UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

May 27, 2011

EA-11-047

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Resources
5000 Dominion Blvd.
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION UNIT 2 - NRC SPECIAL INSPECTION REPORT 05000336/2011008; PRELIMINARY WHITE FINDING

Dear Mr. Heacock:

On April 14, 2011, the U. S. Nuclear Regulatory Commission (NRC) completed a Special Inspection at your Millstone Power Station (Millstone) Unit 2. The inspection was conducted in response to an unanticipated reactor power transient event that occurred on February 12, 2011. The NRC's initial evaluation of this event satisfied the criteria in NRC Inspection Manual Chapter 0309, "Reactive Inspection Decision Basis for Reactors," for conducting a special inspection. The Special Inspection Team (SIT) Charter (Attachment 2 of the enclosed report) provides the basis and additional details concerning the scope of the inspection. The enclosed inspection report documents the inspection results, which were discussed at the exit meeting on April 14, 2011, with Mr. A. J. Jordan, Millstone Site Vice President, and other members of your staff.

The Special Inspection Team (the team) examined activities conducted under your license as they relate to safety and compliance with Commission rules and regulations and with the conditions of your license. The team reviewed selected procedures and records, observed activities, and interviewed personnel. In particular, the team reviewed event evaluations, causal investigations, relevant performance history, and extent-of-condition to assess the significance and potential consequences of issues related to the February 12 event.

The team concluded that the plant operated within acceptable power limits and no equipment malfunctioned during the power transient. Nonetheless, the team identified several issues related to procedure discrepancies and human performance that complicated the event. Additionally, the team noted that Dominion's initial response to the event was not appropriately thorough and timely, did not highlight the significance of the unplanned power increase and reactivity control issues, and was narrowly focused. The enclosed chronology (Attachment 3 of the enclosed report) provides additional details regarding the sequence of events and event complications.

This report documents one finding that, using the reactor safety Significance Determination Process (SDP), has preliminarily been determined to be White, or of low to moderate safety significance. The finding is associated with a performance deficiency involving the failure of Millstone personnel to carry out their assigned roles and responsibilities and inadequate

reactivity management during main turbine control valve testing, which contributed to the unanticipated reactor power increase. Specifically, the Millstone Unit 2 operations crew failed to implement written procedures that delineated appropriate authorities and responsibilities for safe operation and shutdown, and a procedure for controlling reactor reactivity. In addition, the licensee failed to establish written procedures for Reactor Protection System (RPS) Variable High-Power Trip (VHT) setpoint reset and for power operation and transients involving multiple reactivity additions.

This finding was assessed using NRC Inspection Manual Chapter (IMC) 0609, Appendix M, "SDP Using Qualitative Criteria," because it involved human performance errors. Preliminarily, the NRC has determined this finding to be of low to moderate safety significance based on a qualitative assessment. There were no immediate safety concerns following the transient because the event itself did not result in power exceeding license limits or fuel damage. Additionally, interim corrective actions were taken, which included removing the Millstone Unit 2 control room crew involved in the transient from operational duties pending remediation, and establishment of continuous management presence in the Millstone Unit 2 control room while long term corrective actions were developed.

The finding involved two apparent violations (AVs) of NRC requirements involving Technical Specification 6.8, "Procedures," that are being considered for escalated enforcement action in accordance with the Enforcement Policy, which can be found on NRC's Web site at http://www.nrc.gov/reading-rom/doc-collections/enforcement/.

In accordance with NRC Inspection Manual Chapter (IMC) 0609, we will complete our evaluation using the best available information and issue our final determination of safety significance within 90 days of the date of this letter. The significance determination process encourages an open dialogue between the NRC staff and the licensee; however, the dialogue should not impact the timeliness of the staff's final determination. Before we make a final decision on this matter, we are providing you with an opportunity to (1) attend a Regulatory Conference where you can present to the NRC your perspective on the facts and assumptions the NRC used to arrive at the finding and assess its significance, or (2) submit your position on the finding to the NRC in writing. If you request a Regulatory Conference, it should be held within 30 days of your response to this letter, and we encourage you to submit supporting documentation at least one week prior to the conference in an effort to make the conference more efficient and effective. If a Regulatory Conference is held, it will be open for public observation. If you decide to submit only a written response, such submittal should be sent to the NRC within 30 days of your receipt of this letter. If you decline to request a Regulatory Conference or submit a written response, you relinquish your right to appeal the final SDP determination, in that by not doing either, you fail to meet the appeal requirements stated in the Prerequisite and Limitation Sections of Attachment 2 of IMC 0609.

Please contact Sam Hansell by telephone at (610) 337-5046 and in writing within 10 days from the issue date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision. The final resolution of this matter will be conveyed in separate correspondence.

Because the NRC has not made a final determination in this matter, no Notice of Violation is being issued for this inspection finding at this time. Please be advised that the number and characterization of the apparent violations described in the enclosed inspection report may

change as a result of further NRC review. In addition, the report documents one self-revealing finding, of very low safety significance (Green). This finding did not involve a violation of NRC requirements.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room and from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

for

Christopher G. Miller, Director
Division of Reactor Safety

Docket No. 50-336
License No. DPR-65

Enclosure: Inspection Report 05000336/2011008
w/Attachments: Supplemental Information (Attachment 1)
Special Inspection Team Charter (Attachment 2)
Detailed Sequence of Events (Attachment 3)
Appendix M Table 4.1 (Attachment 4)

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Sincerely,

/RA/
Peter R. Wilson for:

Christopher G. Miller, Director
Division of Reactor Safety

Docket No. 50-336
License No. DPR-65

Enclosure: Inspection Report 05000336/2011008
w/Attachments: Supplemental Information (Attachment 1)
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U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No.:	50-336
License No.:	DPR-65
Report No.:	05000336/2011008
Licensee:	Dominion Nuclear Connecticut, Inc
Facility:	Millstone Power Station, Unit 2
Location:	P.O. Box 128 Waterford, CT 06385
Dates:	February 22 through April 14, 2011
Team Leader:	P. Presby, Senior Operations Engineer, Division of Reactor Safety
Team:	B. Haagensen, Resident Inspector, Division of Reactor Projects B. Fuller, Operations Engineer, Division of Reactor Safety
Observers:	D. Galloway, Program Supervisor, Connecticut Department of Environmental Protection, Bureau of Air Management, Radiation Division
Approved By:	Samuel L. Hansell, Jr., Chief Operations Branch Division of Reactor Safety

Enclosure

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SUMMARY OF FINDINGS

IR 05000336/2011008; 02/22/2011 - 04/14/2011; Millstone Nuclear Power Station (Millstone) Unit 2; Special Inspection for the February 12, 2011, Unanticipated Reactor Power Transient Event; Inspection Procedure 93812, Special Inspection.

A three-person NRC team, comprised of two regional inspectors and one resident inspector, conducted this Special Inspection. One representative from the State of Connecticut, Department of Environmental Protection accompanied the team. One finding with potential for greater than Green safety significance and one Green finding were identified. The significance of most findings is indicated by their color (Green, White, Yellow, or Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP); the crosscutting aspect was determined using IMC 0310, "Components Within the Cross Cutting Areas;" and findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

NRC Identified and Self Revealing Findings

Cornerstone: Initiating Events

- **Preliminary White:** A self-revealing finding was identified involving the failure of Millstone personnel to carry out their assigned roles and responsibilities and inadequate reactivity management during main turbine control valve testing on February 12, 2011, which contributed to the unanticipated reactor power increase. Specifically, the Millstone Unit 2 operations crew failed to implement written procedures that delineated appropriate authorities and responsibilities for safe operation and shutdown and a procedure for controlling reactor reactivity. In addition, the licensee failed to establish written procedures for the Reactor Protection System (RPS) Variable High-Power Trip (VHT), and for power operation and transients involving multiple reactivity additions.

  The finding has preliminarily been determined to be White, or of low to moderate safety significance. The finding is also associated with two apparent violations of NRC requirements specified by Technical Specifications. There were no immediate safety concerns following the transient because the event itself did not result in power exceeding license limits or fuel damage. Additionally, interim corrective actions were taken, which included removing the Millstone Unit 2 control room crew involved in the transient from operational duties pending remediation, and establishment of continuous management presence in the Millstone Unit 2 control room while long term corrective actions were developed. Dominion entered this issue, including the evaluation of extent-of-condition, into the corrective action program (CR413602) and performed a root cause evaluation (RCE).

