U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No.: 50-271

Report No.: 94-08

Licensee: Vermont Yankee Nuclear Power Corporation
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Ferry Road
Brattleboro, VT 05301

Facility: Vermont Yankee Nuclear Power Station

Location: Vernon, Vermont

Dates: March 28 to April 1, 1994

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Approved by: _____ 5/12/94
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Findings: Performance during this inspection period is summarized in the Executive Summary.

Unresolved item 50-271/93-80-02 which concerned main steam isolation valve closure capability following a loss of coolant accident was closed.

The team identified two unresolved items. The first item regarded long term operability of the core spray (CS) 'A' system including isolation capability of the injection valves following prolonged elevated pressurization of the discharge header (UNR 50-271/94-08-01). The second item concerned was assigned to determine whether the diesel fire pump fuel oil day tank had been permitted to drop below the Technical Specification limit of 150 gallons (UNR 50-271/94-08-02).

EXECUTIVE SUMMARY

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Operations: Current plant status and emergent issues were effectively communicated to appropriate portions of the licensee organization during control room shift briefings and daily plant manager meetings. The detailed discussion of emergent problems and action item assignment at the plant manager meetings was a specific strength. The number of control room deficiencies was properly controlled and minimized. Operator aids and controlled system drawings were generally correct and of good quality. Operations department management initiated appropriate actions correct minor discrepancies and to clarify management expectations for the use of operator aids. A detailed self assessment resulted in several positive initiatives to enhance the management of temporary modifications.

Deficient operating conditions were typically addressed in a timely manner. However, the team identified three instances in which longstanding deficient conditions were not properly resolved or documented. The most significant of these conditions was the continued elevated pressurization of the 'A' core spray discharge header since reactor startup from the refueling outage in October 1993. These occurrences indicate a need for improved management oversight and a more progressive questioning attitude on the part of the operations staff.

Maintenance and Surveillance: The industry and vendor experience review program have improved and reduced the likelihood of emergent safety problems at Vermont Yankee. Quality Assurance department involvement in this program significantly enhanced the depth of issue reviews and findings. However, continued area for improvement still exists as indicated by continued reliance on personnel knowledge vice implementing procedural guidance and less than thorough assessment of selected issues raised by the several NRC Information Notices. The process for cancellation or rejection of work orders has improved. Self assessments concerning this activity have actively supported this progress.

Engineering and Technical Support: Engineering personnel properly addressed the generic issues raised concerning operability of main steam isolation valves (MSIV) in the event of a loss of coolant accident (LOCA). The engineering calculation was technically sound and justified operability of the MSIVs during a LOCA.

Management and Corrective Actions Processes: Corrective Action Task Force reviews have been detailed. Progress toward development of a single path (event report) corrective action process is promising. Causal analysis for potentially reportable occurrences has improved. This is a direct result of management involvement at the daily plant manager meeting. Notwithstanding, causal analysis of routine corrective action reports (CAR) continue to be narrowly focused and do not sufficiently evaluate human performance or work control practices as contributing factors. Managers expectations appear low, resulting in cursory event analysis and minimal follow-up verification. Routine CAR evaluations do not reliably prevent recurrence.

(EXECUTIVE SUMMARY CONTINUED)

Management involvement has resulted in improved self assessment capabilities at several positions within the licensee organization. A self assessment of Technical Specification surveillance requirements was a positive initiative to improve processes and reduce the heavy reliance on personnel. The team observed a wide disparity between departmental manager performance expectations and conceptions of the content/benefit of self assessment programs. Internal licensee audits have identified similar findings. Appropriate management focus has been devoted to strengthen the quality of departmental self assessments.

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DETAILS

1.0 INSPECTION SCOPE AND OBJECTIVE

From March 28 to April 1, 1994, three NRC inspectors conducted an operational safety followup inspection at the Vermont Yankee Nuclear Power Station. The inspection was performed to evaluate the effectiveness of licensee corrective actions implemented to address perceived performance weaknesses previously documented in NRC Operational Safety Team Inspection (OSTI) Report 50-271/93-80. Principle areas of concern which remained open included:

1. Licensee acceptance of readily correctable deficient operating conditions may degrade safety.

2. The industry experience review process may fail to properly identify and evaluate applicable components.

3. Documentation was unavailable to support main steam isolation valve closure capability following a loss of coolant accident (UNR 50-271/93-80-02).

4. A two tiered corrective action guideline established too high of a threshold for rigorous root cause evaluation.

5. Self-assessments were inconsistently implemented throughout the station.

2.0 OPERATIONS

2.1 Communication of Plant Operating Status and Emergent Issues

The team observed control room operations, attended periodic management meetings, and reviewed control room logs to determine whether operating status and emergent issues were properly communicated to appropriate portions of the licensee organization. The shift supervisor conducted briefings at the beginning of each shift for all watch section members. Planned evolutions were discussed in appropriate detail. A summary writeup from the previous daily plant manager meeting was filed in the Operations Night Order book. This summary provided valuable information to the watch section regarding the status and resolution of emergent issues which had arisen over the past few weeks. Pertinent industry issues, regulatory information, and planned maintenance schedules were documented in appropriate detail. Interviews of control room personnel indicated that this recent addition to the Night Order book has resulted in improved operator knowledge of equipment condition and issue resolution. Shift turnover briefings were conducted in a professional and thorough manner. Alarms received in the control room were reviewed and discussed with the operators. Operators were cognizant of control board and plant conditions.

