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Inspectors:	D. Florek, Senior Operations Engineer, Team Leader J. Williams, Senior Operations Engineer S. Dennis, Operations Engineer J. Trapp, Senior Reactor Analyst W. Cook, Senior Resident Inspector W. Scott, Senior Operations Engineer, HQMB, NRR S. Dinsmore, PRA Analyst, SPSB, NRR
Approved by:	Glenn W. Meyer, Acting Chief Operator Licensing and Human Performance Branch Division of Reactor Safety

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EXECUTIVE SUMMARY

This inspection reviewed Vermont Yankee's engineering analyses to establish and implement a program to meet 10 CFR 50.65, the maintenance rule. The report covers a week onsite inspection by regional and NRR inspectors during the week of December 19, 1997.

ENGINEERING

Scoping (E1.1)

VY had done a good job on identifying those system, structures and components (SSCs) to be included in the scope of the maintenance rule. Based on the sample of SSCs reviewed, the SSCs were properly included within the scope of the maintenance rule.

RISK RANKING AND EXPERT PANEL (E1.2)

The level of detail provided in the PRA, truncation limits and quality of the PRA were appropriate to perform risk categorization in accordance with the maintenance rule. The risk ranking methodology was consistent with industry guidance and the basis for expert panel risk ranking decisions were thoroughly documented in the meeting minutes. The risk ranking by the expert panel for the sample of systems reviewed was appropriate.

The conduct of the expert panel was consistent with the expert panel administrative guidelines and appeared to have added value to the program.

PERFORMANCE CRITERIA AND UNAVAILABILITY MEASURING (E1.3)

Performance criteria for the systems included within the scope of the maintenance rule appeared to be acceptable. However, the VY methodology for establishing reliability performance criteria differed from other prior accepted maintenance rule programs. As such, an inspection followup item was identified to obtain further insights into the VY methodology. A potential liability regarding the reliability performance criteria was appropriately resolved by providing additional guidance in the Maintenance rule Program Manual. A violation was identified for inadequate determination of the effectiveness of risk significant SSC maintenance during a refueling outage because unavailability was not monitored. Prompt corrective actions resulted in closure of this violation during the inspection.

GOAL SETTING AND MONITORING (a)(1) AND USE OF INDUSTRY WIDE OPERATING EXPERIENCE (E1.4)

The goal setting and monitoring of selected (a)(1) systems were appropriate. Corrective action plans were found to be generally well implemented and for the most part timely. Use of industry operating experience to assess in-scope SSCs was evident. System engineers interviewed were generally knowledgeable of their assigned systems and familiar with the maintenance rule and its implementation.

PREVENTIVE MAINTENANCE AND TRENDING FOR (a)(2) SSCs (E1.5)

The criteria established and trending for the systems within the scope of the maintenance rule were appropriate. Industry wide experience was appropriately used to assist in determining root cause and corrective actions. Additionally, VY administrative procedures established the proper guidelines for initiating goals, trending, and monitoring.

The system engineers and expert panel reviewed and revised system basis documents, performance evaluations, and performance improvement plans as required. It was noted, in some cases during the initial implementation of the maintenance rule and development of the system engineering department assignments, that event report investigations were not completed in a timely manner. A review of more recent documents showed that a strong effort had been made and has successfully reduced the backlog and improved the timeliness in completing the investigations.

PLAN ASSESSMENT BEFORE TAKING EQUIPMENT OUT OF SERVICE (E1.6)

The approved procedures for the planning and control of equipment removed from service, at power, to perform preventive maintenance were determined to be appropriately detailed and consistent with the intent of 10 CFR 50.65, paragraph (a)(3). The implementation of these procedures and the specific LCO Plan executed for the A RHRSW pump replacement during the week of December 15, 1997, were well planned and executed.

PERIODIC EVALUATIONS AND BALANCING RELIABILITY AND AVAILABILITY (E1.7)

VY had developed appropriate guidelines for conducting and documenting periodic assessments. The guideline covered the topics required by the rule.

The periodic assessment that was dated November 1997 was not completed in a timely manner. However, it adequately covered the areas required in paragraph (a)(3) of the rule and was determined to be thorough.

STAFF KNOWLEDGE

The maintenance rule coordinator and his assistant in the maintenance organization demonstrated an excellent knowledge of the maintenance rule program and were key to the successful implementation. System engineers had good overall knowledge of the maintenance rule and the specific applicable requirements to their duties. A management challenge may occur due to the imminent transfer of control of the maintenance rule program to the system engineering organization from the maintenance organization.

Operations personnel were able to fulfill their responsibilities under the rule during normal operations and emergent work situations. Their understanding of rule was acceptable.

SELF ASSESSMENTS (E7)

The audit provided a good assessment and identified some recommendations. VY appeared to be responsive in addressing most recommendations. However, lack of timely resolution of the recommendation to track unavailability during a refueling outage contributed to the violation identified during this inspection.