  The finding is more than minor because the performance deficiency (PD) was associated with the human performance attribute of the Initiating Events cornerstone and affected the cornerstone objective of limiting the likelihood of those events that upset plant

stability and challenge critical safety functions during power operations. Additionally, the PD could be viewed as a precursor to a significant event. Because the finding primarily involved human performance errors, probabilistic risk assessment tools were not well suited for evaluating its significance. The team determined that the criteria for using IMC 0609, Appendix M, "Significance Determination Process Using Qualitative Criteria," were met, and the finding was evaluated using this guidance, as described in Attachment 4 to this report. Based on the qualitative review of this finding, regional management concluded the finding was preliminary of low to moderate safety significance (preliminary White).

The team determined that the PD resulted from several causes; however, the team concluded that the primary cause was ineffective reinforcement of Dominion standards and expectations. The team also concluded that this finding had a cross-cutting aspect in the Human Performance area, Decision Making component, because Dominion licensed personnel did not make the appropriate safety-significant decisions, especially when faced with uncertain or unexpected plant conditions to ensure safety was maintained. This includes formally defining the authority and roles for decisions affecting nuclear safety, communicating these roles to applicable personnel, and implementing these roles and authorities as designed [H.1(a)]. (Section 2.1)

- **Green**: The team identified a self-revealing finding of very low safety significance (Green) for improper operation of the turbine controls during turbine control valve testing. Specifically, the inspectors identified that control room operators failed to correctly implement surveillance procedure SP-2651N, "Main Control Valve Testing." Incorrect operation of the turbine controls caused an unplanned power increase from 88 percent to 96 percent. Dominion entered this issue into the corrective action program (CR415094).

  The team determined that this finding was more than minor because it was similar to NRC Inspection Manual Chapter 0612, Appendix E, "Examples of Minor Issues," Example 4b, in that the incorrect operation of the turbine load selector pushbutton caused a plant transient. The finding was associated with the human performance attribute of the Initiating Events cornerstone and affected the cornerstone objective of limiting the likelihood of those events that upset plant stability and challenge critical safety functions during power operations. The team concluded that the finding was of very low safety significance (Green) because it did not contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment or functions would not be available. Enforcement action does not apply because the performance deficiency did not involve a violation of a regulatory requirement. The team also determined that the finding had a cross-cutting aspect in the Human Performance area, Resources component, because Dominion did not provide adequate training of personnel and sufficient qualified personnel [H.2(b)]. (Section 2.2)

REPORT DETAILS

1. Background and Description of Event

In accordance with the Special Inspection Team (SIT) Charter (Attachment 2), team members (the team) conducted a detailed review of the February 12, 2011, unanticipated reactor power transient event at Millstone Nuclear Power Station (Millstone) Unit 2, including a review of Millstone Unit 2 operators' response to the event. The team gathered information from the plant process computer (PPC) alarm printouts and parameter trends, interviewed station personnel, observed an event reconstruction on the simulator, observed on-going control room activities, and reviewed procedures, logs, and various technical documents to develop a detailed timeline of the event (Attachment 3).

On Saturday February 12, 2011, Millstone Unit 2 experienced an unintended 8 percent reactor power transient (88 percent to 96 percent) during the performance of quarterly main turbine control valve testing. As more fully described below, the transient was caused by multiple human performance errors committed independently by the operators involved with the testing, and was compounded by problems in communications and command and control.

Two days prior to the event, the control room operating crew that was involved with the event attended a four hour just-in-time simulator training session for the planned reactor power decrease to 88 percent and the Millstone Unit 2 main turbine control valve testing evolution. The crew also received a briefing on the planned evolution from Millstone Operations Department management on February 12, just prior to beginning the main turbine control valve test.

On the day of the Millstone Unit 2 main turbine control valve test, the Millstone Unit 2 control room was staffed with the following normal five-person crew complement:

- Shift Manager (SM);
- Unit Supervisor (US);
- Operator At The Controls Reactor Operator (OATC RO);
- Balance of Plant Reactor Operator (BOP RO); and
- Shift Technical Advisor (STA), a non-licensed position.

Additionally, 3 other individuals were in the control room specifically to support performance of the test:

- an SRO-licensed and SM-qualified individual to provide operations management oversight;
- an SRO-licensed individual designated as the "Reactivity SRO" to directly supervise all reactivity changes; and
- a Reactor Engineer to assist with development and implementation of the reactivity plan.

Initial conditions for the control valve testing were established as follows:

1. Unit 2 reactor power was reduced to 88 percent.

2. The main turbine valve control was transferred from Load Limit to Load Set, applying a control signal to position the turbine control valves to maintain the existing main generator load.

3. The crew adjusted turbine load and the turbine bypass valve controller automatic setpoint to open one of the turbine bypass valves approximately 10 percent. Turbine bypass flow is established by the test procedure to allow the turbine bypass controller to automatically compensate for any small steam flow perturbations, thereby maintaining constant reactor power during testing.

A 600 gallon reactor coolant system (RCS) dilution was initiated to compensate for the effects of core fission product poison (Xenon) concentration changes initiated by the reactor power reduction.

The test procedure provided direction to the operators to maintain constant turbine first stage pressure (± 10 psig) using the Load Set INCREASE and DECREASE pushbuttons while slowly rotating the turbine first stage pressure feedback potentiometer from the OUT to the IN position over a one minute period. Insertion of first stage pressure feedback into the control loop ensures the control valves change position in response to changes in first stage pressure, which varies linearly with turbine load. When a control valve is stroked closed for testing, load set control with first stage pressure feedback attempts to automatically maintain turbine load constant by opening the other three control valves in response to decreasing first stage pressure.

At approximately 11:30 am, the BOP RO correctly began rotating the turbine first stage pressure potentiometer toward the IN position. However, in response to increasing turbine first stage pressure, the BOP RO incorrectly depressed the INCREASE load selector button (rather than the DECREASE load selector button), thereby increasing steam supplied to the turbine and further increasing first stage pressure. When the operator did not get the desired response (a reduction in first stage pressure), the BOP RO pressed the INCREASE pushbutton 3 more times, followed by two depressions of the DECREASE pushbutton. The increased steam demand by the turbine resulted in lower RCS cold leg temperature, the automatic closure of the one partially open turbine bypass valve, and a reactor power transient over a three minute period which peaked at 96 percent power.

Neither the STA (who was performing the peer-check) nor the US (who was observing the test) initially corrected the BOP RO, because both also incorrectly believed pressing the INCREASE button was the correct action. Additionally, none of these three individuals informed the rest of the crew that they had an unexpected response and that a transient was in progress.

At the onset of the event, the RPS VHT setpoints were below 96 percent (Ch A at 95.7 percent, Ch B at 95.4 percent, Ch C at 94.9 percent, and Ch D at 94.4 percent). During the turbine transient, reactor power increased toward the VHT setpoints. The Reactivity SRO observed the illumination of the VHT setpoint reset permissive lights (one light per RPS channel), and incorrectly assumed they were illuminating due to minor power fluctuations associated with the fission product poison build-in and on-going RCS dilution. Consequently, he increased the margin to the trip setpoint by resetting the VHT setpoints upward four times during the power rise. If the SRO had not reset the VHT, the RPS would have automatically initiated a high power reactor trip due to the magnitude of the reactor power increase from 88 to 96 percent. In addition to preventing the automatic trip, the Reactivity SRO did not understand or question why reactor power was increasing, and did not inform anyone on the crew of his actions to reset the VHT setpoints.

The SM observed the closure of the partially open turbine bypass valve and directed the OATC RO to lower the turbine bypass valve controller setpoint to re-open the valve and directed the Reactivity SRO to withdraw one bank of control rods four steps to raise reactor temperature. Each of these actions added further positive reactivity and contributed to the reactor power increase. He also directed the US to return to a position of oversight and he directed the BOP RO to stop manipulating turbine controls.

After the plant stabilized, the SM incorrectly determined that the power transient had been limited to a maximum of four percent power, based on using the excore nuclear instruments instead of the more accurate Q-power indication, and decided to complete the turbine control valve testing before the end of the shift. Excore nuclear instruments did not accurately indicate the amount of the power increase due to normal instrument behavior in a significantly reduced primary coolant temperature environment. The full extent of the power transient was not identified until the next day when Millstone reactor engineers completed a formal assessment of the transient.

