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EXECUTIVE SUMMARY

Kewaunee Nuclear Power Plant
NRC Inspection Report 50-305/97011(DRS)

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The report covers a one week on-site inspection by regional and Office of Nuclear Reactor Regulation inspectors, and a contractor from Brookhaven National Laboratory.

In general, the program met the requirements of the maintenance rule (MR); however, two issues were identified concerning the establishment of reliability performance criteria and the use of run to failure performance criteria. Two violations and one inspection follow-up item were identified during the inspection.

Maintenance

- Scoping of structures, systems, and components (SSCs) was considered good. The recently completed rescoping effort appropriately placed additional systems and functions of SSCs under the MR scope.

- The risk assessment processes were acceptable means of implementing the equipment out-of-service evaluation at both power and shutdown conditions.

- The detailed assessment of system functions for MR purposes was good. The majority of performance criteria established were acceptable. However, one violation was identified in that some reliability performance criteria were not adequately linked to the failure rate assumptions in the probabilistic risk assessment. Another violation was identified where inappropriate performance criteria of "run to failure" was used for the post-loss-of-coolant-accident hydrogen control ventilation system and the hydrogen analyzers. The use of the "run to failure" criteria was not justified to conclude the systems could fail during an accident without affecting the accident mitigation function.

- Tanks, supports, buildings, and enclosures as structures were adequately scoped under the MR. The program established for monitoring of structures was acceptable, although procedural guidance was only recently implemented.

Quality Assurance

- The quality program audits identified a number of issues and concluded the MR program was not effectively implemented. The corrective actions performed after the 1997 audit were effective to establish a program that generally met MR requirements. The use of independent personnel provided significant insights into the MR program.

Engineering

- The engineering staff's determination that monitoring hydrogen concentration, reducing hydrogen concentration, and providing the capability of installing an external hydrogen recombiner were not MR functions was not technically justified to allow the functions to have "run to failure" performance criteria.

Report Details

Summary of Plant Status

The plant was operating at approximately 96 percent power during the inspection.

Introduction

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The report covers a one week on-site inspection by four regional inspectors and a consultant from Brookhaven National Laboratory. Assistance and support were provided by members from the Quality Assurance and Maintenance Branch, Office of Nuclear Reactor Regulation (NRR), and the Probabilistic Safety Assessment Branch, NRR.

I. Operations

O4 Operator Knowledge and Performance

O4.1 Operator Knowledge of Maintenance Rule

a. Inspection Scope (62706)

The inspectors interviewed three senior reactor operators and three reactor operators to determine if they understood the general requirements of the maintenance rule (MR) and their particular duties and responsibilities for its implementation.

b. Observations and Findings

The operators had a general knowledge of the MR and their role in its implementation. The operators stated that their duties included recording equipment out-of-service times and implementing the night order on risk configuration management, which addressed elective maintenance activities.

The operators indicated that the MR highlighted and increased the awareness of risk significant systems. In addition, the MR did not distract them from their responsibility to safely operate the plant. The MR aided the operators in the decision-making process as to what equipment could be safety taken out-of-service.

c. Conclusions

Operators' knowledge was consistent with their responsibility for implementation of the MR. There was no indication that the MR detracted from the operators' ability to safely operate the plant. The MR helped the operators monitor and limit the risk associated with taking equipment out-of-service.

II. Maintenance

M1 Conduct of Maintenance (62706)

M1.1 SSCs Included Within the Scope of the Rule

a. Inspection Scope

The inspectors reviewed the scoping documentation to determine if the appropriate structures, systems, and components (SSCs) were included within their MR program in accordance with 10 CFR 50.65(b). The inspectors used NRC Inspection Procedure (IP) 62706, "Maintenance Rule," Nuclear Management Resource Council (NUMARC) 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," as references during the inspection.

b. Observations and Findings

The scoping method was described in procedure GNP 8.20.1, "Maintenance Rule Scoping and Performance Criteria." The scoping criteria included safety-related systems, nonsafety-related systems that were relied upon to mitigate accidents or transients or were used in emergency operating procedures (EOPs), systems whose failure could prevent safety-related SSCs from fulfilling their safety-related function or systems whose failure could cause a reactor trip or actuation of a safety-related system. Based on the recent quality program audit findings, a rescoping effort was conducted to ensure all systems and system functions were adequately addressed under the MR. The original scoping effort was by system, while the rescoping effort was performed by system function.

In general, rescoping of systems and system functions was good. The licensee identified 14 systems that were not included within the initial scope of the MR. The licensee considered a total of 96 systems during the scoping phase; of these 68 systems were determined to be within the MR scope. System functions excluded from the MR scope were adequately justified. The SSCs reviewed by the inspectors were properly scoped within the requirements of the MR.

c. Conclusions

The inspectors concluded that SSC functions were properly scoped into the MR program. Documentation during the rescoping effort was considered acceptable.