Daily plant manager meetings, initiated since the OSTI, were conducted early each morning. The team noted that the meetings were well attended by representatives of the various plant

and engineering disciplines and that meaningful discussions of emergent problems were conducted. Daily work activities were summarized with any additional support needs clearly identified. Emergent issues were closely scrutinized by key managers, resulting in a good review of operational impact and assignment of corrective actions. This is discussed further discussed in Section 5.1.1. The team concluded that communication of operating conditions, daily activities, and emergent problems has improved.

2.2 Resolution of Deficient Operating Conditions

The OSTI previously identified a weakness in the administrative accountability of control room deficiencies. In addition, operators were slow to initiate action to evaluate and correct discrepant conditions. Examples included elevated drywell temperatures, locked-in offgas system high radiation alarms, and frequent bypass and deactivation of the turbine load bay fire protection system. The team reviewed logs, controlled documentation, and procedures and conducted personnel interviews to determine whether deficient conditions were being properly addressed.

2.2.1 Control Room Deficiencies

Control and tracking of control room deficiencies has improved. An internal commitment was established to perform self audits of posted control room deficiencies on a quarterly basis. Management has placed significant emphasis on this issue and accelerated the audit periodicity to approximately monthly. The team reviewed recent audits of control room deficiencies and conducted a walkdown of control room panels to independently verify the results of the most recent audit. Some shift supervisors occasionally continue to close maintenance work orders without clearing the associated control room deficiency tag as required by administrative procedure 0021, "Work Orders." This observation was documented in the recent audits and appropriate corrective action was initiated. The licensee effectively minimized the number of existing control room deficiencies and established corrective maintenance priorities commensurate with the safety significance of the deficient component or indicator.

2.2.2 Deficient Plant Conditions

The team reviewed reactor building, turbine building, and outside auxiliary operator tour log records for the past six months to ensure compliance with station procedures, to determine if entries were correctly made, and to verify proper communication of equipment status. Administrative procedure (AP) 0150, "Conduct of Operations and Operator Rounds," requires operators to circle abnormal or unusual log readings and report them to the shift supervisor. The cause of the abnormal reading must be investigated, with results recorded in the remarks section of the log. All remarks section entries must be initialled and annotated with the time of entry. The duty senior control room operator or shift supervisor must ensure that a work order request has been generated, initiate compensatory measures as appropriate, and notify higher management as appropriate. In general, operator logs were

correct and included good assessments and remarks to address deficient conditions. Examples included identification and work order initiation for a reactor water cleanup seal leak and adjustment of the reactor vessel level backfill system flowrate on February 7, 1994. However, the team identified three distinct exceptions for which longstanding deficient conditions were not properly documented, evaluated, and/or corrected. These conditions were (1) Elevated core spray 'A' discharge header pressure, (2) Fire pump diesel generator fuel oil day tank low level, and (3) Inoperable main stack flow rate indicator.

- Elevated core spray (CS) 'A' discharge header pressure was logged and circled consistently from October 1993 until the time of this inspection. The prescribed pressure band for this parameter is 85 to 150 pounds per square inch gauge (psig). This corresponds to the system keep fill pressure supplied from the condensate system via a pressure reducing station. This reducing station provides water at 85 psig during power operation and 150 psig when the reactor plant is shut down. Pressure higher than expected indicates potential leakage past closed valves from a higher pressure source such as the reactor vessel or a failed pressure reducer from the condensate system. The same pressure reducer services the 'B' core spray discharge header and the two residual heat removal system headers which continued to indicate normal pressure of 85 psig during reactor operation and 150 psig when the plant was shut down. Therefore the team concluded that the pressure reducing station was functioning properly. Operator logs indicated that CS 'A' discharge pressure had gone as high 300 psig and that operators were venting the discharge header to relieve pressure as frequently as three times per day. The team concluded that the most probable cause of the elevated CS 'A' pressure was leakage from the reactor vessel (RV) past the normally closed CS injection valve (CS-12A).

  Significant backleakage from the RV to systems with lower design pressure, such as core spray, could increase the likelihood of an intersystem loss of coolant event. In addition, excessive leakage could result in void formation within CS system piping, resulting in a hydrodynamic effect called water hammer which can cause piping damage during system operation. The team noted that CS piping temperature remained approximately 200 degrees F below that necessary to cause boiling at the current system pressure. Therefore the likelihood of void formation and subsequent water hammer is very low.

  The team discussed the elevated CS 'A' pressure with various licensee personnel including licensed operators, engineering personnel, and department managers. The licensee did not have a common understanding of the cause of the elevated pressure. Proposed causes ranged from a failed pressure regulator, to a leaking condensate system block valve, to leakage from the RV past CS-12A. Licensed operators recalled that the CS 'A' discharge header overpressure alarm had annunciated (setpoint 300 psig) in the past, but believed the most recent occurrence to be over a year ago. The Operations department manager stated the expectation that this alarm would be documented in the control room logs if it occurred. Discussions with

licensed operators did not indicate a clear understanding of that expectation. A detailed engineering assessment of the condition had not been performed to support long term operability of the CS system and the containment isolation function of CS-12A. Station management did not have a clear understanding of the magnitude of the CS pressurization. The team expressed concern regarding the limited licensee understanding and assessment of the CS 'A' discharge header pressurization condition. Operations department personnel subsequently presented the basis for current operability. The team determined that this basis was adequate. The licensee initiated a Basis for Maintaining Operability (BMO) engineering evaluation to assess the long term operability effect of the pressurization condition and to recommend appropriate corrective action. This concern remains unresolved pending assessment of the licensee BMO (UNR 50-271/94-08-01).

