

February 29, 2000

Mr. Samuel L. Newton
Vice President, Operations
Vermont Yankee Nuclear Power Corporation
185 Old Ferry Road
Brattleboro, Vermont 05301

SUBJECT: NRC INTEGRATED INSPECTION REPORT 05000271/1999010

Dear Mr. Newton:

On January 16, 2000, the NRC completed an inspection at your Vermont Yankee (VY) facility. The enclosed report presents the results of that inspection.

During the six weeks covered by this inspection period, the conduct of activities at Vermont Yankee was characterized by safe plant operations. Operators responded well during two separate events which involved a trip of one reactor recirculation pump and a trip of one circulating water pump. There were no safety significant events during this report period.

However based on the results of this inspection, we have determined that three Severity Level IV violations of NRC requirements occurred. These violations involve: (1) an inadequate procedure for refueling interlock checks; (2) failure to properly implement a motor-operated valve maintenance procedure during refueling outages in 1995, 1996, and 1998; and (3) use of unverified design inputs in certain motor-operated valve calculations. These violations are being treated as Non-Cited violations (NCVs), consistent with Section VII.B.1.a of the Enforcement Policy (NUREG 1600, November 1999). If you contest these violations, or their severity levels, you should provide a written response within 30 days of the date of this inspection report, with the bases for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator, Region I, the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001, and the NRC Resident Inspector at the Vermont Yankee facility.

Samuel L. Newton

2

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practices," a copy of this letter and its enclosure will be placed in the NRC Public Document Room.

Sincerely,

/RA/

Clifford J. Anderson, Chief
Projects Branch 5
Division of Reactor Projects

Docket No.: 05000271
License No.: DPR-28

Enclosure: NRC Inspection Report 05000271/1999010

Docket No. 050000271
License No. DPR-28

cc w/encl:

R. McCullough, Operating Experience Coordinator - Vermont Yankee
G. Sen, Licensing Manager, Vermont Yankee Nuclear Power Corporation
D. Rapaport, Director, Vermont Public Interest Research Group, Inc.
D. Tefft, Administrator, Bureau of Radiological Health, State of New Hampshire
Chief, Safety Unit, Office of the Attorney General, Commonwealth of Massachusetts
D. Lewis, Esquire
G. Bisbee, Esquire
J. Block, Esquire
T. Rapone, Massachusetts Executive Office of Public Safety
D. Katz, Citizens Awareness Network (CAN)
M. Daley, New England Coalition on Nuclear Pollution, Inc. (NECNP)
State of New Hampshire, SLO Designee
State of Vermont, SLO Designee
Commonwealth of Massachusetts, SLO Designee

Samuel L. Newton

3

Distribution w/encl:

C. Anderson, DRP

R. Summers, DRP

R. Junod, DRP

Region I Docket Room (with concurrences)

PUBLIC

Nuclear Safety Information Center (NSIC)

NRC Resident Inspector

Distribution w/encl (VIA E-MAIL):

J. Shea, RI EDO Coordinator

E. Adensam, NRR

R. Croteau, NRR

W. Scott, NRR

D. Screnci, PAO

Inspection Program Branch, NRR (IPAS)

DOCDESK

DOCUMENT NAME: G:\BRANCH5\1-VY\INSPECT\VY1999010.WPD

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI/DRP		RI/	
NAME	BmcDermott CJA f/		Canderson CJA	
DATE	02/29/00		02/29/00	

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No. 05000271
Licensee No. DPR-28

Report No. 05000271/1999010

Licensee: Vermont Yankee Nuclear Power Corporation

Facility: Vermont Yankee Nuclear Power Station

Location: Vernon, Vermont

Dates: December 6, 1999 - January 16, 2000

Inspectors: Brian J. McDermott, Senior Resident Inspector
Edward C. Knutson, Resident Inspector
Douglas A. Dempsey, Reactor Inspector
Roy L. Fuhrmeister, Reactor Inspector

Approved by: Clifford J. Anderson, Chief
Projects Branch 5
Division of Reactor Projects

EXECUTIVE SUMMARY

Vermont Yankee Nuclear Power Station NRC Inspection Report 05000271/1999010

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a six week period of routine resident inspector activities. In addition, in-office reviews of inspector follow-up and unresolved items were performed by two region-based inspectors.