Report Details

E1 Conduct of Engineering (62706)

E1.1 Structures, Systems and Components (SSCs) Included Within the Scope of the rule (62706)

a. Inspection Scope

The team reviewed the scoping documentation to determine if the appropriate structures, systems and components (SSCs) were included within the maintenance rule program in accordance with 10 CFR 50.65(b). The team used NRC Inspection Procedure (IP) 62706, NUMARC 93-01, Regulatory Guide (RG) 1.160, the VY Final Safety Analysis Report (FSAR), the Emergency Operating Procedures (EOPs), and other reference information provided by VY.

b. Observations and Findings on Scoping

Vermont Yankee 10 CFR 50.65 Implementation Guideline No. 2, "Selection of SSCs within the Scope of 10 CFR 50.65," provided the instructions for the selection of SSCs that were in scope. SSCs were identified as described in the Maintenance, Planning and Control (MPAC) Master Equipment List (MEL) computer data base. The functions of SSCs were taken from a number of sources, including:

FSAR
Technical Specifications
VY Safety Classification Manual
VY IPE
Environmental Qualification Program Manual
VY Engineering Design Basis
Safe Shutdown Capability Analysis
System Description manuals and training materials.

With the functions in hand, the SSCs were identified as being in scope if they met any of the following conditions:

Supported key safety functions
Safety related
Used to mitigate accidents or transients
Used in the EOPs
Non-safety related, but whose failure prevented safety related SSCs from fulfilling their safety related function
Failure has caused or could cause a scram or safety system actuation.

The SSCs that were identified as being in scope were then reviewed and approved by the expert panel.

VY provided a list of 122 SSCs developed from the MPAC MEL computer data base that were considered for maintenance rule scoping. A number of the SSCs (21) were not considered as plant SSCs. These included such categories as consumable materials and supplies, inventory adjustments, and office equipment and supplies. Eighty two SSCs were scoped into the rule. The team reviewed the listing and system bases descriptions, and verified that a sample of SSCs were properly scoped.

The team found that a number of systems were included in larger SSCs such as nuclear boiler, and liquid and solid radwaste. The team discussed a number of scoping decisions with VY maintenance rule personnel. Based upon the use of radiation protection personnel to respond to and help mitigate accidents and the descriptions of equipment in FSAR section 7.14, the team had further discussions on the scoping decisions for radiation protection equipment and supplies, and plant installed radiation protection equipment. During these discussions, VY indicated they had not reviewed these systems from the point of view discussed and would reconsider these SSCs. The team found this response to be appropriate and had no further concerns.

c. Conclusions

VY had accurately identified and included the appropriate SSCs in the scope of the maintenance rule program.

E1.2 Safety (Risk) Determination, Risk Ranking, and Expert Panel (62706)

a. Inspection Scope

Paragraph (a)(1) of the maintenance rule requires that goals be established commensurate with the safety significance of the SCC. Implementation of the rule, using the guidance contained in NUMARC 93-01, required that safety be taken into account when setting performance criteria and monitoring under (a)(2) of the rule. This safety consideration should be used to determine if the SSCs would be monitored at the system, train, or plant level.

The team assessed the process for determining the safety significance of SSCs included in the scope of the maintenance rule. The team also verified that the expert panel had properly determined the safety significance for several SSCs. The team interviewed several expert panel members and reviewed expert panel meeting minutes to verify that the conduct of the expert panel was consistent with administrative guidelines.

b. Observations and Findings on Safety (Risk) Determinations, Risk Ranking, and Expert Panel

Safety Determinations and Rankings

An expert panel determined the safety significance of SSCs included within the scope of the maintenance rule in accordance with 10 CFR 50.65 Implementation Guideline 3, "Risk Significant Determination of In-Scope SSCs." The expert panel members used information derived from the probabilistic risk assessment (PRA) to assist in their decision making. The plant-specific PRA importance measures were used to rank SSCs with regard to risk significance. The expert panel used a key safety function risk matrix to assist in determining the risk significance of containment and shutdown support SSCs.

The RISKMAN software was used to calculate SSC risk ranking importance measures. The PRA model used was essentially the same model used for the IPE with a few minor data corrections. These data corrections resulted in a core damage frequency (CDF) increase from 4.3E-6 in the IPE to the current CDF value of 5.0E-6. The hardware enhancements discussed in the IPE submittal have been implemented and were accounted for in the IPE PRA model. Generic data was used for all components with the exception of major mechanical components which used plant specific bayesian updated data. The PRA analysis performed to support risk ranking used a sequence truncation level of 1E-9. The truncation level was approximately 3 orders of magnitude below the baseline CDF.

The quantitative measures used to assess system risk significance were risk achievement worth (RAW), risk reduction worth (RRW), and sequences which cumulatively contribute to 90 percent of the overall calculated CDF. The risk ranking selection criteria used was consistent with the NUMARC 93-01 guidance for maintenance rule implementation.

The team reviewed a sample of SSCs within the scope of the rule to verify that the expert panel had properly identified the risk significant SSCs. The team found that the expert panel had properly identified the risk significant SSCs.