- The fire pump diesel generator (DG) fuel oil day tank level remained below the operator log specification (>9/16 full) for a period of approximately six weeks before the condition was corrected. The lowest measured level during the period was 1/2 full. Operating procedure 4105.01, "Monthly Operational Check of Fire Pumps" specifies that a tank level of 15/32 full satisfies the Technical Specification requirement of 150 gallons. This was supported by a tank level calculation performed as part of a licensee self assessment. The team reviewed the calculation and questioned whether the determination of usable volume had properly accounted for various factors including the slope of the tank in relation to the location of the level instrument and the unusable sump volume at the bottom of the fuel tank. The licensee initiated a subsequent review of the level calculation to ensure the above factors had been properly accounted for and to verify that the fire pump DG fuel oil day tank had not gone below the minimum level required by Technical Specifications. This issue is unresolved pending NRC review of the licensee validated fuel oil day tank volume calculation (UNR 50-271/94-08-01).

  A work order to refill the fire pump DG fuel oil day tank was properly initiated following initial identification of the low tank level. However, the required completion date was subsequently postponed. The licensee could not identify the reason for deferring the work order. Operators continued to accept the low tank level condition, without validating progress of the work order for almost six weeks. In response to these issues the licensee initiated a corrective action report (CAR) to identify and correct the cause of the delay in refilling the tank. In addition, the licensee is considering revisions to the diesel fire pump surveillance procedures to clarify acceptance criteria and corrective actions when tank level falls below the conservative administrative limit. The team concluded that this action was appropriate to preclude recurrence.

- The main stack air flow instrument remained inoperable since November 1993. Compensatory air flow measurements were properly taken at four hour intervals as required by Technical Specifications and a design change to upgrade the reliability of the flow instrument was initiated. The team reviewed the proposed design modification and determined that, when implemented, stack air flow measurement reliability would be significantly improved. Control room watchstanders were knowledgeable that the air flow instrument was out of service and the instrument was properly listed in the limiting condition of operability log. However, operator logging practices were inconsistent. The team noted that control room operators continued to record the air flow instrument measurement in their logs and did not annotate that the reading was unreliable. Senior licensed operators failed to identify this inconsistency during their management reviews of the control room logs. The team identified this logging practice to the Operations Section Manager for resolution.

The three examples listed above indicate that Operations department self assessments to improve operator sensitivity to longstanding deficient conditions have not been fully effective. Operator knowledge of plant conditions is generally of high quality. However, evaluation and correction of deficient conditions has not been consistent. Some known deficient conditions have not been elevated sufficiently or communicated between departments to achieve appropriate resolution. Continued management attention to this issue is warranted.

2.3 Use of Operator Aids and Controlled Drawings

The team reviewed the use of operator aids and controlled drawings in the control room to determine whether these documents were properly maintained to provide useful and accurate information to support plant operation. The team inspected 37 operator aids in the control room. Each aid was accurate and was listed in the Operator Aid Status Book as required by operations department procedure (OP) 0162, "Control of Operator Aids and Temporary Labels." However, while the information contained on the operator aids was currently accurate, the team observed inconsistencies that raised the question of validity and positive control of operator aids. Some of the aids were clearly marked with a stamp "Operator Aid (OP-0162) Do Not Remove Without SS Permission," while others were not marked. One aid was stamped "Uncontrolled Copy, For Information Only." Two aids did not have a shift supervisor initial indicating approval for use. White out was used to change the information on an aid without shift supervisor initials indicating authorization of the change. In addition, several augmented offgas (AOG) system drawings were posted on walls adjacent to the AOG control panels. These drawings were stamped "For Information Only," but were not controlled as operator aids. The team verified that these drawings were current, but questioned their intended use since they were not considered to be operator aids. The Operations department manager stated that the drawings were helpful for system understanding, but could not be used as a reference for any AOG control manipulation.

The team discussed management expectations for use of operator aids with the Operations department manager to determine whether operator aid quality was consistent with intended use. Management expectations were not documented in OP 0162 and were not uniformly understood by control room operators. The team interviewed several licensed operators and concluded that everyday use of operator aids significantly differed from management expectations. The licensee subsequently initiated several actions to resolve the operator aid labeling and application inconsistencies. Actions included reassessment of the number of operator aids in the control room, adding "OP-0162" markings for consistency, elimination of several "Uncontrolled Copy" markings, and revision of OP 0162 to more clearly state management expectations for use of operator aids. The team determined that this action was adequate to improve the quality and use of operator aids.

A controlled copy of electrical and mechanical system drawings is maintained in the control room for reference by licensed personnel. The team reviewed a sample of eight drawings and to determine whether the control room copy was being maintained up to date. Seven of the drawings were current. Drawing A-210, "Augmented Offgas System" was outdated by over three years. The licensee failed to identify this discrepancy during the previous three annual 100 percent audits of controlled drawings in the control room. In response to this finding, the licensee promptly updated this drawing, initiated a corrective action report to determine the cause of the outdated drawing, and initiated a confirmatory audit of the control room drawings. Based on a further review of control room controlled drawings, the team concluded that the outdated AOG drawing was an isolated occurrence. Corrective actions were appropriate to assure the quality of controlled drawings in the control room. The team discussed operator aids and controlled drawings with the Operations department manager who identified these as potential subjects for future operations department self assessments.