Operations

- Appropriate control of safety system alignments, implementation of Technical Specification required actions, and adequate operability reviews for degraded equipment were observed during routine control room tours. (Section O1.1)
- Operators responded well to the automatic trip of one reactor recirculation pump by promptly taking action to exit the exclusion areas of the power to flow map. The operators also initiated appropriate corrective actions for two additional equipment problems that occurred during the period of single recirculation loop operation. (Section O1.2)
- One circulating water pump tripped due to ice blockage at the intake structure. Prompt operator action to restore normal circulating water flow prevented the loss of condenser vacuum. (Section O1.3)
- VY identified that a TS requirement for certain neutron monitoring equipment was not met for 13 minutes during a refueling interlock check because of an inadequate surveillance procedure (LER 1999005-00). However, a different neutron monitoring system was operable and administrative controls were in place to preclude any reactivity problems. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy, (NUREG 1600, November 1999). This violation was entered in VY's corrective action program as ER 99-1528. (Section O8.2)

Maintenance

- There were no significant problems identified during the observation of routine maintenance and surveillance activities during this inspection period. (Section M1.1)
- Corrective maintenance for failure of two recirculation motor generator lubricating oil (LO) system valves was well planned and supported by the VY organization. The decision to remain at reduced power to address the potential for the same problem with the other recirculation motor generator LO system was conservative. (Section M2.1)
- Equipment failures associated with the reactor recirculation system were appropriately evaluated by VY's Maintenance Rule Program. (Section M2.1)

Executive Summary (cont'd)

- Maintenance on the internals of six risk-significant safety-related valves was not performed correctly by contractor technicians during refueling outages in 1995, 1996, and 1998. The failure to properly implement procedures for chamfering of valve internal surfaces is a violation of Technical Specification requirements. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NUREG 1600, November 1999). This violation was entered in VY's corrective action program as Event Reports 98-0986 and 98-1367. (Section M8.1)

Engineering

- In 1998, VY identified that the chamfer dimensions on the internal edges of five high energy line break isolation valves were inconsistent with applicable work documents and design calculations. These inconsistencies were corrected prior to the plant restarting from the spring 1998 refueling outage. However, the failure to use appropriate calculation inputs was identified as a violation of the design control requirements of 10 CFR 50, Appendix B, Criterion III. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy, (NUREG 1600, November 1999). This violation was entered in VY's corrective action program as Event Report 98-1051. (Section E8.1)

Plant Support

- The alternative testing performed on the total flooding carbon dioxide fire suppression systems for the east and west switchgear rooms was evaluated by the Office of Nuclear Reactor Regulation and found to be acceptable. (Section F8.1)

TABLE OF CONTENTS

EXECUTIVE SUMMARY	ii
TABLE OF CONTENTS	iv
Summary of Plant Status	1
I. Operations	1
O1 Conduct of Operations	1
O1.1 Observation of Routine Plant Operations	1
O1.2 Single Reactor Recirculation Loop Operations	1
O1.3 Loss of Main Circulating Water Pump Due to Ice in the Intake Structure	2
O8 Miscellaneous Operations Issues	3
O8.1 Year 2000 Rollover	3
O8.2 In-office Review of LERs Related to Operations	3
II. Maintenance	4
M1 Conduct of Maintenance	4
M1.1 Maintenance and Surveillance Observations	4
M2 Maintenance and Material Condition of Facilities and Equipment	5
M2.1 Reactor Recirculation Pump Motor Generator Lube Oil System Valve Failures	5
M8 Miscellaneous Maintenance Issues	6
M8.1 (Closed) URI 05000271/1998008-04: MOV Concerns Regarding Procedure Adherence	6
M8.2 Review of Open Items Related to Engineering	8
III. Engineering	9
E8 Miscellaneous Engineering Issues	9
E8.1 (Closed) URI 05000271/1998008-05: Thrust Calculations for Safety-Related MOVs	9
E8.2 Review of Open Items Related to Engineering	11
E8.3 Administrative Closure of Items Related to Engineering	12
IV. Plant Support	12
F8 Miscellaneous Fire Protection Issues	12
F8.1 (Closed) URI 05000271/1998008-08: Alternative of Testing of CO ₂ Fire Extinguishing System	12
V. Management Meetings	13
X1 Exit Meeting Summary	13

ATTACHMENTS

Attachment 1 - List of Acronyms Used

Table of Contents (cont'd)

Attachment 2 - Items Opened, Closed, or Discussed

Report Details

Summary of Plant Status

Throughout most of the inspection period, the Vermont Yankee (VY) plant operated at 100 percent power. On December 21, the "A" Reactor Recirculation Pump automatically tripped, resulting in an unplanned power reduction to 40 percent. The failure of a maintenance valve in the pump's motor generator lubricating oil system caused the automatic trip. After the "A" Reactor Recirculation Pump was returned to service, maintenance was performed on the "B" Reactor Recirculation Pump to preempt similar failures. No significant power changes occurred after the plant was returned to full power on December 22.