Expert Panel

The expert panel administrative guidance and charter was provided in the 10 CFR 50.65 Implementation Plan. The expert panel membership included representatives from operations, maintenance, engineering, reactor and computer engineering, instrument and control, and the PRA group. The experience of expert panel members was verified to be consistent with the administrative guidelines. The team reviewed expert panel members training records to verify that the members had received PRA training in accordance with the administrative guidance. The administrative procedures defined the responsibilities of the expert panel to include approving the SSCs that were within the program scope, approving the risk significance and performance criteria for SSCs, and approving Performance Improvement Plans for SSCs that exceed the performance criteria. The administrative procedures guidance describing the responsibilities of the expert panel were consistent with the NUMARC 93-01 guidance. The expert panel minutes reviewed were detailed and of good quality.

c. Conclusions on Safety (Risk) Determinations, Safety (Risk) Ranking, and Expert Panel

The level of detail provided in the PRA, truncation limits and quality of the PRA were appropriate to perform risk categorization in accordance with the maintenance rule. The risk ranking methodology was consistent with industry guidance and the basis for expert panel risk ranking decisions were thoroughly documented in the meeting minutes. The risk ranking by the expert panel for the sample of systems reviewed was appropriate.

The conduct of the expert panel was consistent with the expert panel administrative guidelines and appeared to add value to various maintenance rule review functions.

E1.3 Performance Criteria Development and Unavailability Monitoring (IP 62706)

a. Inspection Scope

The team reviewed program documents in order to evaluate performance criteria and unavailability monitoring for SSCs under (a)(2) of the maintenance rule.

b. Observations and Findings

The team reviewed the performance criteria under (a)(2) of the maintenance rule. The methodology for establishing reliability and unavailability performance criteria were outlined in 10 CFR 50.65 Implementation Guideline No. 5, "Establishing Performance Criteria." The team sampled the reliability and unavailability performance criteria established for risk significant SSCs.

The base unavailability performance criteria assumed two equipment outages, for a duration of 60% of the total Technical Specification allowed outage time, during a three year period. The base unavailability performance criteria could then be adjusted by the expert panel to account for previous operating experience and anticipated changes to the LCO maintenance program. The PRA engineers had performed a sensitivity analyses to determine the change in core damage frequency associated with setting the PRA unavailability basic events equal to the maintenance rule unavailability performance criteria for all of the SSCs modeled in the PRA. The sensitivity analyses results indicated an increase in CDF of approximately 20% above the baseline CDF. The team determined that the expert panel had appropriately established unavailability performance criteria.

The reliability performance criteria were based on the following formula established by VY:

Reliability Performance Criteria = S + N + I.

S = 2, the standby failure allowance.

N = the normally operating equipment train allowance of 1 for each operating train of the system.

I = instrumentation allowance (I = 0, 1, 2) based on analyst's judgement as to the scope of the instrumentation in the system

The formula's derivation was based on several PRA based sensitivity studies. The sensitivity studies used to establish the standby failure allowance (S) were based on an analysis of 5 standby systems. The sensitivity studies used to determine the normally operating equipment train allowance (N) were based on 3 normally operating systems. A detailed evaluation of the reactor protection system was performed to establish the expected failure rate for instrumentation systems (I).

The PRA engineers developed fault trees to reflect the total number of component failures that would be included as system/train maintenance rule functional failures (MRFFs) in accordance with the maintenance rule. These fault trees were used to establish system/train mean failure rates. The basic event data included uncertainty so that both mean and upper/lower bound failure rates could be calculated. The calculated failure rates were used as input into the binomial (for standby trains) and poisson (for operating trains) probability distributions to determine the failure probabilities for various number of failures, assuming an estimated number of demands during a 3 year period. The standby failure allowance (S = 2) was selected based on a qualitative assessment of the results of this analysis.

The PRA engineers conducted a PRA based sensitivity study to establish the expected MRFF for each operating train of a system assuming the train operated 100% of the time throughout a three year period. The results indicated that the uncertainty in the component failure rates had a significant affect on the expected MRFF rate. The expected failure rate, using the lower bound failure rate data, ranged from approximately 1 to 2 failures during a 3 year period. The expected failure rate, using the upper bound failure rate data, varied from 4 to 10 failures during a 3 year period. Based on the large uncertainty in failure rates, VY conservatively selected 1 failure during a 3 year period for the performance criteria for a normally operating train.

The mean component failure rate, using the mean failure rate data, for the reactor protection system was determined to be 6 or 7 component failures during a 3 year period. The number of expected failures decreased to approximately 2 for the lower bound and increased to approximately 10 when using the upper bound failure rate data. The PRA engineers concluded that the VY failure rates experience for this system reflected the lower bound calculated failure rate. Based on this analysis, the

PRA engineers established that the reliability performance criteria would be increased to account for instrumentation failures. The magnitude of the performance criteria increase applied was based on the perceived complexity of the associated instrumentation and on the engineering judgement of the PRA engineers.

