SUMMARY OF INSPECTION FINDINGS

As part of its assessment of the pilot program results, the staff reviewed each of the inspection findings to determine any common themes among the findings that might warrant additional focus in the inspection program. Each inspection finding was designated as being identified during either the mechanical, electrical, operations-mechanical, or operations-electrical portions of the inspection procedure. Each finding was also coded to indicate whether the finding was associated with the original plant design, a design modification, a lack of an appropriate analysis, inadequate corrective action, design control errors, inadequate operating procedures, or other concerns.

The results of the staff's analysis indicate a fairly balanced number of findings between the electrical and mechanical areas. Of significance is the number of findings that were identified as being associated with the operations-mechanical and operations-electrical interfaces, an area that was focused on during the pilot inspections, but an area that previously had not received significant inspection focus. The staff plans to continue this focus in future inspections. Also noteworthy is the large number of findings associated with inadequate corrective action. This is consistent with other recently performed NRC evaluations of engineering issues.

Vermont Yankee

Green. The team identified a non-cited violation of 10 CFR Part 50.63, "Loss of All Alternating Current Power," because the licensee had not completed a coping analysis for the period of time the alternate alternating current (AC) source (the Vernon Hydro-Electric Station) would be unavailable and had not demonstrated by test the time required to make the alternate source available for a station blackout event involving a grid collapse. (Electrical, b, d)

Green. The team identified a non-cited violation of Technical Specification 6.4.C, "Procedures," because the licensee failed to establish adequate procedures for determining the operability of the 115 kilovolt (kV) Keene line, which is designated as an alternate immediate access power source if the 345/115 kV auto transformer is lost. (Operations-Electrical, f)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," because the licensee used incorrect and non-conservative voltage values in calculations performed to assure that electrical equipment would remain operable under degraded voltage conditions. (Electrical, e)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," because the licensee did not implement measures to ensure that the design basis for the cooling water supply to the lube oil cooler of the reactor core isolation cooling (RCIC) system was correctly translated into the specifications, drawings, procedures, or

instructions. Specifically, the installed pressure control valve in the lube oil cooler water supply line was not independent of air systems, and the installed piping between the pressure control valve and lube oil cooler did not contain a restricting orifice. A contributing cause of this finding is related to the cross cutting area of Problem Identification and Resolution. The licensee had previously reviewed the failure positions of air-operated equipment and issued a report,

"Compressed Air Systems," dated July 16, 1989. During this review, the licensee did not identify that the pressure control valve was not independent of the instrument air system. (Mechanical, a, d)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," because the licensee failed to correct a longstanding non-conformance in the operation of pressure control valve PCV-13-23. The team determined through interviews with Vermont Yankee staff that during initial start-up testing, problems were identified with the automatic operation of this valve which affected its ability to properly supply cooling flow to the RCIC lube oil cooler. (Operations-Mechanical, d, f)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," because the licensee had neither established the correct condensate storage tank (CST) temperature limit for use in the plant transient analyses nor translated the CST temperature limit into plant procedures. A contributing cause of this finding is also related to the cross-cutting area of Problem Identification and Resolution. The licensee identified this issue in December 2002, but concluded that the non-conservative CST temperature had little to no effect on the transient analyses. (Mechanical, e)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," because between June 2001 to September 2004, the licensee did not adequately coordinate between the operations department and the engineering organization regarding procedure revisions that increased the length of time required to place the reactor core isolation cooling system in service from the alternate shutdown panels. (Operations-Mechanical, b, f)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," because the licensee had conducted motor-operated valve (MOV) diagnostic tests using procedures that did not include acceptance limits, which were correlated to and based on applicable (stem thrust and torque) design documents. Additionally, MOV diagnostic testing had been conducted solely from the motor control centers using test instrumentation that had not been validated to ensure its adequacy. (Mechanical, electrical, g)

V.C. Summer

Green. The team identified a violation of 10 CFR Part 50, Appendix B, Criterion III, Design Control and 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action. The violation involves a potential design vulnerability for the emergency feedwater (EFW) flow control valves to become plugged by tubercles and other debris from service water, which could result in a common mode failure of the EFW system. Historical licensee corrective actions have not adequately resolved this issue. (Mechanical, a,d)

