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Licensee: Vermont Yankee Nuclear Power Corporation Brattleboro, Vermont 05301

Facility Name: Vermont Yankee Nuclear Power Station

Inspection Conducted: February 27 - March 10, 1989

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Inspection Summary: A special announced Maintenance Team Inspection was performed at the Vermont Yankee Nuclear Power Station on February 27 - March 10, 1989 (50-271/89-80).

Areas Inspected: An in-depth team inspection of the Vermont Yankee maintenance program and its implementation was performed. The inspection included a review of maintenance documents and observations of maintenance work in progress. The inspectors used the NRC Maintenance Inspection Guidance, dated September 1988, and Temporary Instruction 2515/97, dated November 3, 1988.

Results: Overall, the maintenance program and its implementation were found to be adequate. Areas of strengths and weaknesses were identified and are outlined in the executive summary and discussed in the report. Appendix 3 to the report presents a listing of weaknesses with cross references to the applicable sections of the report. Appendix 4 is a list of three unresolved items identified during the inspection with similar cross references provided. One violation was identified involving failure to follow procedures (50-271/89-80-04).

EXECUTIVE SUMMARY

Background

The Nuclear Regulatory Commission considers the effective maintenance of equipment and components a major aspect of ensuring safe nuclear plant operations and has made this objective one of the NRC's highest priorities. To this end, the Commission issued a Policy Statement dated March 23, 1988 that states, "it is the objective of the Commission that all components, systems, and structures of nuclear power plants be maintained so that plant equipment will perform its intended function when required. To accomplish this objective, each licensee should develop and implement a maintenance program which provides for the periodic evaluation, and prompt repair of plant components, systems, and structures to ensure their availability."

To ensure effective implementation of the Commission's maintenance policy, the NRC staff has undertaken a major program to inspect and evaluate the effectiveness of licensee maintenance activities. This inspection was one of a series being performed by NRC to evaluate the effectiveness of maintenance activities at licensed power reactors. The inspection was conducted in accordance with the guidance provided in NRC Temporary Instruction 2515/97 and the NRC Maintenance Inspection Guidance. The temporary instruction includes a "Maintenance Inspection Tree" that identifies for inspection the major elements associated with effective plant maintenance.

Scope of Inspection

The maintenance inspection at the Vermont Yankee Nuclear Power Station (VYNPS) was initiated with a site meeting between the team leader and the licensee maintenance superintendent and other representatives on February 2-3, 1989 where the scope of the inspection, including the function of the maintenance inspection tree, was discussed. A list of requested site-specific information was provided by the licensee in response to a letter dated December 27, 1988. A copy of the attachment to the December 27, 1988 letter is included in this report as Appendix 1. A comprehensive pre-inspection submittal of information based on this request was provided to the team leader by Vermont Yankee Nuclear Power Corporation (VYNPC) on February 3, 1989. VYNPS was shutdown for an outage in mid-February 1989, and remained shutdown during this inspection.

The NRC inspection team spent from February 13 to February 24, 1989 (two weeks) preparing for on-site activities by inspecting the information submitted by the licensee. The team conducted the onsite inspection at Vermont Yankee from February 27 to March 10, 1989.

The on-site inspection focused on the observation of maintenance work in progress at the site and on licensee activities supporting this work, including support provided by the engineering, training, and management organizations. Maintenance activities selected for detailed review included equipment identified in the probabilistic risk assessment (PRA) for a similar plant as having

the potential for contributing significantly to core damage accident sequences or to the reduction of the risk associated with plant operations. Other maintenance activities were selected for inspection based on the scope of work in progress during the inspection, recent failures of safety-related equipment, special interest items, and NRC inspection experience.

A presentation of the Vermont Yankee Maintenance Program was given by the licensee on February 27, 1989, following the entrance meeting. The following items were discussed during the presentation:

- Preventive and Predictive Maintenance
- Surveillance
- Corrective Maintenance
- Equipment Upgrades
- Deficiency Reporting
- Post-Maintenance Testing Criteria

Daily meetings were held by the NRC team leader with plant management and maintenance supervision to summarize the inspection team findings and identify areas where additional information was required. On the morning of March 9, 1989, a communication session was held during which each NRC inspector presented significant findings to Vermont Yankee management. A summary of the inspection team findings, including a presentation of an evaluated maintenance inspection tree, was discussed with licensee representatives including management, supervisors and engineers at an onsite meeting on March 10, 1989 (see Appendix 2 for attendees).

Results

The inspection team evaluated three major areas: (1) overall plant performance as affected by maintenance; (2) management support of maintenance; and (3) maintenance implementation. Under each of these major areas, elements considered important to the proper functioning of the area were inspected. For each element, the inspectors evaluated both the program and how effectively the program was implemented. The inspection results for each area are summarized in the following paragraphs, and the weaknesses and unresolved items are listed in Appendixes 3 and 4, respectively. In addition, a violation regarding documentation problems associated with calibration of tools is discussed in Section 3.3.d.

Overall Plant Performance as Related to Maintenance

General plant housekeeping and control of maintenance work areas, equipment, tools, and material were observed to be well suited for accomplishing maintenance work during the refueling outage. Observation of maintenance work in progress and review of completed work indicated that maintenance is being performed by skillful, knowlegeable and competent plant personnel and contractors. Maintenance work is well supervised and indicates that the standard for the quality of work is high. This standard is reflected in a relatively low rework rate for maintenance and repairs on plant systems. The good housekeeping and knowledgeable maintenance personnel are strengths in their maintenance program.

Management Support of Maintenance

Although overall management support at the corporate and plant levels for maintenance appeared strong and effective, the inspectors could find no formal or documented policy directive either at its corporate or plant level that specified management responsibilities for the review and appraisal of the maintenance program and for industry initiatives for improving the program. Nevertheless, the licensee's informal management oversight and feedback system appeared to work well to assure safe and reliable plant operations. However, the inspection team concluded that to assure a consistent approach in maintenance activities within the maintenance department sub-groups, to improve the quality and scope of feedback information, and to provide a baseline to assess trends for the overall maintenance program, the licensee needs to establish a more formalized and documented set of program directives and to strengthen its feedback system.

The licensee's lack of a comprehensive formal maintenance plan that clearly documents objectives, policies, responsibilities, authorities, and accountability weakens management's controls to assure effective maintenance of the plant. A clear, comprehensive program document would not only provide a consistent approach to maintenance activities, but would establish a baseline to appraise the adequacy of the policy and its approach and to measure its effectiveness. Currently, the licensee's maintenance program is based more on the stability of maintenance staff, their skill in their trades and professions, and their knowledge of plant system characteristics that come with long-term experience, than on formally and clearly established management controls. This area is considered a weakness in the licensee's maintenance program.

The maintenance program as currently implemented has not been comprehensively reviewed in a structured manner since its inception at plant start-up. Although individual changes, upgrades, and adjustments have been made to the program on an as-needed basis, no plans are currently underway or scheduled in the near future to systematically evaluate the program in the light of past experiences and plant aging. The licensee indicated, however, that a review of maintenance is in the planning stage, and will be implemented when finalized and approved by management.

The licensee has a program to review the appropriateness and technical adequacy of completed maintenance activities. However, these reviews are not being completed in a timely fashion. There is a large backlog of completed Maintenance Requests awaiting such review. Also, the maintenance department compiles and trends equipment performance problems on a regular basis but this information is not communicated to or reviewed by upper management. These are considered weaknesses in the maintenance program.

The inspection team also concluded that the licensee's lack of effective policy and procedures for controlling and updating manufacturer technical manuals is a weakness in the current maintenance program as implemented.

Licensee management has not established a program, goals, or the necessary training for the use of PRA concepts in its maintenance activities.

However, despite these weaknesses, the licensee has implemented an adequate maintenance program. Its adequacy is reflected in the relative absence of repeat corrective maintenance tasks, and generally effective predictive and preventive maintenance activities. The strength of the maintenance organization lies in its long-term, highly skilled, and dedicated employees who are backed by a dedicated and knowledgeable engineering and supervisory maintenance staff. The licensee's failure to develop a comprehensive set of documents to formalize and upgrade existing practices; thereby, providing an infrastructure capable of sustaining future good performance in light of the certainty of staff turnover, is considered the licensee's greatest weakness.

Vermont Yankee has adequate technical support to conduct maintenance activities. Additional resources are available through the Yankee Nuclear Support Division in Framingham, Massachusetts.

The licensee does not have a separate QC organization. They use a "Peer Inspection" technique instead. This "Peer Inspection" technique was found to be adequate and effective in identifying deficiencies in the implementation of the maintenance program. Additional oversight is provided by the onsite presence of the corporate QA group.

Radiological controls are adequately integrated into the maintenance program. The experience of the ALARA Coordinators is considered a strength, as evidenced by the dose reductions associated with the reactor head assembly.

Overall control of regulatory documents was considered effective. The level of review was generally adequate, although sufficient information was not routinely included in the documentation to appreciate the scope and level of review performed to close open items.

Maintenance Implementation

The licensee has developed a functional work control program. Work is planned and scheduled in accordance with appropriate administrative procedures. However, the greater strength again appears to be in the professional attitude and attention to detail shown by the staff. The plant staff appear to be "self starters" in striving to improve their plant's performance. Indeed, the inspectors noted the pride in load factor and availability data recently compiled by Vermont Yankee (1984 established a world record for reliability and 1988 was the plant's second best operating year). It was apparent that the staff and management appreciate the role that judicious preventive and corrective maintenance play in overall plant performance.

The licensee's post-maintenance test requirements are not proceduralized in their adminstrative procedure and the licensee does not have an integrated Master Equipment List. These are considered weaknesses in their maintenance program.

Overall, the licensee has established a well functioning maintenance organization. This organization has a well developed program for performing corrective and preventive maintenance. The main strength of the organization lies in its

highly trained and competent staff. Careful selection and an effective training program assure that contracted personnel are well qualified for performing their jobs. The contracted work is supervised and monitored in a satisfactory manner. The failure trending program under development is well conceived and will probably contribute significantly to improving the predictive maintenance program.

Maintenance facilities were generally well controlled, equipped, and maintained. The inspectors noted that the layout and utilization of these facilities are well planned, organized, and controlled throughout the plant to accommodate the movement of maintenance materials and equipment. The existing administrative controls over procurement, receipt inspection, storage, and issuance of materials were adequate for ensuring that maintenance materials are properly available when needed and issued properly for their intended use. The control of tools and meter and test equipment was also adequate for supporting maintenance activities; however, minor problems were identified in the documentation and labeling of calibrated torque wrenches.

The licensee's staffing controls are generally effective, with a low turnover rate for maintenance personnel. The management policy is to not tolerate poor performance or the use of drugs. The maintenance training programs and their implementation are well established and documented, with a test and qualification process in place.

The Maintenance Inspection Tree

The inspection team's conclusions about the status of the plant's maintenance program are indicated by colors (green, yellow, or red) on the maintenance inspection tree (Figure 1). For parts II and III of the tree, the upper left portion of each block indicates how well the topic of the block is described and documented in the plant maintenance program, including adequacy of procedures. The lower right portion of each block indicates the team's conclusion as to the effectiveness of implementation of the topic covered by that block. Green indicates that the program is well documented or that program implementation is effective. However, even for blocks shaded green, some areas for improvement may be indicated in the report. Yellow indicates a marginal but acceptable condition and red indicates the topic is missing or the intent of that portion of the tree is not being met by the maintenance activities. Blue indicates the item was not evaluated or could not be properly evaluated due to recent changes.