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

a. Inspection Scope

Paragraph (a)(1) of the MR requires that goals be commensurate with safety. Additionally, implementation of the MR using the guidance contained in NUMARC 93-01, required that safety be taken into account when setting performance criteria and monitoring under paragraph (a)(2) of the MR. This safety consideration was to be used to determine if the SSC should be monitored at the system, train, or plant

level. The inspectors reviewed the methods and calculations that the licensee established for making these risk determinations. NUMARC 93-01 recommended the use of an expert panel to establish safety significance of SSCs by combining probabilistic risk assessments (PRA) insights with operations and maintenance experience, and to compensate for the limitations of PRA modeling and importance measures. The inspectors reviewed the composition of the expert panel and the experience and qualifications of its members. The inspectors reviewed the licensee's expert panel process and the information available which documented the expert panel decisions. The inspectors interviewed several members of the expert panel to determine their knowledge of the MR and to understand the functioning of the panel.

b.1 Observations and Findings on the Expert Panel

The expert panel members were knowledgeable concerning the requirements of the MR and understood their responsibilities. The panel members had received training and demonstrated an understanding in the use of PRA. Discussions, decisions, and expert panel activities were documented in the panel minutes.

The panel composition included personnel from maintenance, operations, engineering (including a PRA engineer), plant licensing, and the maintenance rule coordinator (MRC). The nuclear experience of the panel members (excluding the MRC) ranged from 10 to 24 years. The panel members used their experience in conjunction with the PRA to assess SSC risk significance. The expert panel's responsibilities also included review and approval of scoping decisions, goal-setting action plans, performance criteria selection, and the dispositions to reclassify SSCs from (a)(2) to (a)(1) and (a)(1) to (a)(2).

c.1 Conclusions on Expert Panel

The expert panel was a well-balanced group of qualified, experienced personnel. The panel members used their experience in conjunction with the PRA to assess SSC risk significance.

b.2 Observations and Findings on Risk Determinations

b.2.1 Analytical Risk Determining Methodology

Plant-specific PRA studies were used to rank SSCs with regard to their safety significance. These studies included the updated Kewaunee Individual Plant Examination (IPE), and considerations of some external events analysis. The plant-specific PRA model was a large fault tree model, and the software GRAPHATER was used to quantify the PRA model. The IPE study, specifically for internal events, was based on a Level 1 PRA, which provided information on core damage frequency (CDF), and a Level 2 PRA for large early release was used for sensitivity analysis.

For the risk ranking process, the licensee staff used a truncation level of 3E-10 CDF per reactor year. This was about five orders of magnitude less than the overall CDF estimate of 3.9E-5 per reactor year. In addition, for the most important accident sequence, loss of off-site power, the truncation was 1E-10. The truncation level used for the risk significance determination process was considered reasonable.

The general quality and level of detail of the plant-specific IPE study was not reviewed. However, the PRA, although updated following the 1997 refueling outage to reflect the plant configuration, incorporated availability and reliability data based on operating experience of the plant only up to 1989. Not having updated the PRA database to reflect more recent plant data was considered by the inspectors to be a weakness in the MR implementation. At the time of the inspection, the licensee staff indicated that the PRA database would be updated every cycle to support the MR following the next refueling outage (1998).

b.2.2 Adequacy of Expert Panel Evaluations

The MR program document and the expert panel meeting minutes were determined to adequately describe the risk significance determination process. The risk significance determination was function based and relationships between safety functions and SSCs modeled in PRA were not always well-documented. The expert panel, in conjunction with a PRA ranking methodology, was used to determine the risk significance of functions in and out of the MR scope.

For functions modeled in the PRA, two importance measures were evaluated by the expert panel (risk achievement worth (RAW) and Fussell-Vesely (F-V)), in addition to 90% CDF contribution. In some instances, risk reduction worth was used in place of F-V importance measure. The licensee evaluated the importance of functions relative to the RAW and F-V importance measures, and 90% CDF contribution in agreement with NUMARC 93-01 guidance. Sensitivity analyses on the risk ranking were performed by adjusting the PRA importance measures and 90% CDF.

Several functions deemed high safety (risk) significant using the three quantitative measurements were downgraded by the expert panel to low safety significant. The technical bases for downgrading these functions included specific conservatisms in the PRA assumptions and alternative paths for these functions. The technical justifications were reasonable to downgrade the functions' safety significance.

The expert panel determined the safety significance of SSCs not modeled in the IPE by reviewing the Level 2 results, industry experience, operation and maintenance experience, and engineering judgment. The expert panel compensated for the limitations of the PRA applications by upgrading approximately 30 functions to be high safety significant that were not modeled or did not meet one of the three PRA quantitative measurements.

The inspectors observed the expert panel meeting on August 7, 1997. The agenda included a number of issues identified during the inspection, including the concern with the justification for some reliability performance criteria. The meeting approved a number of reliability performance criteria revisions to resolve the concerns. The discussions reflected a balanced evaluation by the panel members, considering both PRA insights and operational concerns consistent with NUMARC 93-01 guidance.

c.2 Conclusions on Risk Determinations

The approach to establishing the risk ranking for SSCs within the MR scope was acceptable. The expert panel's risk determinations effectively compensated for the

limitations of the PRA applications. A weakness in the determination process was the use of an outdated PRA database.