2.4 Temporary Modifications

The OSTI concluded that the temporary modification (TM) process was adequately implemented. However, station management reviews of temporary modifications (TMs) greater than six months old were not consistently performed. Several outstanding older TMs had passed the completion date assigned by the plant operations review committee (PORC) without being presented to PORC for another review. In addition, some TMs were not promptly converted to permanent modifications following completion of permanent design changes. The licensee subsequently performed a broad self assessment of the TM process and proposed a significant revision to administrative procedure (AP) 0020, "Control of Temporary and Minor Modifications."

The team reviewed the past three quarterly audits of outstanding TMs, the current TM index, and the pending revision to AP 0020 (revision 17). The number of outstanding TMs and TMs older than six months has decreased slightly over the past year. At the close of this report there were 40 outstanding TMs, 29 of which were older than six months. The TM self assessment resulted in several positive changes to the TM process. The review/approval process for TMs older than six months was strengthened, the impact on affected procedures

and controlled system drawings was more clearly identified, and criterion for conversion of a TM to a permanent change are better defined. The licensee plans to implement revision 17 to AP 0020 following the completion of licensed operator requalification training on this subject in June 1994. Management has placed a priority on the conversion of TMs to permanent design changes. The near term (1994/95) Major Project Work list identifies 13 outstanding TMs (11 over six months old) for conversion. The team concluded that the licensee had dedicated appropriate resources and initiated positive actions to improve the management of temporary modifications.

3.0 MAINTENANCE AND SURVEILLANCE:

3.1 Operating Experience Review Program (OERP)

The OSTI previously concluded that the licensee was performing adequate reviews of industry experience information. The OSTI identified that reviews of industry experience information relied heavily on the Maintenance and Planning Control (MPAC) system to confirm whether a particular referenced component was used in the plant. However, the MPAC data base was incomplete and reviews by using MPAC alone could result in missing referenced equipment. The licensee has subsequently revised administrative procedure (AP) 0028, "Operating Experience Review and Assessment/Commitment Tracking" to require that a review of industry information include an evaluation of the generic/broader implications of the information and the need for field verification.

NRC Information Notices (INs)

The team reviewed twenty 1993 Information Notices (INs) to determine the current effectiveness of the licensee operations experience feedback program. The team noted that the scope of review for several INs was appropriately expanded where applicable. For example, review of IN 93-48, "Failure of Turbine Driven Main Feedwater Pump to Trip," was expanded to include the HPCI and RCIC systems which also have control oil trip systems. Overall, the team concluded that the licensee's scope of IN review, evaluation, and tracking and completion of corrective actions continued to improve following the OSTI. The team did, however, have several comments on the following notices:

- IN 93-69 "Radiography Events at Operating Power Reactors"

The licensee concluded that Vermont Yankee has a good program to prevent overexposure during radiography based on a checklist which requires a search of the area and an announcement prior to exposing the source. However, other plants which experienced radiography events had similar controls. The common cause of the events in the IN was a lack of worker knowledge of radiography hazards and worker disregard for radiography postings. The Vermont Yankee review did not address this common cause and general employee training (GET) was not reviewed or enhanced in this area. The licensee GET program does not specifically address radiography.

- IN 93-37 "Eyebolts with Indeterminate Properties Installed on Limitorque Valve Operator Housing Covers"

This IN was closed based on the personal knowledge of the motor operated valve (MOV) engineer who stated that eyebolts are not installed on the 58 Limitorque model SMB 00/000 valve operators. The team did not identify any eyebolts during their plant walkdown of accessible areas. However, defense-in-depth would dictate visually inspecting these valves at the next scheduled maintenance opportunity as was recommended in the Limitorque Maintenance Update. The team discussed this with the responsible engineer who agreed with this observation and subsequently updated the MOV inspection procedure. Improvements on performing field inspection verifications were noted in the licensee disposition of IN-93-97, "Failure of Yokes Installed on Walworth Gate and Globe Valves."

- IN 93-96 "Improper Reset Causes Emergency Diesel Generator Failures"

An emergency diesel generator at a nuclear power plant tripped on June 11, 1993, due to inadequate reset operation of the latch assembly. The manufacturer recommended that proper resetting of the trip mechanism would be enhanced by slowly moving the reset lever fully to the rest position and back, twice. This information was originally brought to Vermont Yankee's attention via the Fairbanks-Morse diesel generator users group on August 10, 1993. This information was put in the operations night order book but no procedural changes were made to the diesel operating procedure since it was observed that operators repeatedly and thoroughly reset the trip lever. Subsequently, IN 93-96 was issued December 14, 1993, and procedural changes are now being processed. Overall, the team concluded that lessons learned from a diesel failure at another utility could have been formally incorporated into operating procedures in a more timely manner.

- IN 93-61 "Excessive Reactor Coolant Leakage Following a Seal Failure in a Reactor Recirculation Pump"

A boiling water reactor recirculation pump seal failure was attributed to introduction of debris and corrosion products into the seal cavity and improper depressurization following hydrostatic testing. Specifically, the utility determined that improper depressurization could result in a "U" cup inversion inside the seal which could result in excessive leakage. The team reviewed Vermont Yankee recirculation pump maintenance procedures and concluded that cleanliness considerations were adequately addressed. However, the licensee did not review maintenance procedures to evaluate applicability of the hydrostatic testing issue.