I. Operations

O1 Conduct of Operations¹

O1.1 Observation of Routine Plant Operations

a. Inspection Scope (71707)

The inspectors routinely toured the control room to assess the conduct of activities, verify safety system alignments, and verify compliance with Technical Specification (TS) requirements. Equipment deficiencies identified in control room logs were reviewed, and discussed with shift supervision, to evaluate both the equipment condition discussed and the licensee's initial response to the issue.

b. Observations and Findings

No problems were identified with the status of plant safety systems during the control room tours or review of Event Reports (ERs). A sample review of work orders and ERs found that the basis for operability of degraded equipment was adequately evaluated and documented.

c. Conclusions

Appropriate control of safety system alignments, implementation of Technical Specification required actions, and adequate operability reviews for degraded equipment were observed during routine control room tours.

O1.2 Single Reactor Recirculation Loop Operations

a. Inspection Scope (71707)

On December 21, the "A" Reactor Recirculation Pump tripped due to a problem with the recirculation motor generator (MG) lubricating oil system. The inspector reviewed VY's subsequent actions to stabilize the plant, establish conditions for long term single recirculation loop operation, and restore two loop operations.

¹Topical headings such as O1, M8, etc., are used in accordance with the NRC standardized reactor inspection report outline. Individual reports are not expected to address all outline topics.

b. Observations and Findings

At 3:18 a.m. on December 21, one of the two operating lubricating oil (LO) pumps supplying the "A" Recirculation MG tripped. Because the system's third LO pump (normally in standby) was already out of service, the "A" Recirculation MG tripped on low LO pressure.

Operators responded by reducing power with the remaining reactor recirculation pump and control rods to exit the exclusion areas of the power to flow map. The reactor stability monitor showed no indication of instability during the transient. Operators noted that reactor vessel water level continued to increase after the reactor recirculation pump trip, and took manual control of the level control system to restore normal level. This apparent level control system problem was entered in VY's corrective action program as ER 99-2075.

Technical Specification 3.6.G lists required actions for continued single loop operation. The inspector verified that these actions were commenced and completed within the specified times.

Operators initiated appropriate actions to investigate a failure of the "A" Recirculation Pump MG to start on demand (ER 99-2094). After resolution of this problem, the "A" Recirculation system was restored to service. The "B" Recirculation system was then taken out of service to support preemptive maintenance on its motor generator LO system. VY's root cause evaluation for this event, and disposition of equipment problems under the Maintenance Rule Program, are discussed in Section M2.1 of this report.

c. Conclusions

Operators responded well to the automatic trip of one reactor recirculation pump by promptly taking action to exit the exclusion areas of the power to flow map. The operators also initiated appropriate corrective actions for two additional equipment problems that occurred during the period of single recirculation loop operation.

O1.3 Loss of Main Circulating Water Pump Due to Ice in the Intake Structure

a. Inspection Scope (71707)

The inspector reviewed the events surrounding a loss of one circulating water pump that occurred on January 13.

b. Observations and Findings

At 8:45 p.m., the "C" Circulating Water (CW) pump tripped as designed, in response to a low intake bay level. At the time of the pump trip, operators noted that the intake bay water level was approximately 10 feet lower than normal. Operators promptly started the idle CW pump to restore the normal system configuration of two running pumps. As directed by the procedure for loss of circulating water, operators opened the CW recirculation gate, which directs a portion of the CW effluent back to the intake bay. These actions were taken quickly, and there was no significant effect on other plant parameters.

VY's subsequent investigation found that there was a significant amount of ice flowing in the river. This condition is unusual for January, when the river typically is covered with a solid layer of ice. VY determined that the likely cause of the CW pump trip was a large piece of ice that "rolled over" and rapidly blocked an intake bay trash rack. CW recirculation flow was adequate to melt/dislodge the ice and prevent recurrence until the flowing ice subsided. This event was entered into VY's corrective action program as ER 2000-0037.

c. Conclusions

One circulating water pump tripped due to ice blockage at the intake structure. Prompt operator action to restore normal circulating water flow prevented the loss of condenser vacuum.

O8 Miscellaneous Operations Issues

O8.1 Year 2000 Rollover

The inspector observed VY's conduct of activities in the control room between 11:00 p.m. on December 31, 1999, and 1:00 a.m. on January 1, 2000. Operators performed additional checks and verifications of plant systems during the transition period and confirmed that there were no operational problems.

O8.2 In-office Review of LERs Related to Operations

An in-office review of a Licensee Event Report (LER) was performed to assess whether further NRC action is required. The adequacy of the overall event description, immediate actions taken, cause determination, and corrective actions were considered during this review.