M1.3 (a)(3) Periodic Evaluations

a. Inspection Scope

Paragraph (a)(3) of the MR requires that performance and condition monitoring activities, associated goals, and preventive maintenance activities be evaluated, taking into account where practical, industry wide operating experience. This evaluation was required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The inspectors reviewed the procedural guidelines for these evaluations and completed quarterly evaluations.

b. Observations and Findings

Procedure GNP 8.20.3, "Maintenance Rule Quarterly and Periodic Assessments," provided guidance for preparing periodic assessments, which appeared to meet the requirements of 10 CFR 50.65(a)(3) and the intent of NUMARC 93-01. The procedure required performing a periodic assessment within 90 days after the completion of a refueling outage. Since the latest outage was only recently completed, the licensee had not performed a periodic assessment to meet the MR requirement. This will be considered an inspection follow-up item (IFI 50-305/97011-01(DRS)) pending completion of the periodic assessment and review by the NRC.

Two quarterly assessment reports were performed that reviewed plant and procedure changes, industry operating experience, and Kewaunee Assessment Process (KAPs) for potential changes to the MR program. The reports identified several issues that required changes to the program and was considered a good process to ensure the MR program remained up-to-date with the plant configuration.

c. Conclusions

The procedure for performing periodic assessments appeared to meet the requirements of the rule and the intent of the NUMARC implementing guidance. A periodic assessment, however, had not been performed and will remain an open issue for future follow-up.

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

a. Inspection Scope

Paragraph (a)(3) of the MR requires that adjustments be made where necessary to assure that the objective of preventing failures through the performance of preventive maintenance (PM) was appropriately balanced against the objective of minimizing unavailability due to monitoring or PM. The inspectors reviewed the plans to ensure this evaluation was performed as required by the MR.

b. Observations and Findings

Balancing reliability and availability consisted of monitoring SSC function performance against the established performance criteria. If the performance criteria were met, then the criteria were considered balanced. The licensee had not balanced reliability and availability. This task was to be performed during the periodic assessment, which will be reviewed in as part of the previously stated IFI.

The licensee had developed a PM optimization program independent of the MR. Procedure GNP 8.7.1, "Preventative Maintenance Optimization Program Instructions," outlined the program requirements and was applicable to safety-related and nonsafety-related components that may have an impact on the performance of the plant. The optimization program was used to reduce SSC unavailability by coordinating PM and surveillance activities to limit the number of times an SSC was taken out-of-service.

c. Conclusions

The inspectors concluded that the process to balance availability and reliability was in place and appeared acceptable, although implementation will be reviewed after completion of the periodic assessment. The PM optimization program was a good initiative to reduce SSC unavailability.

M1.5 (a)(3) On-line Maintenance Risk Assessments

a. Inspection Scope

Paragraph (a)(3) of the MR specified that when removing plant equipment from service the overall effect on performance of safety functions be taken into account. The guidance contained in NUMARC 93-01 required that an assessment method be developed to ensure that overall plant safety function capabilities were maintained when removing SSCs from service for PM or monitoring. The inspectors reviewed the procedures and discussed the process with the MRC, plant operators, the PRA engineer developing risk configurations, and planning and scheduling personnel.

b. Observations and Findings

The process for plant safety assessments for on-line maintenance was documented in NAD 8.1, "Planning & Scheduling Program/Preventive Maintenance Program." The licensee limited on-line maintenance largely to unexpected failures. As such, the licensee employed a listing of allowable configurations derived primarily from PRA considerations and required consultation with the PRA staff when entering non-analyzed configurations. The list of configurations were contained in a memo from PRA staff titled "Configuration Risk Management," which was maintained in the control room night orders.

A review of recent control room operator logs did not identify any unacceptable equipment out-of-service configurations. Discussions with scheduling personnel indicated that such configurations were rare. Scheduling personnel indicated that for unexpected entry into high risk configurations, the safety significance, time required to

return the equipment to service, and operation and maintenance experience, would be considered for deciding how to return the plant to an acceptable configuration.

The procedure for evaluating shutdown risk was GNP 8.4.1, "Shutdown Safety Assessment (SSA)." The procedure required development of a SSA check list throughout the schedule at least 1 week prior to outage. The configurations developed were largely based on a deterministic approach. The outage schedule was reviewed independently, typically by a shift technical advisor. The procedure also required a review of the SSA check list each shift during the outage.

c. Conclusions

The inspectors concluded that the risk assessment processes were acceptable means of implementing the equipment out-of-service evaluations during at power and shutdown conditions. The PRA staff effectively interacted with scheduling staff for on-line maintenance risk assessment. Scheduling staff and control room operators were aware of safety significant configurations.

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

a. Inspection Scope

The inspectors reviewed program documents in order to evaluate the process established to set goals and monitor under (a)(1) and to verify that PM was effective under (a)(2) of the MR. The inspectors also discussed the program with appropriate plant personnel and reviewed the following systems:

(a)(1) systems	(a)(2) systems
Diesel Generator Electrical	Diesel Generator Mechanical
Control Room Air Conditioning	Radiation Monitoring
Auxiliary Building Special Ventilation and Steam Exclusion	Reactor Building Ventilation and Post LOCA Hydrogen Control
Station and Instrument Air	Shield Building Ventilation
	Spent Fuel Pool Cooling
	Containment Hydrogen Analyzer
	Bleed Steam
	Direct Current (DC) and Emergency Alternating Current (AC) Electrical Distribution

The inspectors 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 were being performed, and that corrective actions were taken when an SSC failed to meet its goal or performance criteria or experienced a maintenance preventible functional failure (MPFF).