The team was concerned that VY reliability performance criteria methodology could result in performance criteria that was inappropriately high and would not identify adverse system performance trends. The PRA engineers stated that the established performance criteria was commensurate with the manner in which the maintenance staff were counting MRFFs. The engineers provided several examples of actual MRFFs that would not have been included as functional failures when establishing PRA reliability data. For example, the plant maintenance staff had determined that an emergency diesel generator (EDG) trip caused by procedural implementation errors during a surveillance and the absence of a seismic support on a casing drain line from the reactor core isolation cooling (RCIC) system were both MRFFs. A PRA analyst would not include these as functional failures when establishing reliability data for the PRA. Therefore, the PRA engineers concluded that it was not appropriate to directly associate MRFFs reliability to the reliability data used in the PRA. The PRA engineers stated that the management philosophy of maintaining a low threshold for identifying MRFFs would result in many more MRFF than would be reflected by the PRA failure rate data. The team conducted a detailed review of actual MRFFs identified for several systems during the past 3 years. The team concluded that the MRFFs reviewed would often not be considered train functional failures in the IPE. Based on this review, the team determined that the reliability performance criteria established was commensurate with VY's practice for screening MRFFs.

The team noted that one potential weakness in the approach to monitoring reliability was that frequent, significant functional failures, such as those used to establish the PRA failure rate data, could occur without the maintenance rule program requiring a performance evaluation. For example, the high pressure coolant injection system (HPCI) performance criteria was 3 MRFFs in a 3 year period. This system is a standby system which could receive as few as 12 demands in a 3 year period. Therefore, it is conceivable that the HPCI system could experience a significant functional failure one time in every four demands and still not exceed the reliability performance criteria. The team concluded that the process of allowing such a high number of failures before performing an evaluation was inappropriate. However, it is important to note that while the team had a concern with the process, a review of the reliability monitoring performed during the past 3 years indicated that VY was properly monitoring reliability and evaluating equipment performance.

To resolve the team's concern, VY revised their Implementation Guideline No. 9, "10 CFR 50.65 Performance Monitoring." The change specified that a monthly review be performed to identify any significant events associated with risk significant SSCs and/or functions which warrant further evaluation. Significant events or performance issues identified through the review would presented to the expert panel for consideration for the initiation of an Event Report to conduct a performance evaluation. The team determined that this program revision appropriately resolved the identified process liability.

Unavailability Measuring

10 CFR 50.65 Implementation Guideline No. 9 "SSC Performance Monitoring" described the program to monitor and trend SSC performance.

Risk significant SSCs were measured for unavailability when the plant was on line or in an unplanned forced outage by use of the control room Maintenance Rule Out of Service Log which was maintained by the control room operators. The operators were knowledgeable of the use of this log. The maintenance rule coordinator, or his assistant, was responsible for transferring the data from the log to the maintenance rule database, which calculated the risk significant SSC unavailability. This task was performed monthly and the results included in the monthly maintenance rule report.

The team found that risk significant SSCs were not measured for unavailability during a refueling outage and considered this to be a problem. VY considered this acceptable because the detailed outage planning maximized the systems available to support critical safety functions. In addition, reliability measuring would occur due to SSC MRFFs which were tracked during the outage. An additional factor was that the PRA, which established the unavailability performance criteria, did not address the plant in a refueling outage.

The team did not agree with VY's position. Whereas the outage plan may have maximized critical safety functions, the VY program did not assess the effectiveness of the outage plan. As a result, the team determined that because unavailability of risk significant SSCs was not measured during the refueling outage, the effectiveness of maintenance during a refueling outage was not adequately demonstrated as required by 10 CFR 50.65 (a)(2). An internal quality assurance (QA) audit of June 1997 also had questioned the appropriateness of not performing unavailability measuring during a refueling outage, but the QA issue has not yet been resolved by VY. As a result of this untimely resolution, the team judged this to be a violation. (VIO 271/97-81-01)

In response, the VY staff modified 10 CFR 50.65 Implementation Guideline No. 9 "SSC Performance Monitoring" during the inspection to provide an acceptable method to measure the effectiveness of risk significant SSCs maintenance during the refueling outage. The method formalized review of the Outage Performance Report to assess the inability to meet the minimum daily planning state for any key plant safety function. This would be a measure of unavailability of key plant systems against the detailed outage plan. This would be a trigger for an Event Report. As a result of the prompt and complete action taken to correct this violation, this violation is considered to be closed.

c. Conclusions

The performance criteria for the systems included within the scope of the maintenance rule appeared to be acceptable. However, the VY methodology for establishing reliability performance criteria differed from other prior accepted maintenance rule programs. As such, an inspection followup item was identified to obtain further insights into the VY methodology (IFI 50-271/97-81-02). A potential liability regarding the reliability performance criteria was resolved by providing additional guidance in the Maintenance Rule Program Manual. A violation was identified for an unacceptable determination of the effectiveness of risk significant SSC maintenance during a refueling outage, because unavailability was not measured. Prompt corrective actions resulted in closure of this violation during the inspection.

