U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-341
License No:	NPF-43
Report No:	50-341/98002(DRS)
Licensee:	Detroit Edison Company (DECo)
Facility:	Enrico Fermi, Unit 2
Location:	6400 N. Dixie Hwy Newport, MI 48166
Dates:	January 14-15,1998 (On-site) January 20 through February 6,1998 February 9-13, 1998 (On-site)
Inspectors:	Andrew Dunlop, Reactor Engineer (Team Leader), RIII Martin Farber, Reactor Engineer, RIII Ronald Langstaff, Reactor Engineer, RIII Rogelio Mendez, Reactor Engineer, RIII Neil O'Keefe, Resident Inspector, Fermi Mike Calley, PRA Consultant, INEEL
Support Member:	Frank Talbot, Operations Engineer, NRR
Approved by:	James A. Gavula, Chief Engineering Specialists Branch 1 Division of Reactor Safety

EXECUTIVE SUMMARY

Enrico Fermi, Unit 2
NRC Inspection Report 50-341/98002(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, resident, and Office of Nuclear Reactor Regulation inspectors, and a contractor from Idaho National Engineering and Environmental Laboratory.

In general, the program met the requirements of the maintenance rule (MR); however, some programmatic areas were weak in some aspects of their implementation. Some good initiatives with the program were also identified. Three violations, one inspection follow-up item, and one unresolved item were identified.

Maintenance

- The scoping determinations were appropriate for most structures, systems, and components (SSCs) and functions. However, a weakness in the scoping process resulted in a violation in that four SSCs/functions were inappropriately excluded from the scope of the MR program. (Section M1.1)

- The approach to establishing the risk ranking for SSCs was adequate, although the downgrading of systems were not always sufficiently justified. (Section M1.2.b.2)

- Although the periodic assessment was adequate to meet the requirements of the MR, some areas were not assessed in great detail in the report. (Section M1.3)

- The processes for assessing plant risk resulting from equipment being out-of-service for on-line maintenance and shutdown risk management were determined to be good. The use of the Initiating Events Guidance Document was considered a good additional initiative to assess the risk associated with on-line maintenance. (Section M1.5)

- The performance criteria for reliability and unavailability were good. However, one isolated violation was identified concerning monitoring an SSC reliability at the system versus the divisional level. (Section M1.6)

- Several functional failures were not identified by the program process, which showed a weakness in evaluating problems for MR applicability. Specifically, failures were not always assessed based on a system licensing basis and design functionality; and potentially allowing compensatory measures to satisfy the system function. Inappropriate functional failure determinations were also identified as a concern by the recent self-assessments. One violation was identified for failure to adequately monitor an (a)(1) SSC against goals. (Sections M1.6.b.1.3)

- The structural monitoring program was effective. Inspections adequately assessed the conditions of structures and corrective actions were initiated to correct deficiencies. (Section M1.6.b.4)

Quality Assurance

- The recent assessments of the MR program were acceptable. The use of outside personnel provided independent insights into the MR program and added to the overall quality of the audit. (Section M7.1)

Engineering

- The system engineers were experienced and knowledgeable about their systems and their responsibilities with respect to the MR. Several tools available to the system engineers were beneficial to provide support in the monitoring of system performance with respect to the MR. (Section E4.1)

Report Details

Summary of Plant Status

The unit was in a forced outage 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, a resident inspector, and a consultant from Idaho National Engineering and Environmental Laboratory. Assistance and support were provided by the Quality Assurance, Vendor Inspection, and Maintenance Branch, Office of Nuclear Reactor Regulation (NRR).

I. Operations

O3 Operations Procedures and Documentation

O3.1 Post-Accident Containment Atmosphere Mixing

a. Scope

The inspectors reviewed the emergency operating procedures (EOPs) and the Updated Safety Analysis Report (USAR) with respect to EOP implementation and applicability of NRC requirements for a mixed containment atmosphere. This issue was unrelated to maintenance rule implementation.

b. Observations and Findings

Appendix A of the USAR stated that the licensee complied with the guidance of Regulatory Guide (RG) 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," Revision 2. Regulatory Position C.1 of RG 1.7, specified that boiling light-water nuclear power reactors, such as Fermi, have the capability to mix the atmosphere inside primary containment. In addition, paragraph (b)(2) of 10 CFR 50.44, "Standards for combustible gas control system in light-water-cooled power reactors," required that reactors have the capability to ensure a mixed atmosphere in containment. Additionally, the Boiling Water Reactor Owners' Group Emergency Procedure Guideline bases stated that operation of the drywell hydrogen mixing system served to redistribute the hydrogen throughout the drywell thereby diluting localized regions of high hydrogen concentrations. Combustible gas control was needed to mitigate hydrogen buildup inside containment following a loss-of-coolant-accident (LOCA).

The drywell fans appeared to be the primary equipment necessary to provide a mixed atmosphere in containment for combustible gas control. Although mixing would have

been provided by drywell sprays used during the initial stages of a LOCA, drywell sprays were not expected to be used during later stages of an accident when hydrogen concentrations would be higher. The inspectors noted that the EOPs directed operators to trip the drywell fans if the drywell pressure exceeded 20 psig and if the suppression pool water temperature exceeded 120°F. USAR Table 6.2-1, "Containment Parameters," provided values that indicated that drywell pressure would exceed 20 psig and suppression pool water temperature would exceed 120°F after a LOCA from a recirculating line break. As such, the EOPs directed operators to trip the drywell fans under conditions that could be expected after a LOCA. Additionally, Section 9.4.5.3 of the USAR stated: "In the event of a postulated design basis accident (LOCA), all of the single-speed drywell cooler fans in AUTO are automatically tripped, and the four two-speed drywell cooler fans then automatically shift to slow speed. Plant procedures prescribe that direct operator action is then required to immediately trip these four fans after such a LOCA event, and also to not return any of the fourteen fans to an operational status. This is done in order to minimize any potential debris generation from unqualified coatings on the interior of the drywell fan housings."

Given that operators were directed to shut off the drywell fans after a LOCA, the inspectors questioned how the licensee met their regulatory commitment to RG 1.7 and the requirements of 10 CFR 50.44. The inspectors acknowledged that providing a mixed atmosphere in containment was less critical for an inerted containment than for a non-inerted containment. However, neither the inspectors nor the licensee were aware of any formal NRC position that exempted plants with inerted containments from the requirements of RG 1.7 and 10 CFR 50.44 to provide a mixed atmosphere. This issue is an unresolved item (50-341/98002-01(DRS)) pending further review by NRC.

c. Conclusions

The issue regarding the requirement applicability for providing a mixed atmosphere in containment was identified as an unresolved item pending further review by the NRC.

O4 Operator Knowledge and Performance

O4.1 Operator Knowledge of Maintenance Rule

a. Inspection Scope (62706)

The inspectors interviewed five licensed operators including one nuclear shift supervisor, three nuclear assistant shift supervisors, and one nuclear supervising operator 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 operations personnel interviewed had a good general knowledge of the MR and their role in its implementation. These personnel were knowledgeable of the responsibilities concerning the tracking of unavailability data and understood the

difference between availability and operability as it applied to the Technical Specifications. A working knowledge was demonstrated for determining the risk significance of taking equipment out-of-service (OOS), although some operators did not fully understand the limitations inherent in using the on-line risk matrix. Operations personnel also stated that implementation of the MR did not significantly impact other operator responsibilities and that they had received recent training on the MR.

c. Conclusions

Operations personnel interviewed had the requisite knowledge necessary to fulfill their responsibilities concerning the MR.