The inspection team concluded that the Vermont Yankee Station has developed a maintenance program that implements the significant attributes of the maintenance tree. The team identified a number of strengths and weaknesses that are discussed in the report. Weaknesses represent potential problems or conditions discussed for licensee evaluation and corrective action as applicable. As weaknesses were identified by the inspection team members, they were presented to licensee representatives for initial review and evaluation during the course of the inspection. Individual weaknesses are discussed in the appropriate areas of the report and are summarized in Appendix 3 of this report. The licensee is encouraged to conduct its own evaluation of maintenance-related activities using the maintenance inspection tree with the objective of finding areas for improvement not identified by the previous self-assessment or this NRC team inspection.

INSPECTION FINDINGS

This report presents the inspection team's findings and conclusions regarding the Vermont Yankee Nuclear Power Station site maintenance program and its implementation. The section numbers of this report do not correspond to the numbering sequence of the Maintenance Inspection Tree (Figure 1).

1. OVERALL PLANT PERFORMANCE RELATED TO MAINTENANCE (Direct Measures)

Scope

The objective of the inspection in this area was to assess overall plant performance as related to maintenance by conducting plant system walkdowns, and direct inspections of completed work and maintenance activities in progress. The overall level of personnel knowledge and management involvement in the final work product were also assessed by these direct measures.

Findings

The inspectors conducted walkdown inspections of plant systems and maintenance in progress to assess the extent to which safe and effective work practices were utilized by maintenance personnel. The inspectors also observed housekeeping, and the arrangement and use of tools, equipment, scaffolding, temporary support structures, system tag-outs, etc. The inspectors toured areas used to perform maintenance work on the emergency diesel generators, the CRD hydraulic control units, feedwater/condensate demineralizer filters, 3A and 3B feedwater heaters, the main turbine generator, and the main condenser. In all of these areas, the inspectors observed that personnel were conscious of a need to practice well disciplined work habits to maintain good housekeeping during and after work hours, and to ensure that maintenance equipment, temporary structures, tools, barriers, etc., are used in a safe and efficient manner. Work spaces were well controlled with properly designated personnel pathways, and with well marked and posted hazard barriers. Temporary service leads (air lines, water hoses, electrical lines, etc.) were arranged and secured in a manner which enhanced work activities without adverse effects in adjacent spaces through which service leads were passing. Specific tasks were conducted with care to avoid damage to plant equipment from the tools and materials used to perform maintenance. Licensee safety inspectors were observed to be actively inspecting plant work areas and temporary storage areas. The inspectors also noted that contractor and technical personnel were generally very conscientious about ensuring that the physical condition of plant components, systems, and equipment were maintained at a high standard. A sense of ownership was evident among these individuals. Spot checks of system tag-outs revealed that tags were clearly identified and the information on them was consistent with information contained in tag-out logs maintained by the plant operation's group.

The inspectors witnessed maintenance technicians generate deficiency reports during the course of planned maintenance work to report previously unreported

conditions. The deficient conditions were reported to the appropriate technical groups for resolution. Followup actions were initiated immediately so as not to impair progress of the ongoing maintenance work. The inspectors observed supervisory and engineering personnel visually checking deficient conditions to ensure that corrective actions would be properly and completely specified.

Conclusion

General plant housekeeping and control of maintenance work areas, equipment, tools and material were well suited for accomplishing maintenance work during the refueling outage. Observation of work in progress and review of completed work indicated that maintenance is being performed by skillful, knowledgeable, and competent plant personnel and contractors. Maintenance work is well supervised and indicates that the standard quality of maintenance work is high. This quality is reflected in the relatively low rework rate for maintenance and repairs on plant systems. Good housekeeping and knowledgeable maintenance personnel are a strength in the licensee's maintenance program.

2.0 MANAGEMENT SUPPORT OF MAINTENANCE

The objective of this part of the inspection was to assess plant and corporate management support of maintenance activities in the plant with respect to the establishment, implementation, and control of an effective maintenance program. The major areas evaluated were management's commitment to and involvement in the organization and administration, resource allocation, and technical support provided to the maintenance organization. Discrete elements within these areas, such as a documented maintenance plan, self-assessment measures, resource allocation, definition of maintenance requirements, and accountability, were evaluated to provide a basis for the team's overall assessment.

2.1 Management Commitment and Involvement

Scope

The objective of this inspection area was to evaluate corporate-level and plant management's commitment to and involvement in assuring the adequacy of plant maintenance as indicated by: (1) corporate level interest and participation in the continuing assessment and improvement of the maintenance program and its support for industry initiatives; and (2) plant management's awareness of the status of the maintenance program and the implementation of maintenance activities.

Findings

The team evaluated these elements through extensive informal discussions and formal interviews with plant and corporate staff, and reviewed the licensee's planned, in-progress, or completed activities with respect to INPO initiatives, industry event communications, and the licensee's experience and data analysis of plant performance.

The corporate and plant management representatives interviewed indicated strong support and interest in the proper performance of plant maintenance. Their commitment to and support of improved maintenance was evident by the initiatives implemented in this area in the recent past.

The licensee's two major initiatives to assess the effectiveness of its maintenance effort and the safety of selected plant systems consisted of an extensive self-assessment of the maintenance program (i.e., meeting INPO guidelines), and a safety system functional inspection (SSFI) performed by a contractor, which was modelled on the NRC criteria for such an inspection. The licensee's SSFI covered emergency power supply (onsite diesel generators) and high pressure coolant injection systems (HPCI). The licensee has implemented structured actions to implement improvements recommended in the self-assessment report. Weaknesses identified and recommendations made in the SSFI report are currently undergoing licensee review and evaluation. Licensee management appears to be taking the findings of both reports seriously, and is trying to implement the recommendations within the constraints of available resources and in view of the relative safety significance of the weaknesses identified.

The licensee also participates in the Nuclear Plant Reliability Data System (NPRDS) and routinely uses NPRDS to enter and retrieve equipment failure data. The engineering support personnel indicated that the information retrieved was used as an analytical tool to determine the root cause of failures.

Through interviews with plant personnel and a review of documentation, the team determined that the licensee informally used plant performance indicators (meeting INPO guidelines) to assess the effectiveness of plant maintenance activities.

The team determined that plant management closely monitors the performance of maintenance activities through informal methods of communication and feedback.

Conclusions

Although overall management support at the corporate and plant levels for maintenance appeared strong and effective, the team could find no formal and/or documented policy directive either at its corporate or plant level that specified management responsibilities for the review and appraisal of the maintenance program and/or industry initiatives for improving the program. Nevertheless, the licensee's informal management oversight and feedback system appeared to work well to assure safe and reliable plant operations. However, the team concluded that to assure a consistent approach in maintenance activities within the maintenance department sub-groups, to improve the quality and scope of feedback information, and to provide a baseline to assess the trend of the overall maintenance program, the licensee needs to establish a more formalized and documented set of program directives and to strengthen the feedback system.

2.2 Management Organization and Administration (Corporate and Plant)

Scope

The objective of inspection in this area was to assess the effectiveness of the organization and administration of the maintenance department and the maintenance program, respectively. The specific areas inspected to provide a broader perspective of maintenance activities included: the existence, availability, and scope of a formal maintenance program; maintenance policy, goals, and objectives; allocation of resources; and identification and definition of maintenance requirements. The team evaluated these areas to provide a basis for the overall assessment and conclusions.

Findings

The team found that Vermont Yankee Nuclear Power Station does not have a unified comprehensive document or set of documents that clearly spells out policies, objectives, and all other elements of the plant's maintenance program. Instead, the program is currently scattered in various administrative and departmental policies, procedures, and instructions. The program's organizational structure and personnel responsibilities, duties and accountabilities, including flow

charts, are described in various documents. Moreover, the team could not identify any formal corporate directive or plant policy statement requiring that a comprehensive maintenance plan be established, regularly reviewed for applicability, and updated when necessary. Key program components, such as accountability, program description and purpose, data use, feedback, and criteria for program changes, are not clearly described and/or cannot be shown in a readily understandable form because of the lack of a unified and clearly documented maintenance program. Although the elements characteristic of an adequate maintenance program appear to be well implemented, they are not readily apparent from documented procedures.

A review of current outage maintenance activities and the routine non-outage activities of the previous operating cycle indicated that the licensee has allocated sufficient resources in manpower and material to the maintenance organization for it to efficiently perform its function. The licensee relies on contractor support for labor intensive activities and for unforeseen non-routine activities during outages and other high activity periods. However, the contractor personnel are well supervised and controlled by the plant's regular staff.

Although they have not established a clearly defined and described maintenance program, the licensee has implemented an adequate program of preventive, predictive, and corrective maintenance (CM). Some of the noteworthy major initiatives in maintenance include use of the MOVAT system in predictive analysis for valve performance; routine preventive maintenance (PM) and testing of safety-related circuit breakers; comprehensive training in basic skills and upgrades; and work planning of complicated maintenance activities.

The maintenance department in the recent past established new positions for a Maintenance Planner (temporary position) and a group of Maintenance Engineers (one senior maintenance engineer and four maintenance engineers). The Maintenance Planner position was filled by a licensed senior reactor operator to provide increased operational insight in planning and scheduling maintenance work. This appointment appears to be an effective way to enhance communications with the operations department and should better prioritize maintenance work to support safe plant operations.

The addition of the maintenance engineers to the staff has provided increased technical support for reviewing predictive and preventive maintenance. The maintenance engineer serves essentially an advisory role and their recommendations are provided to the maintenance supervisor. The maintenance engineers' authority, responsibility, and accountability are not formally established and appear to be more on mutual understanding between the maintenance supervisory and engineering staffs. Although a more formal definition of activities and responsibilities may be desirable, the informal working relationship that has been developed appears to work well.

In the area of defining maintenance requirements, the team observed that the licensee has not performed a comprehensive and structured review of the applicability and adequacy of the plant's maintenance requirements. It appears that the maintenance requirements established at the time of initial operations still remain the basis of the overall maintenance plan. Although many improvements

and new initiatives have been implemented to upgrade plant maintenance, the efforts appear to be on a piece-meal basis without any coherent review of the plan as a whole. The licensee has a program to review the appropriateness and technical adequacy of completed maintenance activities. However, these reviews are not being completed in a timely fashion. There is a large backlog of completed Maintenance Requests awaiting such review. The above two areas (plant maintenance requirements and review of recently completed PM and CM activities) are weaknesses in their maintenance program.

In spite of the lack of programmatic review and assessment of the maintenance program, licensee management has implemented formal and informal measures to assess the effectiveness of maintenance activities. Maintenance supervisory and management personnel regularly perform walkthrough inspections and sample maintenance in progress, review the results of surveillances performed to determine the operability of systems to satisfy plant technical specifications, and review the root cause analysis performed by the plant engineering support group. They also use plant performance indicators as a measure of maintenance effectiveness.

The maintenance department has tracked and analyzed data on performance of equipment from 1972. However, this information is not formally documented and there is not an established mechanism, except a memorandum from the maintenance engineer to the maintenance supervisor, to disseminate the information to higher management or to pursue an issue, as in the case of an adverse trend. The inspectors noted that in many cases, the trend graph showed a rise towards the acceptance limit (DG-1-1B; SW pumps; SW system as a whole; FPFD system; RWCU system; core spray system), but that there was no formal plan available indicating the existence of a longterm program to reverse the trend. Also, there was no documented evidence that these analyses had been communicated to plant or corporate higher management for their review and evaluation.