(Closed) LER 05000271/1999005-00: Inadequate Procedures Result in the Failure to Establish the Neutron Monitoring System Configuration Required by Plant Technical Specifications

On November 4, 1999, operators performed refueling interlock checks in preparation for reactor refueling operations in accordance with approved plant procedures. A portion of these checks requires that the reactor mode selector switch (RMSS) be placed in the

"startup" position. After completing the checks, VY identified that TS requirements associated with placing the RMSS in "startup" had not been met. TS table 3.1.1 requires that either the average power range monitor (APRM) reduced high flux scram signals are operable or that the high flux source range monitor (SRM) scram be in noncoincidence (i.e., the SRM shorting links are removed). Neither of these conditions had been met during the refueling interlock checks performed on November 4, 1999.

The inspector determined that this event was of minimal safety significance. The intermediate range monitors were operable for the 13-minute duration of the event and provided high flux scram protection. In addition, the control rod withdrawals performed during refueling interlock checks are insufficient to achieve criticality. As corrective action for this event, VY revised the refueling interlock test procedure to specify requirements for neutron monitoring system operability.

Technical Specification table 3.1.1 requires, in part, that either a minimum of four channels of APRM reduced high flux scram are operable, or the SRMs are operating in noncoincidence, prior to placing the RMSS in the "startup" position for the purpose of performing refueling interlock checks. Contrary to the above, on November 4, 1999, VY performed refueling interlock checks and operated with the RMSS in the "startup" position for a period of approximately 13 minutes while the APRMs were inoperable and the SRMs were not operating in noncoincidence. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy, (NUREG 1600, November 9, 1999). This violation was entered in VY's corrective action program as ER 99-1528. **(NCV 05000271/1999010-01: Neutron Monitor System TS Not Met During Refueling Interlock Checks)**

II. Maintenance

M1 Conduct of Maintenance

M1.1 Maintenance and Surveillance Observations

a. Inspection Scope (61726, 62707)

The inspector observed portions of plant maintenance activities to verify the use of approved procedures, appropriate conduct and control of the work, and compliance with regulatory requirements. The inspector also observed portions of surveillance activities to verify proper calibration of test instrumentation, use of approved procedures, conformance to Limiting Conditions for Operations (LCOs). Following the completion of maintenance and surveillance activities, the inspector verified that safety systems were returned to their appropriate standby alignments.

b. Observations and Findings

The inspector observed portions of the in-plant work and/or reviewed work documents associated with the following activities:

- "A" and "B" Emergency Diesel Generator monthly surveillances, observed December 21 and 22, 1999
- Residual Heat Removal Service Water Valve V10-89B Limit Switch Adjustment, observed January 12, 2000
- "A" Service Water Pump Packing Repair, observed on January 13, 2000
- Trouble Shooting Feedwater Heater Level Control Valve LCV-103-4B-1, reviewed on December 28, 1999

c. Conclusions

There were no significant problems identified during the observation of routine maintenance and surveillance activities during this inspection period.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Reactor Recirculation Pump Motor Generator Lube Oil System Valve Failures

a. Inspection Scope (62707)

The inspector observed troubleshooting and corrective actions taken in response to a reactor recirculation motor generator lubricating oil system problem that resulted in a trip of the "A" reactor recirculation pump. The inspector also reviewed VY's implementation of the Maintenance Rule Program for component failures related to this event.

b. Observations and Findings

The variable speed reactor recirculation pumps at VY are each powered by a motor generator (MG) set. Each MG has a lubricating oil (LO) support system with three pumps. During normal operation, two LO pumps are running and the third pump is in auto/standby. The manual discharge isolation valves for four of the six LO pumps were replaced during the 1999 refueling outage. These valves are non-safety class, four-inch single disc gate valves.

On December 15, 1999, an operating LO pump for the "A" Recirculation MG tripped, and the standby LO pump automatically started. VY's initial troubleshooting determined the LO pump had tripped its thermal overloads due to no flow conditions created when a stem-to-disc separation occurred in its discharge isolation valve. This condition was confirmed by radiography on December 20, 1999.

On December 21, 1999, the "A" Reactor Recirculation Pump tripped, placing the plant in single recirculation loop operation (see section O1.2). The cause of the recirculation pump trip was low LO pressure for the "A" Recirculation MG. Investigation revealed that a second LO pump had tripped due to a stem-to-disc separation in its discharge isolation valve.

The two remaining LO pump discharge isolation valves installed during the 1999 refueling outage were found to have indications of the same failure mechanism. VY implemented immediate actions to preclude additional failures from occurring prior to resuming two recirculation loop operation and returning to full power. The inspector observed portions of in-field and shop work associated with these immediate actions, reviewed the temporary modification for removal of the valve discs (TM 99-035), reviewed the 10CFR50.59 screening evaluation, and attended the PORC meeting at which the TM was reviewed and approved. No problems were noted.