- IN 93-59 "Unexpected Opening of Both Doors in an Airlock"

This IN was issued July 26, 1993, and involved a concern that, at a nuclear power plant, part of an airlock interlock system was removed from service apparently without a fundamental understanding of its function in assuring the integrity of the containment boundary. On August 27, 1993, the drywell airlock interlock was defeated at Vermont

Yankee while reactor water temperature was above 212°F. Although containment integrity was maintained, the technician who defeated the interlock did not realize there was a requirement to maintain the interlock operable. The Vermont Yankee review of the IN was completed on October 28. The team noted that the Vermont Yankee operations experience program does not have a prioritization scheme to assure issues immediately applicable to the site are reviewed on a more timely basis.

- IN 93-101 "Jet Pump Hold Down Beam Failure"

This IN addressed a recently observed intergranular stress corrosion cracking (IGSCC) failure of a jet pump hold down beam. The location of the initiating crack could not be detected by current ultrasonic testing inspection techniques. The IN further stated that once a crack initiated, the crack could propagate to beam failure in less than one operating cycle. Vermont Yankee had previously upgraded all jet pump hold down beams with beams that were manufactured using the high temperature annealing (HTA) heat treatment process. These beams are much less susceptible to IGSCC. Information Notice 93-101 stated that the IN was not applicable to plants which had installed beams which had undergone HTA heat treatment. Therefore the licensee concluded that the IN did not apply to Vermont Yankee. However, as a conservative action, the licensee upgraded method of visual beam inspection that would be the implemented during the next regularly scheduled inservice inspection (ISI) of the jet pump hold down beams. This action adequately addressed the information presented in the IN.

The team informed the licensee of pertinent information documented in NUREG/CR-3052, "Closeout of IE Bulletin 80-07: BWR Jet Pump Assembly Failure" related to recommended inspection intervals and techniques for these beams. This document recommends a more frequent ISI interval and an ultrasonic testing technique in lieu of the visual inspection currently implemented at Vermont Yankee. Subsequently, the Reactor Engineering Department reopened the disposition of IN 93-101 and NUREG/CR-3052 to reevaluate the current ISI inspection schedule. This action demonstrated a positive safety perspective and appropriately addressed the team's concern.

Service Information Letters (SILs)

Vermont Yankee quality assurance surveillance report 93-29 (June 21, 1993) identified that the evaluations of past vendor information (pre-1989) and actions undertaken did not fully encompass all the issues. The OSTI also concluded that additional work was needed to ensure the adequacy of past reviews of industry and vendor experience to reduce the possibility of the existence of safety vulnerabilities. The licensee completed a preliminary review of all 567 General Electric SILs to assess the adequacy of the responses and to determine the need for further review of the SIL recommendations. From this initial population, 57 SILs were identified as needing a more detailed review of the Vermont Yankee response. The team reviewed the licensee response to the following SILs which were re-examined by Vermont Yankee:

- SIL 002 Peeco Paddle Type Flow Switches
- SIL 010 Differential Pressure Indicating Switch Setpoint Drift
- SIL 052 Control Rod Uncoupling Rod Replacement
- SIL 070 Hydraulic Shock Suppressor Application
- SIL 087 Gimball Pins for Refueling Platform Fuel Grapple Mast
- SIL 454 Control Rod Latch Tool Malfunction

The team observed that the re-examination of these older SILS by the licensee was thorough and complete. Recommendations were reviewed for applicability and incorporated into licensee procedures where appropriate. The team also concluded that the original quality assurance audit of the past SILs was of good scope and well detailed in its findings. The team noted, however, that the response to SIL 052 relied on personnel knowledge vice providing detailed criterion for a worker. Specifically, SIL 052 detailed occurrences of inadvertent control rod uncoupling caused by improper installation of the uncoupling rod. Licensee control rod drive (CRD) exchange procedure (OP 5211), Step 6.37 states, "verify correct installation of uncoupling rod." This procedure, however, lacked specificity in that it did not provide acceptance criterion for the worker to verify that the uncoupling rod is correctly installed in the center hole of the CRD coupling spud vice incorrectly installed in the spud flow hole.

OERP Conclusion

The quality and depth of reviews by the licensee continue to show improvement over those reviewed prior to the OSTI. The team did not identify any safety concerns with respect to the above information notices and service information letters. However, continued room for improvement still exists as evidenced by continued reliance on personnel knowledge vice implementing procedural guidance and less than thorough assessment of selected issues raised by the generic communication.

3.2 Work Order Process

The OSTI found little defense-in-depth in the oversight of the work order process, particularly in the management oversight of work prioritization and planning and the follow-up of cancelled or rejected work orders. The licensee stated in its response to the OSTI report that it had enhanced the work order process to include administrative requirements for canceling work orders.

The team interviewed the Operations Planning Coordinator and reviewed the maintenance backlog and recent work orders for appropriate priority assignments. The team observed that the licensee has assigned an experienced plant operator as an Operations Planning Assistant to provide defense-in-depth for work prioritization. In addition, a table of work priority case definitions was added to administrative procedure (AP) 0021, "Work Orders."