II. Maintenance

M1 Conduct of Maintenance (62706, 62002)

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 the MR program in accordance with 10 CFR 50.65(b). Scoping documents reviewed included: the Maintenance Rule Program Manual (MRPM), Appendix G, "Maintenance Rule SSC Specific Functions," and MR03, "Scoping." 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 RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, were used as references during the inspection.

b. Observations and Findings

The scoping determinations were appropriate for most systems and functions. However, four examples were identified where the scoping determinations were inappropriate. Although only a few examples were identified, the examples represented a weakness with respect to determinations for nonsafety-related equipment used in EOPs and equipment used to mitigate accidents or transients. The inspectors identified the following systems and functions that were inappropriately excluded from the scope of the licensee's MR program:

- Intermediate and Power Range Neutron Flux Information (C5100-03): This safety-related equipment, used to support function C5100-03, provided neutron flux information to control room operators so they could determine whether the reactor was shutdown and whether reactor power was less than 3%. This information was necessary to identify a scram condition without associated shutdown to operators so they could take action to mitigate an anticipated

transient without scram accident. In addition, the neutron flux information was necessary to support several reactor pressure vessel (RPV) control EOP decision steps. Consequently, the inspectors concluded that this equipment met the scoping criteria of 10 CFR 50.65(b)(1). The licensee agreed that this function should have been in scope. The licensee was not aware of any recent equipment failures that had impacted this function.

- Rod Block Monitoring (C5114): The rod block monitoring system was a nonsafety-related system that automatically blocked control rod withdrawals, which could violate Technical Specification safety limits. Although the USAR described the rod block monitoring system as a "power generation " system, Section 15.4.2, "Rod Withdrawal Error at Power," of the USAR accident analyses took credit for the rod block monitoring system to mitigate reactivity and power distribution anomaly transients. The system engineer (SE) stated that although some analyses for prior fuel cycles supported removal of the rod block monitor, the analysis for the current fuel cycle did not support its removal. In addition, no 10 CFR 50.59 safety analyses had been performed to delete the credit taken in USAR Chapter 15 for the rod block monitor. Consequently, the inspectors concluded that the rod block monitoring system was used to mitigate a transient and met the scoping criteria of 10 CFR 50.65(b)(2)(i).

- Steam Tunnel Cooling (T4111): The steam tunnel cooling system was a nonsafety-related system for maintaining main steam tunnel temperature below 130°F and was required to operate during normal plant operation. The licensee's MR Program Position 96-025, "Justification for Steam Tunnel Cooling System (T4111) Not In The Maintenance Rule Scope," stated that a loss of steam tunnel cooling would result in a main steam line isolation and reactor scram on a high steam tunnel temperature signal. Despite this statement, the position paper inappropriately recommended that steam tunnel cooling remain out of scope. Based on the information provided in the position paper, the inspectors concluded that the steam tunnel cooling system could cause a reactor scram and a safety-related system actuation, such that the system met the scoping criteria of 10 CFR 50.65(b)(2)(iii). The licensee agreed that this function should have been in scope. The licensee was not aware of any recent equipment failures that had impacted this function.

- Containment Purge and Drywell Vent Function (T4802-07): The nonsafety-related equipment used to support function T4802-07 was used in the hydrogen control EOPs for establishing a purge to backup the hydrogen recombiners. In addition, one of the valves covered by this function was necessary to establish a drywell vent path used for both hydrogen control and primary containment pressure control. Additionally, USAR Section 6.2.5, "Primary Containment Combustible Gas Control," took credit for the containment purge capability as a backup to the hydrogen recombiners for hydrogen control. Consequently, the inspectors concluded that the equipment needed to support the containment purging function was used to mitigate accidents and was used in EOPs, thereby meeting the scoping criteria of 10 CFR 50.65(b)(2)(i). The licensee agreed that

this function should have been in scope. The licensee was not aware of any recent equipment failures that had impacted this function.

As of January 14, 1998, the above systems and functions were not included within the scope of the licensee's MR program which constituted a violation of 10 CFR 50.65(b) (50-341/98002-02(DRS)).

In addition to the above violation examples, the inspectors noted that the licensee had excluded the rod position information system (RPIS) from the scope of their MR program. The RPIS was a nonsafety-related system that provided information to operators necessary for determining whether all rods were inserted to support several RPV control EOP decision steps. The licensee stated that without RPIS, the EOPs directed operators towards more conservative reactivity control actions and that a safe shutdown would still be achieved. Additionally, operators stated that RPIS was not needed to mitigate an accident. The inspectors concluded the licensee's position was technically acceptable.

c. Conclusions

The scoping determinations were appropriate for most systems and functions. However, four systems/functions were inappropriately excluded from the scope of the MR program resulting in one violation of 10 CFR 50.65(b). The inappropriate scoping determinations represented a weakness in the original scoping process.

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 safety assessment (PSA) insights with operations and maintenance experience, to compensate for the limitations of PSA 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 was composed of experienced personnel representing operations, maintenance, design and system engineering, work control, risk assessment, and the site MR principle engineer. Expert panel activities were established and controlled by MRPM MR02, "Expert Panel," which included the qualifications for expert panel members, meeting frequency, and quorum requirements. The expert panel responsibilities included approving revisions to the MR program, SSC scoping changes, SSC risk determinations, and reviewing (a)(1) goal setting and get-well plans.

The inspectors reviewed transcripts of several expert panel meetings. The respective SEs were present for discussions of their systems, and were considered voting members. The deliberations and discussions were well-controlled and reflected a balanced evaluation by the panel, considering both risk and operational concerns. Transcribing expert panel meetings provided excellent documentation of decisions.

The MR training provided to the expert panel members was effective; however, their PSA knowledge was limited. This was somewhat compensated for by having a PSA expert on the panel to answer questions. Also, the risk determination process utilized compensated for limited understanding of the PSA.

c.1 Conclusions on Expert Panel

The expert panel was a well-balanced group of qualified, experienced personnel. The panel used PSA in conjunction with their experience base to assess the safety significance of SSCs.

b.2 Observations and Findings on Risk Determinations

b.2.1 Analytical Risk Determining Methodology

The process for establishing the safety (risk) significance of SSCs was documented in MRPM MR01, "Maintenance Rule Program Description," and MR04, "Determination of Risk significance." These documents were reviewed and found to have adequately described the process of determining safety significance.

The licensee used guidance similar to NUMARC 93-01 for the identification of safety significant SSCs modeled in the Individual Plant Examination (IPE). The three measures used for assessing safety significance determination were if an SSC's Fussell-Vesely value had been greater than 0.5%, if an SSC's risk achievement worth had been equal to or greater than 2.0, or if an SSC's probabilistic importance value had exceeded 1%. The PI measure was defined by the licensee as the ratio of the sum of core damage frequencies for the sequences that the top event was a contributor and the total core damage frequency (CDF).

The licensee used plant-specific PSA studies to rank SSCs with regard to their safety significance. These PSA studies included the IPE PSA model, the Individual Plant

Examination of External Events, and the updated PSA model. The IPE PSA model was used for the original safety significance determination for the MR. The safety significance determinations were revised based on the updated PSA model, which reflected current plant configurations, but included only a limited amount of plant specific data. The PSA model was a large event tree model, and the RISKMAN computer code was used to develop and quantify the model.

