or Components |
| SSS | Station Shift Supervisor |
| URI | Unresolved Item |