2. Human Performance

2.1 Overall Crew Performance

a. Inspection Scope

The team interviewed the Millstone Unit 2 control room personnel that responded to the February 12, 2011, event, including four SROs (SM, US, reactivity SRO, operations manager assigned to oversee evolution), two ROs (OATC RO, BOP RO), the STA and the Reactor Engineer to determine whether these personnel performed their duties in accordance with plant procedures and training. The team also reviewed narrative logs, sequence of events and alarm printouts, condition reports, PPC trend data, procedures implemented by the crew, and procedures regarding roles and responsibilities of operations personnel.

b. Findings/Observations

Multiple Examples of Procedural Violations and Inadequate Procedures Relating to Control Room Crew Performance During a Plant Transient

Introduction: A self-revealing finding was identified involving the failure of Millstone personnel to carry out their assigned roles and responsibilities and poor reactivity management during main turbine control valve testing on February 12, 2011, which contributed to the unanticipated reactor power increase. Specifically, the Millstone Unit 2 operations crew failed to implement written procedures that delineated appropriate authorities and responsibilities for safe operation and shutdown and a procedure for controlling reactor reactivity. In addition, the licensee failed to establish written procedures for the RPS VHT setpoint reset and for power operation and transients involving multiple reactivity additions.

The finding has preliminarily been determined to be White, or of low to moderate safety significance. The finding is also associated with two apparent violations of NRC requirements specified by Technical Specifications. There were no immediate safety concerns following the transient because the event itself did not result in power exceeding license limits or fuel damage. Additionally, interim corrective actions were taken, which included removing the Millstone Unit 2 control room crew involved in the transient from operational duties pending remediation, and establishment of continuous management presence in the Millstone Unit 2 control room while long term corrective actions were developed.

Description: On February 12, 2011, the Millstone Unit 2 control room crew was preparing to perform quarterly main turbine control valve testing. The unit was at 88 percent reactor power with one turbine bypass valve 10 percent open in automatic and the main turbine on Load Set control. Operators were in the process of placing turbine first stage pressure feedback in service.

During the conduct of the main turbine control valve testing, multiple operators failed to correctly implement written procedures as described below:

a. Dominion Procedure OP-AP-300, "Reactivity Management," states the Reactor Operator will stop and question unexpected situations involving reactivity, criticality, power level, or core anomalies and will meet the anomalous indication with conservative action. Dominion Procedure OP-AA-106, "Infrequently Conducted or Complex Evolutions," establishes expectations for the need to stop the test or evolution when unexpected conditions arise or unexpected behavior is experienced. However, as the BOP RO placed turbine first stage pressure feedback in service, he noted an increase in first stage pressure and incorrectly pressed the turbine load set INCREASE pushbutton instead of the DECREASE pushbutton. When the BOP RO did not get the desired response, he depressed the INCREASE pushbutton three more times, followed by two depressions of the DECREASE pushbutton, rather than stopping in the face of uncertainty as expected. The actions by the BOP RO resulted in a rapid, unintended reactor power rise.

b. Dominion Procedure OP-AP-300, "Reactivity Management," states the Shift Technical Advisor will provide engineering expertise to shift operators, as required, during periods of significant reactivity changes. However, the STA was peer-checking the turbine manipulations and did not identify that the BOP RO actions were incorrect. Because the STA was dedicated to supporting the turbine evolution as the peer checker, he was unable to remain within his assigned role and did not provide his engineering expertise to the crew regarding the multiple inappropriate reactivity additions by other members of the crew.

c. Dominion Procedure OP-AA-100, "Conduct of Operations," states the Unit Supervisor will provide oversight of plant operations and ensure the plant is operated safely in accordance with procedures. Dominion Procedure OP-AP-300, "Reactivity Management," states the Unit Supervisor will direct reactivity changes and ensure reactivity manipulations are made in a deliberate, carefully controlled manner. However, the US was focused on the turbine evolution during the event and did not provide effective oversight to the crew in responding to the power rise. The US also did not initially identify that the BOP RO should have been depressing the DECREASE rather than the INCREASE pushbutton. After the SM directed the US to resume his oversight role, the US did not clearly report to the rest of the crew that a power increase was in progress.

d. Dominion Procedure OP-AA-100, "Conduct of Operations," states the Shift Manager will maintain a broad perspective of plant operations as the senior management representative on shift. However, the SM did not recognize that turbine operations were causing changes in plant parameters. He observed the closure of the partially open turbine bypass valve and, believing this to be the result of the effects of fission product poison build-in, directed the OATC RO to lower the turbine bypass valve controller setpoint to re-open the valve.

e. Dominion Procedure OP-AP-300, "Reactivity Management," states the Reactor Operator will stop and question unexpected situations involving reactivity, criticality, power level, or core anomalies and will meet the anomalous indication with conservative action. However, the OATC RO, who was adding positive reactivity by diluting the RCS at the time, followed the SM's direction without question and adjusted the turbine bypass valve setpoint to reopen the valve, thereby adding additional positive reactivity to the core. The Millstone Unit 2 control room crew had practiced the control valve testing evolution on the simulator two days prior to the event with the OATC RO monitoring the turbine bypass valve position. This training apparently led the OATC RO to think his primary responsibility during the event was turbine bypass valve monitoring and control rather than his other reactivity control responsibilities as the Operator at the Controls.

f. Dominion Procedure OP-AP-300, "Reactivity Management," states that adding positive reactivity is never an appropriate way to address unstable plant conditions, and also that it is non-conservative to withdraw control rods in an attempt to restore primary coolant temperature during a transient. However, after directing reopening of the turbine bypass valve, the SM directed the Reactivity SRO to withdraw one bank

of control rods four steps to raise reactor temperature. This action added positive reactivity, thereby further exacerbating the power increase.

g. Dominion Procedure OP-AP-300, "Reactivity Management," states the Reactivity SRO reports to the Unit Supervisor, has no concurrent duties, directly monitors the reactivity change, and will provide peer checks for the reactor operator for all reactivity manipulations. The Reactivity SRO had been monitoring the rod repositioning and RCS dilutions that were performed by the OATC RO as expected. When the OATC RO began monitoring turbine bypass valve position, the Reactivity SRO continued to monitor the ongoing RCS dilution. The Reactivity SRO believed that if he needed to personally manipulate any controls, he would no longer be acting as the Reactivity SRO. When the SM directed rod withdrawal, the Reactivity SRO glanced at a digital readout of RCS temperature, and, not noticing any change in the parameter, incorrectly concluded the plant was not in a transient and withdrew control rods.

h. Dominion Procedure OP-AA-106, "Infrequently Conducted or Complex Evolutions," states the Senior Operations Manager assigned to oversight of the test will ensure tests are conducted in a manner that maximizes the margin of safety of the Unit. An SRO-licensed and SM-qualified individual was assigned to the control room to provide operations management oversight of the power reduction and testing for this infrequently performed evolution. His responsibilities included ensuring that the test was conducted in a manner that maximizes the margin of safety of the unit. However, this individual did not identify that the multiple reactivity additions, which were made during the transient, were inappropriate, either during or following the transient. He also did not identify that any members of the crew deviated from expected roles and responsibilities during the transient.

In addition to the failures by the Millstone Unit 2 control room crew to implement written procedures, the unplanned reactor power transient event was further exacerbated by the lack of written procedures for operation of the reactor protection system and for specific actions for power operation and transients involving multiple reactivity additions. Specific examples of these failures are provided below:

a. At the onset of the event, the RPS VHT setpoints were below 96 percent. During the turbine transient, reactor power increased toward the VHT setpoints. The Reactivity SRO observed the illumination of the VHT setpoint reset permissive lights (one light per RPS channel), and incorrectly assumed they were illuminating due to minor power fluctuations associated with the fission product poison increase and on-going dilution. Consequently, he increased the margin to the trip setpoint by resetting the VHT setpoints upward four times during the power rise. If the SRO had not reset the VHT, the RPS would have automatically initiated a high power reactor trip due to the magnitude of the power increase from 88 percent to 96 percent. In addition to preventing the automatic trip, the Reactivity SRO did not understand or question why reactor power was increasing, and did not inform anyone on the crew of his actions to reset the VHT setpoints. The inspection team reviewed existing

station procedures, and determined that there was no procedural prohibition for resetting the VHT setpoint under any conditions.

b. During the turbine steam flow increase power transient event (which introduced positive reactivity to the reactor), the crew also added positive reactivity by 1) an on-going RCS dilution, 2) opening a turbine bypass valve, and 3) withdrawing control rods. The inspection team identified that station reactivity management procedures did not provide adequate guidance regarding multiple, concurrent, positive reactivity additions during power operations.