The inspectors also observed that there was no effective mechanism to update manufacturer's technical manuals for equipment despite the fact that some manufacturers provide an approved procedure specifying the process for controlling formal revisions of their manuals. Formal revisions of manufacturer technical manuals were infrequent in part, due to the fact that manufacturers do not widely distribute revisions to old customers on a consistent basis. In some cases, the information on a particular piece of equipment is developed at other sites and received by the licensee through other channels. The team noted that information received by the licensee in manuals, other than a formal technical manual revision, was filed separately from the manuals for which they were intended, and these files were not controlled. Such a filing system makes determining the validity and/or currency of information contained in the controlled manuals very difficult. The potential also exists for missing updated information regarding the validity or effectiveness of planned maintenance on an item. That this is a weakness in the licensee's maintenance program as currently implemented.

Conclusions

Based on the above findings, the team concluded that the lack of a comprehensive, formal maintenance plan clearly documenting objectives, policies, responsibilities, authorities, and accountability, is a weakness in the management controls the licensee has instituted. A clear, comprehensive program document would not only provide a consistent approach to maintenance activities, but it would establish a baseline to appraise the adequacy of the policy and its approach and to measure its effectiveness. Currently, the licensee's maintenance program is based more on the stability of their maintenance staff, their skill in the trade or profession, and the knowledge of the plant system characteristics that comes with a long term job experience, than on formally and clearly established management controls.

The maintenance program as currently implemented has not been comprehensively reviewed in a structured manner since its inception at plant start-up. Although individual changes, upgrades, and adjustments have been made to the program on an as-needed basis, no plans are currently underway or scheduled in the near future to systematically evaluate the program in the light of past experiences and plant aging. The licensee, however, indicated that a review of maintenance is in the planning stage and will be implemented when finalized and approved by management.

The appropriateness and technical adequacy of current maintenance activities are not being reviewed in a timely fashion. There is a large backlog of completed Maintenance Requests awaiting such review. Also, the maintenance department compiles and trends equipment performance problems on a regular basis but this information is not communicated to or reviewed by upper management. These are considered weaknesses in the maintenance program.

The inspectors concluded that the licensee's lack of an effective mechanism for updating manufacturer technical manuals is a weakness in the current program as implemented.

However, despite these weaknesses, the licensee has implemented an adequate maintenance program. It's effectiveness is reflected in the absence of repeat corrective maintenance tasks and generally effective predictive and preventive maintenance activities. The strength of the maintenance organization lies in its long term, highly skilled, and dedicated employees who are backed by a dedicated and knowledgeable engineering and maintenance supervisory staff.

2.3 Technical Support

The inspectors evaluated the technical support the maintenance organization receives from other parts of the organization, such as Engineering, Health Physics, Quality Assurance, Quality Control, Fire Protection, and Operations. The evaluation consisted of a review of the licensee's established policy, goals, and objectives and an assessment of their effectiveness. The team selected maintenance-related items from generic PRA, Licensee Event Reports, and generic issues identified by NRC and industry sources, and evaluated how the maintenance and other organizations interacted on these issues.

2.3.1 Internal Corporate Communication Channels

Scope

The objective of this inspection element was to evaluate the licensee's organizational communication systems to assure that corporate policies for the maintenance organization are incorporated into plant procedures and that a feedback system has been established so that maintenance concerns are identified to management for their information and action as required.

Findings

Plant management and interested organizations are made cognizant of maintenance concerns in daily meetings and through the review of Maintenance Requests which are issued in accordance with procedure AP-0021 to correct the identified deficiencies or problems. The most important means for communicating maintenance and refueling concerns were the daily outage meetings, chaired by the Outage Manager, and attended by top management and representatives from each site organization. The meetings were held during the outage to discuss the status of current work and to properly plan, prioritize, and coordinate pending outage activities. The inspectors attended several of the meetings and noted their effectiveness.

The inspectors reviewed the licensee's established methods for communications between Maintenance and Engineering to support maintenance activities. The team interviewed the Engineering Support Supervisor and an Engineering Program Manager. The inspectors also reviewed various procedures and selected maintenance requests to determine the depth and scope of communications with and support from Engineering.

The inspectors found that corporate (offsite) Engineering and the resources of the Yankee Nuclear Support Department (YNSD) are involved in maintenance on an as-needed basis. The resources of YNSD are not directly accessible or used in day-to-day plant activities. Maintenance and site Engineering Support request technical assistance only through their appropriate program managers at the corporate level.

Conclusion

The inspectors concluded that the licensee's organization exhibited strong communications in response to maintenance and outage-related issues. The daily meetings were effective and productive.

2.3.2 Engineering Support

Scope

The objective of this part of the inspection was to evaluate the extent to which engineering principles and evaluations are integrated into the maintenance process. This was accomplished by reviewing work orders, activities concerning unusual events, failure analyses, and other maintenance activities to evaluate the effectiveness of Engineering Support.

Findings

The Engineering Support Department (ESD), corporate program managers, and YNSD provide the primary engineering resources for maintenance activities.

Day-to-day activities are handled by engineers within the maintenance department, with additional support being provided from ESD or the corporate office on an as-needed basis. YNSD services are coordinated by the corporate program managers and are therefore not directly accessible to the plant staff, although close informal communications are maintained between YNSD and cognizant plant personnel.

To evaluate the support provided by both ESD and YNSD to the maintenance department, the inspectors reviewed component substitution, material upgrades and dedication, 50.59 reviews, and design change requests. These reviews indicated that adequate engineering support is provided for maintenance activities. However, the inspectors noted that no formal training program has been established in the methodology for performing root cause analysis.

During a plant tour, the inspectors noted that paint was peeling from large areas of the upper drywell, with some areas exceeding a foot in diameter. The inspectors questioned the potential for the loose paint to clog the ECCS suction screens in the torus. In response, the licensee stated that this paint peeling issue had been identified previously and that an engineering evaluation had been performed by YNSD. Because of narrow net positive suction head margins for the ECCS pumps, YNSD recommended that Vermont Yankee remove the loose paint before each restart. This loose paint removal process was instituted into the VY prestart checklist. The inspectors raised the concern that the loose paint may build up fast enough during the 18 month operating cycle, and that the post-accident environment may cause additional peeling to fall down. This paint peeling may eventually get to the suction of the ECCS pumps to cause clogging problems. The licensee stated that they would evaluate and address this concern after completion of this inspection. On May 12, 1989, the inspector called the licensee regarding this issue. The licensee stated that the paint peeling problem has been evaluated, and the evaluation has been reviewed and approved by VY PORC. The analysis of the paint chips indicated that the paint pieces will break up into fine pieces, so small that they will pass through the pump suction screens and core spray nozzle without causing clogging. This is an unresolved item pending NRC review of licensee evaluation (50-271/89-80-01). As indicated in the transmittal letter of this report, the NRC has requested that the licensee provide their basis for closing this issue within 30 days of receiving this report.

Conclusion

Engineering Support to the maintenance process has been well integrated. A particular strength is the resources available from YNSD. However, management attention is needed to: (1) establish a formal root cause analysis program and (2) resolve the potential problem for loose paint to clog the ECCS suction screen.

2.3.3 Role of PRA in the Maintenance Process

Scope

The objective of this part of the inspection was to determine the extent that probabilistic risk assessment (PRA) concepts are considered in the maintenance program and in such areas as planning, scheduling, and prioritization of work. The inspectors reviewed licensee activities related to the application of PRA to the maintenance program.

Findings

The licensee has neither a formal documented program nor goals for the integration of PRA into the maintenance program, although the licensee is aware of those systems which have the potential to have a major impact upon plant safety.

Conclusion

Licensee management has not established a program, goals, or the necessary training for the use of PRA concepts in plant maintenance activities. The team examined the maintenance activities of selected PRA-significant systems and components and found them to have effective maintenance and technical support.

2.3.4 Role of Quality Control

Scope

The objective of this part of the inspection was to determine the extent of Quality Control (QC) involvement in the maintenance process. The inspectors reviewed the licensee's procedures for implementing the QC surveillance program and trending of findings. The inspectors held discussions with QC personnel, and reviewed work packages and QC inspection plans for appropriate hold points.

Findings

Quality control and independent inspection at Vermont Yankee is implemented at the department level rather than being performed by a separate QC organization. The concept is referred to as the "Peer Inspection" program. The scope and direction of QC inspections are determined by individual department supervisors and are performed by independent inspectors who are ANSI N45.2.6, Level II qualified and who are not directly responsible for the work being reviewed. QC inspection criteria are either incorporated into specific maintenance procedures or job-specific QC attributes, and are developed and documented in a QC Inspection Report. The Department Heads annually review departmental QC performance and forward recommendations to the Plant Manager.

The inspectors reviewed several maintenance request packages, associated maintenance procedures, amplifying instructions, and QC attribute lists (Inspection Reports). The inspectors also observed QC inspections in progress during the CRD scram discharge valve diaphragm replacement work. The QC checklists and reports reviewed by the inspectors addressed the important elements of the activity and contained the appropriate QC hold points and sign-offs.

Conclusion

Although the licensee does not have a separate QC organization, the "Peer Inspection" concept appears adequate and effective in identifying deficiencies in the implementation of the maintenance program. Additional oversight is provided by the onsite presence of the corporate QA group.

2.3.5 Integration of Radiological Controls into the Maintenance Process

Scope

The objective of this part of the inspection was to determine the coordination and integration of radiological controls into the planning and performance of maintenance work. The inspection included a review of the "As Low As Reasonably Achievable" (ALARA) steps that are incorporated into planning for maintenance work as well as the ALARA practiced as work was performed.

Findings

The licensee has established policies and procedures to integrate radiological controls and ALARA principles into the maintenance process.

All Plant Design Change Requests, Engineering Design Change Requests, Plant Alteration Requests, Maintenance Requests, Work Requests, and Installation and Test Procedures are reviewed for ALARA concerns by the ALARA Engineer. Work schedules during the outage were published daily and the Radiation Protection Supervisor attended the daily outage management meeting.

Radiation Work Permits (RWPs) are the controlling documents for work performed in the Radiation Controlled Area. Jobs with exposure estimates greater than 1 man-rem require the authorization of the ALARA Engineer and those greater than 10 man-rem require approval of the ALARA Committee.

The integration of radiological controls into the maintenance process was conducted in accordance with plant policies and procedures. The RWP procedure currently allows work in areas less than 100 mr/hr. Work expected to exceed one man-rem can be performed without an RWP. This is considered an area where improvement can be made. However, the inspectors noted that a more conservative approach was taken in the actual issuance criteria for RWPs.

Dedicated ALARA Coordinators review work requests and evaluate the need for job-specific ALARA reviews. The interdepartmental coordination between Radiation Protection, Maintenance, and Operations was particularly noteworthy with respect to reactor head disassembly and reassembly. The detailed review and cooperation resulted in an overall exposure reduction for reactor head disassembly from approximately 8 man-rem for previous job evolutions to just under 3 man-rem during this outage. This substantial reduction in radiation exposure is considered a strength in their maintenance program. However, additional exposure reductions could be realized relative to the manual unshackling of the moisture separator shield blocks.

Observations of work in progress indicated that job coverage by the RP technicians

was adequate and that workers were sensitive to compliance with RWP requirements. The team noted, however, that the breathing zone air (BZA) samplers used by the licensee were inappropriate in that they were affixed with a vortex separator. The vortex separator, designed for use by the mining industry, only measures "respirable" particles (those less than 5 microns in size) and therefore may not represent true air concentrations. After discussions with the licensee, the vortex separators were removed from all BZAs to more accurately sample air concentrations of radioactive materials.