E1.4 Goal Setting and Monitoring (a)(1) and Use of Industry Wide Operating Experience (IP 62706)

a. Inspection Scope

The team reviewed program documents in order to evaluate goals and monitoring under paragraph (a)(1) of the maintenance rule. The team discussed (a)(1) SSCs program implementation with representatives of the maintenance department and discussed selected (a)(1) systems with the responsible systems engineers including use of industry operating experience. The team performed detailed programmatic reviews of the following (a)(1) SSCs:

480 Volt AC (VAC) System
Service Water System
Service Air System
Control Rod Drive System
Main Stack Radiation Monitor

b. Observations and Findings

Based upon the team's review of documentation and discussions with the responsible station staff, the established (a)(1) SSC performance goals were found to be reasonable and appropriate for the system maintenance rule functional failures (MRFFs) identified. The root cause(s) and corrective actions implemented for each (a)(1) system, as identified in their respective performance evaluation and performance improvement plan (PIP), were likewise appropriate. The team noted proper review and consideration of industry operating experience for the service water, control rod drive and 480 VAC systems. Systems engineers interviewed were knowledgeable of their systems and familiar with the implementation of the maintenance rule.

For the service water system, the system engineer was the principal author of the performance evaluation and PIP. With the minor exception that the PIP long-term corrective actions for the service water system were not transferred from the PIP into the commitment tracking system (CTS), the team identified no significant discrepancies with implementation of (a)(1) system corrective actions. The service water long-term corrective actions were entered into the CTS prior to the close of the inspection and verified by the team. A review of all active PIP corrective actions by VY had identified this oversight as an isolated case. An event report was initiated to evaluate the cause of this tracking oversight to ensure proper corrective action to prevent recurrence.

Monitoring of (a)(1) system goals was appropriate. In the case of the 480 VAC system, recent performance trending demonstrated that this system would soon achieve its performance goal and be subject to expert panel consideration of return to an (a)(2) system status. Team review of this 480 VAC GE AK-series breaker design problem (over-current protection relay failures) with the responsible systems and electrical maintenance engineers verified that an appropriate corrective action plan had been developed. The team's review included an examination of spare breakers in the warehouse. The maintenance plan being used to replace the aging dashpot and unreliable RMS-9 over-current trip relays with new "Digitrip" relays takes advantage of previously scheduled preventive maintenance. Work Orders for individual breaker relay replacements were entered into the computer-based maintenance planning and scheduling system and assigned target implementation dates. The team's review of this relay replacement schedule and completed modification records, to date, determined that the breaker corrective action plan was timely and appropriately prioritized for safety related breakers.

The plant stack radiation monitor was placed in (a)(1) due to MRFF considerations attributed to a poor design. The system is planned to be replaced early 1998. After the system is replaced, appropriate goals will be monitored to determine the effectiveness of the new system.

The CRD system was placed in the (a)(1) category due to a repetitive MRFF on the 'B' train. Additionally, unavailability exceeded the established criteria due to the train failures and unsuccessful overhauls of the "B" CRD pump. The initial root cause investigation, Event Report (ER) 96-0885, was completed in 135 days which exceeded the VY administrative guideline of 120 days. The ER included a performance improvement plan, a root causes assessment, and corrective action plan.

The initial MRFF occurred on October 1, 1996, when the 'B' CRD pump had to be secured due to abnormal pump indications (unusual noise and leaks). A root cause determination determined internal pump stage bushing degradation, and the pump was overhauled and returned to service on October 23, 1996. The following day the pump was secured after exhibiting symptoms similar to the first failure, and another cause determination was performed. It was concluded that a soft foot condition, bearing housing misalignment, stage bushing material and operation of the system under low flow conditions were among the contributing causes of the failures. Additionally, the first cause determination had failed to identify all the causes of the first failure.

Based on the conclusions of the second cause determination and extensive use of industry-wide experience, various corrective actions were recommended in a revised PIP. These included changing the stage bushing material to one similar to the original design and limiting operation of the system under low flow conditions until a bypass line around the pump minimum flow restricting orifices could be installed prior to the refuel outage in 1999. The revised PIP was evaluated and approved by the expert panel on December 12, 1997. The pump was placed back in service following the second overhaul with procedural limitations on operating at low flow conditions. No failures have occurred since the second overhaul.

The scoping, currently established corrective actions, and goals of the CRD system appear acceptable and appropriate, although the initial event investigation was not completed in a timely manner per VY administrative guidelines. The system performance was being monitored and additional goals will be monitored following completion of all corrective actions in 1999. The system engineer was very knowledgeable of the system and planned to continue reviewing industry recommendations and updating the PIP as required.

c. Conclusions

The goal setting and monitoring of selected (a)(1) systems were appropriate. Corrective action plans were found to be generally well implemented, and for the most part, timely. Use of industry operating experience to assess in-scope SSCs was evident. System engineers interviewed were generally knowledgeable of their assigned systems and familiar with the maintenance rule and its implementation.