The process to evaluate onsite passive structures for inclusion under the MR was reviewed. Structures evaluated by the inspectors included buildings, enclosures,

storage tanks, earthen structures, and passive components and materials housed there in. In addition, the inspectors assessed by what means performance of structures determined to be within scope were monitored for degradation.

b. Observations and Findings

The MR program document provided guidelines used to develop performance criteria and goals for SSCs monitored under the MR. The performance criteria and goals were documented and retrievable. Performance was monitored against established performance criteria over a rolling 18-month cycle . Performance criteria and scope determinations were evaluated for individual functions of systems. In many cases, systems had several functions with individual (and different) performance criteria to suit the specific functions. Performance criteria ranged from limiting MPFFs for specific valves to condition monitoring for piping. In general, performance criteria were acceptable for the specific functions.

Section 9.3.2 of NUMARC 93-01 recommended that high safety significant SSC performance criteria be set to assure that the availability and reliability assumptions used in the risk determining analysis (i.e., PRA) were maintained. The inspectors evaluated the performance criteria to determine if they had been adequately set under (a)(2) of the MR, consistent with the assumptions used to establish SSC safety significance. The inspectors noted instances where different values for unavailability and reliability performance criteria than what were used in the PRA had been utilized.

b.1 Reliability Performance Criteria

As a result of a previous violation (50-305/97002-04(DRS)), the licensee had adjusted reliability performance criteria to better reflect PRA failure rate assumptions. The majority of the revised reliability performance criteria were considered acceptable. However, the reliability performance criteria of a number of high safety significant systems were not consistent with assumptions made in the PRA without adequate justification. The following three examples were identified during the inspection.

The safety injection (SI) system reliability performance criteria was 1 MPFF per 6 demands, or a failure rate of 1.67E-1 while the PRA assumed a value of 1.8E-3. In the second example, the residual heat removal (RHR) system reliability performance criteria was 1 MPFF for 9 demands, or a failure rate of 1.11E-1, while the PRA assumed a value of 1.8E-3. In the third example, the steam generator power operated relief valves (PORVs) reliability performance criteria was 1 failure in 4 demands, or a failure rate of 2.5E-1, while the PRA assumed a value of 5.3E-3. The failure to adequately relate the number of MPFFs to the failure rate probability assumptions in the PRA is a violation of 10 CFR 50.65 (a)(2) since the licensee failed to define performance criteria that could demonstrate that these SSCs were effectively controlled through the performance of appropriate PM (VIO 50-305/97011-02(DRS)).

As a result of concerns raised by the inspectors, the licensee revised reliability performance criteria or expanded the criteria justification in the August 7, 1997, expert panel meeting, consistent with the approach recommended in NUMARC 93-01. The following systems/components performance criteria were modified: steam generator PORVs, steam dump valves, SI system, RHR system, pressurizer PORVs, 480 volt

electrical distribution system, and condensate supply to the auxiliary feedwater pumps. Performance criteria changes were incorporated into Maintenance Rule Database. The licensee planned to place the RHR system into (a)(1) as a result of the revised reliability performance criteria being exceeded. The inspectors reviewed the changes and considered the changes acceptable to demonstrate the link to the PRA model.

b.2 Unavailability Performance Criteria

The unavailability sensitivity study for high safety significant systems was reviewed to determine if the availability performance criteria established could be maintained or needed to be adjusted to the unavailability assumptions used in the PRA. The baseline CDF for Kewaunee was 3.9E-5. The unavailability performance criteria increased the CDF by 33%, assuming each system was at the unavailability performance criteria limit. It was determined that based on the small increase in base CDF that the performance criteria for availability appeared acceptable.

b.3 "Run to Failure" Performance Criteria

A number of functions had reliability performance criteria of "run to failure." These functions included mitigating or preventing a hydrogen buildup in containment and providing indication of hydrogen concentration in containment. The engineering staff determined that these functions did not provide an accident mitigation function and were in MR scope only due to the safety-related classification of various components. (See Section E4.2 for discussion of the determination.) Because of the perceived minimal safety significance in terms of the MR, the licensee elected to use performance criteria of "run to failure" for these functions. The inspectors noted that regular PM, such as surveillances, were being performed on the systems and components needed to support these functions. The systems and components affected were the post-loss-of-coolant-accident (LOCA) hydrogen control ventilation system and the hydrogen analyzers. The inspectors recognized that performance criteria was established for the containment isolation valves in the post-LOCA hydrogen control ventilation system. However, the performance criteria only addressed the closing function of the valves and did not address the opening function, which would be necessary to respond to an accident. The failure to establish appropriate performance criteria that could demonstrate that these standby SSCs were effectively controlled through the performance of appropriate PM is a violation of 10 CFR 50.65 (a)(2) (VIO 50-305/97011-03(DRS)).

b.4 Performance Criteria for Low Safety Significant Normally Operating SSCs

Plant level performance criteria were established for low safety significant normally operating SSCs using the guidelines contained in NUMARC 93-01. The criteria were: less than 2 plant trips per 18 months, less than 3 engineered safety feature actuations per 18 months, and greater than 83% capacity per 18 months. The steam generators were placed in (a)(1) due to the capacity performance criteria not being met. The plant level performance criteria were acceptable.

b.5 Goals Established for (a)(1) SSCs

Corrective actions planned for (a)(1) SSCs appeared to be appropriate to improve performance of (a)(1) SSCs. While corrective actions were explicitly outlined for all SSCs placed in (a)(1), the goals were not always well documented.