The failure of the recirculation MG LO pump discharge isolation valves was entered into VY's corrective action program as ER 99-2071. Through discussions with the VY Maintenance Rule Program Coordinator, the inspector verified that the "A" Recirculation MG trip had been classified as a maintenance rule functional failure. This failure did not result in the "A" Recirculation subsystem exceeding its reliability criteria and the subsystem remained in Maintenance Rule (a)(2) status. VY determined the "A" Recirculation Pump's failure to start on demand did not effect the subsystem's Maintenance Rule function. The LO valve failures were considered for Maintenance Rule implications, but the LO support system is only monitored in terms of the impact it has on the reliability of the recirculation system. No problems were identified.

c. Conclusions

Corrective maintenance for failure of two recirculation motor generator lubricating oil (LO) system valves was well planned and supported by the VY organization. The decision to remain at reduced power to address the potential for the same problem with the other recirculation motor generator LO system was conservative.

Equipment failures associated with the reactor recirculation system were appropriately evaluated by VY's Maintenance Rule Program.

M8 Miscellaneous Maintenance Issues

M8.1 (Closed) URI 05000271/1998008-04: MOV Concerns Regarding Procedure Adherence

a. Inspection Scope (92902)

Vermont Yankee Event Report 98-0986 documented that a step was missed during the performance of an installation and test (I&T) procedure on reactor core isolation cooling (RCIC) pump discharge valve V13-20, that required notification of the motor-operated valve (MOV) coordinator for his inspection of the valve internals prior to reassembly.

On May 26, 1998, VY reported to the NRC (Event Notification 34290) that an additional six primary containment isolation valves in the high pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), and reactor water cleanup (RWCU) systems did not have the proper chamfering of various valve internal surfaces.

The inspector reviewed pertinent documents and discussed the licensee's disposition of the valves with the MOV coordinator.

b. Observations and Findings

RCIC Pump Discharge Valve

Work order 97-05189-23 was issued, in part, to perform inspections and dimension checks of the internals of valve V13-20 and to chamfer the disk and body guides and seating surfaces in accordance with procedure OP 5201, form VYOPF 5201.04, and the I&T procedure. Step 7.5.2.3 of the I&T procedure required chamfering of the in-body guide and seat per VYOPF 5201.04 and documenting the as-built/as-left conditions on the applicable valve drawings. Step 7.5.2.4 required the disk guide leading edges to be rounded and the conditions to be documented similarly. The acceptance criterion specified in form VYOPF 5201.04 was "1/16th [inch] minimum rounded edge/chamfer." Step 7.5.2.5 required performance of a post-modification visual inspection to verify that all field changes to the valve were documented on the applicable wear and clearance drawing.

The "work performed" text of the work order stated "...chamfered wedge and in body guides," and form VYOPF 5201.04 was filled out indicating that 1/16th-inch chamfers already existed on the body and disk seats, while the body and disk guides were chamfered to 1/16-inch on April 14. The valve was reassembled on April 19 without notifying the MOV coordinator so that an inspection of the valve internals could be performed and the measurement data reviewed. This was contrary to step 7.5.2.5 of the I&T procedure and step 1.2.3.2 of OP 5201, which states that prior to reassembly of the GL 89-10 valve, the measurement data must be reviewed and determined to be acceptable by engineering. In addition, the applicable valve drawings were not updated as required by the procedure.

Upon learning that the valve had been reassembled, the MOV coordinator directed that the valve be reopened for inspection. On April 27-28, the licensee found that the disk and body guides had not been chamfered in accordance with VYOPF 5201.04 criteria. The disk seat edge chamfers did not appear to have been reworked per OP 5201. After chamfering the required areas per procedure, the applicable steps of the I&T procedure were signed off and the valve was closed up. The licensee did not document the as-found and as-left chamfers on form VYOPF 5201.04 and again failed to update the valve drawings as required by the I&T procedure.

Failure of the contractors and VY maintenance personnel to follow the steps in the I&T procedure and OP 5201 regarding contacting the MOV coordinator, installing the specified chamfers, and updating the valve drawings is the first of two examples of a violation of Technical Specification 6.5.A.5, which requires adherence to procedures for preventive and corrective maintenance operations which could have an effect on the safety of the reactor. During later review of this issue by the NRC, it did not appear that the workers intentionally failed to follow the procedure guidance. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NUREG 1600, November 1999). This violation is in VY's corrective action program as an Event Reports 98-0986 and 98-1367. **(NCV 05000271/1999010-02: Failure to Follow Procedures For MOV Maintenance)**

High Energy Line Break Isolation Valves

During testing of HPCI steam line isolation valve V23-15 on April 30, 1998, unusual noises were heard coming from the valve. The valve internals last had been worked in April 1995 using Revision 14 of procedure OP 5201, which specified a 1/32" rounded edge or chamfer. When the valves were opened for inspection, the licensee found that the required chamfers were not installed as expected (although the body seats appeared to be rounded). The licensee reinspected valves V12-15, V12-18, V13-15, V13-16 and V23-16 since they were also worked in April 1995 using Revision 14 of procedure OP 5201.