E1.5 Preventive Maintenance and Trending for (a)(2) SSCs

a. Inspection Scope

The team reviewed program documents in order to evaluate the process established to verify that preventive maintenance had been demonstrated to be effective for SSCs under (a)(2) of the maintenance rule. The team discussed the program with appropriate plant personnel. The team also verified that appropriate performance criteria had been set for several SSCs. The team performed detailed programmatic reviews of maintenance rule implementation for the following (a)(2)SSCs.

Reactor water cleanup (RWCU)
Post accident sampling (PASS)
Structures - reactor building (BLD)
Reactor building closed cooling water (RBCCW)
Emergency diesel generator (DG)

The team reviewed each of these (a)(2) systems to verify that performance criteria were established, that appropriate monitoring and trending were being performed, and that corrective actions were taken when a SSC failed to meet its performance criteria or experienced a MRFF.

b. Observations and Findings

Reactor Water Cleanup

The RWCU system was properly scoped based on being safety related. Although the system was not determined to be risk significant, the basis document properly identified some ancillary functions which were evaluated as risk significant. Plant level criteria were assigned to monitor this SSC as well as performance monitoring for reliability on each pump train, single train system, and total system aggregate.

The system was in (a)(2) with trending status due to exceeding system and aggregate reliability performance criteria. This indicated, per VY procedure, that a performance evaluation was required to determine if dispositioning to an (a)(1) status was necessary. The performance evaluation appropriately determined based on the identified causes, functions impacted, completed corrective actions, and applicable industry experience that the overall SSC performance was acceptable. The system has since exhibited no failures and performance monitoring and appropriate maintenance continue. Root cause determinations and corrective actions were timely for all functional failures. The use of industry experience to assist in determining the proper course of action was evident upon review of the performance evaluation and system engineering documents. The system engineer, although having recently been assigned the system, was knowledgeable of its history and operation.

Post Accident Sampling System

The PASS system was properly scoped based on being safety related. The system performance criteria monitors reliability.

In the current 3 year rolling cycle, the PASS system has had one functional failure due to a degraded component in a recorder. Event report (95-0564) properly detailed the investigation, although timeliness was not evident in the documentation reviewed. The event investigation of the failure took 5 months to be completed which exceeded the VY administrative guideline of 120 days. The root cause of the failure and specified corrective actions were appropriately completed. No additional failures have occurred.

The SSC has demonstrated acceptable performance and had continued to be monitored for reliability. The planned maintenance and surveillance activities were deemed appropriate. The system engineer was very knowledgeable of the system.

Reactor Building

The reactor building is a subsystem of the building and structures SSC and has been properly scoped under the rule as safety related and was judged risk significant. The performance criterion used to monitor the SSC were related to structural integrity concern or a potential structural concerns as determined by condition monitoring.

The reactor building has recently (December 11, 1997) been classified (a)(2) with trending due to exceeding its performance criteria for functional failures in a rolling 3 year period due to inner door seal failures. This will require a performance evaluation for the system to determine if it should be placed in an (a)(1) status. Event Report 97-1706 detailed the failures.

Root cause analyses and corrective actions were taken. Industry-wide experience was used to assist in the corrective action process. The latest failure identified a repetitive failure but for a different root cause. During all of these failures, secondary containment was maintained with the outer door seal although it was identified that this seal, is also prone to the same failures.

The system engineer was knowledgeable of the problems with the door seal and similar industry experience and planned to research and write the performance evaluation. The process described in the basis document to determine a structural integrity or potential structural concern was acceptable for condition monitoring.

Reactor Building Closed Cooling water

The RBCCW system was properly scoped based on being safety related and was judged risk significant. Unavailability and reliability criteria were appropriately assigned to monitor this SSC on each equipment train, single train system, and total system aggregate.

RBCCW major equipment train 'B' is currently in an (a)(2) with trending due to exceeding its established performance criteria for unavailability. Event report 96-0014 acceptably detailed the failures and events which led to the current status. The report also detailed the root causes, corrective actions, and follow up recommendations required to reduce system unavailability. Based on recent performance the corrective actions taken were proper.

The system engineer was recently assigned the SSC and was knowledgeable of its past problems and current status. Maintenance activities were appropriate and system unavailability has been trending down over the past year.

Emergency diesel generator and auxiliaries

The DG system was properly scoped based on being safety related and was judged risk significant. Unavailability and reliability criteria were appropriately assigned to monitor this SSC for the two redundant subsystem trains.

DG subsystem train 'A' is in an (a)(2) with review status due to reliability being at the established performance criteria level. The event reports detailing the failures which led to the current system status were reviewed for adequacy of root cause determination, use of industry wide experience, corrective action recommendations, and follow up requirements. All were found to be acceptable.

The system engineer was very knowledgeable of the system, its current status, and the performance monitoring being performed. No failures have occurred since the corrective actions were taken from previous events in September 1996 and March 1997.

c. Conclusions

The performance criteria and trending for the (a)(2) systems were appropriate. Industry wide experience was appropriately used to assist in determining root cause and corrective actions. Additionally, VY administrative procedures established the proper guidelines for initiating goals, trending, and monitoring.