Analysis: The performance deficiency was the failure of Millstone personnel to carry out their assigned roles and responsibilities and poor reactivity management during main turbine control valve testing, which contributed to the unanticipated reactor power increase. Specifically, the Millstone Unit 2 operations crew failed to implement written procedures that delineated appropriate authorities and responsibilities for safe operation and shutdown and a procedure for controlling reactor reactivity. In addition, the licensee failed to establish written procedures for the RPS VHT setpoint reset and for power operation and transients involving multiple reactivity additions. Multiple factors contributed to this deficiency; however, the primary cause was ineffective reinforcement of Dominion standards and expectations. Traditional enforcement does not apply since there were no actual safety consequences, impacts on the NRC's ability to perform its regulatory function, or willful aspects to the finding.

The finding is more than minor because the finding was associated with the Human Performance attribute of the Initiating Events cornerstone and affected the cornerstone objective of limiting the likelihood of those events that upset plant stability and challenge critical safety functions during power operations. Additionally, the PD could be viewed as a precursor to a significant event. Because the finding primarily involved human performance errors, probabilistic risk assessment tools were not well suited for evaluating its significance. The team determined that the criteria for using IMC 0609, Appendix M, "Significance Determination Process Using Qualitative Criteria," were met, and the finding was evaluated using this guidance as described in Attachment 4 to this report. Based on the qualitative review of this finding, regional management concluded the finding was preliminarily of low to moderate safety significance (preliminary White). The completed Appendix M table is attached (Attachment 4). There were no immediate safety concerns following the transient because the event itself did not result in power exceeding license limits or fuel damage. Additionally, interim corrective actions were taken, which included removing the Millstone Unit 2 control room crew involved in the transient from operational duties pending remediation, and establishment of continuous management presence in the Millstone Unit 2 control room while long term corrective actions were developed.

This finding had a cross-cutting aspect in the Human Performance cross-cutting area, Decision Making component, because Dominion licensed personnel did not demonstrate adequate operational decision-making, especially when faced with uncertain or unexpected plant conditions. This includes formally defining the authority and roles for decisions affecting nuclear safety, communicating these roles to applicable personnel, and implementing these roles and authorities as designed [H.1(a)].

Enforcement: The team identified two apparent violations of Technical Specification 6.8, "Procedures," which states, in part, that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide (RG) 1.33, February, 1978. Regulatory Guide 1.33, Appendix "A," Paragraph 1, "Administrative Procedures," requires written procedures for authorities and responsibilities for safe operation and shutdown as well as general plant operating procedures appropriate for power operation and transients. Regulatory Guide 1.33, Appendix A, Paragraph 3, "Procedures for Startup, Operation, and Shutdown of Safety-Related PWR Systems," requires, in part, written procedures for changing modes of operation, as appropriate, for the reactor control and protection system. Regulatory Guide 1.33, Appendix A, Paragraph 5, "Procedures Abnormal, Off-normal, or Alarm Conditions," requires, in part, written procedures for other expected transients that may be applicable.

The first apparent violation involved the failure of the Millstone Unit 2 control room crew to implement written procedures that delineated appropriate authorities and responsibilities for safe operation and shutdown and a procedure for controlling reactor reactivity. As noted in the Description section above, on February 12, 2011, the seven operators in the control room (4 SROs, 2 ROs and 1 non-licensed operator) inadequately implemented Dominion procedures for authorities and responsibilities for safe operation and shutdown during the performance of main turbine control valve testing. The inappropriate actions of the operators directly contributed to an unanticipated 8 percent increase in Millstone Unit 2 reactor power.

The second apparent violation involved the licensee's failure to establish written procedures for the RPS VHT setpoint reset and for power operation and transients involving multiple reactivity additions. As noted in the Description section above, on February 12, 2011, Dominion did not have written procedures regarding operation of the Millstone Unit 2 VHT setpoint reset pushbuttons (a part of the reactor protection system) during steady-state or plant transient conditions. As a result, during the unanticipated plant transient on February 12, 2011, a Millstone Unit 2 SRO reset the VHT setpoint a total of four times without adequate guidance from a plant procedure, thereby prohibiting the automatic trip that would have occurred, had the VHT setpoint not been reset. Additionally, Dominion did not have an adequate written procedure related to reactivity control regarding multiple concurrent positive reactivity additions during at-power operations. Specifically, during the unanticipated reactor transient event, three separate positive reactivity additions occurred (RCS dilution, manual opening of a turbine bypass valve, and manual withdrawal of control rods), and the existing procedures did not provide guidance to address this situation.

Following review of the event, the licensee documented the condition in the corrective action process (CR 413602). Immediate corrective actions included removal of the Millstone Unit 2 control room crew involved in the transient from operational duties pending remediation, issuance of a Standing Order regarding VHT setpoint reset, and establishment of continuous management presence in the Millstone Unit 2 control room while long term corrective actions were developed.

Pending determination of final safety significance, this finding with the associated apparent violations will be tracked as **AV 05000336/2011008-01, Multiple Examples of Procedural Violations and Inadequate Procedures Relating to Control Room Crew Performance During a Plant Transient**.

2.2 Turbine Operation

a. Inspection Scope

The team interviewed the control room personnel that were directly involved with the turbine load increase during the February 12, 2011, unanticipated reactor transient event. The team also reviewed narrative logs, sequence of events and alarm printouts, condition reports, PPC trend data, procedures implemented by the crew, and procedures regarding roles and responsibilities of operations personnel.

b. Findings/Observations

Improper Operation of Turbine Control Valves During Testing

Introduction: The inspectors identified a self-revealing finding of very low safety significance (Green) for improper operation of the Millstone Unit 2 turbine controls during turbine control valve testing. Specifically, the inspectors identified that Millstone Unit 2 control room operators failed to correctly implement surveillance procedure SP-2651N, "Main Control Valve Testing." Incorrect operation of the turbine controls contributed to an unplanned reactor power increase from 88 percent to 96 percent.

Description: On February 12, 2011, the Millstone Unit 2 control room operators incorrectly performed step 4.1.13.c of SP-2651N while conducting main turbine control valve testing. This step required the operator to use the turbine load selector pushbutton to maintain turbine first stage pressure within ±10 psig of the initial pressure for the current power level, 88 percent. However, in response to an increasing trend in first stage pressure, the control operators improperly selected "INCREASE" on the turbine load set selector pushbutton instead of "DECREASE". This action caused the turbine control valve to further open and compounded the increasing trend in turbine first stage pressure. The control operators pushed the "INCREASE" pushbutton a total of four times before the operators recognized that they should have, instead, pressed the "DECREASE" pushbutton. The operators subsequently took action to stop the power increase and stabilize the plant by depressing the "DECREASE" push button twice. The unexpected turbine load increase resulted in a plant transient, raising reactor power from 88 percent to 96 percent before power was stabilized.

The STA conducted peer checking for the control operator during the control valve testing evolution and the US closely supervised the operation of the turbine controls. Both individuals failed to identify or correct the mis-operation of the turbine load selector. All three operators then failed to communicate the extent of the plant transient to the SM which contributed to additional human performance errors, thereby exacerbating the plant transient.

Analysis: The team determined that the control room operator's failure to correctly implement step 4.1.13.c of SP-2651N was a performance deficiency. The cause of this performance deficiency was reasonably within Dominion's ability to foresee and correct to ensure proper operator response during turbine control valve testing. Traditional enforcement does not apply since there were no actual safety consequences, impacts on the NRC's ability to perform its regulatory function, or willful aspects to the finding. The finding is more than minor because it was similar to NRC Inspection Manual Chapter 0612, Appendix E, "Examples of Minor Issues," Example 4b, in that the incorrect operation of the turbine load selector pushbutton caused a plant transient.

The finding was associated with the Human Performance attribute of the Initiating Events cornerstone and affected the cornerstone objective of limiting the likelihood of those events that upset plant stability and challenge critical safety functions during power operations. Specifically, the mis-operation of the turbine load selector upset plant stability by causing a plant transient that raised reactor power from 88 percent to 96 percent. The inspectors conducted a Phase 1 screening in accordance with NRC IMC Attachment 0609.04, "Phase 1 – Initial Screening and Characterization of Findings," and determined that the finding was of very low safety significance (Green) because it did not contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment or functions would not be available.