Another area of concern involved fuel movement and drywell access controls. Allowing personnel access to the upper areas of the drywell (above the N2 feedwater nozzles and biological shield) while moving a peripheral fuel bundle to its maximum elevation adjacent to the vessel flange could result in lethal exposures to personnel if a postulated fuel drop accident occurs simultaneously. This concern was first documented by General Electric (GE) in an Operating Experience Report (OER No. 78), dated May 31, 1973, and again in a Service Information Letter (SIL No. 354), dated February 18, 1981. Even though the licensee performed a detailed evaluation and verification of the GE information, they currently allow full access to the upper elevations of the drywell during fuel movement. Although additional radiological controls (alarming dosimeters and remote detectors) are required in the drywell during fuel movement, unacceptably high exposures could still result during the time it would take to evacuate the upper drywell areas. The licensee committed to reevaluate administrative controls during fuel movement. This is an unresolved item pending NRC review of licensee's resolution to this issue. (50-271/89-80-02)

Due to the potential for high radiation levels to workers in the traversing incore probe (TIP) room, the licensee has implemented an additional level of control by allowing Radiation Protection to request a tag out of the TIP drives prior to work. RP incorporated this as a requirement in their TIP room entry procedure. The inspectors reviewed the implementation of the controls associated with an actual TIP room entry. Since the electrical breaker for the TIP drives had previously been tagged out to RP for general work in the drywell, the work group requested permission from RP to be added to the existing tag as an additional work party leader in lieu of generating another tag. The inspectors noted subsequent to the work that control room personnel had failed to update the tag-out log to indicate the additional work party. The tag could have been cleared and the equipment energized with workers still in the room. The inspector also noted that procedure AP-0140, "VY Local Control Switching Rules," does not address how to add an additional work party to an existing tag. The licensee stated they will evaluate the need to strengthen controls in this area. This is an unresolved item pending NRC review of licensee evaluation and corrective action. (50-271/89-80-03)

Conclusion

Radiological controls are adequately integrated into the maintenance program. The experience of the ALARA Coordinators is considered a strength, as evidenced by the dose reductions associated with the reactor head disassembly. Additional management attention is warranted in the following areas: the controls for access to the upper levels of the drywell during fuel movement, and the administrative control of tag-outs as it applies to an additional work party.

2.3.6 Integration of Regulatory Documents in the Maintenance Process

Scope

The objective of this part of the inspection was to determine the methods used to integrate regulatory documents in the maintenance process and to change these documents as a result of periodic reviews and updates.

Findings

Regulatory documents are initially processed by the Licensing Engineer at the plant and tracked as licensing action items (LAIs). Applicable documents requiring action are forwarded by the Licensing Engineer to either the corporate office or to the site for resolution. All such documents are also processed through the Assessment Coordinator for record keeping and final assignment to the appropriate department superintendents.

The licensee's current backlog of only 46 open regulatory items indicates an aggressive approach to the identification and resolution of these items. A sampling of commitments shows that the responsibility for resolution is clearly assigned. Personnel assigned these items were aware of their responsibilities and management was aware of the status of each item. The inspectors' review of previously closed items indicated a generally adequate level of review, although the documentation provided in many packages was minimal.

NRC Information Notice 87-66, "Inappropriate Application of Commercial Grade Components," which specifically addresses safety class Agastat time-delay relays, received minimal review and documentation. The documentation provided in this package consisted only of the statements that there was "no impact on plant operation or safety" and that the "QC program at VY prevents the occurrence of similar events or problems." No information as to the scope or depth of the review was provided. Inspectors followup indicated that the responsible engineer had examined the procurement system and verified that the appropriate Agastat model numbers and safety class designations were currently entered into the computer tracking system. However, the licensee did not verify any previously installed components to identify if a problem had existed. The inspectors performed a spot examination of various safety and non-safety-related Agastat relays. All safety-related components had the appropriate model numbers, although one safety-related Agastat time-delay relay was found to have been inappropriately documented in the licensee's safety-related IE Instrument List as a General Electric HFA relay. The licensee made the approriate changes to update the list. The licensee also checked the rest of the instrument list and did not find any additional errors.

Conclusion

Overall control of regulatory documents was considered effective. The level of review was generally adequate, although sufficient information was not routinely provided to adequately document the scope and level of review performed to close open items.

3.0 MAINTENANCE IMPLEMENTATION

The purpose of this part of the inspection was to determine the effectiveness of the established maintenance controls and, more importantly, the quality of work performed. The controls established in four areas were evaluated: work control (Section 3.1), plant maintenance organization (Section 3.2), maintenance facilities equipment and materials controls (Section 3.3), and personnel control (Section 3.4). The team evaluated effectiveness through observation of work in progress and a review of completed work orders, procedures, and other documentation associated with maintenance and training of maintenance personnel, work in progress, tools in stock, spare parts, and held discussions with all levels of personnel.

3.1 Work Control

Scope

The objective of this inspection area was to evaluate the effectiveness of the maintenance work control process to assure that plant safety, operability and reliability are maintained. The inspectors evaluated the following areas:

(a) Review of work in progress
(b) Control of work orders
(c) Equipment maintenance records
(d) Job planning
(e) Work scheduling
(f) Post-maintenance testing
(g) Completed work control documents

Findings

(a) Review of Work in Progress

The inspectors observed work in progress on the main turbine and a standby diesel generator. While on the turbine deck, the inspectors noted the maintenance procedure and technical manual were in evidence and being used. Discussions with the turbine repair supervisor found him to be knowledgeable about plant requirements (although he is a contractor), as well as about technical issues.

In preparation for maintenance on the "B" diesel generator, the plant staff conducted a timed start of the engine. While a plant operator was in the engine room to perform pre-start checks and prelube the engine, no operating procedure was in evidence. The inspector noted that the engine lube oil level, air receiver pressure, jacket water temperature, and several other routine pre-start checks were made, and that the operator was in communication with the control room for engine pre-lube and starting instructions. Subsequent discussion with the licensee revealed that their procedure was kept in the control room and that prerequisite (pre-start) checks are confirmed by telephone with the operator at the diesel engine.

After the engine was successfully started, run approximately 3 minutes and shut down, the inspectors noted that the engine was not barred over (turned or cranked with no intent to start) as recommended by the diesel generator technical manual. Subsequent discussions with the licensee revealed that a conscious decision not to bar the engine over had previously been made by plant management as a matter of Technical Specification compliance. The Technical Specifications require demonstrated operability following any action or event that renders a diesel generator inoperable. To bar the engine over after each run as recommended by the manufacturer, the engine would first have to be blocked from responding to any automatic start signal that might be received during the 1- or 2-minute barring operation. A literal interpretation of Technical Specifications would require a demonstration of operability (engine start) after the auto start block was removed. Following engine shutdown, the manufacturer's recommended barring should be performed, but the engine auto start feature would again have to be blocked, which would lead to another operability run. In weighting the options available to them, plant management chose not to follow the engine manufacturer's recommendation for proper engine care in favor of strict Technical Specification compliance.

In response to the inspectors' questions, the licensee stated that they had discussed this issue with the engine manufacturer and that they were pursuing the manufacturer's recommendation of an "air roll" after shutdown to enhance engine reliability and longevity. The licensee has added this modification to their list of future work items. Addition of this "air roll" feature will also allow the licensee to bar over the engine during pre-lube as recommended by the engine turbine manual. The inspectors had no more questions regarding this issue.

The inspectors observed corrective maintenance being performed on the "B" diesel generator. The corrective maintenance was made necessary when scratches were found on two camshaft lobes during an engine inspection in late 1987. Following the discovery of camshaft distress, the "B" diesel generator was placed on the work list for the current (RFO 14) refueling outage. In the interim, a special monitoring program was begun to detect deteriorating performance (if any) through changes in cylinder temperature (No significant changes in engine performance attributable to camshaft wear were noted). Replacement camshafts (eight sections) and associated parts (gaskets, nuts, washers, etc.) were concurrently ordered. In reviewing the work packages, the inspectors noted additional parts associated with the camshaft replacement were special ordered from the engine vendor after the work was begun. This is an example where maintenance planning could be improved by considering repair parts availability.

The inspectors also observed the performance test conducted on 125-Volt battery "A". The discharge test was being conducted in accordance with Technical Specification Section 3/4, Part 10.2.c, which states in part, "Once each operating cycle, each station 125 Volt battery shall be subjected to a rated load discharge test." However, such discharge testing is never recommended by the battery manufacturer, nor by Section 5.2 of IEEE Standard 450-1980, item 2. The IEEE Standard, which is used to schedule the discharge testing of other station batteries, recommends a performance test frequency of every 5 years. It was noted that station battery "A" appeared to be new. (The inspectors were advised that the battery was replaced in 1985, then discharge tested in 1987, in accordance with item 1 of IEEE Standard 450-1980, Section 5.2.)

The inspectors raised the concern that excessive and unwarranted discharge testing of station batteries may be, in the long term, detrimental to the battery reliability. (The 125-Volt station batteries are safety related.) While such testing is required by plant Technical Specifications, the reliability of safety-related equipment may be compromised by administrative, not technical requirements.

To address this concern, the licensee stated that a Technical Specification change is being considered. This change would demonstrate continuing battery operability by a service test which follows the specified emergency load profile, performed every or alternate refueling outage, with a performance test conducted every 5 years. Such testing should enhance battery reliability and longevity, while demonstrating that actual load requirements are met. In the interim, battery operability is demonstrated in accordance with Technical Specifications and therefore there is no immediate safety concern.

(b) Work Order Control

The inspectors reviewed the licensee's method of work order control. The vehicle used to control maintenance is the Maintenance Request (MR), which may be initiated by any member of the plant staff or management. The MR form is comprehensive and has provisions appropriate to all foreseeable circumstances. Each MR bears a unique sequencing number, as well as the initiator's name and date. Appropriate blocks are provided to guide the MR through the review process and adequate space is provided for necessary written descriptions. Provision for the performance of emergency maintenance is provided by telephone review and concurrence from the Engineering Supervisor. In addition, the Shift Supervisor has written authority to direct maintenance without an accompanying MR in an emergency. In this case, the MR package is to be generated quickly either before or immediately after completion of the maintenance work.

In summary, the inspector found that the MR format was comprehensive and that approvals for commencement of work (Shift Supervisor tagout approval), as well as QAC review and Nuclear Plant Reliability Data System (NPRDS) review, were adequately addressed.

(c) Equipment Maintenance Records

The inspector reviewed completed MRs and the equipment record (visi-card) file associated with them. Completed MRs were filed in numeric order, which made retrieval easy using the accompanying log. For example, the inspector cross-referenced MR 89-0724 (replacement of 8 RHR containment spray nozzles) with the visi-card for the RHR system. The appropriate work entry was found on the visi-card to match the work performed. Repair time is not routinely entered on the visi-card, even though a space is provided for such an entry.

Vermont Yankee does not have a single Master Equipment List that meets the generally accepted industry standard (i.e., INPO) for such lists. The licensee has several discrete lists in use by different departments. Many of these lists are called Master Equipment Lists by the user departments, and are referred to as such in approved plant procedures. The maintenance department uses their

visi-record system as an equipment list; there is a plant Master Equipment List for safety-related equipment, and another Master Equipment List for Environmentally Qualified (EQ) equipment as defined in the EQ manual. Although the inspectors found no obvious examples of confusion resulting in maintenance errors, the existence of several "master" lists with the same title and different functions is confusing and is cause for concern. The licensee is considering the development of a computerized data base as their Master Equipment List. This would standardize the equipment listing and aid the maintenance process.