In April/May 1998, when opened for reinspection, the licensee found (with one exception) that the valves did not have the chamfers that had been documented in the 1995 and 1996 work orders, although some of the edges appeared to have been rounded. The NRC concluded that the instructions in form VYOPF 5201.04 were not followed in 1995; although, the poor work and documentation were not indicative of willful violations of requirements. This is the second example of the non-cited violation of Technical Specification 6.5.A.5 regarding adherence to maintenance procedures identified above.

c. Conclusions

Maintenance on the internals of six risk-significant safety-related valves was not performed correctly by contractor technicians during refueling outages in 1995, 1996, and 1998. The failure to properly implement procedures for chamfering of valve internal surfaces is a violation of Technical Specification requirements. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NUREG 1600, November 1999). This violation was entered in VY's corrective action program as Event Reports 98-0986 and 98-1367.

M8.2 Review of Open Items Related to Engineering (92903)

The following open items were reviewed based on additional information obtained from the licensee to determine whether additional NRC followup was warranted.

(Closed) IFI 05000271/1999003-02: Maintenance Rule Corrective Action For Feedwater Minimum Flow Valve Failures

VY initially identified a major modification to replace the feedwater minimum flow valves. For several reasons, VY deferred this corrective action plan to the 2001 refueling outage. This open item was initiated to track NRC review of short term corrective actions that were being considered as an alternative to the valve replacements.

On several occasions, feedwater pump minimum flow valves had failed to open fast enough to satisfy the pump's protective logic. Problems had been experienced during initial pump starts and during transients that had caused a rapid closure of the feedwater regulating valves. These failures contributed to the feedwater system being monitored as a category "(a)(1)" system under VY's Maintenance Rule Program. To correct these problems, VY implemented Minor Modification 99-034 during the 1999 refueling outage.

The allowable time for operation of the pumps under low flow conditions was increased based on an evaluation by the pump vendor and VY design engineering. The inspector concluded that this action reasonably addressed the previous problems. The post modification testing and actual pump starts at the conclusion of the outage demonstrated the minimum flow valves are operating acceptably. No additional followup of this issue is warranted, and therefore this item is closed.

III. Engineering

E8 Miscellaneous Engineering Issues

E8.1 (Closed) URI 05000271/1998008-05: Thrust Calculations for Safety-Related MOVs

a. Inspection Scope (92903)

The inspector reviewed design calculations for six primary containment isolation valves in the high pressure coolant injection, reactor core isolation cooling, and reactor water cleanup systems. The calculations determined the maximum thrust required to close the valves in the event of a high energy line break.

b. Observations and Findings

In Supplement 3 of Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," the NRC concluded on the basis of high risk significance and laboratory tests that (1) certain valves in high energy lines may require more closing thrust than would have been predicted from the standard industry equation using typical friction factors, and (2) correction of any deficiencies concerning the valves needed to be given priority in implementing GL 89-10 programs.

The need to chamfer (or bevel) the internal sliding surfaces of HELB isolation valves comes from the Electric Power Research Institute (EPRI) performance prediction program methodology (PPM) that the licensee committed to use in letters to the NRC dated April 18, 1996 (BVY 96-52), May 9, 1996 (BVY 96-63), and November 3, 1997 (BVY 97-144). The PPM analyzes valve physical characteristics (materials of construction and internal dimensions) against fluid conditions to predict thrust requirements. Under blowdown (HELB) conditions, the sharpness of the leading edges of the valve body and disk seats and guides are critical attributes. Per EPRI Topical Report TR-103244, "EPRI MOV Performance Prediction Program: Performance Prediction Methodology Implementation Guide," sharp edges can result in seat or guide damage and inability to predict required thrust. While unpredictability does not indicate that substantial damage will occur, an unpredictable outcome "...should be considered a significant indicator of potentially high thrust requirements." The criteria for "sharp" surfaces are 0.06 inches (0.06") or less for disk seat outer diameter/body seat ring inner diameter, and 0.04" or less for the disk guide bottom edge.

The inspector reviewed the PPM calculations that were performed by the licensee in December 1996. The calculations were used to confirm the appropriateness of the valve factors assumed to calculate thrust requirements using the standard industry

equation, and the NRC closed its review of the licensee's GL 89-10 program in Inspection Report 50-271/97-08 based, in part, on the PPM results. The initial calculations indicated an unpredictable outcome due to PPM software inputs that specified sharp disk guide bottom edges. The licensee revised the inputs to reflect a 0.04" chamfer on the guide edges, which resolved the "unpredictable" result.