The inspectors determined that this finding had a cross-cutting aspect in the Human Performance cross-cutting area, Resources component, because Dominion did not provide adequate training of personnel and sufficient qualified personnel [H.2(b)]. The just-in-time training (JITT) for turbine control valve testing had not adequately prepared the control room operators to respond to a change in turbine first stage pressure. In addition, the use of the STA for peer checking, although not prohibited by plant administrative procedures, had been previously identified during recent (May 2010) licensed operator requalification training in plant-specific operating experience as being a contributing cause for a plant transient during control valve testing on Unit 3 in 2007. Nevertheless, the shift allowed the STA, who was not licensed, to be the peer checker for this evolution in place of a qualified licensed reactor operator.

Enforcement: This finding does not involve enforcement action because no regulatory requirement violation was identified. Dominion entered this issue into their corrective action program (CR415094) and conducted an RCE to determine corrective actions to prevent recurrence. Because this finding does not involve a violation of regulatory requirements and has very low safety significance, it is identified as **FIN 05000336/2011008-02, Improper Operation of Turbine Control Valves During Testing**.

3. Organizational Response

3.1 Immediate Response

a. Inspection Scope

The team interviewed personnel, reviewed various procedures and records, and observed control room operations to assess immediate response of station personnel to the unanticipated reactor power transient event.

b. Findings

No findings of significance were identified.

The team noted that Dominion's initial response to the event was not appropriately thorough and timely, did not highlight the significance of the unplanned power increase and reactivity control issues, and was narrowly focused. Following post-event plant stabilization, a crew brief was conducted to assure good common understanding of transient and to determine whether testing should proceed. However, the crew did not identify the many human performance issues during the event, including control rod withdrawal, VHT reset, steam dump operation, multiple communication errors, and incorrect transient diagnoses.

Initially, Dominion personnel incorrectly concluded that Unit 2 reactor power increased by four percent (rather than the actual eight percent) during the transient. This extent of power increase was challenged during immediate post-event discussions between Dominion managers, but the Dominion management team did not correctly identify the extent of the power rise until the following day. Based on an incomplete and inaccurate initial assessment of the event, Crew D was allowed to complete the test, return power to 100% and stand an additional shift in the control room the following day before Dominion management removed them from operating duties. Although all of Crew D was off-shift the following week (per normal shift rotation), two of the individuals involved in the human performance errors were not formally disqualified from watchstanding until several days after the event, after NRC questioned Dominion's basis for not disqualifying those individuals. As of two weeks after the event, Dominion had only generated two condition reports related to the event and these two condition reports did not address all identified deficiencies related to the event. See the detailed sequence of events (Attachment 3).

Millstone Operations department management issued a new standing order related to VHT setpoint reset. However, a number of weeks elapsed before operating procedures were revised to provide updated approved plant procedures for the VHT setpoint operation.

3.2 Post-Event Root Cause Evaluation and Actions

a. Inspection Scope

The team reviewed Millstone's RCE Report for the unanticipated reactor power transient event to determine whether the causes of the event and associated human performance issues were properly identified. Additionally, the team assessed whether interim and planned long term corrective actions were appropriate to address the cause(s).

b. Findings

No findings of significance were identified.

The RCE was thorough and appeared to identify all underlying causal factors. The associated proposed corrective actions appeared to adequately address the underlying causal factors. Dominion identified the root cause as an ineffective crew performance management program. The identified contributing causes and issues included:

- Improper implementation of standards and fundamental work practices by the crew;
- Operator knowledge weakness related to understanding main turbine operation;
- Inadequate guidance for VHT setpoint reset;
- Inadequate pre-job briefs;
- Inadequate just-in-time training;
- Weaknesses in test procedure guidance for controlling first stage pressure; and
- Lack of guidance on control of multiple concurrent reactivity additions.

4OA6 Meetings, Including Exit

Exit Meeting Summary

On April 14, 2011, the team discussed the inspection results with Mr. A. J. Jordan, Site Vice President, and members of his staff. The team confirmed that proprietary information reviewed during the inspection period was returned to Dominion.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Dominion Personnel

L. Armstrong	Manager, Training
D. Bajumpaa	Nuclear Safety Analyst
B. Bartron	Supervisor, Licensing
C. Chapin	Assistant Operations Manager
W. Chesnut	Supervisor Nuclear Shift Operations Unit 2
S. Claffey	Reactor Engineer
T. Cleary	Licensing Engineer
G. Closius	Licensing Engineer
K. Grover	Manager, Operations
J. Hampton	Simulator Tester
A. Jordan	Site Vice President
R. MacManus	Director, Nuclear Station Safety & Licensing
G. Marshall	Manager, Outage and Planning
H. McKenney	Supervisor Shift Operations Support
J. Riley	Lead Instructor – Unit 2 Operator Requalification Training
R. Riley	Supervisor of Nuclear Shift Operations Unit 3
J. Semancik	Plant Manager
C. Tan	Simulation Engineer
C. Zorn	Turbine System Engineer

Others

D. Galloway	Program Supervisor, Connecticut Department of Environmental Protection, Bureau of Air Management, Radiation Division

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000336/2011008-01	AV	Multiple Examples of Procedural Violations and Inadequate Procedures Relating to Control Room Crew Performance During a Plant Transient (Section 2.1)
05000336/2011008-02	FIN	Improper Operation of Turbine Control Valves During Testing (Section 2.2)

LIST OF DOCUMENTS REVIEWED

Condition Reports (CR)

CR413602	CR415089	CR415096
CR415944	CR415091	CR415097
CR415087	CR415094	CR415104

SUPPLEMENTAL INFORMATION

Standing Order
SO-11-04 (Relating to VHT setpoint reset)

Procedures
MP-PROC-OPS-SP 2651N, "Main Control Valve Operability Test," Rev 004-03
MP-PROC-OPS-OP 2204, "Load Changes," Rev 023-06
MP-PROC-000-AD-AA-102, "Procedure Use and Adherence," Rev 4
MP-PROC-OPS-OP 2304C, "Make Up (Boration and Dilution) Portion of CVCS," Rev 023-03
MP-PROC-000-OP-AA-100, "Conduct of Operations," Rev 11
MP-PROC-000-OP-AP-300, "Reactivity Management," Rev 11
MP-PROC-000-OP-AA-106, "Infrequently Conducted or Complex Evolutions," Rev 5
MP-GARDMP-000-OP-AA-1800, "Operator Fundamentals," Rev 2

Miscellaneous
Control Room Operations Narrative Logs
Unit 2 Sequence of Events Recorder Printout for February 12, 2011
Unit 2 Alarm History Printout for February 12, 2011

Root Cause Evaluation
Root Cause Evaluation RCE 001044, "Unplanned 8% Reactor Power Excursion"

LIST OF ACRONYMS

ADAMS	Agency-wide Documents Access and Management System
AV	Apparent Violation
BOP RO	Balance of Plant Reactor Operator
CFR	Code of Federal Regulations
CR	Condition Report
CV	Control Valve
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
HEP	Human Error Probability
IMC	Inspection Manual Chapter
JITT	Just in Time Training
MT	Main Turbine
MW	Megawatt
NRC	Nuclear Regulatory Commission
OATC RO	Operator at the Controls Reactor Operator
OMOC	Operations Manager on Call
PARS	Publicly Available Records
PD	Performance Deficiency
PPC	Plant Process Computer
PRA	Probabilistic Risk Assessment
psig	pounds per square inch gauge
RCE	Root Cause Evaluation
RCS	Reactor Coolant System
RE	Reactor Engineer

SUPPLEMENTAL INFORMATION

RG	Regulatory Guide
RO	Reactor Operator
RPS	Reactor Protection System
SDP	Significance Determination Process
SM	Shift Manager
SRO	Senior Reactor Operator
SIT	Special Inspection Team
STA	Shift Technical Advisor
TS	Technical Specification
US	Unit Supervisor
VCT	Volume Control Tank
VHT	Variable High Power Trip