The system engineers and expert panel reviewed and revised system basis documents, performance evaluations, and performance improvement plans as required. It was noted, in some cases during the initial implementation of the maintenance rule and development of the system engineering department assignments, that event report investigations were not completed in a timely manner. (This was also described in section E1.4.) A review of more recent documents shows that a strong effort has been made and has successfully reduced the backlog and increased the timeliness in completing the investigations.

E1.6 Plant Safety Assessments before Taking Equipment Out of Service (IP 62706)

a. Inspection Scope

Paragraph (a)(3) of the maintenance rule states that the total impact of maintenance activities on plant safety should be taken into account before removing equipment from service for planned maintenance. The team reviewed the Limiting Condition for Operation (LCO) maintenance procedures and discussed the process with responsible station staff.

b. Observations and Findings

The operations guidelines for removing equipment from service were provided in Administrative Procedure 0125, "Plant Equipment Control." The shift supervisors have the responsibility of ensuring that the equipment removal from service will not compromise plant safety. A 2-by-2 redundancy matrix is provided as Figure 1 in AP 0125 to assist the shift supervisors in making a risk informed decision on removing plant equipment from service. The risk matrix provides the operator an indication of systems that provide a similar safety function and systems which mitigate the same type of accident scenarios. For example, the standby liquid control and alternate rod injection provide similar functions and are indicated on the matrix as a functional link. The Vernon electric tie line and the HPCI system would both be used to mitigate the consequences of a loss of offsite power and were identified as an event link in the matrix. The team determined that the redundancy matrix was a useful reference in assessing the risk associated with emergent plant work. The Shift Operation and Work Planning staff interviewed were cognizant in the use of the risk matrix. A review of equipment out-of-service logs indicated that VY was implementing appropriate controls to minimize risk associated with conducting emergent work activities.

The team examined the guidelines for removal of plant equipment from service at power and the A residual heat removal service water (RHRSW) system pump LCO plan implemented the week the team was onsite for their inspection. The team found that the A RHRSW pump LCO plan, developed to replace the pump, was consistent with the guidance of 10 CFR 50.65 Implementation Guideline No. 7, "Equipment Removal from Service", and "LCO Maintenance Plan Guideline." These guidelines were also reviewed and found to satisfy the intent of 10 CFR 50.65 paragraph (a)(3).

The assessment of RHRSW system unavailability and reliability, and the assessment of compensatory actions and IPE risk importance, were thorough. The overall LCO maintenance planning package, reviewed and approved through the Plant Operations Review Committee to the Plant Manager, was extremely comprehensive and consistent with the requirements of 10 CFR 50.65 and guidance in NRC Part 9900 Technical Guidance, "Maintenance - Voluntary Entry into LCOs for Operation Action Statements to Perform Preventive Maintenance," dated April 18, 1991.

The team observed portions of the A RHRSW pump LCO maintenance activities and verified appropriate implementation of the plan. The planned activities were executed within the established timetable and the new pump was satisfactorily post-maintenance tested and restored to service on December 18, 1997.

c. Conclusions

The approved procedures for the planning and control of equipment removed from service, at power, to perform preventive maintenance were determined to be appropriately detailed and consistent with the intent of 10 CFR 50.65, paragraph (a)(3). The implementation of these procedures and the specific LCO Plan executed for the A RHRSW pump replacement were well planned and executed.

E1.7 Periodic Evaluations and Balancing Reliability and Availability (a)(3) (IP 62706)

a. Inspection Scope

The maintenance rule requires that performance and condition monitoring activities and associated goals and preventive maintenance activities be evaluated, taking into account where practical, industry operating experience. The evaluations are required every refuel cycle or 24 months. The rule also requires that adjustments be made where necessary to assure that the objective of preventing failures through the performance of preventive maintenance was appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The team reviewed the VY program guidance for developing periodic assessments and one periodic assessment that was recently completed.

b. Observations and Findings

10 CFR 50.65 Implementation Guideline No. 8, "Periodic Maintenance Effectiveness Assessments", provided guidance for performing the periodic assessment required by the rule. The guideline covered the information discussed in NUMARC 93-01 and required by the rule.

The periodic assessment covered the period from May 1995 through October 1996. The team noted that the report was dated November 18, 1997, and did not consider this a very timely assessment. VY indicated that the delay was mainly due to waiting for industry feedback on developing periodic assessments. The assessment followed VY guideline 8 and adequately covered the subject as required by the rule. The periodic assessment report referenced and included 13 attachments. This resulted in a very comprehensive report. Eight action items were identified in the assessment that were directed towards improving the maintenance rule program. The team noted that VY had already taken some actions to address these items.

The team noted that VY had assessed the performance of SSCs under (a)(1) and (a)(2) of the rule and took into account industry operating experience. The team also noted that the balancing of reliability and availability were addressed in the report.

c. Conclusions

The team concluded that VY had developed appropriate guidelines for conducting and documenting periodic assessments. The guideline covered the topics required by the rule.

The periodic assessment that was dated November 1997 was not completed in a timely manner. However, it effectively addressed the areas required in paragraph (a)(3) of the rule and was determined to be thorough.