For the risk ranking process, the licensee used a truncation level of 1.0E-12 for quantification and the overall CDF was 7.2E-6 per reactor year. The truncation level used for the safety significance determination process was considered to be reasonable.

b.2.2 Adequacy of Expert Panel Evaluations

The licensee approach to safety significance determinations also included evaluations by the expert panel. The first evaluation was based on a Delphi approach, similar to that described in NUMARC 93-01. Expert panel members assessed each SSC based on four accident response functions and six normal operation functions. Results were obtained and the top 36 SSCs were retained for further evaluation.

The final evaluation was to assess all the SSCs identified by the PSA importance measures and by the expert panel's Delphi approach. Based on the rankings and additional PSA insights, the expert panel downgraded 19 SSCs. Although most decisions were considered acceptable, the decisions to downgrade the core spray (CS) system and the reactor recirculation (RR) system appeared to have insufficient justification as one of the three importance measures was exceeded. Based on the inspectors concern, the licensee provided additional information to clarify the decision process. The CS system had a probabilistic importance value of 2.19% (criteria used was a value of at least 1%), but was downgraded with the justification that the Fussell-Vesely and risk reduction worth values were low. Since the probabilistic importance value for the CS system did not exceed the established criteria by a wide margin, the inspectors accepted the downgrade justification. The RR system had a risk achievement worth of 6.8 (criteria used was a value of at least 2), but was downgraded with the justification that the Fussell-Vesely and risk reduction worth values were low. The justification to downgrade the RR system just because other importance measures did not meet the cutoff criteria appeared inappropriate based on the importance measure that was exceeded. Nevertheless, the risk ranking for the RR system would not affect the established performance criteria as it was already acceptable for a high safety significant system. Based on the inspectors concern, the licensee stated that the RR safety significance will be reviewed again by the expert panel.

The inspectors also noted that while the emergency diesel generator (EDG) system was a high safety significant system, the residual heat removal (RHR) complex heating ventilation and air conditioning system (HVAC) was only a low safety significant system. The RHR complex HVAC was used to provide ventilation for the EDGs and the support systems in each of the four EDG rooms. The licensee stated that the EDG rooms did not require cooling because the EDGs were rated to operate at 122°F and that the EDG rooms would not approach this temperature, which was the basis for not including the

RHR complex HVAC in the PSA. This evaluation was based on engineering judgement and not on temperature studies or design calculations. The study stated in part, "It is assumed that due to the large size and open layout of the RHR complex pump rooms that pump room ventilation is not required for the success of any of the equipment in the RHR complex." The inspectors questioned the validity of the assumption without the reliance on actual temperature measurements and secondly, while the study implied that ventilation was not required for the pumps, no mention was made of the EDGs, which were in separate rooms.

The licensee provided the inspectors additional information including room temperature calculations and the systems importance measures for the RHR complex HVAC system that were determined from a PSA study. Based on this additional information, the inspectors considered safety significance ranking acceptable.

c.2 Conclusions on Risk Determinations

The approach to establishing the risk ranking for SSCs was adequate, although the ranking of three systems required further justification.

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 (PM) activities be evaluated, taking into account where practical, industry-wide operating experience (IOE). 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 the 1997 periodic assessment.

b. Observations and Findings

The guidance for conducting periodic assessments were contained in procedure MRPM MR11, "Periodic Assessment." The guidance for preparing periodic assessments was considered minimal, consisting of a basic outline in which the report would be prepared. The 1997 periodic assessment did contain the appropriate evaluations to meet the requirements of 10 CFR 50.65(a)(3) and the intent of NUMARC 93-01, Sections 12 and 13.5. Several areas, however, contained minimal assessment information. This included the areas associated with balancing availability and reliability, IOE, and goals and corrective actions for (a)(1) systems. The first two examples were discussed in Sections M1.4 and M1.7, respectively. As for goals and corrective actions, the assessment did not explicitly identify what the goals were for each (a)(1) system and the status of the get-well plans. Although not included in the periodic assessment, these issues were discussed with the expert panel on a monthly frequency to monitor the progress of get-well plans. In addition, several graphs depicting system unavailability were not adequately reviewed to identify anomalies with the data. For example, three of the four residual heat removal service water pumps had unavailability time for PM and

surveillances, while the fourth pump had zero unavailability time during the same period. The licensee stated the guidance document will be strengthened, along with the areas discussed above in future periodic assessments.

c. Conclusions

Although the guidance for performing periodic assessments was minimal, the 1997 assessment was adequate to meet the requirements of the MR and the intent of the NUMARC implementing guidance. Some areas in the periodic assessment, however, were not assessed in great detail.

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 ensure that the objective of preventing failures through the performance of PM was appropriately balanced against the objective of minimizing unavailability due to monitoring or PM.

b. Observations and Findings

The MRPM MR01 provided minimal guidance for balancing reliability and unavailability for high safety significant SSCs. Balancing consisted of ensuring both the reliability and availability performance criteria were met, which was an acceptable method for balancing. The procedure stated that adjustments shall be made, where necessary, to maintenance activities to ensure that the objective of preventing failures was appropriately balanced against the objective of assuring acceptable SSC availability.

The 1997 periodic assessment report stated that most systems demonstrated a good balance of availability and reliability. This conclusion was based on no SSCs exceeding their OOS hours (unavailability performance criteria), however, the report did not address if SSCs reliability criteria were exceeded. Both criteria must be addressed to adequately assess balancing. In addition, neither the periodic assessment report nor the MR procedure discussed what actions to take when conditional probability was not met, which combined both reliability and unavailability into one criteria. This criteria was exceeded for the auxiliary electrical and the EDG systems.

c. Conclusions

Although the program guidance and periodic assessment documentation for balancing reliability and unavailability was weak, no SSCs were considered unbalanced.

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 PSA engineers, the work control scheduling supervisor, work week manager, refueling outage planner supervisor, and a nuclear shift supervisor.

b. Observations and Findings

The process for risk management when equipment was taken OOS was documented in the MRPM MR01 and MR12, "Equipment Out of Service Risk Management." Additional guidance was contained in Work Management Guidelines Memorandum, NPSC 96-0058, and Operations Department Instruction ODI-044, "Operations Outage Philosophy." All of these documents were reviewed and found to adequately describe the process of risk management when taking equipment OOS.

The process utilized a 13-week schedule with anticipated outage windows identified. The PSA group utilized the 13-week schedule to develop a contingency system outage importance risk matrix. The matrix used four risk rankings for the results obtained from an evaluation with the PSA model. If a configuration resulted in an instantaneous CDF greater than 1.0E-3, then the configuration was designated as Unacceptable in the matrix and the configuration was prohibited. The remaining risk rankings used in the matrix were based on the conditional core damage probability (CDP) for an anticipated configuration (i.e., the duration of the equipment being OOS was taken into account). The remaining risk rankings were Low (CDP less than 1.0E-6), Moderate (CDP between 1.0E-6 and 1.0E-5), and High (CDP greater than 1.0E-5). The risk ranking levels were consistent with the quantitative screening criteria described in the Electric Power Research Institute PSA Applications Guide for temporary plant configurations.