The expert panel was required to review and approve the disposition of SSCs to (a)(2). No SSCs had been dispositioned to (a)(2), although the expert panel deliberated dispositioning the diesel generator (electrical) SSC to (a)(2) as discussed in Section M2.1 of this report.

b.6 Structures and Structure Monitoring

Guidance for structure monitoring was specified by procedure NEP 8.4, "Maintenance Rule Inspection Guideline for Buildings and Structures." NEP 8.4 specified that structures be inspected at least every 5 years. The guidance for identifying (a)(1) structures reflected the guidance of NRC IP 62002, "Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants." The NEP 8.4 guidance was considered acceptable, although the procedure was not written until over a year after MR requirements went into effect.

The licensee performed baseline inspections for most structures during 1996, although some areas in the auxiliary building and the condensate storage tanks had not yet been inspected. The engineering staff planned to perform a comprehensive walkdown by the end of 1997, which would address areas missed by the previous inspections. The results of the baseline inspections were documented in an assessment and addendum, dated March 7, 1996, and November 7, 1996, respectively. Documentation of observations from baseline inspections included a brief text describing the condition and photographs. The documentation was not always sufficiently detailed to allow for detection of changes in conditions during follow-up inspections. For example, length of existing cracks was not always documented. In addition, although seepage into a containment sump had been noted during refueling outages, the potential effects of seepage on structural components inside containment had not been evaluated. The licensee planned to evaluate the effect of seepage upon structural integrity.

c. Conclusions

The detailed assessment of system functions for MR purposes was good. The majority of performance criteria established were acceptable. However, one violation was identified in that some reliability performance criteria were not adequately linked to the failure rate assumptions in the PRA. Corrective actions were implemented to address this issue before the end of the inspection. Another violation was identified where inappropriate performance criteria of "run to failure" were used for the post-LOCA hydrogen control ventilation system and the hydrogen analyzers. The use of the "run to failure" criteria did not demonstrate that PM of SSCs was effective. Goals and corrective actions for (a)(1) SSCs were appropriate. Tanks, supports, buildings, and enclosures as structures were adequately scoped under the MR. The program established for monitoring of structures was acceptable, although procedural guidance was only recently implemented.

M1.7 Use of Industry-wide Operating Experience

a. Inspection Scope

Paragraph (a)(1) of the MR states that goals shall be established commensurate with safety and, where practical, taking into account industry-wide operating experience (IOE). Paragraph (a)(3) of the MR states that performance and condition monitoring activities and associated goals and PM activities shall be evaluated at least every refueling cycle. The evaluation shall be conducted taking into account IOE. The inspectors reviewed the program to integrate IOE into the MR monitoring program.

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

The methodology for evaluating and initiating action for IOE information was to ensure that lessons learned were used to prevent occurrences of such events and to improve plant safety and reliability.

Industry and in-house operating experiences were screened and, if applicable, processed as an Operating Experience Assessment (OEA) report for further evaluation. The MRC performed a quarterly review of closed OEAs for MR impact. In addition, the program reviewed IOE when setting goals for (a)(1) systems.

c. Conclusions for Use of Industry wide Operating Experience

The inspectors concluded that adequate processes were in place to incorporate information from IOE into goal development and the quarterly assessments.

M2 Maintenance and Material Condition of Facilities and Equipment (61706, 71707)

M2.1 General System Review

a. Inspection Scope

The inspectors conducted a detailed examination of several systems from a MR perspective to assess the effectiveness of the program when it was applied to individual systems.

b.1 Observations and Findings for the Diesel Generator (DG) Electrical System

The DG electrical system had three high safety significant functions with performance criteria to monitor reliability and unavailability at the train level. The DG electrical system was being monitored under (a)(1) as a result of an apparent second MPFF concerning a broken conductor ring-lug termination in DG control panel. The broken lug would have rendered the DG sequential loading relays inoperable. The ring-lug was probably damaged during a design change work activity that was installing cables in DG control panel. Based on a subsequent review, the licensee determined the failure was not caused by a maintenance activity, such that the damaged lug did not constitute an MPFF. The expert panel's initial decision to place the system under (a)(1) was conservative. The panel's decision to return the DG electrical system to (a)(2) was appropriate.

b.2 Observations and Findings for the Control Room Air Conditioning System

The control room air conditioning system had three high safety significant functions. The control room air conditioning system was being monitored under (a)(1) because the control room chillers exceeded the unavailability performance criteria. The high chiller unavailability resulted from a variety of causes. The corrective actions and goals to return the system to (a)(2) were reviewed and appeared acceptable.

b.3 Observations and Findings for the Auxiliary Building Special Ventilation and Steam Exclusion (ASV) System

The ASV system was a standby system that had three high safety significant functions and two low safety significant functions. Functions associated with dampers were tracked as part of a damper super system.