The team observed that the new table was vague and did not provide a substantive basis for making work priority determinations. The Operations Planning Coordinator continued to be the primary source of information for determining work priority assignments. The team interviewed the Operations Planning Coordinator regarding criteria used to assign priorities and determined that he uses appropriate safety-based criteria, but that they are not documented. The team concluded that, although a backup for the Operations Planning Coordinator has been provided, work prioritization continues to rely heavily on the experience and judgement of plant staff with little procedural defense-in-depth. The team's review of work priorities and the maintenance backlog identified no safety concerns.

Since the OSTI, the licensee had revised AP 0021 to add requirements for documentation and review of the cancellation or rejection of work orders. The team reviewed the changes and found that they provide an adequate means to ensure that the bases for cancellations can be appropriately reviewed and assessed. In addition, the changes require that cancelled work orders be reviewed quarterly by the Technical Programs Department.

The team reviewed the licensee's "Self Assessment of Cancelled Work Orders" dated March 7, 1994, which documented review of all work orders cancelled during the fourth quarter of 1993, the first quarter for which the new documentation requirements applied. The team independently reviewed the cancelled work orders and noted that while the quality of documentation did not consistently meet the intent of the procedure change, improvement had been made. The licensee's self-assessment also identified this concern and concluded that the process was effective but that further training was needed.

The team concluded that the licensee has made adequate improvements in AP 0021 to provide good management oversight and follow-up of cancelled and rejected work orders. The licensee's first quarterly review of cancelled work orders was an effective, critical review with substantive recommendations. Although the documentation of the reasons for canceling some work orders remained weak, the team determined from its review that work order cancellation/rejection was being appropriately implemented.

4.0 ENGINEERING AND TECHNICAL SUPPORT

4.1 (Closed) Unresolved Item (50-271/93-80-02) Engineering Analysis of Main Steam Isolation Valve Closure Capability Following a Loss of Coolant Accident

The OSTI concluded that the licensee response to GE Service Information Letter (SIL) No. 477, "Main Steam Isolation Valve Closure" was incomplete in that a force balance calculation had not been completed to ensure that the inboard main steam isolation valves

(MSIVs) would remain closed following containment pressurization from a loss of coolant accident (LOCA). In its response to the OSTI report dated November 12, 1993, the licensee stated that information was presented to the NRC Resident Inspector for closeout of this item.

The team reviewed SIL No. 477 and licensee calculation regarding this issue. The licensee provided a force balance calculation, as discussed in Recommendation No. 3 of the SIL, to determine the containment pressure required to overcome the spring force holding the MSIVs shut. The licensee made conservative assumptions regarding decay of MSIV pneumatic pressure based on a postulated leakage rate and compared that to the FSAR containment pressure time history following a design basis LOCA. The calculation demonstrated that the combined spring force and MSIV pneumatic pressure would be sufficient to maintain the MSIVs shut against containment pressure at all times following a design basis LOCA. The licensee used this calculation to determine an appropriate low MSIV air pressure alarm setpoint.

The team concluded that the licensee evaluation included appropriate conservative assumptions, was thorough, and addressed the issues raised in SIL No. 477. Based on the team's review of the information provided by the licensee, unresolved item 50-271/93-80-02 is closed.

5.0 MANAGEMENT AND CORRECTIVE ACTION PROCESSES:

5.1 Corrective Action Processes

The Vermont Yankee staff uses a two-tiered method to classify conditions adverse to quality. The lower, entry-level tier involves routine processes which identify potential issues for reportability evaluation (potential reportable occurrence (PRO)) or identify the need for a corrective work order request (WOR). A PRO may be elevated to a corrective action report (CAR) following management review. Routine CARs require an event description, immediate corrective action taken, apparent cause, recommended corrective action, follow-up verification, and supervisor/superintendent review. The higher tier includes licensee event reports (LER), significant CARs, and significant nonconformance reports (NCR). These processes require formal root-cause analysis, evaluation of similar conditions, and corrective actions. A nine-element evaluation is required for significant events. These detailed evaluations are normally not generated for PROs, corrective work orders, radiation protection incident reports, quality control findings, or material deficiency reports.

The OSTI previously found that there was a very thorough review of significant issues and very little evaluation of routine items. The OSTI concluded that the licensee's corrective action systems were adequate for addressing significant issues when raised. However, the threshold for entering the more rigorous application of root-cause determinations was too high and did not provide appropriate opportunities to identify and correct recurring problems. Vermont Yankee quality assurance audit VY-93-17 also concluded that the corrective action

process may not be effective or meet plant needs in correcting adverse conditions. A combined utility assessment of Vermont Yankee (October 18-22, 1993) determined that the various corrective action processes were fractured and lacked the consistency needed to identify, evaluate, and correct both process deficiencies and plant hardware problems.

To address these deficiencies, the licensee formed a corrective action Commitment to Excellence Program (CEP) task force. The mission of this task force is to determine the root cause of the corrective action program deficiencies and recommend improvements. The task force identified the following primary causes of the licensee's deficient corrective action efforts:

- Management has not consistently placed a priority on effective implementation of the Corrective Action Program.

- There is little ownership or accountability for implementing the program requirements or for implementing corrective actions that result from the program.

- The primary focus has historically been on fixes and not on the root causes (in many of the cases, cause is not determined at all).

- There is a general lack of awareness and guidance on what constitutes the corrective action program, how it works, what the main objectives are, and who is responsible for what.

- There is inadequate communication of expectations to the workers and inadequate involvement of the workers in developing cause assessments and corrective actions.