The risk matrix was limited to a two system outage configuration and the PSA engineers were to be contacted to evaluate specific combinations not covered by the matrix. The matrix was cross-referenced with all of the high safety significant systems to ensure that the risk significant combinations were addressed. The process also included an Initiating Events Guidance Document to identify any initiating events that would become particularly important in an outage configuration and would provide examples of activities to avoid to help minimize risk.

The licensee stated that the EOOS computer code was anticipated to be available in May 1998 for their on-line maintenance risk assessments. Utilization of EOOS would strengthen the licensee's on-line maintenance risk assessment because additional plant

configurations could be evaluated and a quantitative result would be available to indicate which SSCs were the most important to return to service.

The shutdown risk management process was based on the standard industry approach, using industry guidance. The Outage Risk Assessment Management (ORAM) program was used to evaluate plant risk from planned and actual outage activities. ORAM was used to evaluate the plant status for five functional areas; decay heat removal, vessel inventory operations, electric power systems, containment systems, and reactivity management.

c. Conclusions

The processes for assessing plant risk resulting from equipment being OOS for on-line maintenance and shutdown risk management were determined to be good. The use of the Initiating Events Guidance Document was considered a good additional initiative to assess the risk associated with on-line maintenance.

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
Emergency Diesel Generators	DC Power
Annunciators	High Pressure Coolant Injection
Auxiliary Electric	Process Radiation Monitors
General Service Water	Reactor Building Closed Cooling Water
	Emergency Equipment Cooling Water
	Residual Heat Removal
	Reactor Building HVAC
	RHR Complex HVAC

The inspectors reviewed each of these systems to verify that goals or performance criteria were established in accordance with safety significance, that IOE 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

therein. In addition, the inspectors assessed by what means performance of structures determined to be within scope were monitored for degradation.

b. Observations and Findings

In general, the established specific performance criteria were good. One isolated example of an inappropriate performance criterion was identified and discussed below. Most high safety significant systems and functions were monitored by both reliability and availability performance criteria. Exceptions had an appropriate technical justification. Reliability and availability criteria were supported by the original PSA for modeled systems. The licensee established a reliability performance criteria of ≤ 3 MPFFs for all systems unless a more restrictive criteria was warranted. Reliability was monitored over a rolling 3-year period. Availability was monitored over a rolling 1-year period.

b.1 Observations and Findings for Reliability and Unavailability Performance Criteria

The inspectors reviewed the performance criteria to determine if the licensee had adequately set performance criteria consistent with the assumptions used to establish the safety significance. Section 9.3.2 of NUMARC 93-01 recommends 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., PSA) were maintained. The process for establishing performance criteria was documented in the MRPM MR01 and MR06, "Establishing Performance Criteria."

Specific performance criteria were established for all high safety significant SSCs and for low safety significant SSCs that were in standby mode. For SSCs modeled in the PSA, the licensee determined the reliability and availability performance criteria based on the conditional probability obtained from the original PSA results. The method and conditional probability obtained for the SSCs were described in Position Paper 96-001, "Development of Conditional Probability for SSCs Modeled in the Fermi 2 PSA." The conditional probability value encompassed the standby availability and the probability to start and the probability to run.

A concern with this approach was the potential masking of one factor by another where it was possible that an imbalance between availability and reliability could result in only a negligible change in the conditional probability. The conditional probability values were used by the licensee to determine the following: the maximum number of allowable failures by assuming that the SSC was always available, the maximum OOS time by assuming no demand failures, and the maximum OOS time with demand failures determined from the maximum allowed unavailability given a specific number of failures of interest that would not cause the SSC to fail its conditional probability performance criteria. The method, along with the maximum number of allowable failures and maximum OOS time with demand failures for the SSCs, were described in Position Paper 96-002, "Extraction of Train Level Conditional Probability from System or Division Level Conditional Probability Values and Redundancy Factor Determination." With these additional criteria, the licensee should be able to detect significant imbalances between availability and reliability, which would alleviate the potential masking concern.

Based on the above evaluations, the performance criteria were adequately linked to the original PSA model results. This linkage, however, had not been reconfirmed with the updated PSA model. The licensee stated this linkage was in progress to ensure the performance criteria established remained acceptable. This is an inspection follow-up item (IFI) (50-341/98002-03(DRS)) pending completion of the linkage between the performance criteria and the updated PSA model, and review by the NRC.

Several specific issues and concerns were identified during the inspection and discussed below:

b.1.1 Program Documentation

Appendix D of the MRPM, "Guidelines for Determining Functional Failures (FFs) and Maintenance Preventable Functional Failures (MPFFs)," implied that many systems should be monitored at the system level. However, monitoring at the divisional level was necessary for many of these systems due to design basis requirements. In response, the licensee verified that most of the systems actually were appropriately monitored at the divisional level. One exception was identified for the nuclear boiler system as discussed in section M1.6.b.1.2. The inspectors independently verified that monitoring of the post accident containment monitoring system had been accomplished at the divisional level. During this inspection, the licensee revised Appendix D to appropriately clarify that divisional monitoring was required for a number of systems.

b.1.2 Nuclear Boiler Reactor Pressure Vessel Parameter Indication Performance Criterion

Nuclear boiler system function B2100-04 was a low safety significant function to provide indication of RPV parameters to control room operators. The RPV parameter indications included reactor pressure and water level. These parameters were used extensively by operators for RPV control EOP decisions. The equipment that supports function B2100-04 was monitored under the reliability performance criterion of three system level MPFFs per three years. Section 6.0 of Appendix D gave an example where the failure of one division of instrumentation providing indication to the control room would not be considered a FF if the other division was functioning. Failure of both divisions of instrumentation would be considered a FF. The inspectors noted that the licensee was committed to meet the intent of RG 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 2. Regulatory position C.1.3.1.b of RG 1.97 specified that no single failure should prevent the operators from being presented the information necessary for them to determine the safety status of the plant and to bring the plant to and maintain it in a safe condition. This single failure criteria applied to category 1 instrumentation such as reactor pressure and water level. Divisional functionality was required to ensure this single failure criteria was met because one of the two divisions could be assumed to be lost for a design basis accident. Consequently, monitoring at the system level was inappropriate and the basis for the November 17, 1997, periodic assessment classification of the nuclear boiler system as (a)(2) was inadequate. Consequently, the failure to monitor the nuclear boiler instrumentation at the divisional level is considered a violation of 10 CFR 50.65 (50-341/98002-04(DRS)).

During this inspection, the licensee revised Appendix D to specify that divisional failures would be considered FFs for the nuclear boiler indication instrumentation. The licensee also reviewed the history of the nuclear boiler indication instrumentation and determined that there had been no divisional FFs within the 3 year monitoring period.

b.1.3 Functional Failure Determinations

The licensee did not always consider equipment functionality in terms of the licensing and design basis requirements. Consequently, two instances were noted where MPFFs were not properly identified. In the first instance, licensing basis functionality requirements were not fully considered for the high pressure coolant injection (HPCI) system. In the second instance, inappropriate maintenance activities which resulted in loss of equipment functionality was not properly evaluated. Additionally, a SE inappropriately believed it was acceptable to take credit for compensatory actions for evaluating RHR complex HVAC equipment failures. The inspectors considered the identification of MPFFs essential to monitor a system's reliability performance. The determinations of FFs was also a concern identified during licensee self-assessments. These issues are discussed below.