In most cases, the disk and body seat chamfers input into the PPM software were the nominal dimensions shown on manufacturers' drawings rather than the 1/32" chamfers documented in the 1995/1996 work orders. For the disk guide bottom edges, the licensee assumed 0.04" chamfers, the minimum required by the PPM to achieve predictable results. The licensee informed the inspector that its conclusion had been based on discussions with the contractor personnel who had worked on the valves. However, the licensee's conclusion was not consistent with the dimensions documented in the 1995/1996 work orders, nor the actual, as-found conditions identified by the licensee during the reinspections performed in April/May 1998.

Use of unverified assumptions in the PPM calculations was contrary to licensee procedure AP-0017, "Calculations and Analyses," which requires input data to be obtained from verified or QA (Quality Assurance) sources, and was a violation of 10 CFR 50, Appendix B, Criterion III, which requires measures to be established for verifying or checking the adequacy of design. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy (NUREG 1600, November 9, 1999). The violation is in the licensee's corrective action program as ER 98-1051. **(NCV 05000271/1999010-03: Unverified Design Inputs in MOV Calculations)**

The inspector independently calculated the thrust requirements and capabilities of the valves and determined that the margin above the minimum thrust requirements varied from 22% (V12-15) to 150% (V13-16). While internal damage may have occurred under blowdown conditions due to the less than optimum guide surface conditions identified by the licensee during the 1998 inspections, there was reasonable assurance that the valves would have functioned to isolate a high energy line break.

c. Conclusions

In 1998, VY identified that the chamfer dimensions on the internal edges of five high energy line break isolation valves were inconsistent with applicable work documents and design calculations. These inconsistencies were corrected prior to the plant restarting from the spring 1998 refueling outage. In addition the NRC determined that, prior to the corrections, all of the valves exceeded the minimum thrust requirements. However, the failure to use appropriate calculation inputs was identified as a violation of the design control requirements of 10 CFR 50, Appendix B, Criterion III. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy, (NUREG 1600, November 1999). This violation was entered in VY's corrective action program as Event Report 98-1051.

E8.2 Review of Open Items Related to Engineering (92903)

The following open items were reviewed based on additional information obtained from the licensee to determine whether additional NRC review was warranted.

(Closed) IFI 05000271/1997008-01: Resolution of EDG Piping Weld Issue

Long term resolution of this issue is being tracked by VY Basis for Maintaining Operation (BMO) 97-39, "Less than full penetration welds on vendor supplied skid mounted piping for emergency diesel generators." This issue was communicated to the Office of Nuclear Reactor Regulation and subsequently, NRC Information Notice 98-43, "Leaks in the Emergency Diesel Generator Lubricating Oil and Jacket Cooling Water Piping." As reflected in the Information Notice, VY's short term actions have been acceptable and therefore, this inspector follow-up item is closed.

(Closed) IFI 05000271/1998012-02: Potential for Post LOCA Reactor Building Pressurization

This item was opened pending further NRC review of the potential for the pressurization of the reactor building under post accident conditions. A VY review of the licensing basis for secondary containment and the standby gas treatment system determined that the potential for this phenomenon was not part of their original licensing basis. The inspector's independent review also found no mention or evaluation of this phenomenon. However, VY performed an engineering evaluation to assess the potential effects of pressurization for a short duration, using a bounding set of assumptions. The evaluation found that the consequences of a design basis accident, even with a 30 minute period of reactor building pressurization, would still be well within the limits of 10CFR100. Based on the results of VY's engineering review, and the original licensing basis information, no additional NRC followup of this issue is warranted. This inspector followup item is closed.

(Closed) IFI 05000271/1998080-06: Containment Pressure Response

This item was opened pending the results of a revised containment analysis that would account for operation under Extended Load Line Limit Analysis and a recalculation of the torus free air volume. The inspector sought to verify that the revised peak accident pressure would be less than the containment leak rate test pressure of 44 psig. Prior to the conclusion of the 1999 refueling outage, VY revised Basis for Maintaining Operation (BMO) 98-15 on the basis of a General Electric peak containment analysis. This new analysis confirmed that the anticipated peak containment pressure following a design basis accident would be well below the original 42.2 psig anticipated peak pressure listed in the FSAR and the 44 psig leak rate test pressure required by the Technical Specifications. No additional followup of this issue is warranted based on this result. This inspector followup item is closed.

E8.3 Administrative Closure of Items Related to Engineering

The following open items were closed based on an administrative review of the original inspection reports and a determination that there were no violations of NRC requirements documented.