SPECIAL INSPECTION TEAM CHARTER

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

SPECIAL INSPECTION TEAM CHARTER

February 18, 2011

MEMORANDUM TO: Samuel L. Hansell Jr., Manager
Special Inspection Team

Peter A. Presby, Leader
Special Inspection Team

FROM: Peter R. Wilson, Acting Director **/RA/**
Division of Reactor Safety

Darrell J. Roberts, Director **/RA/**
Division of Reactor Projects

SUBJECT: SPECIAL INSPECTION TEAM CHARTER - MILLSTONE POWER STATION UNIT 2 OPERATOR PERFORMANCE DURING MAIN TURBINE CONTROL VALVE TESTING ON FEBRUARY 12, 2011

In accordance with Inspection Manual Chapter (IMC) 0309, "Reactive Inspection Decision Basis for Reactors," a Special Inspection Team (SIT) is being chartered to evaluate operator performance and organizational decision-making during a Millstone Power Station Unit 2 main turbine control valve test on February 12, 2011. The decision to conduct this special inspection was based on meeting the deterministic criteria (involved questions or concerns pertaining to licensee operational performance) specified in Enclosure 1 of IMC 0309, and in accordance with Section 04.04, "Additional Factors That May Warrant an IIT, AIT, or SIT." The risk associated with this event was not amenable to probabilistic risk analysis. The absence of a calculable increase in conditional core damage probability (CCDP) is based upon the inability to reasonably and accurately approximate the human performance reliability attributes associated with the operator performance that precipitated the unanticipated reactor power level changes. IMC 0309, Section 04.04 states that, "factors such as openness, public interest, and public safety should be appropriately considered by NRC when deciding whether to dispatch an IIT, AIT, or SIT.".

SPECIAL INSPECTION TEAM CHARTER

The SIT will expand on the inspection activities started by the resident inspectors and augmented by a Division of Reactor Safety (DRS) inspector who was dispatched to the site soon after the event. The Team will review the causes of the event, and Dominion's organizational and operator response during the event. The Team will perform interviews, as necessary, to understand the scope of operator actions performed during the event. The Team will also assess whether the SIT should be upgraded to an Augmented Inspection Team in accordance with IMC 0309.

The inspection will be conducted in accordance with the guidance contained in NRC Inspection Procedure 93812, "Special Inspection," and the inspection report will be issued within 45 days following the final exit meeting for the inspection.

The special inspection will commence on February 22, 2011. The following personnel have been assigned to this effort:

Manager:	Samuel L. Hansell, Jr., Branch Chief Operations Branch, DRS, Region I
Team Leader:	Peter A. Presby, Senior Operations Engineer Operations Branch, DRS, Region I
Team Members:	Brian C. Haagensen, Millstone Power Station Resident Inspector Division of Reactor Projects (DRP), Region I
	Brian J. Fuller, Operations Engineer Operations Branch, DRS, Region I

Enclosure: Special Inspection Team Charter

SPECIAL INSPECTION TEAM CHARTER

Special Inspection Team Charter
Millstone Power Station
Unit 2 Operator Performance During Main Turbine Control Valve Testing on February 12, 2011

Background:

Based on preliminary information, the following is a description of the event. On Saturday, February 12, 2011, Millstone Power Station Unit 2 reduced power to 88 percent for main turbine control valve testing. In preparation for the test, Dominion procedure SP 2651N, "Main Control Valve Operability Test," provides written instructions for the operators to slowly rotate the turbine first stage pressure feedback potentiometer from the "OUT" to the "IN" position over a one minute period while maintaining turbine first stage pressure by using the "LOAD SELECTOR INCREASE and DECREASE" pushbuttons. As the Balance of Plant (BOP) Reactor Operator (RO) rotated the turbine first stage pressure potentiometer, turbine first stage pressure and reactor power increased. The BOP RO incorrectly went to increase instead of decrease on the load selector button. When he did not get the desired response, he pressed the increase button at least two more times. The Shift Technical Advisor, who was acting as both the peer checker and the Control Room Supervisor directing the evolution, did not apparently detect the incorrect manipulation and did not correct the BOP RO. The increased steam demand lowered reactor coolant average temperature (Tavg) and caused a power increase to 96 percent power over 90 seconds. While the transient was occurring, the Variable Over Power Trip (VOPT) reset lights were illuminated. The crew reset the VOPT several times during the event.

The Shift Manager recognized that a transient was occurring and directed the BOP RO to stop his actions. He directed the reactivity Senior Reactor Operator to withdraw control rods four steps to stabilize Tavg while temperature was decreasing, an action that compounded the power increase. After Tavg and reactor power were stabilized, the main turbine control valve test was completed and Unit 2 was returned to 100 percent power.

Currently, Millstone Unit 2 is in Mode 1 at normal operating pressure and temperature. There was no impact to Unit 3. Dominion is currently investigating the operators' response to this event. Additionally, Dominion has suspended the qualifications of the operations crew while the investigation continues. The NRC resident inspectors and a DRS senior operations engineer have provided follow-up to this event under the Reactor Oversight Process (ROP) baseline inspection program.

Basis for the Formation of the SIT:

The IMC 0309 review concluded that one of the deterministic criteria was met due to questions or concerns pertaining to licensee operational performance. This criterion was met based on human performance errors that occurred and led to the unanticipated reactor power excursion. The human performance errors included:

- Depressing the increase button on the load selector instead of decrease;
- Inadequate self and peer checking;
- The addition of positive reactivity (control rod withdrawal) while reactor power was already increasing, without understanding the nature of the transient;

SPECIAL INSPECTION TEAM CHARTER

- Manipulating control rods while in an oversight/supervisory role; and
- Resetting the VOPT setpoint during a transient, without understanding the nature of the transient.

In accordance with IMC 0309, the event was evaluated for risk significance because one deterministic criterion was met. However, the risk associated with this event was not amenable to probabilistic risk analysis. The absence of a calculable increase in conditional core damage probability (CCDP) is based upon the inability to reasonably and accurately approximate the human performance reliability attributes associated with the operator performance that precipitated the unanticipated reactor power level changes.

IMC 0309, Section 04.04 states that, "factors such as openness, public interest, and public safety should be appropriately considered by NRC when deciding whether to dispatch an IIT, AIT, or SIT." In light of the aforementioned human performance errors, and consistent with Section 4.04, Region I has decided to initiate an SIT.

Objectives of the Special Inspection:

The Team will review the causes of the event, and Dominion's organizational and operator response during the event. The Team will perform interviews, as necessary, to understand the scope of operator actions performed during the event.

To accomplish these objectives, the team will:

1. Develop a complete sequence of events including follow-up actions taken by Dominion, and the sequence of communications within Dominion and to the NRC subsequent to the event;

2. Review and assess crew operator performance and crew decision making, including their adherence to expected roles and responsibilities, including the command and control function associated with reactivity manipulations, the use of procedures, log keeping, and overall communications;

3. Evaluate the extent of condition with respect to the other crews;

4. Determine the appropriateness and safety significance of resetting the VOPT setpoint during this event;

5. Evaluate the effectiveness of supervisory oversight of Senior Reactor Operators (SROs) in light of the on-duty Shift Manager directing the Reactivity Oversight SRO to manipulate control rods while in the oversight role;

6. Review and assess the effectiveness of Dominion's response to this event and corrective actions taken to date. This includes overall organizational response, the root cause evaluation, and adequacy of immediate, interim and proposed long-term corrective actions;

SPECIAL INSPECTION TEAM CHARTER

7. Review the adequacy of operator requalification training as it relates to this event, including the integration of newly licensed operators into the operator requalification training program;

8. Assess the decision making and actions taken by the operators to determine if there are any implications related to the site's safety culture;

9. Evaluate_ Dominion's application of pertinent industry operating experience, including INPO SOER 1Q-2, "Engaged, Thinking Organizations," to assess the effectiveness of any actions taken in response to the operating experience; and

10. Document the inspection findings and conclusions in a Special Inspection Team final report within 45 days of inspection completion.

Guidance:

Inspection Procedure 93812, "Special Inspection", provides additional guidance to be used by the SIT. Team duties will be as described in Inspection Procedure 93812. The inspection should emphasize fact-finding in its review of the circumstances surrounding the event. Safety concerns identified that are not directly related to the event should be reported to the Region I office for appropriate action.

The team will conduct an entrance meeting and begin the inspection on February 22, 2011. While on-site, the Team Leader will provide daily briefings to Region I management, who will coordinate with the Office of Nuclear Reactor Regulation, to ensure that all other pertinent parties are kept informed. The Team will also coordinate with the Region / State Liaison Officer to implement the Memorandum of Understanding between the NRC and the State of Connecticut to offer observation of the inspection by representatives of the state. A report documenting the results of the inspection will be issued within 45 days following the final exit meeting for the inspection.