- The licensee had failed to identify the January 17, 1997, freezing of a condensate storage tank (CST) level instrumentation line as a FF for the HPCI system (Deviation Event Report (DER) 97-0092). The freezing would have prevented the HPCI system suction transfer from the CST to the suppression pool upon a low CST level as described in USAR Section 6.3.2.2.1. The freezing occurred because the door to the cabinet protecting the instrument line had been bent open to allow operators to obtain CST level readings for a surveillance activity. The opening left by the bent cabinet door allowed the instrument line to freeze and, as such, was maintenance preventable.

  The licensee inappropriately determined that the frozen instrument line was not a FF for the HPCI system because, they believed, a suction transfer would have occurred upon a high suppression pool water level. (The licensee had correctly classified the freezing as a MPFF for the reactor core isolation cooling (RCIC) system which lacked a high suppression pool level suction transfer.) However, the licensee's evaluation only considered a LOCA event in which the water in the CST would be transferred to containment. The licensee's evaluation failed to consider other design basis events such as a safe-shutdown earthquake (SSE). USAR Table 3.2-1 identified the HPCI system as a seismic category I system. USAR Section 3.7 defined seismic category I SSCs as those SSCs that were designed to remain functional in the event of an SSE as described in RG 1.29, "Seismic Design Classification," Revision 3. Regulatory Position C.1 of RG 1.29 specified that Category I SSCs be designed to withstand the effects of an SSE and remain functional. USAR Table 3.2-1 identified seismic requirements as not being applicable to the CST. Consequently, as part of the plant design basis, the CST would be assumed lost following an SSE and a suction transfer on high suppression pool level would not occur. The inspectors concluded that the frozen instrument line would have rendered both RCIC and HPCI inoperable following an SSE because of the lack of a of low CST level suction transfer to the suppression pool. The inspectors noted that HPCI and RCIC would be the only means of coolant injection for

maintaining adequate core cooling at high pressure following an SSE. In addition, the inspectors noted that the licensee had experienced an event where the CST had been rendered unavailable (Inspection Report 50-341/86-35).

During the inspection, engineering staff stated that the freezing of the CST level instrumentation did not render the HPCI system inoperable per Technical Specifications. The inspectors noted, however, that Action 34 of Technical Specification Table 3.3.3-1 required that the HPCI system be declared inoperable within 24 hours if the CST level instrumentation remained inoperable and the HPCI system had not been manually aligned to take suction from the suppression pool.

The inspectors concluded that the freezing of the CST level instrument line was an MPFF of the HPCI system that was not identified as such by the licensee. The failure to identify a MPFF for the HPCI system which was classified as (a)(1) is considered a failure to monitor performance against licensee-established goals as required by 10 CFR 50.65(a)(i) (50-341/98002-05(DRS)). Furthermore, the failure of CST level instrumentation was not considered in the decision to return the HPCI system to (a)(2).

- On January 23, 1996, operators were cycling the mechanical draft cooling tower bypass valve per a surveillance procedure. Operators inadvertently isolated all flow paths for all safety-related service water systems briefly due to an inadequate procedure (DER 96-0067). The licensee had not identified this system isolation as a FF. The failure was maintenance preventable because the failure occurred as the result of a maintenance activity, i.e., the surveillance. The inspectors concluded that this MPFF should have been included in the historical system reviews. The inclusion of this event as a MPFF, however, would not have changed the system's MR categorization. The licensee preliminarily concluded that the event constituted a MPFF for the mechanical draft cooling tower system.

- During discussions regarding the RHR complex HVAC system, the SE stated that when a damper problem was identified, the problem was documented, compensatory actions were taken to block the damper in position, and trouble-shooting was performed to resolve the problem. The SE also stated that even if trouble-shooting verified that an equipment problem existed that would have caused the damper to not reposition automatically as designed, the failure would not be counted as a FF because compensatory actions ensured that the function was met. The inspectors considered taking credit for compensatory actions inappropriate because, by doing so, equipment reliability of the ventilation dampers would not be effectively monitored under the MR. However, the inspectors did not identify any equipment failures for which an inappropriate evaluation had been performed.

b.1.4 Monitoring SSC Unavailability During Shutdown Conditions

Section 4.2.3 of the MRPM MR10, "Monitoring," indicated that unavailability for SSCs would only be monitored during Modes 1, 2, and 3. This was not consistent with the MR, which was applicable during all modes of operation when SSCs were required to be operable. The licensee's position was that monitoring SSC unavailability during

shutdown conditions would not provide useful information to monitor the effectiveness of maintenance due to the large number of possible acceptable plant configurations and redundancies available when shutdown. Additional basis for the licensee's process included that unavailability performance criteria were conservatively derived from the full-power PSA, SSC reliability was monitored during all modes, and an emphasis on outage planning with a defense-in-depth strategy was in place to ensure multiple systems were available for a given function. The defense-in-depth strategy employed ORAM to evaluate the risk of specific plant configurations and provided an illustration of the risk level (green, yellow, orange, red) during an outage. When SSC's reliability/unavailability caused significant changes to the outage schedule or resulted in challenges to the defense-in-depth strategy, an outage critique would be issued and evaluated by the expert panel. For example, due to a number of performance issues with the refueling bridge during the last refueling outage, the expert panel classified the system as (a)(1).

Although the inspectors concluded that the process in place appeared to monitor the effectiveness of maintenance during outages, there was not a clear link between this process and the MR program. Based on the inspectors concerns, the licensee revised MRPM MR02 and MR10 to provide a link between the expert panel reviewing the outage critique reports and the MR program to ensure the effectiveness of maintenance for SSCs required to be operable during shutdown conditions was being monitored. The inspectors considered the revisions acceptable.

b.1.5 Maintenance Preventable Redundancy Factor Failure (MPRFF) Performance Criteria

The general service water (GSW) and station air systems were both configured as single-train, redundant component systems. The GSW system used five redundant pumps and strainers discharging to a common header, while the station air system used three compressors discharging to the plant air system. Because of this configuration, an OOS compressor in the station air system would not result in a FF and the system/train would not incur any unavailability. Similarly, depending on plant loads, ambient temperatures, and lake temperatures, none, one, or more GSW pumps and strainers could have been OOS without losing function or incurring unavailability. Because this configuration minimized the potential for FFs and unavailability at the system/train level, conventional performance criteria such as train reliability and unavailability provided no useful information as component failures would be "masked." Since FFs could occur at components served by the GSW and station air systems, the licensee had established conventional reliability criteria for these two systems. In place of unavailability criteria, the licensee established the MPRFF criterion. This criterion allowed tracking the performance of the system/train through events that caused a pump or compressor to go OOS and eliminate redundancy. Events were evaluated first to identify redundancy failures and then to identify maintenance preventable failures. The inspectors considered MPRFF criterion as an acceptable alternative to unavailability because it countered the effects of masking. While the inspectors endorsed this criterion, two limitations placed on its implementation were considered inappropriate. These limitations were to not consider redundancy failures if the plant was in cold shutdown

(mode 4) or if the redundancy failure was the result of a planned maintenance activity with a duration of less than 1 day. The licensee agreed to remove these limitations.

b.2 Observations and Findings for Plant Level Performance Criteria for Low Safety Significant Normally Operating SSCs