The function for isolating potential leakage which bypasses the shield building annulus was being monitored under (a)(1) because of repetitive solenoid valve failures. The corrective action plan for the system was to replace the solenoid valves with valves from a different manufacturer. At the time of the inspection, all except two valves had been replaced and no failures had occurred with replacement valves. The licensee planned to remove the system from (a)(1) status when all of the valves had been replaced, which appeared acceptable.

b.4 Observations and Findings for the Station and Instrument Air System

The station and instrument air system had one high safety significant and one low safety significant functions. The station and instrument air system was being monitored under (a)(1) because system failures exceeded the reliability performance criteria. The failures were due to a variety of causes and not repetitive in nature. The corrective actions and goals to return the system to (a)(2) were under evaluation.

b.5 Observations and Findings for the DG Mechanical System

The DG mechanical system had eight high safety significant functions with appropriate performance criteria. The DG system was being monitored under (a)(2). System performance was good and no MPFFs were identified.

b.6 Observations and Findings for the Radiation Monitoring System

The radiation monitoring system had three low safety significant functions and one high safety significant function. The radiation monitoring system was being monitored under (a)(2). System performance was good and no MPFFs concerns were identified.

b.7 Observations and Findings for the Reactor Building Ventilation and Post LOCA Hydrogen Control System

The reactor building ventilation and post-LOCA hydrogen control system was a standby system consisting of six low safety significant functions and two high safety significant functions. The performance criteria for each function were appropriate with the exception of the function for preventing and reducing hydrogen buildup because they

were considered "run to failure." The justification for categorizing the hydrogen recombiners as "run to failure" was that the equipment was in scope only because of safety-related designation and that various methods of hydrogen removal existed (see Sections M1.6 and E4.2). One MPFF for vacuum breakers had been identified. However, the MPFF was not tracked under the MR program due to administrative error. The error was of little consequence because the MPFF did not cause a performance criterion to be exceeded.

b.8 Observations and Findings for the Spent Fuel Pool Cooling System

The spent fuel cooling system had one low safety significant function. The spent fuel cooling system was being monitored under (a)(2). System performance was good and no MPFFs were identified.

b.9 Observations and Findings for the Shield Building Ventilation System

The shield building ventilation system was a standby system consisting of three high safety significant functions. The shield building ventilation system was being monitored under (a)(2). The performance criteria for each function were appropriate.

b.10 Observations and Findings for the Containment Hydrogen Analyzer System

The containment hydrogen analyzer was a low safety significant, standby system. The hydrogen analyzers performance criterion was considered "run to failure." The justification for categorizing the hydrogen analyzers as "run to failure" was that the Updated Safety Analysis Report (USAR) analyses determined there would not be a significant amount of hydrogen for approximately 11 days after an accident. Consequently, the licensee considered use of hydrogen analyzers as a recovery action which was outside the scope of the MR (see Sections M1.6 and E4.2).

b.11 Observations and Findings for the Steam Bleed System

The steam bleed system was a low safety significant system with plant level performance criteria. The steam bleed system was being monitored under (a)(2). System performance was good and no MPFFs concerns were identified.

b.12 Observations and Findings for the DC and Emergency AC: Electrical Distribution System

The DC and emergency AC electrical distribution system was a high safety significant system with performance criteria to monitor reliability and unavailability. The system was being monitored under (a)(2). System performance was good and no MPFFs or unavailability concerns were identified.

c. Conclusions for General System Review

The inspectors concluded that the licensee was properly monitoring each SSC under (a)(1) or (a)(2) of the MR. The use of run to failure performance criteria for several systems was not adequately justified. The corrective actions, both in progress and planned, for SSCs in (a)(1) appeared adequate. The inspectors did not identify in the

SSCs reviewed any MPFFs not previously identified. SSC functions for the system reviewed were properly scoped under the MR.

M2.2 Material Condition

a. Inspection Scope

In the course of verifying the implementation of the MR using NRC IP 62706, the inspectors performed walkdowns using NRC IP 71707, "Plant Operations," to examine the material condition of the systems listed in Section M1.6.

b. Observations and Findings

With minor exceptions, the systems were free of corrosion, oil leaks, water leaks, trash, and based upon external condition, appeared to be well maintained.

c. Conclusions

In general, the material condition of the systems examined was very good.

M7 Quality Assurance in Maintenance Activities (40500)

M7.1 Licensee Self-Assessments of the Maintenance Rule Program

a. Inspection Scope

The inspectors reviewed two quality program (QP) audits conducted in June 1996 and March 1997, both of which pertained to implementation of the MR.

b. Observations and Findings

The QP audits identified a number of good issues and provided appropriate recommendations. The overall conclusion of both audits indicated that the MR program was not considered effectively developed, procedurized, or implemented in accordance with 10 CFR 50.65. The 1997 audit identified that some Quality Assessment Reports from the 1996 audit were closed although corrective actions were not adequately implemented. As a result of the 1997 audit, a complete MR program review was performed. The results of this review was the basis for the MR program evaluated during this inspection. This review, with a couple of exceptions, was able to establish a MR program to monitor the effectiveness of maintenance.

The QP audits were conducted by a multi-disciplined team, which included technical consultants and MRCs from other facilities. This approach provided an independent viewpoint, which added to the overall quality of the audits.

c. Conclusions

The QP audits identified a number of issues and concluded the MR program was not effectively implemented. The corrective actions performed after the 1997 audit were

effective to establish a program that met MR requirements. The use of independent personnel provided significant insights into the MR program.