Before the end of the first day onsite, the Team Manager shall provide a recommendation to the Regional Administrator as to whether the SIT should continue or be upgraded to an Augmented Inspection Team response.

This Charter may be modified should the team develop significant new information that warrants review.

DETAILED SEQUENCE OF EVENTS

February 12, 2011 Power Transient Event

The team constructed the sequence of events from a review of Control Room narrative logs, plant process computer (PPC) data (alarm printout, sequence of event printout, plant parameter graphs) and plant personnel interviews.

MILLSTONE UNIT 2 EVENT TIMELINE		
Clock Time [date] (hr:mm:ss)	**Event Time**	**Description**
2/10/11		Operations Crew D attends four hour simulator just-in-time training session to prepare for scheduled quarterly main turbine (MT) valve testing. Partial evolution pre-job brief conducted.
2/12/11 06:00		Operations Crew D assumes the day shift watch. Unit 2 is in MODE 1, 100% reactor power.
07:50		Quarterly main turbine (MT) stop valve testing complete.
08:33		Pre-job briefing for the downpower, MT control valve (CV) testing, and up-power. Personnel in attendance for brief, and also throughout the downpower and control valve testing: ➢ A Shift Manager-qualified individual assigned by operations management to provide oversight for the reactivity evolutions ➢ The crews' Shift Manager (SM) ➢ Unit Supervisor (US) ➢ Reactivity SRO (normally the crew's work control supervisor) ➢ RO assigned as Operator at the Controls Reactor Operator (OATC RO) ➢ RO assigned as Balance of Plant Reactor Operator (BOP RO) ➢ Shift Technical Advisor (STA) ➢ Reactor Engineer (RE)
08:59		Commence downpower for MT valve testing per reactivity plan.
10:15		Stabilize plant at 88% power, following 173 gallons boration, control rod insertion from 180 steps to 158 steps and turbine load reduction using load limit.
10:35		102 gallon dilution to maintain steady Reactor Coolant System (RCS) temperature during build-in of fission product poisons.
10:44		100 gallon dilution.
10:53		150 gallon dilution.
11:02		150 gallon dilution.
11:06		OATC RO begins 600 gallon dilution.

DETAILED SEQUENCE OF EVENTS

MILLSTONE UNIT 2 EVENT TIMELINE		
Clock Time [date] (hr:mm:ss)	**Event Time**	**Description**
11:19		BOP RO shifts turbine load control from Load Limit to Load Set.
11:20		OATC RO adjusts turbine bypass valve setpoint to open 'A' turbine bypass valve to 10% open. BOP RO adjusts main turbine load to maintain RCS temperature. US, BOP RO and STA discuss and jointly agree on a planned action, to depress the Load Set INCREASE button, if 1st stage pressure increases while placing 1st stage pressure feedback in service.
11:24:42		Start letdown diversion to waste to lower VCT level 89% to 79%.
11:26:15		BOP RO, with peer checks from STA and direct observation by US, begins to place 1st stage feedback in service and depresses INCREASE pushbutton multiple times in response to rising 1st stage pressure.
11:26:32	0	Control valves begin opening. Beginning of transient. Conditions: RCS Tcold 542.8°F, MT CV position 38.1% open. MT first stage pressure 476 psig.
11:26:44	12 sec	RCS Tcold is decreasing.
11:27:34	1 min, 2 sec	'A' turbine bypass valve fully closes.
11:27:56	1 min, 24 sec	Reactivity SRO resets Channel A Variable High Power Trip (VHT).
~ 11:28:00	1 min, 28 sec	SM directs OATC RO to lower turbine bypass valve setting to re-open 'A' turbine bypass valve. Tcold approximately 541.5°F.
11:28:02	1 min, 30 sec	600 gallon dilution is complete.
11:28:18	1 min, 46 sec	OATC RO adjusts 'A' turbine bypass valve setpoint. Valve opens to 2% open position for approximately 6 seconds and then recloses automatically.
11:28:40	2 min, 8 sec	Reactivity SRO resets Channel A VHT (2nd time during transient).
~ 11:28:40	2 min, 8 sec	SM directs US to return to position of oversight, away from the turbine control panel.
11:28:40	2 min, 8 sec	Turbine 1st stage pressure is about 524 psig, up from 476 psig prior to transient. US recalled later that at this point the Load Set INCREASE pushbutton had been depressed 4 times and the Load Set DECREASE pushbutton had been depressed 2 times.
11:28:44	2 min, 12 sec	Reactivity SRO withdraws Group 7 Control Element Assemblies (control rods) 4 steps per SM direction. Tcold approximately 538.7°F. Neither SM nor Reactivity SRO are aware of turbine load increase and temperature transient in progress.
11:29:14	2 min, 42 sec	Turbine load stabilizes at new setpoint on Load Set. Control valves reach maximum open during transient at 70.5% open position.
11:29:18	2 min, 46 sec	Reactivity SRO resets Channel A VHT (3rd time during transient).

DETAILED SEQUENCE OF EVENTS

MILLSTONE UNIT 2 EVENT TIMELINE		
Clock Time [date] (hr:mm:ss)	**Event Time**	**Description**
11:29:28	2 min, 56 sec	Tcold reaches minimum during transient at 537.5°F. Minimum pressurizer pressure is 2238 psia.
11:29:32	3 min, 0 sec	Reactivity SRO resets Channel A VHT (4th time during transient). Reactor power stabilized at ~96%.
11:30:56		Stop letdown diversion to waste.
11:31:56		BOP RO shifts turbine load control from Load Set to Load Limit.
11:32:18		Reactivity SRO resets Channel A VHT.
11:35:52		Reactivity SRO resets Channel A VHT.
~11:37		Turbine load gradually reduced by the operator to restore RCS Tcold to program value.
~11:50		Turbine load stabilized at pre-event level.
~12:00	34 min	SM calls his immediate supervisor (Senior Unit 2 Licensed Individual). The SM characterizes the event as a 4% increase in reactor power. After discussion, both agree, okay to complete MT CV testing.
12:18		Turbine load control transferred to Load Set.
~12:30		SM calls immediate supervisor again. During this call, discussion reveals SM mistakenly believed the SM-qualified individual assigned by operations management to provide oversight for the reactivity evolutions, who was in the control room, was fulfilling the roll of Operations Manager on Call (OMOC). The immediate supervisor directed the SM to inform the actual OMOC of the event.
12:33		Recommenced main turbine control valve stroking satisfactorily.
~12:40	1 hr, 14 min	SM briefs OMOC on the event (estimated time from SM recollection).
12:55	1 hr, 29 min	OMOC informs Assistant Operations Manager.
12:56		Completed main turbine control valve stroking.
~13:04	1 hr, 38 min	Assistant Operations Manager calls Operations Manager.
13:06		BOP RO returns turbine load control to Load Limit.
~13:25	2 hrs	Management conference call between Plant Manager, Operations Manager, Assistant Operations Manager, SM, Operations Management oversight person on shift. Discussed event as understood at the time (single human performance error associated with turbine load increase button causing a 4% power increase). Decided to have SM meet with mgmt team following morning to fully debrief on the occurrence. Rearranged watch bill to accommodate SM debrief.