As long-term corrective action, the CEP task force is currently developing a streamlined corrective action program. The existing multiple corrective action processes (*i.e.*, CARs, NCRs, PROs, LERs, etc.) will be consolidated into a single initiating document. The team reviewed a draft of the new corrective action process and had several observations. Clear entry conditions are defined for which an "event report" is required. Non-consequential and near-miss events are also captured. An event report can be initiated by any member of the plant staff so that previously unreported problems can now be pursued to identify trends and root causes. The old process had first-line supervisors decide whether a report should be initiated. Each event report will be discussed at the morning plant manager meeting to provide for upper management oversight of problem evaluation, assignment of responsibilities (ownership), and determination of necessary actions. Quality Services' review will also be included in the corrective action process as part of an independent, real-time evaluation. The licensee is currently using a benchmarking process to develop the Vermont Yankee corrective action program.

Overall, the team concluded that the draft corrective action program actively addressed current program deficiencies. The corrective action CEP task force effectively identified the primary causes of the current program inadequacies. The new corrective action program is scheduled to be implemented in August 1994.

5.1.1 Potential Reportable Recurrences (PROs)

The OSTI review of PROs found several examples in which identified problems did not receive required corrective action or additional follow-up. The PROs focused mainly on the reportability aspect of the problem. The short-event descriptions provided on the PRO strongly biased the need for additional corrective actions during management review. As corrective action towards these weaknesses, PROs and other plant events are reviewed daily at the morning plant manager meeting. The objective of these reviews is to assess the significance of the PRO, review operability and notification decisions, discuss corrective actions, and provide a forum in which other department managers can provide input. The inspectors attended these morning meetings (Section 2.1) and reviewed the 40 PROs initiated since January 1994. The inspectors noted that a more in-depth discussion and evaluation of the problem/event was evident on these recent PROs. Those PROs which required further evaluation were appropriately dispositioned to the CAR system. Corrective actions for the PROs were appropriate and commensurate with their safety significance. Also, PROs were no longer being used to focus exclusively on the reportability of an issue. For example, PRO 94-40, "Inoperable Appendix R Fire Barrier," was documented even though the responsible engineer knew the issue was not reportable. The documentation of this issue provided a means for upper management review, allowed for trending, and formal assignment of corrective actions. Overall, the inspectors noted improvement in the evaluation, review, and disposition of PROs.

5.1.2 Corrective Action Reports (Update to UNR 50-271/93-33-01)

The OSTI previously determined that evaluations of significant CARs were generally complete and addressed most of the root causes and causal factors that led to a given event. "Routine" problems were, however, typically addressed with very little self-assessment of the human or procedural factors that led to a given problem or issue. Unresolved item 50-271/93-33-01 addressed weaknesses in the licensee's corrective action processes, specifically focusing on inadequacies in the licensee's investigation of various issues surrounding the maintenance on the wrong control rod drive mechanism which resulted in unplanned leakage during a reactor vessel hydrostatic test. The team reviewed the following routine CARs to determine whether the depth of root-cause analysis had improved:

- CAR 93-49, "Defeat of Drywell Airlock Interlock"

On August 27, 1993, a worker defeated the drywell airlock interlock during a maintenance activity. The licensee's apparent cause determination was that the worker was trying to be "efficient" by completing two steps of a work order concurrently. The worker was unaware of the administrative requirement to maintain the interlock operable when the reactor water temperature is greater than 212°F.

- CAR 93-53, "Core Spray Valve 11-B Failure to Stroke"

On September 22, 1993, a core spray valve failed to stroke shut during surveillance testing following static thrust testing. The licensee's apparent cause determination concluded that the technician failed to tighten a terminal screw after relanding a lead and the failure of a second party verification.

- CAR 93-67, "Disconnection of Steam Flow Summer"

During troubleshooting on December 3, 1993, total steam flow summer FSUM-6-75 became inadvertently disconnected from the instrument loop causing a loss of steam flow input to the reactor vessel water level control system. No plant transient occurred due to reactor level control being selected to single element. The licensee's apparent cause determination concluded that the technician was unfamiliar with the panel installation of "GE-MAC" equipment.

- CAR 93-59, "Control Rod Drive Flange Leak During Hydrostatic Test"

This report documented the inadvertent loosening of bolts on a control rod drive (CRD) for which no maintenance was planned. The error went undetected during the outage for approximately 50 days until discovery during a reactor coolant system hydrostatic test. The licensee had reviewed this event under routine CAR 93-59 and had failed to address numerous work control and personnel issues raised. At the time of this inspection, the licensee stated that this specific issue will be reevaluated as a significant CAR.

- CAR 93-66, "Control Rod Drive Drivedown Seal Installed Backwards"

Routine CAR 93-66 involved drive down seals installed backward on CRD 18-39 resulting in sluggish CRD response during post-maintenance testing. Although the deficient condition was apparently corrected during the outage, the CAR was not assigned until December 1, 1993. The CAR determined the apparent cause of the event to be inadvertent reverse installation of the seal. Furthermore, in accordance with the licensee Corrective Action Guideline, this issue should have been addressed in a significant CAR as an event which could affect core reactivity.

Although routine CARs require only an "apparent" cause (*i.e.*, the suspected reason for the problem), the inspectors considered the cause determinations of the above issues to be lacking in depth of evaluation. The CARs narrowly focused on correcting each individual problem and did not thoroughly investigate the root cause of each event. Each of the above CARs raised questions of adequacy of supervisory oversight (pre-job briefing, worker selection, supervision during work), work order and procedure adequacy (procedures not used, followed incorrectly, work package preparation), questioning attitude of workers, human factors (work environment, complex systems), quality control usage, and communications. However, it was not apparent to the team that all of these questions were addressed by the licensee's cause determination process.