M8 Miscellaneous Maintenance Issues

M8.1 (Closed) VIO 305/97002-04: Failure to establish goals commensurate with safety in accordance with 10 CFR 50.65 for the residual heat removal system. Performance criteria had since been revised to better reflect PRA reliability assumptions. However, some cases were identified during this inspection in which the reliability performance criteria could allow a failure rate significantly greater than that assumed in the PRA. Although this violation is considered closed, a similar violation was identified in Section M6.b.1 of this report.

III. Engineering

E4 Engineering Staff Knowledge and Performance (62706)

E4.1 Engineer's Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

The inspectors interviewed engineers and managers to assess their understanding of PRA, the MR, and associated responsibilities.

b. Observations and Findings

The engineers were experienced and knowledgeable about the systems and had an understanding of the MR. The MR program relied heavily on the expert panel members and the MRC for the implementation of the MR. The responsibilities of the engineers were to review KAPs for MPFFs and establish corrective action plans.

c. Conclusions

The engineers were experienced and knowledgeable about the systems. The reliance on the expert panel to implement the program, while limiting the engineers MR responsibilities, appeared acceptable.

E4.2 Maintenance Rule Function Determination

a. Scope

Engineering personnel had determined that the post-LOCA hydrogen control and analysis systems and components were only within the scope of the MR due to an inappropriate safety grade classification. The engineering determination was that most of the functions accomplished by these systems and components were not necessary for mitigation of an accident. The systems and components affected by this determination included a) the containment hydrogen analyzers, b) post-LOCA hydrogen control ventilation system, and c) the capability to connect external hydrogen recombiners. The inspectors reviewed licensee documents associated with this determination.

b. Observations and Findings

Engineering personnel documented the basis for the determination in Appendix 5 to the Maintenance Rule Program Plan. For MR purposes, the engineering staff had determined that SSCs not needed during the first 72 hours of an accident were not needed for mitigation purposes. Rather, SSCs only needed after the first 72 hours of accident were considered necessary only for accident "recovery." The 72 hour time frame was chosen to be consistent with other licensing bases such as the 10 CFR 50, Appendix R, and plant specific design bases. Because the USAR stated that 3.5% hydrogen concentration would not be reached until 11 days after an accident under the most conservative assumptions, engineering personnel had determined that hydrogen analysis and control were "recovery" actions. In addition, the Westinghouse Owners Group basis documentation for the EOP steps which dealt with hydrogen described the actions as "recovery" actions.

Section 14.3.9 of the USAR discussed the methods of controlling hydrogen which could be generated after a LOCA. The two preferred methods discussed for controlling hydrogen were venting and repressurization. These methods of controlling hydrogen relied upon the post-LOCA hydrogen control ventilation system. In addition, the USAR noted that the capability to use an external hydrogen recombiner had been provided.

The need to perform actions based on hydrogen concentration were specified by the following steps in EOPs: step 23 of EOP E-1, step 7 of EOP FR-C.1, and step 7 of EOP FR-Z.1. These steps directed operators to check hydrogen concentration and, if hydrogen concentration was in the range of 0.5% to 6%, to decrease hydrogen concentration in accordance with procedure N-RBV-18C. Procedure N-RBV-18C provided guidance to use the post-LOCA hydrogen control ventilation system and external hydrogen recombiners. Although the basis documents described the EOP steps as being "recovery" actions, the inspectors determined that the steps were for mitigating the consequences of an accident rather than a recovery action such as system restoration. A 0.5% hydrogen concentration could exist early during an accident and operators could, by the procedure steps noted above, be directed to reduce hydrogen concentrations well before 72 hours.

Hydrogen monitoring and dedicated hydrogen penetrations were mandated in response to the Three Mile Island (TMI) accident in order to mitigate the buildup of hydrogen which could result from a LOCA. Item II.F.1.6, of Enclosure 3 to NUREG-0737, "Clarification of TMI Action Plan Requirements," outlined requirements for containment hydrogen monitors. This item specified that continuous indication and recording shall be functioning within 30 minutes of the initiation of safety injection. The licensee committed to install equipment for this item as described by correspondence dated April 23, 1982. The capability to measure hydrogen concentration in containment was also required by 10 CFR 50.44(b)(1). Item II.E.4.1 of Enclosure 3 to NUREG-0737 outlined requirements for dedicated hydrogen penetrations. This item specified that dedicated penetrations be provided for purge systems or external recombiners and that components furnished to satisfy the requirement be safety grade. By correspondence dated July 1, 1981, the licensee stated that the post-LOCA hydrogen control system, described in Section 14.3.9 of the Final Safety Analysis Report, met the requirements for this item. 10 CFR 50.44 required that nuclear power plants of this vintage have the capability to

install an external recombiner following the start of an accident. This capability was provided by the post-LOCA hydrogen control ventilation system.

c. Conclusion

Based on the need to determine hydrogen concentration for performance of EOP steps to mitigate an accident, the inspectors concluded that the function of determining hydrogen concentration was a MR function. Similarly, based on the need to reduce hydrogen concentration for performance of EOP steps to mitigate an accident, the inspectors concluded that the function of reducing hydrogen concentration was a MR function. In addition, the inspectors determined that the capability to install an external recombiner was also a MR function. The determination that these functions provided little or no contribution to system safety function to be allowed to run to failure and were not MR functions was not technically justified.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors discussed the progress of the inspection with licensee representatives on a daily basis and presented the inspection results to members of licensee management at the conclusion of the inspection on August 8, 1997. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary; none was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