The licensee has a two-tiered root cause analysis program. On the larger, system wide level, the operating staff reviews each failure event to establish its root cause. This analysis is intended to focus on the larger human issues that can cause a failure event. For example, these issues could be procedure content and clarity, training inadequacies, human factors, communications, coordination between departments, etc. The Engineering Department, on the other hand, reviews failure events at the component level. This review is much more narrow and technical in scope. The inspectors reviewed the root cause analysis memorandum prepared by the engineering staff and found it adequate. Topics included component design, construction and application, maintenance history, testing required, service life, etc. The root cause analysis program as implemented by the licensee appears to be a logical approach to the subject.

The final step in maintenance request processing is consideration for Nuclear Plant Reliability Data System (NPRDS) applicability. The inspectors reviewed the licensee's NPRDS process and found it adequate. The licensee's yearly input of NPRDS reports of failure (Form NPRDS-4) is average for all utilities, thus indicating that the licensee meets the industry norm for NPRDS participation.

(d) Job Planning

The inspectors reviewed various aspects of job planning in use by the licensee. Of particular note was evidence of appropriate technical manuals in use during non-routine or unusual maintenance activities. The inspectors noted that the battery vendor's technical manual was in use at the testing location and the diesel generator technical manual was on a clean bench at the front end of the engine. In the case of the camshaft replacement on the diesel generator, the vendor manual parts drawing was used to order expected replacement parts. As noted in Paragraph a) above for the diesel generator camshaft repair, improvements can be made in this area so that parts expected to be used are available, do not require special orders, and will thus not suddenly appear on the "critical path."

Major work items have a walkdown review sheet (the walkdown review process is documented in plant procedure VY-PWG), and when possible, the procedure to be performed is walked through in its entirety. This process includes simulating adjustments and ensuring that tooling, staging, shielding, etc., are appropriate and available, and that the procedure is logical and can be performed as described. When it is not possible to walk through or simulate the work to be performed (e.g., the work is in a high radiation area), experienced staff members review the procedure package and provide their comments on the intended

plan. Every attempt is made to make the walkdown process as complete and accurate as possible in an attempt to make the actual maintenance go as quickly and efficiently as possible.

(e) Work Scheduling

Maintenance scheduling during plant operation is coordinated by the operations department. Routing maintenance tasks are discussed, scheduled, and tracked by maintenance department foremen and shift supervision in the control room. Larger, non-routine maintenance tasks that may stretch over several days or weeks are subjects of discussion at the weekly plant staff meeting. These major maintenance tasks thus receive the attention of operating, maintenance, and plant supervision.

The maintenance scheduling system used during outages is, by necessity, more sophisticated. During each refueling outage, the operations planning group assumes responsibility for tracking the myriad maintenance requests associated with the outage. A computer program is used to arrange MRs both by the system and by numerical order. Tracking begins when the Shift Supervisor authorizes work to begin. Tracking ends when post-maintenance testing is satisfactorily completed and a "close out" status entry is made to the tracking system computer program.

The inspectors reviewed both scheduling systems (during operation and during the outage) and found them adequate. The licensee stated they are considering the use of the computer tracking system during operations as well as during refueling outages because of the system's flexibility and accuracy.

(f) Post-Maintenance Testing

The inspectors reviewed several maintenance requests (MR) to determine the extent and technical adequacy of post-maintenance testing (PMT). This review found that PMTs performed were entered in Section D of the MRs reviewed. Interviews with the maintenance and operations staff revealed that PMT requirements may be invoked by either maintenance or operations as necessary, based on the work accomplished. For example, maintenance on safety related motor operated valves is followed by the generic procedure associated with the maintenance performed (e.g., valve leak testing or stroke timing). The process and criteria of PMT are not prescribed in the Maintenance Request procedure (AP-0021), which controls the maintenance activities. Lack of a proceduralized PMT requirement is a weakness in the licensee's maintenance program.

(g) Review of Completed Work Control Documents

The inspector interviewed members of the maintenance staff and found that there is no formal procedure that describes how completed work control documents are reviewed. However, work control documents are reviewed based on their complexity. For example, maintenance that is controlled by an MR only (routine tasks well within the craftsmen's basic knowledge) receives a review by the appropriate department head or assistant foreman. This review is conducted to ensure that the MR is complete, all data is taken and values are appropriate, the work

effort is correct for the problem described, and that the MR package is complete. Maintenance items that require an accompanying procedure (surveillance items, for example) receive a review by an assistant foreman and another review by the Maintenance Engineering staff. These reviews are designed to ensure accuracy and completeness.

Conclusion

The licensee has developed a functional work control program. Work is being planned and scheduled in accordance with directives. The licensee's strength appears to be in the professional attitude and attention to detail shown by the staff. The staff and management appear to be "self starters", striving to improve their plant's performance. Indeed, the inspectors noted the pride in load factor and availability data recently compiled by Vermont Yankee (1984 established a world record for reliability and 1988 was the plant's second best operating year). It was apparent that the staff and management appreciate the role that judicious predictive, preventive, and corrective maintenance play in overall plant performance.

The licensee does not have a procedurized requirement for their post-maintenance testing nor an integrated Master Equipment List. These are considered weaknesses in their maintenance program. Areas where there is room for improvement generally involve formalizing the actions now being taken. Formalization (documentation of a comprehensive approach to an activity) generally will enhance consistent performance of tasks and provide a baseline for controlling and measuring trends in future performance. The inspectors recognize that excessive documentation can limit flexibility and timely response to plant conditions; however, given the licensee's strong dependence on the current staff's skill and knowledge, near term formalization of program requirements to set the stage for continued good performance in the face of projected future staff turnover would appear to be very prudent. The inspectors considered this one issue to be the licensee's greatest liability in sustaining future good performance.

3.2 Plant Maintenance Organization

Scope

The objective of this inspection was to determine the effectiveness and extent of control exercised by the maintenance organization for: (a) maintenance activities, (b) contract maintenance personnel, (c) deficiency identification and control, and (d) maintenance trending.

Findings

(a) Control of Plant Maintnance Activities

The inspectors observed work in progress in mechanical, electrical, and instrumentation and control (I&C) disciplines, and interviewed various staff members

performing the work. The team found that maintenance activities generally follow the steps outlined in the Vermont Yankee maintenance procedures. All work performed by Vermont Yankee or by contractor maintenance personnel is closely monitored by Vermont Yankee supervisors.

Although Vermont Yankee does not have a general procedure which applies directly to configuration control, the integrity of work performed on mechanical, electrical and I&C systems is governed by other procedural requirements contained in a series of licensee documents. Furthermore, Vermont Yankee relies heavily upon the expertise and knowledge of maintenance personnel and supervisors for maintaining system and component integrity during repair work.

All materials used during maintenance are documented on the MR forms for safety-related repairs by indicating the number of the Material Issue slip from the warehouse. However, this documentation is not vigorously carried out and the inspectors observed that one slip number often applies to several material items (e.g., gaskets, rings, etc. were obtained from the warehouse for repairs on multiple components). The inspectors also found that the licensee does not have an effective policy for controlling and updating vendor manuals (See paragraph 2.2 for more detail).

Vermont Yankee uses the "Peer QC" method to independently verify most activities by which craftsmen and technicians not directly involved in the work being performed monitor it to verify quality. The team found this method to be effective for monitoring maintenance work.

Although the licensee has a satisfactory program for controlling maintenance work performed by its staff and by contractor personnel, in many cases the documentation for the work is informal and not included in official records. This lack of formal documentation is a potential source of errors and is an area that need to be improved.

For mechanical maintenance, the inspectors reviewed implementation of work controls for the following activities:

- Emergency Diesel Generator "A" overhaul
- Feedwater/Condensate Demineralizer Filter Replacement
- 3A and 3B Feedwater Heaters Modifications and Repairs
- Main Turbine-Generator Low Pressure Turbine "A" Rotor Replacement
- Main Turbine CIV and Stop Valves Inspection
- Main Condenser Boot Replacement

The inspectors' review of maintenance documents used for these activities, in combination with interviews of maintenance personnel, supervisors, and contractors, indicates that administrative and special work controls are being effectively implemented. Maintenance personnel were knowledgeable about work controls which applied to their activities and were able to demonstrate how specific controls for which they had responsibility were being implemented. The inspectors noted that mechanical maintenance personnel generally have the opportunity

to exercise judgement on the methods and techniques for implementing work controls at a level appropriate for a specific activity. The inspectors observed that the close involvement of supervisory and management personnel during maintenance work in progress provided additional assurance that work controls were properly implemented and that contractor personnel were closely adhering to maintenance program requirements. The inspectors also noted that the work areas, tools, materials, and replacement parts were properly identified and were consistent with specifications in maintenance work documents.

In the electrical maintenance areas, the inspectors observed maintenance work being performed on the following components:

- Limitorque operator on motor-operated valves (MR 88-2831)
- Target Rock valves (MR 89-0273)
- Breakers in 115k line (MR 88-2139), 4kV line (MR 88-2108) and 480 VAC line (MR 88-2068)
- Bus bar in 4kV line
- Overcurrent relays
- Main station battery

The maintenance on these components was performed in most cases by contractor personnel and supervised by the Vermont Yankee staff. The inspectors observed the work as it progressed and talked to the craftsmen and their supervisors. The inspectors found that the work was performed in a highly competent way. The technicians were well trained, experienced, and motivated. For example, the maintenance of limitorque valve operators was performed by personnel from MOVATS Company, which specializes in this type of maintenance work. Repairs of cracked insulation on the 4KV bus bar were performed by personnel from General Electric Company, the original designer of this component.

In the I&C maintenance area the inspectors observed on-going maintenance activities on the Control Rod Drive System and the Scram Discharge Volume instrumentation. The work involved replacement of diaphragms in scram valve actuators and replacement of the existing RIS power supply with a "Technipower" power supply. The inspector found that the technicians were knowledgeable about the requirements and the work, had controlled and calibrated measuring tools and equipment, and were performing the work according to the procedure specified. The wiring connecting the power supply was properly terminated and trained.

The inspectors noticed, however, that the MR for the Control Rod Drive System specified a quality control inspection of two valves at the beginning of each shift, although there were no QC personnel present and no indication that any quality control inspection took place at the beginning of the shift. In response to the inspector's concern, the licensee representatives from the maintenance department indicated that in their opinion a shift refers to the total period of time it took to finish the job, which could be in some cases several days, weeks, or months. The inspector pointed out to the licensee that a shift has been formally defined and approved by plant management in the Outage Manual as lasting 10 hours. This issue was brought to the maintenance superintendent for

resolution. He explained that this was due to incorrect use of the word "shift" in the MR. It was always their intent to perform under this MR quality control inspections of a total of six valves during the outage, two valves from each of the three shift-crews. He stated that the MR would be revised to avoid the confusion.

The inspectors found that, in general, the maintenance activities in mechanical, electrical, and I&C areas were being performed in an efficient and professional manner.

(b) Control Of Contracted Maintenance

A large portion of the maintenance work at the Vermont Yankee plant is performed by contractor personnel, especially during refueling outages. In some cases, the contractor personnel work directly under supervision of Vermont Yankee staff. At other times, especially for some larger maintenance jobs that are subcontracted to outside organizations, these firms then provide their own supervision, very often follow their own procedures, which have been reviewed and approved by Vermont Yankee PORC, and may have their own QA program which has been approved by Vermont Yankee QA. However, regardless of the contractor's programs, the Vermont Yankee staff always monitors the progress of the work and maintains final approval.