Appropriate plant level criteria had been established for low safety significant normally operating SSCs. The plant level criteria consisted of < 2 maintenance preventable SCRAMS per year, < 3 maintenance preventable SCRAMS per cycle, < 3 maintenance preventable unplanned safety system actuations per cycle, and ≤ 4.5% maintenance preventable unplanned capability loss factor per three years. The inspectors noted that the main turbine control system had been classified as (a)(1) because the plant level criteria for maintenance preventable SCRAMS per cycle had been exceeded. Additionally, the 345kV switchyard had been classified as (a)(1) because the plant level criteria for maintenance preventable unplanned capability loss factor had been exceeded.

b.3 Observations and Findings for Goals Established for (a)(1) SSCs

Goals for (a)(1) SSCs were not explicitly outlined in the corrective action get-well plans for (a)(1) systems nor other program documentation. The MR program staff stated that the goals were the same as the performance criteria for the systems, along with any enhanced monitoring identified in the get-well plan. The use of appropriate performance criteria as goals was acceptable, however, (a)(1) system goals needed to be explicitly documented. The inspectors noted that sustained conformance to established performance criteria was used as a basis to return (a)(1) systems to (a)(2). The get-well plans for (a)(1) systems were generally good, outlining the corrective actions necessary to return the system to (a)(2).

b.4 Observations and Findings on Structures and Structure Monitoring

The structural monitoring program was delineated in MRPM MR14, "Structure Monitoring." This document provided a listing of structures, and provided inspection acceptance criteria and qualifications for personnel performing the inspections. A checklist containing inspection guidelines and a list of inspection attributes were included as part of MR14. The program was consistent with current industry practice and met the guidelines in RG 1.160, Revision 2.

The MR structural baseline inspections were considered complete and the results acceptable. The baseline inspection took credit for structural inspections done throughout 1994 following the December 1993 main turbine catastrophic failure. Discrepancies were identified, documented, evaluated, and appropriate corrective action initiated as needed. There were no structures inspected that were considered as degraded. The inspectors did a walkdown inspection of selected structures. No structural deficiencies that had not been identified during the licensee's baseline inspection were identified.

c. Conclusions

The majority of performance criteria were considered good. However, one isolated example of an inappropriate reliability performance criterion was identified. The performance criteria for reliability and unavailability were adequately justified with the original PSA assumptions, although this justification had yet to be completed for the updated PSA model. Goals and monitoring for systems classified as (a)(1) were appropriate, with the exception of the HPCI system discussed in M2.1.b.6. The structure monitoring program was consistent with current industry guidance and practice. Baseline inspections were properly completed; deficiencies and the associated resolution were properly documented.

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 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. The MR principal engineer, SEs, and the operating experience coordinator were interviewed to learn the extent to which they understood the application of IOE information to MR processes.

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

The inspectors noted that MRPM MR01 specified the use of IOE in scoping, establishment of performance criteria, goals, and get-well plans, and in the periodic assessment. MR01 did not identify the process for incorporating IOE into the MR program, nor did it identify MLS04, "Operating Experience Review Program," as the station's IOE program. MLS04 was a guideline for gathering, evaluating, and acting on IOE. The fundamental approach of MLS04 was that if a review by group leaders and the IOE coordinator identified a potential issue then a Condition Assessment Resolution Document (CARD) was to be prepared. Application of IOE to the MR program was not specified in MLS04.

Although the MR program was not formally linked to the station's IOE program, IOE was being used in the MR program. The SEs showed that they were aware of the IOE program, the requirements to incorporate it into the MR activities, and how to obtain IOE information. Computer access to IOE from a wide range of sources was available to SEs. It was evident that information from IOE was incorporated into (a)(1) goals and get-well plans; however, no documentation supporting incorporation of IOE into (a)(2) performance criteria was available. The licensee stated that this was considered during expert panel meetings. The inspectors considered the evaluation of IOE in the periodic assessment as weak and marginally acceptable. The review did not provide specific information identifying where IOE had been advantageously used, nor did it provide

specific comparisons of equipment performance compared to industry performance. The periodic assessment discussion on the use of IOE dealt with general information and highlighted a need for better use of this information in creating get-well plans. The licensee stated lessons learned from IOE were discussed during weekly SE meetings.

c. Conclusions for Use of Industry-wide Operating Experience

The IOE review program was not clearly linked to the MR program. However, SEs were clearly using IOE information and understood the need to incorporate it into the MR program. Documentation showing appropriate consideration of IOE in MR activities was limited to the system-specific (a)(1) get-well plans.

M2 Maintenance and Material Condition of Facilities and Equipment (62706, 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 Standby Emergency Diesel Generator (EDG) System

The EDG system consisted of one high safety significant function and two low safety significant functions, which were adequately monitored by reliability and conditional probability performance criteria. The EDG system was being monitored under (a)(1) for exceeding the conditional probability performance criterion on one of the four EDGs, due to two start failures. The conditional probability performance criteria of 95% was considered conservative, because it took into account availability, the percentage of successful starts, and the percentage of successful runs. The licensee goals and corrective actions for returning the EDG system to (a)(2) were considered acceptable.

b.2 Observations and Findings for the Annunciator System

The annunciator system consisted of one low safety significant function, which was adequately monitored by reliability performance criteria and goals. The system was appropriately monitored under (a)(1) as of November 11, 1996, due to numerous FFs that had been experienced. The FFs were the result of an inadequate system design. As a result of the failures experienced, the licensee planned to perform significant modifications to the system to address the design problems.

b.3 Observations and Findings for the Auxiliary Electrical System

The auxiliary electrical system consisted of four high safety significant functions and three low safety significant functions, which were adequately monitored by reliability and conditional probability performance criteria. The system was monitored under (a)(1) due

to a number of FFs and poor reliability. A major refurbishment of combustion turbine generator (CTG) 11-1 was performed from April to December 1996. When the CTG reliability did not improve, the system get-well plan was appropriately modified and additional refurbishment performed from July to November 1997. Subsequently, the unit was run 50 times over a 3-week period to demonstrate adequate reliability prior to returning it to service.

The inspectors considered that this system was appropriately addressed under the MR. A significant amount of OOS time was taken to perform numerous work items intended to improve system performance, and when the expected improvement was not demonstrated additional OOS time was taken. The expert panel decided not to count the unavailability time incurred during CTG 11-1 refurbishments toward the conditional probability criteria. The expert panel's decision was based on the extensive refurbishments resulted in virtually a new machine. Thus, the OOS time was considered to not representative the current system performance.

The inspectors reviewed the MR historical system review for this system. The result was thorough, but inspectors noted that it lacked any IOE with similar equipment. Also, the design basis document for the system stated that the system age and lack of replacement parts provided challenges. The inspectors observed that the licensee was replacing obsolete parts on an as-needed basis, but had no systematic approach to address the age-related problems in the equipment, which was originally provided for the Fermi 1 plant and still in use supporting Fermi 2.