E. Coen, PRA Engineer, Engineering and Technical Support (E&TS)
C. Haataja, Mechanical Maintenance Superintendent
R. Hanson, Operations Supervisor
G. Harrington, Plant Licensing Supervisor
P. Lindberg, Maintenance Superintendent
R. Pulec, Superintendent, Nuclear Licensing and Systems
D. Ropson, Manager, E&TS
K. Schommer, Maintenance Rule Coordinator
C. Schrock, Manager, Kewaunee Nuclear Plant
C. Smoker, Superintendent, Plant Quality Programs
F. Stanaszak, PRA Analyst, E&TS
T. Webb, Evaluation Process Leader
K. Weinhauer, Assistant Manager, Plant Operations

LIST OF INSPECTION PROCEDURES USED

IP 62706:	Maintenance Rule
IP 40500:	Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 71707:	Plant Operations
IP 62002:	Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

50-305/97011-01(DRS)	IFI	Periodic Assessment
50-305/97011-02(DRS)	VIO	Reliability/Unavailability PRA Performance Criteria
50-305/97011-03(DRS)	VIO	Containment Hydrogen Monitoring and Removal Performance Criteria

Closed

50-305/97002-04(DRS)	VIO	Failure to Establish Goals Commensurate with Safety
50-305/97011-02(DRS)	VIO	Reliability/Unavailability PRA Performance Criteria

LIST OF ACRONYMS USED

AC	Alternating Current
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
DC	Direct Current
DG	Diesel Generator
EOP	Emergency Operating Procedure
E&TS	Engineering and Technical Support
F-V	Fussell-Vesely
IFI	Inspection Follow-up Item
IOE	Industry Operating Experience
IP	Inspection Procedure
IPE	Individual Plant Evaluation
KAP	Kewaunee Assessment Process
LOCA	Loss-of-Coolant-Accident
MPFF	Maintenance Preventable Functional Failure
MR	Maintenance Rule
MRC	Maintenance Rule Coordinator
NUMARC	Nuclear Management Resource Council
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
OEA	Operating Experience Assessment
PDR	Public Document Room
PM	Preventive Maintenance
PORV	Power-Operated Relief Valve
PRA	Probabilistic Risk Assessment
QP	Quality Programs
RAW	Risk Achievement Worth
RHR	Residual Heat Removal
SI	Safety Injection
SSA	Shutdown Safety Assessment
SSC	Structure, System, or Component
TMI	Three Mile Island
USAR	Updated Safety Analysis Report
VIO	Violation

LIST OF DOCUMENTS REVIEWED

Maintenance Rule Program Plan, Rev. 1, July 15, 1997

Maintenance Rule Database Changes, August 7, 1997

NAD 8.20, "Maintenance Rule Implementation," Rev. A, July 15, 1997

GNP 8.20.1, "Maintenance Rule Scoping and Performance Criteria," Rev. A, July 15, 1997

GNP 8.20.2, "Maintenance Rule Data Evaluation and Goal Setting," Rev. A, July 15, 1997

GNP 8.20.3, "Maintenance Rule Quarterly and Periodic Assessments," Rev. Orig., July 15, 1997

GNP 11.8.1, "Kewaunee Assessment Process (KAP)," Rev. Orig., April 30, 1996

GNP 8.4.1, "Shutdown Safety Assessment (SSA)," Rev. B, August 26, 1996

GNP 8.7.1, "Preventative Maintenance Optimization Program Instructions, Rev. Orig., February, 13, 1996

NAD 11.8, "Kewaunee Assessment Process (KAP)," Rev. A, March 13, 1997

NAD 8.1, "Planning & Scheduling Program/Preventive Maintenance Program," Rev. Orig., June 29, 1993

NEP 5.5, "PRA Application Documentation Form," Rev. Orig., July 17, 1997

NEP 8.4, "Maintenance Rule Inspection Guideline for Buildings and Structures," Rev. Orig., August 4, 1997

EOP E-1, "Loss of Reactor or Secondary Coolant," Rev. L, October 15, 1996

EOP FR-C.1, "Response to Inadequate Core Cooling," Rev. K, July 2, 1996

EOP FR-Z.1, "Response to High Containment Pressure," Rev. H, July 2, 1996

Operating Procedure N-RBV-18C, "POST-LOCA Hydrogen Control," Rev. J, February 22, 1994

E. D. Coen Memo, "Configuration Risk Management," August 1, 1997

Baseline Inspection Assessment and addendum, March 7, 1996 and November 7, 1996

Maintenance Rule Quarterly Reviews, July - September 1996, October - December 1996

Individual Plant Examination (IPE) for the Kewaunee Nuclear Power Plant, November 1993

Audit Number 96-021, Audit of Maintenance Rule Program, August 30, 1996

LIST OF DOCUMENTS REVIEWED (cont'd)

Audit Number 97-022, Audit of Maintenance Rule Program, April 14, 1997

Wisconsin Public Service Corporation Letter NRC-81-107, from E.R. Mathews to D.G. Eisenhut, July 1, 1981

Wisconsin Public Service Corporation Letter NRC-82-67, from E.R. Mathews to D.G. Eisenhut, April 23, 1982