Contractor personnel are selected first by reviewing their resumes and then by interviewing potential candidates before selection is made All those not employed by Vermont Yankee for longer than a year undergo a background check by the plant security, with special attention paid to drug and alcohol use.

Selected candidates undergo training, described in procedure AP 0700, which consists of General Employee Training (GET), including familiarization with the general plant rules and regulations. This training must be taken by all new employees. Then each employee receives specialized training in the area of his or her expertise. This training may be performed in different departments, but it is always coordinated by the Vermont Yankee Training Department. The training may consist of classroom lectures and/or on-the-job practical training. In many cases the training includes working on mockups of actual plant equipment to allow employees to gain needed experience before they start working on actual equipment which may be located in radiation areas.

The inspectors reviewed the training program and interviewed the training coordinator. The program seems well planned and able to provide comprehensive training in the areas of interest to the maintenance organization. It is flexible and continually modified and updated to meet the needs of the plant. The team was especially impressed by the great attention paid to practical training. As an example, Vermont Yankee purchased an expensive circuit breaker for the sole purpose of using it as a training tool.

All work performed by contractors is controlled by the Vermont Yankee maintenance staff through a maintenance request system. Contractor work is verified and approved by appropriate VY staff members. The VY maintenance organization is responsible for providing contractors with up-to-date procedures and vendor

manuals and an existing program controls a release of the procedures to working parties. There is also a process by which these procedures are continuously updated.

The review and updating of vendor manuals is done by the maintenance supervisory staff, but the process is very informal and not particularly efficient (See section 2.2 for additional detail regarding vendor manual control). Before starting a maintenance job, the responsible supervisor assures that all the people assigned to the job have proper training. If training is needed, the supervisor's responsibility is to inform the Training Department in advance so that proper training can be provided.

(c) Deficiency Identification and Control

The inspectors reviewed the licensee's maintenance organization's equipment deficiency identification and control and interviewed plant management and supervisory personnel. The inspectors determined that the licensee has a well established program for identifying equipment deficiencies in the plant. Each deficiency identified could fall into one of three categories and result in the issuance of a Maintenance Request (MR), a Non-Conformance Report, or a Potential Reportable Occurrence Report. The licensee then takes appropriate action which is determined by a suitable procedure. The inspectors also learned the details on how the different elements of the organization interact and how rigorously actual maintenance work follows the path determined by the written procedures. Based on their review of maintenance procedures and interviews, the inspectors determined that in general the present program of deficiency identification and control provides a means for conducting successful maintenance operations in the Vermont Yankee plant.

(d) Maintenance Trending

The maintenance organization has a program for the systematic trending of equipment and system failures. The purpose of this program is to evaluate the need for increased maintenance activities to identify the need for common failure mode analysis and to determine gradual trends in equipment failure rates. When the program was instituted in 1985, failure data from 11 previous years were analysed and the average and control failure rates (two standard deviations) were determined. Presently the program includes trending of failures for 24 components and systems and already provides useful information for planning preventive maintenance on Uninterruptible Power Supply (UPS) and other components. There is an ongoing effort to extend this program to include the root cause of failures. Trending this parameter would provide much more useful data than trending equipment failures, because it would eventually permit a suitable analysis to determine common cause failures. Expansion of this part of the program is, however, still in its preliminary stage.

Specifications in the procedure for preparing trending data requires that the assigned maintenance engineering personnel record failures of equipment and the probable cause from the information on Maintenance Request Forms. These data

are then plotted on trending charts and analysed for the root cause of the failure. Presently there is backlog of data on which this analysis has to be performed. The engineer in charge told the inspectors that in the future they intend to put more resources in this area to reduce the backlog. Once this program is fully implemented it should produce useful results which will help to enhance the plant's maintenance program.

Conclusions

The inspectors concluded that the maintenance organization had a well developed program for performing corrective and preventive maintenance. The main strength of the organization lies in its highly trained and competent staff. Careful selection and an effective training program assured that contractor personnel were well qualified for performing their jobs appropriately. The contracted work is supervised and monitored in a satisfactory manner. The failure trending program under development is well conceived and will probably contribute significantly to the improvement of the predictive maintenance program. The inspectors found Vermont Yankee to have a well functioning maintenance organization.

3.3 Maintenance Facilities, Equipment, and Material Controls

Scope

The objective of this inspection was to assess the plant's maintenance facilities and controls over maintenance equipment, tools, and materials to determine how well these activities support maintenance work. The following areas were evaluated during this inspection:

(a) Provision of maintenance facility and equipment
(b) Establishment of material controls
(c) Establishment of maintenance tool and equipment controls
(d) Control and calibration of meter and test equipment

Findings

(a) Provision of Maintenance Facility and Equipment

The inspectors conducted an extensive tour of maintenance facilities to assess the extent to which facility arrangement, layout, and accessibility are conducive to efficient maintenance operations. The inspectors noted that the locations of mechanical workshops, the machine shop, fabrication shop, main storehouse, tool room, and temporary repair shops are physically adjoined to and clustered around the reactor and turbine buildings in such a manner that ready access to these facilities is afforded from all areas inside the plant.

Maintenance facilities are located to provide controlled access from the outdoors for passage of personnel and material without requiring that they enter through the plant. The flow of personnel and material throughout the plant is well accommodated by efficient traffic patterns and locations of entrance and exit points to maintenance facilities. The I&C equipment storage and testing

shops are located directly adjacent to the control room, switchgear rooms, and cable spreading room for ready access to those areas. The machine shop, tool room, and storehouse are located in close proximity to each other and afford efficient access to these areas. Supervisor's offices are located directly adjacent to and within sight of maintenance shop facilities. Maintenance and I&C Engineering offices are also located adjacent to their respective shops; however, they are not within direct view and were afforded some separation from normal plant traffic. The Maintenance Superintendent's and Plant Manager's offices, located in the administration building, provided ready access to maintenance facilities but were adequately separated from the plant with regard to their administrative duties. Support organizations, such as Health Physics, Safety, and Fire Protection, also share facilities immediately adjacent to the plant and generally do not need to have direct access to the maintenance shops, although direct access to the plant is afforded.

The inspectors walked throughout the reactor and turbine buildings to observe the temporary maintenance areas established to provide local support for specific maintenance and modifications projects (e.g., turbine rotor replacement, feedwater heater modifications and repairs, plant pipe lagging, and replacement). The inspectors noted that the ample space allocated to all in-plant maintenance areas permitted efficient work and avoided congestion. Staging and laydown areas were well organized and controlled to provide sufficient temporary storage and efficient material utilization, component layup space, and personnel traffic routes. Scaffolding for all plant areas during the outage was provided by a single contractor and was arranged and constructed in a way to afford the efficient passage of personnel and materials around affected areas. More than a sufficient quantity of scaffolding was provided for the necessary maintenance work and it was arranged to provide direct and safe access to work areas. Scaffolding was well protected against personnel hazards and was often utilized to provide temporary support for service lines or other temporary equipment which could create a safety hazard at floor level.

The inspectors observed that communications systems were installed in all areas throughout the entire site. The "Gaitronics" four-channel phone-pager system was heavily utilized by maintenance personnel for short conversations. An independent sound power phone network was also installed for supporting specific maintenance and testing work. These systems provided more than adequate communication service for maintenance work in progress.

(b) Establishment of Material Controls

For Material Controls review, the inspectors reviewed the adequacy of administrative policies and procedures for implementing effective control of materials (components, spare parts, consumables, etc.) used in maintenance, beginning with material requisition and extending throughout material installation or use. The inspectors observed that adequate guidelines have been established for identifying and assigning necessary material specifications, by site-based "user departments," for use in maintenance applications. Adequate controls have been implemented for identifying safety-related materials and for specifying the necessary special controls over the procurement of safety-class material. The

"Safety Classification Manual" provides the necessary instructions to site groups who initiate material requisitions. The inspectors observed the process of initial material requisition, through the corporate purchasing function, QA review, purchase approval, and final ordering. These procedures were adequately controlled and sufficiently well established to ensure that in most cases material requisitioned for maintenance activities are processed far enough in advance of use to be available in sufficient quantity for their intended purposes. No maintenance activities were observed to be delayed due to late requisition processing or purchasing.

The inspectors noted that adequate guidelines have been developed for ensuring that proper material certificates are provided with material that arrives on site. The inspectors reviewed documentation of individual material history packages maintained on safety class items in receipt inspections. All packages reviewed contained complete information and certifications to support material identification through objective evidence obtained from approved suppliers. The approved suppliers' list was also reviewed by the inspectors and a discussion was held with the licensee's vendor audit group regarding the vendor audit program. The inspectors reviewed several recent vendor audit reports conducted on several "approved vendors" currently providing contractor services during the outage. No unsatisfactory conditions were noted.

The inspectors reviewed the computerized data base used for tracking the entire site storehouse inventory. Minimum and maximum stocking levels are identified, as is current inventory on hand. Automatic reordering is initiated when inventory drops below minimum levels. The inspectors noted that all material designated for a specific application may not necessarily be entered into the storehouse inventory listing but may be temporarily stored in the storehouse. Observations of controls on the issuance of all material out of the storehouse indicate that inventoried material is released only after certifications are made which associate specific work orders with specific material purchase orders.

The inspectors examined the site storehouse stock areas to evaluate the adequacy of this facility in supporting the maintenance effort. This facility provides good physical security for all store materials and provides a "Category B" storage environment for plant spare parts and consumable material. The inspectors observed the areas designed for flammable and explosive materials storage and determined that adequate controls were in effect to keep these materials segregated from normal stock. The inspectors noted that no positive controls are implemented in the storage areas to maintain "qualified" material physically separate from "non-qualified" material. This does not appear to adversely affect support to the overall maintenance effort since "qualified" material is adequately marked and physically identified by tagging. All material is identified by safety class in work packages and procurement documents which are verified to be consistent before any material is released from the storehouse. Non-conforming material is well segregated in the areas designated exclusively for receipt inspection. The inspectors observed these areas to ensure that receipt inspection QC requirements were adequately implemented and that documentation of material history was maintained in a manner which provides complete traceability. The inspectors reviewed the methods for upgrading and/or

dedicating material presently in the storehouse to a higher safety classification than was originally designated by the purchase order. The upgrade process can also be used to extend the shelf life of storehouse material where sufficient technical justification can be shown. The inspectors reviewed selected material upgrade and dedication evaluation (MAUDE) packages extending from 1987-89 and found no unsatisfactory conditions.