The inspectors identified a number of documentation inconsistencies among MR documents and various source documents. For example, the design basis document listed CTG 11-1 as safety-related, while MR documents did not, and the safety significance classification conflicted among several MR documents.

b.4 Observations and Findings for the General Service Water (GSW) System

The nonsafety-related GSW system consisted of one high safety significant function, which was adequately monitored by reliability and MPRFF performance criteria. The MPRFF criterion addressed the impact of maintenance on the built-in redundancy of the system as discussed in section M1.6.b.1.5. The system was properly classified as (a)(1) under the MR program due to exceeding MPRFF performance criterion during the historical review period. The get-well plan developed to address the system's problems was considered acceptable. Performance of pumps and strainers improved as a result of focused engineering and maintenance efforts. Key elements of this were rebuilding all the pumps and better scheduling of maintenance activities to preclude a situation where a pump/strainer failure, while another pump was OOS for maintenance, would cause a loss of redundancy. The inspectors reviewed corrective action documents and noted that the hardware problem rate was declining. This, combined with better scheduling, had resulted in the rate of MPRFFs declining. During the review of corrective action documents, the inspectors identified that DER 960617-01 was not properly identified as an MPRFF even though it was caused by a corrective maintenance activity done under work request number 00Z964481. Because of the

number of other MPRFFs, there was no impact on the system's MR classification. The licensee staff acknowledged the discrepancy.

b.5 Observations and Findings for the Direct Current (DC) Electrical System

The DC system consisted of five high safety significant functions and two low safety significant functions, which were adequately monitored by reliability and unavailability performance criteria. The DC system was being monitored under (a)(2). The inspectors were concerned with a condition that had existed since startup in that the DC battery chargers were experiencing trips whenever the battery chargers were placed on equalize charge. The licensee found that the equalize trip set point of 137.5 volts was set near the high voltage shutdown trip set point of 138.5 volts. Since each set point had a plus or minus tolerance of 0.5 volts, a set point overlap or a minor set point drift could cause inadvertent tripping of the chargers. A modification design change was proposed to change the trip set points. System performance was otherwise good.

b.6 Observations and Findings for the High Pressure Coolant Injection (HPCI) System

The HPCI system consisted of three high safety significant functions and one low safety significant function, which were adequately monitored by reliability and conditional probability performance criteria. Based on the historical review, the system was initially monitored under (a)(1). Due to improvements in reliability, the system was returned to (a)(2) monitoring on August 26, 1997. Most FFs had been appropriately identified by the licensee. However, the licensee had failed to identify the freezing of a CST level instrumentation line as a FF for the HPCI system as discussed in Section M1.6.b.1.3.

b.7 Observations and Findings for the Process Radiation Monitor System

The process radiation monitor system consisted of two high safety significant functions and three low safety significant functions, which were adequately monitored by reliability performance criteria. The system was performing satisfactorily and was monitored under (a)(2). The inspectors noted a documentation discrepancy in that this system was not included on the list of risk significant systems despite having two high safety significant functions.

b.8 Observations and Findings for the Reactor Building Closed Cooling Water System

The nonsafety-related reactor building closed cooling water system consisted of two low safety significant functions, which were adequately monitored by reliability performance criteria. A review of system performance determined that the system was properly monitored under (a)(2). Hardware performance problems were correctly evaluated for FF determinations. The inspectors noted that a variety of design deficiencies had resulted in significant modifications, including a supplemental chilled water system. As a result of the modifications, the system was in good material condition.

b.9 Observations and Findings for the Emergency Equipment Cooling Water System

The emergency equipment cooling water system consisted of two high safety significant functions and one low safety significant function, which were adequately monitored by reliability and availability performance criteria. Evaluation of design deficiencies resulted in the identification of a series of potential FF modes. These were analyzed and determined not to be maintenance related. A review of corrective action documents revealed very few actual hardware problems and a walkdown showed that the system was in good material condition. Although the system was properly monitored under (a)(2), the licensee had established a comprehensive corrective action program to resolve the design issues.

b.10 Observations and Findings for the Residual Heat Removal (RHR) System

The RHR system consisted of three high safety significant functions and five low safety significant functions, which were monitored by reliability and unavailability performance criteria. System performance was good and appropriately monitored under (a)(2). The MR historical review was detailed, and included some limited industry experience. The licensee was not tracking unavailability during periods when the plant was shutdown. Although this appeared to be inappropriate since one train was required for shutdown cooling, this issue was resolved as discussed in section M1.b.6.1.3 of this report.

b.11 Observations and Findings for the Reactor Building Heating, Ventilation, and Air Conditioning (RBHVAC) System

The RBHVAC system consisted of six low safety significant system functions, which were monitored by reliability performance criteria. System performance was good and appropriately monitored under (a)(2). One functional failure review conducted prior to MR implementation was weak in that there was insufficient justification to support the conclusion that the cause was not maintenance preventable. The evaluation was for the failure of a RBHVAC damper actuator which caused the RBHVAC system fans to trip (DER 96-0735). The actuator failed because of a large tear in the actuator diaphragm. Although no root cause was performed, the SE concluded that the failure was not maintenance preventable. Although the lack of a root cause evaluation was not inappropriate given the low safety significance of the system, the evaluation did not provide sufficient justification to conclude the failure was not maintenance preventable. The inspectors recognized that even if the failure had been classified as maintenance preventable, the performance criteria for the RBHVAC system still would not have been exceeded and the systems (a)(2) classification would still have been acceptable.

b.12 Observations and Findings for the RHR Complex HVAC System

The RHR complex HVAC system consisted of three low safety significant functions, which was monitored by a reliability performance criterion. The inspectors had questions regarding risk ranking as mentioned in section M1.2. The RHR complex HVAC system was being monitored under (a)(2). The licensee had not identified any MPFFs for this system. The inspectors noted that, historically, the system had

experienced a number of problems with ventilation dampers. The SE stated that of the 44 dampers in the system, none had failed within the last year. An issue regarding FF determinations was discussed in Section M1.6.b.1.3.

c. Conclusions for General System Review

In general, SSCs were being properly monitored under (a)(1) or (a)(2) of the MR. The inspectors did identify several MPFF examples in the SSCs reviewed that were not previously identified, one of which constituted a violation of (a)(1) monitoring. The corrective actions, both in progress and planned, for SSCs in (a)(1) appeared adequate. SSC functions for the systems 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 good.

M7 Quality Assurance in Maintenance Activities (40500)

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

a. Inspection Scope

The inspectors reviewed the August 1997 self-assessment and January 1998 Quality Assurance/Independent Safety Engineering Group surveillance report on the implementation of the MR program.

b. Observations and Findings

These evaluations focused on the implementation of the MR program. Several program strengths and weaknesses were identified. Deficiencies were documented on CARDs to ensure corrective actions were appropriately evaluated. One noted deficiency identified in the self-assessment, surveillance report, and this inspection was a weakness in evaluating issues for FFs. The use of outside personnel on the self-assessment who

were knowledgeable on MR provided insights into the program and added to the effectiveness of the review.

c. Conclusions

The recent evaluations of the MR program were acceptable. The use of outside personnel provided independent insights into the MR program and added to the overall quality of the assessment. A weakness in FF determinations was identified by both the licensee and the NRC.