DETAILED SEQUENCE OF EVENTS

MILLSTONE UNIT 2 EVENT TIMELINE		
Clock Time [date] (hr:mm:ss)	**Event Time**	**Description**
~15:15	3.8 hrs	Another operations management conference call (estimated time/ details from Assistant Operations Manager recollection) between Ops Manager, Assistant Ops Manager, OMOC, the other two senior Unit 2 ops mgmt licensed individuals and a SM not currently on shift. Decided to have the on-shift SM meet with mgmt team following morning (2/13/2011) to fully debrief on the occurrence. Rearranged the dayshift watch bill to accommodate SM debrief. A reactor engineer was assigned during the evening shift to review event data for use the following day in reconstruction of the occurrence.
15:38		Crew D commences power increase to return Unit 2 to full power.
17:05	5.5 hrs	The OMOC contacts one of the NRC Resident Inspectors and informs him of a human performance error during valve testing which resulted in approximately 4% power rise, with no reactor trip, no safety limits exceeded and that Dominion would be investigating further tomorrow.
17:45		Unit 2 returned to 100% reactor power.
~18:00		Crew D relieved by on-coming night shift crew.
23:05	11.5 hrs	Reactor engineering email to Operations management team, containing Unit 2 plant process computer data and summary identifying transient details of 8% power change magnitude (not 4% as originally characterized), inappropriate rod withdrawal, and variable high power trip setpoint resets.
2/13/11 ~06:00		Crew D assumes the dayshift watch from the night shift crew.
2/13/11 ~15:00	27.5 hrs	Ops Manager and Assistant Operations Manager update the NRC Senior Resident Inspector that event was more serious than originally realized, Station management considering pulling the crew off-shift and a senior operations management licensed individual observing remainder of dayshift operations until Crew D is relieved at 18:00.
2/13/11 ~18:00		Crew D relieved by on-coming night shift crew.
2/14/11 ~10:00	46.5 hrs	Operations Manager informs NRC resident staff that Crew D qualifications have been suspended. Crew will meet with management to analyze the event to evaluate the exhibited performance issues.

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Qualitative Decision-Making Attributes for NRC Management Review

1. The SDP is the preferred path for determining the significance of findings in the Reactor Oversight Process.
2. IMC 0609 Appendix M is provided for use when the existing SDP guidance is not adequate to provide a reasonable estimate of the significance.
3. IMC 0609 Appendix M could be used for this case. Appendix M utilizes a qualitative significance determination process focused on the below table where 6 of 8 attributes have some level of applicability.

Decision Attribute	**Applicable to Decision?**	**Basis for Input to Decision – Provide qualitative and/or quantitative information for management review and decision making.**
Finding can be bounded using qualitative and/or quantitative information?	No	The at-power safety significance determination process, IMC 0609 Appendix A, quantitative analysis methodology is not adequate to provide reasonable estimates of the finding's significance. That SDP does not model errors of commission and does not provide a method of accurately estimating changes to the human error probabilities caused by errors of omission. As a result, no quantitative risk evaluation can be performed for this finding. Human errors have the potential to increase the human error probability (HEP) for credited operator actions. The probabilistic risk assessment models are highly sensitive to small variations in HEP changes. The existing PRA research does not currently support a method for varying the performance shaping factors in response to defined error forcing contexts. It is not possible to calculate a valid single point risk estimate. Human performance is a very large contributor to PRA uncertainty.
Defense-in-Depth affected?	Yes	The term "defense in depth" is commonly associated with the maintenance of the integrity and independence of the three fission product barriers. The fission product barriers were not actually compromised by the actions of the crew during this event. While the Reactivity SRO reset the VHT and prevented a reactor trip from occurring, a reactor trip was not actually required to protect the core during this event. The fuel barrier was not actually jeopardized by the crew's actions. On the other hand, the crew plays a vital role in the

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Decision Attribute	Applicable to Decision?	Basis for Input to Decision – Provide qualitative and/or quantitative information for management review and decision making.
		maintenance of defense in depth from the perspective that they operate station controls. Human errors have the potential to compromise the three fission product barriers. The commission of multiple unforeseen human errors in a short period of time during the turbine valve testing was clearly related to a loss of situational awareness and a failure to maintain the roles and responsibilities assigned under the Dominion administrative procedures.
Performance Deficiency effect on the Safety Margin maintained?	Yes	Plant safety analyses credit the variable high-power trip setpoint for some events when determining bounding cases. The Final Safety Analysis Report Chapter 14 safety analysis considers a similar event (a 10% power increase from a turbine control valve failing full open at 100% power) that actually bounds this event where the core is protected from fuel damage. Operator response to this event reduced the margin to the reactor trip setpoint. Operators unintentionally raised turbine load and then, in response, intentionally opened a turbine bypass valve, raised the VHT setpoints and withdrew control rods. However, the flux distribution remained bounded by the safety analysis and RPS actuation was not actually needed to prevent exceeding the departure from nucleate boiling or fuel centerline temperature design limits. Operator action, post-event interviews and lack of procedural guidance for VHT reset all indicate likelihood that other Unit 2 operators may have similarly reset VHT when a reset permissive light illuminates during power transient events where the underlying cause is not immediately apparent. Under different circumstances, there is potential for exceeding acceptable fuel design limits if the VHT were reset during an event with a higher magnitude steam flow increase and core peaking factors closer to operating limits. However, the potential for the event to progress to a core damage state due to operators incorrectly and continually resetting the VHT is unlikely because redundant reactor trips (thermal margin/low pressure

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		and local power density trips) would limit the power increase.
The extent the performance deficiency affects other equipment.	Yes	The failure of the Unit 2 crews to remain within their assigned roles and responsibilities has the potential to affect the operation of equipment that requires operator manual action to function. Other Unit 2 crews displayed a degree of degraded performance in the area of conduct of operations based on post-event assessment. Dominion documented a number of post-event issues related to human performance by the other Unit 2 operating crews. These issues were observed by licensee management personnel during the three week period immediately following the power transient event and demonstrate the pervasiveness of the performance lapses of the Unit 2 control room operators. Improper procedure use and improper peer checking were readily identified behaviors on multiple Unit 2 crews. Ineffective just-in-time training and procedure inadequacies were also factors that degraded all the crews' ability to operate the plant.
Degree of degradation of failed or unavailable component(s).	N/A	
Period of time (exposure time) affect on the performance deficiency.	Yes	With respect to this specific event, Reactor Coolant System cold leg temperature began lowering at 11:26:44 on 2/12/2011. The first VHT setpoint reset occurred at 11:27:56. Reactor power stabilized at 96% at 11:29:32. The entire event lasted approximately 3 minutes. With respect to the latent issues underlying this performance deficiency, the exposure time is indeterminate, but clearly developed over an extended period. The procedural and training performance weaknesses specified above existed for many years. The Dominion root cause evaluation team determined that the causal factors for the event had existed for a

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Decision Attribute	Applicable to Decision?	Basis for Input to Decision – Provide qualitative and/or quantitative information for management review and decision making.
		considerable period of time. However, they did not quantify the exposure time.
The likelihood that the licensee's recovery actions would successfully mitigate the performance deficiency.	Yes	The licensee's root cause analysis was thorough and appeared to identify all underlying causal factors. The associated proposed corrective actions appear to adequately address the underlying causal factors. During the recent April 2011 Unit 2 refueling outage, there were no significant configuration control issues, and no NRC or self-revealing findings or violations. Resident inspectors have observed improved procedure adherence and an improvement in human performance since the Special Inspection in February 2011.
Additional qualitative circumstances associated with the finding that regional management should consider in the evaluation process.	Yes	During this event, <u>all</u> control room operators on the crew failed to either recognize or respond properly to the unintended power transient. <u>None</u> of the operators initially identified the breakdowns in command and control or the deviations from defined roles and responsibilities as worthy of note in the immediate post-event brief or in discussions regarding whether it was appropriate to continue with the turbine testing (other than to identify that the event was initiated by the turbine operator's action to press the increase, rather than the decrease pushbutton). Dominion was initially slow to recognize the scope and the significance of the event. Despite involvement of multiple layers of licensee management personnel during and immediately following the event, numerous performance problems during the event were not fully recognized until the next day after the event. The inadvertent power rise was initially assessed as 4%, vice the actual 8% because the operators used neutron flux instead of Q-power as the indicator of power increase. Actions taken to withdraw reactor control rods, reset VHT setpoints, and open the turbine bypass valve were not identified as inappropriate until a reactor engineering review of plant computer data many hours after the event. NRC inspector challenges of licensee management decisions relating to the event preceded

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Decision Attribute	Applicable to Decision?	Basis for Input to Decision – Provide qualitative and/or quantitative information for management review and decision making.
		Dominion's disqualification of some of the operating crew members. NRC questions led to recognition by licensee that multiple concurrent positive reactivity additions were not adequately addressed by station procedures. NRC challenged the licensee's limited initial use of the condition reporting and procedure change process in response to this event. Following the event, licensee operations management issued a Standing Order to address when acceptable to reset the VHT setpoints. However, Dominion delayed making any related changes to permanent plant procedures. Dominion provided training on recent significant industry reactivity control events. This training was conducted in the training cycle immediately preceding the February 2011 power transient event and was administered to all Millstone station supervisors, including the supervision of Operations Crew D. The human performance errors exhibited during the event indicate this training was not effective.