By narrowly focusing attention on fixing the individual problem associated with each CAR, the licensee has failed to assess the broader human performance and work control process issues that these CARs represent as a whole. The team discussed this issue with the CEP corrective action task force chairman who agreed that the current root-cause techniques are not adequate for all conditions, especially those involving human performance issues. The CEP task force is attempting to address this issue in the long term. However, the team concluded that despite "increased sensitivity," root cause evaluations and corrective actions for routine CARs have not improved since the OSTI. Root cause analyses of routine CARs continue to be cursory, especially for those that involve human performance issues. Managers expectations appear low, through the acceptance of cursory root cause evaluations.

Additionally, the threshold for entering the more rigorous root cause determinations remains too high as was specifically evidenced by CAR 93-59, "Control Rod Drive Flange Leak During Hydrostatic Test", and CAR 93-66, "Control Rod Drive Drivedown Seal Installed Backwards." The assignment of these issues as routine CARs was not consistent with the Vermont Yankee corrective action guideline which requires significant CARs for "events potentially impacting nuclear safety or core reactivity."

5.2 Self-Assessment

The licensee response to the OSTI stressed continued emphasis on development of the self-assessment program to "further instill a questioning attitude" in the plant organization. The licensee issued the Vermont Yankee Self-Assessment Policy in June 1993 requiring each department to "develop and implement departmental self-assessment activities in all functional areas of responsibility." The policy also required that the quality assurance (QA) organization "routinely include departmental self-assessment activities as a part of scheduled audits."

The team reviewed the departmental self-assessment programs and activities of the plant operations, technical services, and engineering organizations. Self-assessment programs were in place in all of the departments reviewed. The quality of the programs and activities varied widely between departments. A strong level of management interest and involvement was apparent in several departments while some of the plant staff struggled with development and implementation of effective programs.

The team examined the 1993 work order trend report which was a component of the Instrumentation & Controls (I&C) department self assessment program. The 4,399 completed work orders were sorted by failure code and reviewed for trends. This report was the first time the licensee used the MPAC system in this manner to identify adverse trends of human performance problems or repetitive equipment deficiencies. The licensee identified multiple instances of personnel error, mostly due to inattentiveness on the part of personnel in the performance of their job. As a result of this identification, the I&C manager is re-evaluating their self-checking program. The team considered this report to be an adequate first step in self-assessment activities by the I&C department. However, this trend report is not a real-time assessment of current performance. The licensee has not yet developed a continuous performance indicator trending program for work orders which would identify adverse trends as they become apparent.

Interviews with various managers indicated that senior management has a good understanding of which areas are weakest and is taking appropriate action to continue improvement in the programs and in the implementation of individual self-assessment activities. Good inter-departmental communications are contributing to development of effective programs throughout the station and the owners of the better programs are benchmarking their programs against other industry programs to achieve further improvement.

Quality Assurance (QA) department review of self-assessment in 1993 focused on development of departmental programs. In the 1994 audit cycle, QA is reviewing individual self-assessment activities. Interviews with QA management and review of recent QA audit and surveillance reports indicated that the QA organization is providing the senior management with critical assessment and recommendations in this area.

The team concluded that, while significant improvements have been mad[illegible]e the 93TI, many areas for improvement remain. The licensee organization had various levels of understanding of self-assessment processes and various depths of questioning of existing processes and practices. With some notable exceptions, documentation of self-assessment activities was weak, failing to identify success criteria or the planned scope and methodology of the activity. The bases for some findings and recommendations were not well developed in the reports. Few of the departmental programs were found to be robust. Some did not identify the department's functional areas of responsibility. Most did not identify previous program weaknesses, program goals, success criteria, or current improvement efforts which could be used to more effectively plan assessment activities. Several did not include generic

departmental concerns or management functions such as training/personnel development, work planning issues, or communications as areas for self-assessment. Licensee management continues to develop further actions to improve in these areas.

5.3 Technical Specification Surveillance Requirement Review

The OSTI report noted that continued management effort to reduce the heavy reliance on personnel was needed. As one of several actions to address this concern the licensee performed a formal self-assessment of Technical Specification (TS) surveillance requirements to ensure correct procedural implementation and to identify potential areas for clarification and improvement. The team met with licensee personnel involved in this effort and discussed their methodology and preliminary results. The licensee dedicated significant resources to review the TS surveillance requirements and associated implementing procedures. The project team concluded that surveillance requirements were being adequately implemented but that many improvements could be made. The licensee developed several hundred recommendations for clarifications and improvements to the plant procedures. In addition, dozens of recommendations for clarification and improvement to the TS were developed.

Responsibility for follow-up of the project team's recommendations had not been assigned at the time of this report. However, the plant manager stated his intention to determine responsibilities in the near future. Procedure change recommendations will be forwarded to the cognizant department heads, and TS change recommendations to licensing, for consideration and action as appropriate. Formal feedback or management oversight of individual responses to the recommendations was not planned. The project team's final conclusions and recommendations were expected to be completed by mid-April 1994, and were not available for NRC review. The team concluded that the TS self assessment was a well directed initiative with good potential. However, recommendations had not yet been implemented, and it was therefore too early for the team to assess the effectiveness of this initiative.