(c) Establishment of Maintenance Tool and Equipment Control

In the areas of Maintenance Tool and Equipment Control the inspectors toured plant areas to observe tools and equipment in use for various maintenance activities. Work documents in use for the emergency diesel generator overhaul and the Hydraulic Control Unit (HCU) scram valves and actuators repair were checked to ensure that the tools and equipment specified by the procedures were in use. The inspectors also verified that finished work was properly documented so that exact tool usage could be retraced at a later time if necessary. Tools and equipment were noted to be clearly identified and serial numbers agreed with the tool room sign-out logs. In one instance, the inspectors noted that a torque wrench (VY #3906) in use on the diesel generator had a calibration label attached which indicated a valid calibration period in excess of the 18 months allowed by Administrative Procedure AP-0201. The inspectors discussed this concern with the Maintenance Engineering Assistant. The Maintenance Department QC records were checked to confirm that the actual allowable period for the wrench was in fact 18 months and that the wrench had been mislabelled. The wrench was more than 12 months from the actual required recalibration date and the engineering assistant indicated that the wrench would have been removed from service slightly earlier than the due date through normal administrative controls.

d) Control and Calibration of Meter and Test Equipment

The inspectors reviewed the "Vermont Yankee Calibrated Tools & Instruments" list for Maintenance Department Meter and Test Equipment (M&TE) to compare equipment specifications with the actual equipment identified on the list. The inspectors toured the tool room areas where Maintenance Department M&TE are calibrated and stored. Storage lockers were noted to be well organized and suitable for protection of calibrated equipment. The inspectors examined the torque wrench bench tester (Snap-On TQTP650), reviewed the procedure for torque wrench calibration with the tool room custodian, and verified that records of certification were maintained for bench test users. No inconsistencies were found. However, the inspectors identified three documentation problems associated with calibration of tools as follows: (1) Three "Hytorc" wrenches designated on the list as being out of service for calibration did not have supporting documentation on M&TE sign-out sheets (VYAPF 0201.01) maintained in the tool room. Section 6.8 of procedure AP 0201 requires any tools removed from the tool area be logged by the tool attendant on VYAPF 0201.03. (2) A further review of tool room documentation revealed that two outdated Torque

Wrench Calibration Data Sheets (VYAPF 0201.03) had been used to record data obtained during a recent calibration of a torque wrench (VY #5115). Administrative Procedure AP-6805 requires that old procedure data sheets and forms be destroyed when a new revision to the applicable plant procedure is issued. (3) The inspectors noted that procedure AP-0201 requires all torque wrenches to be clearly labelled with "CW" and/or "CCW" to indicate which direction the wrench is calibrated, i.e., clockwise or counter clockwise, respectively. No torque wrench in the tool room, and none observed in use in the plant, had the labelling indicating the direction of calibration. These findings constitute a violation of 10 CFR 50 Appendix B, Criterion V (50-271/89-80-04).

Conclusion

The inspectors concluded that maintenance facilities are well arranged, equipped, and maintained in a manner which supports the efficient conduct of maintenance activities at Vermont Yankee. Facility layout and space utilization for maintenance work were well planned, organized, and controlled. The flow of personnel, material, and equipment throughout the plant complex was well accommodated by maintenance facilities.

In the area of material control, the inspectors concluded that existing administrative policies and procedures provide adequate controls for specifying, procuring, receipt inspecting, and storing materials utilized for maintenance work. Safety-related materials are adequately identified and controlled to ensure that such material is properly procured, stored, and issued for the intended use. The material tracking systems in use in the storehouse is adequate for maintaining minimum stock levels and for properly accounting for all material received, stored, and issued from the storehouse. The procurement program was observed to be well administered and implemented to ensure that materials used for maintenance activities are properly specified, obtained, and received in a timely manner which supports maintenance work schedules.

In the area of tool and equipment control, inspectors concluded that tool and equipment identification, storage, and use were adequately controlled in maintenance work.

Management's attention is needed to resolve: (1) the documentation problems associated with the calibration of tools, and (2) torque wrench calibration labels not in accordance with the procedure.

3.4 Personnel Control

Scope

The objective of the inspection in this area was to determine the extent to which personnel are trained and qualified to perform maintenance activities. In assessing this topic, the inspectors examined the following four areas: staffing control, training, testing and qualification, and current status. The inspectors' evaluation was based on interviews, direct observations of the training facility and field activities, and reviews of documents and records.

Findings

Staffing control was assessed mainly through interviews with maintenance supervisors. The team found that organizational charts were complete and up-to-date. The personnel turnover rate is low (less than one percent per year), resulting in a highly experienced staff with typically 8 to 15 years of onsite experience.

The inspectors reviewed the licensee's training and qualification program in four areas: (1) Radiation Protection/Chemistry; (2) Mechanical/Electrical Maintenance; (3) Instrumentation and Controls; and (4) Technical Staff/Manager. The training and qualification program in these four areas is INPO credited. Supervisor/Management training is also provided on an as-needed basis. Diagnostic testing is used to help identify individual weaknesses where additional training may be required.

A formal training, qualification, and certification program does not exist for contractor maintenance personnel. However, in addition to the required indoctrination training, contractor personnel receive speciality training as necessary for specific jobs. Close on-the-job monitoring and supervision are the primary methods used to assure the appropriate level of contractor performance.

Speciality training provided to contractor and licensee personnel for the outage included: scram discharge valve replacement (a mockup valve was purchased for this training), circuit breaker maintenance, squib valve maintenance, and valve maintenance using various valve cutaways. In addition General Electric provided onsite mockup training to support primary recirculation pump maintenance.

An assessment was performed of the licensee's current status of the fitness for duty program and of work performed by unqualified personnel. Drug screening is performed upon initial employment and subsequently as justified by probable cause. State law prohibits the implementation of random drug testing.

Conclusion

Based upon interviews with maintenance supervisors and training personnel, observations of maintenance personnel performing various activities in the field, and reviews of the qualifications of the individuals performing the

work, the inspectors determined that the licensee has a comprehensive and well-planned training program for their maintenance personnel and that the licensee's personnel control program is adequately documented and implemented. Based on the result of interviews with the Medical Services Director and maintenance supervisors, as well as a review of the fitness-for-duty program, the inspectors determined that the licensee has an adequate drug program to ensure worker's fitness for duty.

APPENDIX 1

Appendix 1 is a copy of the attachment to the December 27, 1988 letter to the licensee requesting site specific information.

PRE-INSPECTION REQUESTED INFORMATION

To aid us in preparing for the maintenance inspection please provide us with the following documents, procedures and information in accordance with the designated numbers. If you do not have the requested document or information, it is not necessary to generate it to comply with this request. We recognize that many of the documents requested separately may be inclusive in a larger single document. Please provide five sets of the requested documents. A member of our staff will contact you regarding the best method of transmitting the documents to us.

Section 1 - Description of General Plant Maintenance Activities

1-1 Maintenance administrative procedures which describe your corrective, preventive and predictive maintenance activities.

1-2 Organization charts including the maintenance organization and plant-wide organizations.

1-3 Procedures, charts and other documents which describe your Planning Department and its activities.

1-4 Documents which describe maintenance planning and scheduling meetings and status of maintenance reports.

1-5 Documents which describe the Maintenance and Operations interface during planning, scheduling, work start, work closeout and post maintenance/functional testing.

1-6 Documents which describe your work control process: how a work order is started, planned, executed, closed out and equipment returned to service.

1-7 Documents which describe training and retraining of plant and contractor maintenance personnel. (For maintenance activities only, do not include GET.)

1-8 Documents which describe interfaces and communications among the technical support, engineering support and the maintenance/I&C Departments.

1-9 Documents which describe maintenance work procedure establishment and control: Criteria as to when a procedure is to be used; initial writeup; reviews and approval; revisions; human factors review; QA reviews; requirements for conduct of work; troubleshooting criteria; work closeout; post maintenance testing and restoration of systems.

1-10 Description of methods by which maintenance performance is measured. Are performance indicators used? What are they? Who is informed of the results?

1-11 Description of process for communications with vendors for technical services and latest technical information on equipment and systems installed at the plant, and interfaces with vendors of NSSS for training, modifications and equipment replacement.

1-12 Documents which describe the preventive maintenance and predictive maintenance programs.

- Which equipment is included?
- How is maintenance frequency determined?
- What is done with results of these maintenance actions?

1-13 Documents which describe management involvement in maintenance.

- Are there goals set for the maintenance and I&C Departments?
- Are these goals used in the performance evaluation of managers and supervisors?
- Are these goals communicated to first line supervisors and chiefs?

Section 2 - Status of Plant and Contractor Personnel Who Perform Maintenance.

2-1 The number of craft personnel for electrical, mechanical and I&C maintenance organizations. Please include foremen and foreman to craft ratio.

2-2 The average years of experience for each individual and the turnover rate.

2-3 Description of shift work and work assignments. How do foremen decide on which craft is to perform what type of work?

Section 3 - Status of Plant Equipment and Plant Maintenance

3-1 What equipment failures occurred during the last year of operations?

3-2 What equipment failures have been found during shutdown of plant?

3-3 Describe maintenance and testing for diesel generators and electrical equipment including switchgear that would be required in case of loss of offsite power.

3-4 What component failures present greatest risk from a probabilistic risk standpoint to the plant?

3-5 What have been the areas of high maintenance activity on safety related and non-safety related equipment and components?

3-6 Provide the following status concerning Maintenance Work Orders (MWO).

- Current total listing and status of MWOs, number in planning, number in final sign-off, number on hold for lack of parts, number on hold for engineering assistance, number available to be worked on.
- Projected number of corrective MWOs to be outstanding at start-up by priority.
- Rate of completion of corrective MWO in terms of number completed/month and manhours expended (by craft)/month for the past 12 months.
- Current number of preventive maintenance work orders overdue.
- Rate of completion of preventive MWO for the past 12 months.
- Estimated manhours required to complete current preventive maintenance MWOs.
- Number MWOs requiring rework over past 6 months.

3-7 Provide five corrective maintenance procedures for work that is scheduled for the upcoming outage. MOVs, PRVs, ECS Pumps, Batteries, Switchgear, etc.

3-8 Provide five preventive maintenance procedures that are scheduled for the upcoming outage.

3-9 Provide your overall outage schedule.

APPENDIX 2

PERSONS CONTACTED

Vermont Yankee Nuclear Power Corporation

H. Atkins, Assistant Maintenance Foreman
* D. Bauer, Assistant to Vice President
F. Burger, Receipt Inspection Supervisor
* P. Donnelly, Maintenance Superintendent
G. Gilmore, Storeroom Supervisor
D. Girroir, Senior Quality Assurance Engineer
J. Golonka, Maintenance Technician
* S. Jefferson, Assistant to Plant Manager
* R. Leach, Radiation Protection Supervisor
D. Legere, Senior Maintenance Engineer
* R. Lopriore, Maintenance Supervisor
* J. McCathy, ALARA Engineer
* D. McElwee, Engineering Program Manager
* H. Metell, Engineering Support Supervisor
* W. Murphy, Vice President/Manager of Operation
* R. Pagodin, Technical Service Superintendent
* J. Pelletier, Plant Manager
* R. Spinney, Training Manager
* D. Stafford, I&C Training Coordinator
D. Taylor, Maintenance Engineer
J. Turner, Lead Electrician
* G. Wilder, Maintenance Training Coordinator
* R. Wanczyk, Operation Superintendent
* T. Watson, I&C Supervisor
W. Wittmer, Construction Superintendent

Yankee Atomic Electric Company

J. Culchera, Engineer
* R. Grippardi, Quality Assurance Supervisor
* J. Thayer, Vermont Yankee Project Engineering Manager
S. White, Senior Engineer, Vendor QA Group

Vermont Department of Public Service

* R. Sedano, Chief Engineer
* W. Sherman, Nuclear Engineer

United States Nuclear Regulatory Commission

* G. Grant, Senior Resident Inspector
* J. MacDonald, Resident Inspector

* Denotes those present at the exit meeting at the Vermont Yankee site on March 10, 1989.