IFI 05000271/1999006-01: Surveillance Test Value of RCIC Pump Discharge Pressure

IFI 05000271/1999005-01: ACS Design Basis and Implementing Procedure

IFI 05000271/1998014-03: MOV Torque Switch Failure - Final Resolution

IV. Plant Support

F8 Miscellaneous Fire Protection Issues

F8.1 (Closed) URI 05000271/1998008-08: Alternative of Testing of CO₂ Fire Extinguishing System

This item was opened to review the acceptability of testing of the new, low-pressure, total flooding carbon dioxide fire suppression system installed in the east and west switchgear rooms. VY did not perform the full discharge test required by the code of record for the system (1993 edition of NFPA 12). The testing performed on the system consisted of "puff" testing to ensure the integrity and cleanliness of the carbon dioxide supply piping, logic testing of the actuation circuitry, and alternative testing as described in the Halon® suppression system standard (NFPA 12A). This testing conforms to the guidance in NRC Information Notice 92-28, and with the testing performed on the original high pressure carbon dioxide fire suppression system which was approved in a Safety Evaluation Report dated November 29, 1990.

The question of the adequacy of the testing, without full discharge test as specified by the code of record, was referred to the NRC's Office of Nuclear Reactor Regulation (NRR) by a Task Interface Agreement dated February 17, 1999. NRR's answer, dated November 17, 1999, found the alternative testing performed by VY conforms to the testing approved in the November 29, 1990, Safety Evaluation Report and the guidance in NRC Information Notice 92-28 and is, therefore, acceptable for the purpose. This item is closed.

V. Management Meetings

X1 Exit Meeting Summary

The resident inspectors met with licensee representatives periodically throughout the inspection and following the conclusion of the inspection on February 10, 2000. At this meeting, the purpose and scope of the inspection was reviewed, and the preliminary findings were presented. The licensee acknowledged the preliminary inspection findings.

The inspector asked the licensee whether any material examined during the inspection should be considered proprietary. No proprietary information was identified.

LIST OF ACRONYMS USED

APRM	average power range monitor
BMO	Basis for Maintaining Operation
BVY	Beaver Valley
CFR	Code of Federal Regulation
CW	circulating water
EDG	Emergency Diesel Generator
EPRI	Electric Power Research Institute
ER	Event Report
FSAR	Final Safety Analysis Report
GL	Generic Letter
HELB	high energy line break
HPCI	high pressure coolant injection
I&T	installation and test
IFI	inspector follow-up item
LCO	Limiting Condition for Operation
LER	Licensee Event Report
LO	lubricating oil
LOCA	loss of coolant accident
MG	motor generator
MOV	motor operated valve
NCV	non-cited violation
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
NRR	NRC Office of Nuclear Reactor Regulation
OP	operating procedure
PORC	Plant Operations Review Committee
PPM	performance prediction program methodology
PSIG	Pounds Per Square Inch Gauge
QA	Quality Assurance
RCIC	reactor core isolation cooling
RMSS	reactor mode selector switch
RWCU	reactor water cleanup
SRM	source range monitor
TM	temporary modification
TR	topical report
TS	Technical Specifications
URI	unresolved item
VY	Vermont Yankee

ITEMS OPENED, CLOSED, OR DISCUSSED

OPENED

None

CLOSED

LER 05000271/1999005-00: Inadequate Procedures Result in the Failure to Establish the Neutron Monitoring System Configuration Required by Plant Technical Specifications (page 3)

IFI 05000271/1999003-02: Maintenance Rule Corrective Action For Feedwater Minimum Flow Valve Failures (page 8)

URI 05000271/1998008-05: Thrust Calculations for Safety-Related MOVs (page 9)

IFI 05000271/1997008-01: Resolution of EDG Piping Weld Issue (page 11)

IFI 05000271/1998012-02: Potential for Post LOCA Reactor Building Pressurization (page 11)

IFI 05000271/1998080-06: Containment Pressure Response (page 11)

IFI 05000271/1999006-01: Surveillance Test Value of RCIC Pump Discharge Pressure (page IFI 05000271/1999005-01: ACS Design Basis and Implementing Procedure (page 12)

IFI 05000271/1998014-03: MOV Torque Switch Failure - Final Resolution (page 12)

URI 05000271/1998008-08: Alternative of Testing of CO₂ Fire Extinguishing System (page 12)

URI 05000271/1998008-04: MOV Concerns Regarding Procedure Adherence (page 6)

NON-CITED VIOLATIONS

NCV 05000271/1999010-01: Neutron Monitor System TS Not Met During Refueling Interlock Checks (page 4)

NCV 05000271/1999010-02: Failure to Follow Procedures For MOV Maintenance (page 8)

NCV 05000271/1999010-03: Unverified Design Inputs in MOV Calculations (page 10)