III. Engineering

E4 Engineering Staff Knowledge and Performance (62706)

E4.1 System Engineers' Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

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

b. Observations and Findings

The SEs were experienced and knowledgeable about their systems and had an understanding of the MR. PSA familiarization in risk assessment and MR training were provided to the SEs. The SEs had some knowledge of PSA and how PSA was used to develop the performance criteria. The SEs tracked the performance of their assigned systems and were familiar with the reliability, availability, or conditional probability performance criteria. The SEs' responsibilities included MPFF determinations and the preparation of get-well plans. Two computer data bases were useful tools to help the SEs implement the MR. The data bases provided, for each system, the total number of starts, number of start failures, the OOS hours and the current reliability, availability, and conditional probability percentages. The SEs were also provided with a MR desktop reference book that included an overview of the MR program and get-well plans for (a)(1) systems.

c. Conclusions

The SEs were experienced and knowledgeable about the systems. Several useful tools were available to facilitate the SEs implementation of the MR.

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 February 13, 1998. 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

L. Bugoci, Supervisor, Risk Assessment
D. Cobb, Operations Superintendent
W. Colenello, Work Week Manager
R. Delong, Superintendent, System Engineering
P. Fessler, Plant Manager
D. Gipson, Senior Vice President, Nuclear Generation
K. Howard, Superintendent, Plant Support Engineering
L. Kantola, Outage Management
M. Moren, Work Control Scheduling Supervisor
J. Moyers, Director, Nuclear Quality Assurance
W. O'Conner, Manager of Nuclear Assessment
J. O'Donnell, Maintenance Support Supervisor
N. Peterson, Director, Nuclear Licensing
J. Plona, Technical Manager
J. Ramirez, PSA Engineer
J. Rotondo, Supervisor, Nuclear Quality Assurance Oversight
T. Schehr, Operations Engineer
B. Sheffel, Director, Performance Engineering
S. Stasek, Supervisor, Independent Safety Engineering Group
J. Tibai, Maintenance Rule Principal Engineer

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

50-341/98002-01(DRS)	URI	Requirements for Mixed Atmosphere in Containment
50-341/98002-02(DRS)	VIO	Maintenance Rule Scoping Deficiencies
50-341/98002-03(DRS)	IFI	Performance Criteria Linkage to Updated PSA Model
50-341/98002-04(DRS)	VIO	Inappropriate Reliability Performance Criteria
50-341/98002-05(DRS)	VIO	Failure to Adequately Monitor an (a)(1) Goal

LIST OF ACRONYMS USED

CARD	Condition Assessment Resolution and Document
CDP	Conditional Core Damage Probability
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
CS	Core Spray
CST	Condensate Storage Tank
CTG	Combustion Turbine Generator
DC	Direct Current
DER	Deviation Event Report
DRS	Division of Reactor Safety
EOP	Emergency Operating Procedure
EDG	Emergency Diesel Generator
FF	Functional Failure
GSW	General Service Water
HPCI	High Pressure Coolant Injection
HVAC	Heating, Ventilation, and Air Conditioning
IFI	Inspection Follow-up Item
INEEL	Idaho National Engineering and Environmental Laboratory
IOE	Industry-wide Operating Experience
IP	Inspection Procedure
IPE	Individual Plant Evaluation
LOCA	Loss-of-Coolant-Accident
MPFF	Maintenance Preventable Functional Failure
MPRFF	Maintenance Preventable Redundancy Factor Failure
MR	Maintenance Rule
MRPM	Maintenance Rule Program Manual
NUMARC	Nuclear Management Resource Council
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
OOS	Out-of-Service
ORAM	Outage Risk Assessment Management
PDR	Public Document Room
PM	Preventive Maintenance
PSA	Probabilistic Safety Assessment
RBHVAC	Reactor Building Heating, Ventilation, and Air Conditioning
RCIC	Reactor Core Isolation Cooling
RG	Regulatory Guide
RHR	Residual Heat Removal
RPIS	Rod Position Information System
RPV	Reactor Pressure Vessel
RR	Reactor Recirculation
SE	System Engineer
SSC	Structure, System, or Component
SSE	Safe-Shutdown Earthquake
URI	Unresolved Item
USAR	Updated Safety Analysis Report

LIST OF DOCUMENTS REVIEWED

Maintenance Rule Program Manual

- MR01, "Maintenance Rule Program Description," Revision 4, 1/7/98
- MR02, "Expert Panel," Revision 4, 1/12/98
- MR03, "Scoping," Revision 2, 1/12/98
- MR04, "Determination of Risk Significance," Revision 1, 1/12/98
- MR05, "Determination of SSC Functions," Revision 2, 1/12/98
- MR06, "Establishing Performance Criteria," Revision 5, 2/2/98
- MR07, "Historical Review of SSCs," Revision 0, 6/24/96
- MR08, "SSC Classification," Revision 4, 1/12/98
- MR09, "Establishment of Get Well Plans," Revision 9, 2/2/98
- MR10, "Monitoring," Revision 4, 1/12/98
- MR11, "Periodic Assessment," Revision 1, 11/14/97
- MR12, "Equipment Out of Service Risk Management," Revision 3, 1/12/98
- MR13, "Critical Performance Evaluation Program (CPEP)," Revision 2, 8/27/97
- MR14, "Structural Monitoring," Revision 2, 1/12/98
- Appendix A, "Terms and Definitions," Revision 2, 1/12/98
- Appendix B, "References," Revision 2, 1/12/98
- Appendix C, "Position Papers," Revision 5, 2/2/97
- Appendix D, "Guidelines for Determining Functional Failures (FFs) and Maintenance Preventable Functional Failures (MPFFs)," Revision 5, 2/2/98
- Appendix E, "Attachment Cross Reference List," Revision 5, 1/12/98
- Appendix F, "Maintenance Rule Scoping Summary Report," Revision 1, 1/7/98
- Appendix G, "Maintenance Rule SSC Specific Functions," Revision 2, 2/2/97
- Appendix H, "Maintenance Rule Performance Criteria," Revision 2, 2/2/97
- Appendix I, "On-Line Maintenance Risk Matrix," Revision 0, 1/7/98

Quality Assurance Conduct Manual, MQA11, "Condition Assessment Resolution Document," Revision 0, 8/26/97

Engineering Support Conduct Manual, MES40, "Maintenance Rule Program Description," Revision 4, 1/7/98

Licensing/Safety Engineering Conduct Manual MLS04, "Operating Experience Review Program," Revision 4, 8/27/97

Work Management Guidelines Memorandum, NPSC 96-0058, 12/20/96

Operations Department Instruction ODI-044, "Operations Outage Philosophy," Revision 1, 10/16/97

Fermi 2 Individual Plant Examination Submittal Report, 8/92

Fermi 2 Individual Plant Examination of External Events

NQA Special Surveillance 98-1000 for Assessing the Effectiveness of the Implementation of the Maintenance Rule, 1/26/98

LIST OF DOCUMENTS REVIEWED (continued)

Maintenance Rule Periodic Assessment Report - July 1996 through August 1997, 11/17/97

Maintenance Rule Desktop Reference

Emergency Operating Procedure Flow Charts

Maintenance Rule Program Position Paper 96-001, "Development of Conditional Probability for SSCs Modeled in the Fermi 2 PSA," Revision 0, 1/13/98

Maintenance Rule Program Position Paper 96-002, "Extraction of Train Level Conditional Probability from System or Division Level Conditional Probability Values and Redundancy Factor Determination," Revision 0, 1/13/98

Memorandum from Linda Bugoci to John Tibai, "Updated Risk Significance Basis for Maintenance Rule," TMFR-97-0090, 6/2/97

Memorandum from Earl Page to John Tibai, "Performance Criteria Basis Summary," TMIS-98-0002, 1/13/98