APPENDIX 3

SUMMARY OF WEAKNESSES

Weakness - A potential problem or condition presented for licensee evaluation and corrective action as applicable.	Reference to Report Section
1. Lack of comprehensive and formally documented maintenance plan and policies.	2.2 & 3.1
2. Lack of comprehensive and structured review for adequacy and applicability of the plant's maintenance requirements.	2.2
3. Review for the appropriateness and technical adequacy of completed maintenance activities were not being performed in a timely manner.	2.2
4. Lack of effective policy and procedures for controlling and updating manufacturer technical manuals.	2.2
5. PRA concept not incorporated into Vermont Yankee maintenance program.	2.3.3
6. No integrated Master Equipment List for Vermont Yankee.	3.1
7. Post-maintenance testing requirements were not proceduralized in the administrative procedure.	3.1

APPENDIX 4

SUMMARY OF UNRESOLVED ITEMS

Unresolved items are matters about which more information is required in order to determine whether they are acceptable items or violations. Unresolved items identified during this inspection are listed below:

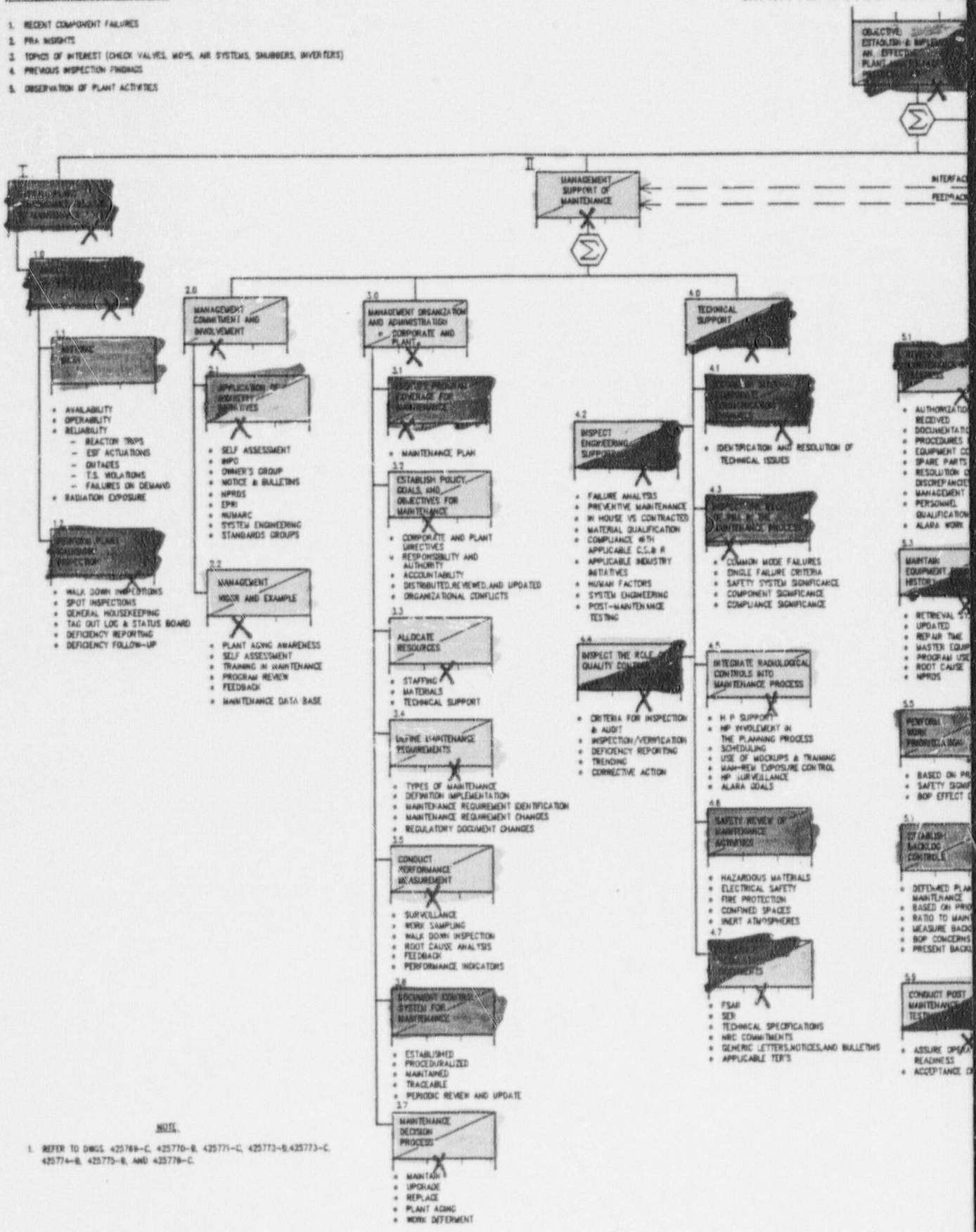
Unresolved Items		Reference to Report Section
50-271/89-80-01	Potential for Drywell paint peeling to clog the ECCS pump suction screen	2.3.2
50-271/89-80-02	Radiation exposure control above the biological shield during fuel movement	2.3.5
50-271/89-80-03	Administrative control of "tag-out" as it applies to an additional work party	2.3.5

FIGURE 1

WORKING TR
MAINTENANCE INSPEC

TREE INITIATORS

1. RECENT COMPONENT FAILURES
2. PRA INSIGHTS
3. TOPICS OF INTEREST (CHECK VALVES, MOV'S, AIR SYSTEMS, SNUBBERS, INVERTERS)
4. PREVIOUS INSPECTION FINDINGS
5. OBSERVATION OF PLANT ACTIVITIES



NOTE:

1. REFER TO DWGS. 425769-C, 425770-B, 425771-C, 425772-B, 425773-C, 425774-B, 425775-B, AND 425776-C.

VERMONT YANKEE, 50-271/89-80

EE
TION TREE

POOR SATISFACTORY GOOD

OVERALL PERFORMANCE EVALUATION

WITH SUFFICIENT ELEMENTS TO CONTROL WORK ACTIVITY

III

5.0

- METHOD FOR WORK IDENTIFICATION
- WORK ORDER STANDARD
- REQUIRED REVIEWS/APPROVALS
- VERIFY ACCURACY OF WORK ORDERS
- EMERGENCY WORK ORDERS
- PROCEDURE PERFORMANCE

5.4

- IMPACT ON SAFETY
- COORDINATION
- DRAWINGS/SKETCHES/TECHNICAL MANUALS
- TASK SEQUENCING
- TOOLS/PARTS AVAILABILITY & QUALIFICATION
- PERSONNEL REQUIREMENTS
- SPECIAL PROCESSES
- EXPOSURE CONTROL

5.6

- APPROPRIATE SUPERVISION
- PROCESS CONFLICTS
- WORK TRACKING SYSTEM
- ALARA CONTROLS

5.8 PROVIDE MAINTENANCE PROCEDURES

- DEVELOPMENT/APPROVAL
- TECHNICALLY CORRECT, CONSISTENT, & TESTED
- CAUTIONS & WARNINGS INCLUDED
- CONTROLLED
- PERIODIC REVIEW AND CHANGE

5.10 REVIEW OF COMPLETED

- PROCEDURALIZED
- CLOSE-OUT SYSTEM
- WALK DOWN INSPECTION
- FEEDBACK
- COMPLETED WORK DOCUMENT REVIEW

6.0

6.1 ESTABLISH CONTROL OF PLANT MAINTENANCE ACTIVITIES

6.1.1 MECHANICAL MAINTENANCE

6.1.2 ELECTRICAL MAINTENANCE

6.1.3 INSTRUMENT AND CONTROL MAINTENANCE

- IDENTIFY WORK FOR ACTION
- ASSURE PLANT & SYSTEM INTEGRITY
- ESTABLISH MONITORING CONTROLS
- CONTROL REWORK AND TEMPORARY REPAIRS
- VENDOR TECHNICAL MANUAL CONTROLS AND UPDATING
- CONTROL PERSONNEL
- PROCEDURE CONTROL
- ESTABLISH MATERIAL CONTROL
- ESTABLISH TOOL CONTROL
- ESTABLISH CONFIGURATION CONTROLS
- WORK PERFORMANCE ACCOUNTABILITY

6.2

- PERSONNEL SELECTION
- TRAINING
- QUALITY CONTROL
- PROCEDURE CONTROL
- PERFORMANCE MONITORING

6.3

- IDENTIFICATION
- REPORTING & TAGGING
- CORRECTIVE ACTION
- CLOSE-OUT SYSTEM

6.4

- SYSTEMIC FIXES vs SPECIFIC FIXES
- ROOT CAUSE ANALYSIS
- SELF ASSESSMENT / PERFORMANCE INDICATORS
- REWORK EVALUATION

6.5 ESTABLISH SUPPORT INTERFACES

- ENGINEERING
- QUALITY
- OPERATION
- SAFETY
- PROCUREMENT

7.0 CONTROL

7.1

- MAINTAINABILITY
- FACILITY ARRANGEMENT & ACCESSIBILITY
- TRAINING & MOCK-UP FACILITIES
- STAGING, LAYDOWN & SCAFFOLDING
- COMMUNICATION SYSTEMS

7.2

- PROCUREMENT
- IDENTIFICATION OF CONSUMABLE MATERIALS
- SPARE PARTS IDENTIFIED
- MATERIAL & PARTS RECEIPT & INSPECTION
- DOCUMENT TRACEABLE
- STORAGE
- ISSUANCE

7.3

- IDENTIFICATION
- STORAGE CONTROL
- TOOL MAINTENANCE, TESTING, & CALIBRATION
- ISSUANCE

7.4 PROVIDE CONTROL & CALIBRATION OF METER & TEST EQUIPMENT

- IDENTIFICATION
- CALIBRATION
- CONTROL
  - STORAGE
  - ISSUE/RECALL
- RANGE & ACCURACY

8.0 CONTROL

8.1 ESTABLISH STAFFING CONTROL

- HIRE, FIRE, AND PROMOTE
- ORGANIZATION CHART
- JOB DESCRIPTION
- TYPE OF CRAFTS
- NUMBER OF PERSONNEL
- TURNOVER RATE REDUCTION
- SHIFT COVERAGE
- EMERGENCY CONDITIONS
- PERSONNEL ACTION

8.2

- GENERAL
- SPECIFIC
- SAFETY RELATED
- SPECIAL WORK
- INPO ACCREDITED T & Q PROGRAM

8.3

- FORMAT APPROVED
- DOCUMENTED
- TRACEABLE

8.4

- T & Q
- DRUG PROBLEMS
- WORK PERFORMANCE BY UNQUALIFIED PERSONNEL
- TURNOVER RATE

LEGEND

EVALUATE SECTION I ELEMENTS

HIGHLITE:
- GREEN- FUNCTIONING WELL
- YELLOW- FUNCTIONING ADEQUATELY
- RED- FUNCTIONING INADEQUATELY
- BLUE- N/A, NOT EVALUATED, OR INSUFFICIENT DATA

EVALUATE MAINTENANCE PROCESS ELEMENT ADEQUACY

HIGHLITE:
- GREEN- ELEMENT WELL DOCUMENTED
- YELLOW- ELEMENT IS ADEQUATELY ADDRESSED
- RED- ELEMENT IS MISSING OR INADEQUATE
- BLUE- N/A, NOT EVALUATED, OR INSUFFICIENT DATA

EVALUATE MAINTENANCE PROCESS ELEMENT IMPLEMENTATION

HIGHLITE:
- GREEN- FUNCTIONING WELL
- YELLOW- IN PLACE BUT COULD BE STRENGHTENED
- RED- IMPLEMENTATION MISSING OR INADEQUATE
- BLUE- N/A, NOT EVALUATED, OR INSUFFICIENT DATA

CRITERIA RATING

BASED ON APPRAISAL FINDINGS ASSIGN A RATING FOR EACH ELEMENT

8/15/88
DRAWING NUMBER
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