E2 Engineering Support of Facilities and Equipment

E2.1 Review of Final Safety Analysis Report (FSAR) Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the FSAR description highlighted the need for a special focussed review that compared plant practices, procedures, and parameters to the FSAR descriptions. While performing the inspection discussed in this report, the team reviewed selected portions of the FSAR. The team verified that the FSAR was consistent with the observed plant practices, procedures and parameters.

E3 Staff Knowledge and Performance

a. Inspection Scope

The team interviewed engineers, managers, and licensed operators to assess their understanding of the maintenance rule and associated responsibilities.

b. Observations and Findings

The maintenance rule coordinator (MRC) and his assistant were very knowledgeable in the implementation of the maintenance rule and appeared to be crucial to the program's effectiveness. VY was in transition with respect to the future of the maintenance rule. The program will be transferred to the systems engineering organization in early 1998, with a yet to be identified maintenance rule coordinator. Systems engineering is also a relatively new function (approximately 1 year old). Despite the relatively new status of system engineering, the system engineers interviewed had a good knowledge of their systems and of the maintenance rule program and its impact on their systems. The system engineers generally had a clear understanding of the performance criteria for their systems and the current status of their system with respect to the goals and performance criteria. The team found that the MRC and his assistant provided excellent support to the system engineers. Additional observations on system engineer knowledge are noted in Sections E1.4 and E1.5.

Overall operator knowledge of the rule was acceptable. Initial general training was provided during the fall of 1996 and recent training during operator requalification has reinforced the various concepts and responsibilities required under the rule. The operators understood their responsibilities. The SROs were specifically questioned about their responsibilities regarding on-line and emergent maintenance risk assessment, and it was apparent they were well versed in the subject. Continuing training was scheduled during upcoming requalification training cycles.

c. Conclusions

The maintenance rule coordinator and his assistant in the maintenance organization demonstrated an excellent knowledge of the maintenance rule program and have been crucial to its implementation System engineers had good overall knowledge of the maintenance rule and the specific applicable requirements to their duties. A management challenge may occur due to the imminent transfer of control of the maintenance rule program to the system engineering organization from the maintenance organization.

The operations personnel were able to fulfill their responsibilities under the rule during normal operations and emergent work situations. Their understanding of rule was acceptable.

E7 Quality Assurance (QA) in Maintenance Activities

E7.1 Self-Assessments of the Maintenance Rule Program

a. Inspection Scope

The team reviewed assessments which were conducted to determine if the maintenance rule was properly implemented.

b. Observations and Findings

The most recent assessment was documented in audit report VY-97-06A. It was performed during the period from June 9-13, 1997. The team found the assessment to be thorough and resulted in six recommendations for improvement. VY was considered to be generally responsive to these recommendations. Four of the six recommendations have been closed out. Two of the recommendations are still pending closure. One of the open recommendations indicated that VY should track unavailability of SSCs during a refueling outage. The team agreed with this finding and judged it to be a violation, as discussed in Section E1.3 of this inspection report.

c. Conclusions

The audit provided a good assessment and identified some recommendations. VY appeared to be responsive in addressing most recommendations. However, lack of timely resolution of the recommendation to track unavailability during a refueling outage contributed to the violation identified during this inspection.

V. Management Meetings

X1 Exit Meeting Summary

The team discussed the progress of the inspection with VY representatives on a daily basis and presented the inspection results to members of management at the conclusion of the inspection on December 19, 1997.

PARTIAL LIST OF PERSONS CONTACTED

Vermont Yankee and Contractors

K. Burns, PRA Specialist
*D. Legere, System Engineering Manager
*G. Maret, Plant Manager
*M. McKinely, Maintenance Rule Engineer
*R. Rusin, Mechanical Facilities Maintenance Manager-MRC Coordinator
R. Turcotte, PRA Specialist
*M. Watson, Maintenance Superintendent

Also contacted various system engineers and operators.

*Denotes those individuals who were at the exit meeting on December 19, 1997.

LIST OF INSPECTION PROCEDURES

IP 62706, Maintenance Rule

LIST OF ACRONYMS

CDF	Core Damage Frequency
CRD	Control Rod Drive
EOP	Emergency Operating Procedure
ER	Event Report
FF	Functional Failure
FSAR	Updated Final Safety Analysis Report
HPCI	High Pressure Coolant Injection System
IP	Inspection Procedure
IPE	Individual Plant Evaluation
LCO	Limiting Condition for Operation
MEL	Master Equipment List
MPAC	Maintenance Planning and Control
MRC	Maintenance Rule Coordinator
MRFF	Maintenance Rule Functional Failure
PIP	Performance Improvement Plan
PRA	Probabilistic Risk Assessment
QA	Quality Assurance
RAW	Risk Achievement Worth
RG	Regulatory Guide
RHRSW	Residual Heat Removal Service Water
RRW	Risk Reduction Worth
SSCs	Structures, Systems and Components
SWS	Service Water System
VY	Vermont Yankee