Green. The team identified a non-cited violation (NCV) of TS 6.8.1.c, Procedures and Programs, for failure to include the proper testing methodology in procedures to meet Technical Specification Surveillance Requirement 4.8.1.1.2.g.6.c, which required testing to demonstrate that all emergency diesel generator trips other than overspeed, generator differential, and low lube oil pressure were automatically bypassed upon loss of voltage on the associated emergency bus concurrent with a safety injection signal. Procedures did not provide for adequate testing of the bypass function. This resulted in the failure to test the bypass function since November 1996, when a similar test deficiency was discovered by the licensee and addressed by a temporary procedure change. The licensee performed testing, subsequent to the inspection, which demonstrated this feature operated properly and entered it into the corrective action program. (Electrical, g)

Green. The team identified a non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action. The licensee failed to take timely action to correct the inability of plant operators to terminate safety injection after an inadvertent emergency core cooling system (ECCS) actuation at power within the time assumed in the plant design and licensing basis. This issue was initially identified in 1993 and had not been corrected as of the date of this inspection. (Operations-Mechanical, d, f)

Diablo Canyon

Green. A noncited violation was identified for inadequate corrective action to address an on-going problem with emergency core cooling system gas voiding in the common suction crossover line. The licensee had a sustained history of gas voiding in emergency core cooling system piping, which had the potential to lead to failure of the centrifugal charging pumps or safety injection pumps during the switchover from cold-leg recirculation to hot-leg recirculation during a loss-of-coolant accident. The team concluded that the corrective actions taken by the licensee focused on managing the symptom of the problem rather than finding and eliminating the cause of the voiding. (Mechanical, d)

Green. A finding was identified associated with the minimum flow settings for the auxiliary feedwater pumps. NRC Bulletin 88-04 identified that many pump minimum flow values were too low because they did not account for flow instability concerns. The team identified that when the licensee addressed this operating experience item, they did not properly verify the minimum flow settings with the pump manufacturer in accordance with the bulletin. A new analysis performed during the inspection by the manufacturer concluded that the existing minimum flow settings did not allow continuous operation. The manufacturer recommended an increased monitoring and maintenance schedule for the existing minimum flow values in order to promptly detect degradation. (Mechanical, c)

Green. A noncited violation was identified for inadequately translating design requirements into calculations used to demonstrate the capabilities of the pressurizer power operated relief valve backup accumulators. The calculation was found to contain a number of non-conservative

errors and did not contain the most current acceptance criteria from accident analyses. As a result, this calculation failed to demonstrate that the backup nitrogen accumulators could operate the pressurizer power operated relief valves for the required number of cycles. Failure to properly demonstrate that the power operated relief valves could be cycled the number of times calculated to be necessary to respond to an inadvertent safety injection actuation was a violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." (Mechanical, b)

Green. A finding was identified for modifying the diesel fuel oil transfer system without properly assessing the resulting net affect on reliability from introducing a new failure potential associated with new active components. As a result, the licensee rejected a small design change, which would have eliminated the failure mode when it was recognized that failure of the new pressure control valves could fail the train. Because the failure potential was not fully assessed, the licensee decided not to implement a change that would have eliminated the impact of the failure, nor were the pressure control valves subject to any preventive maintenance to ensure their reliability. (Mechanical, b)

Green. A noncited violation was identified for failure to demonstrate that load sequencing would satisfy regulatory requirements. The team identified that a single postulated fault occurring during load sequencing with offsite power available could restart load sequencing timers in all three engineered safety features buses and result in a more limiting scenario than previously analyzed by the licensee. This could result in overlaping starting transients for motors that were intended to start separately, which was not evaluated in existing calculations. The combined effects of this could cause later starting times for safety-related loads, potentially affecting system performance assumed in accident analyses. Failure to demonstrate that the system could perform as required considering a single fault was a violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." (Electrical, c)

Green. A noncited violation was identified for not having a procedure to cross-tie fuel oil transfer trains in response to certain failures, contrary to the design and licensing basis of the system. The design and licensing basis of the diesel fuel oil transfer system credited the capability to cross-tie trains in order to meet requirements to maintain the system function and be able to withstand a worst-case single failure. The team identified that the licensee did not have a procedure or training to accomplish this task. Failure to incorporate design and licensing requirements into plant procedures was a violation of 10 CFR Part 50, Appendix B, Criterion III. (Operations-Mechanical, f)

Green. A noncited violation was identified for inadequate design control because the licensee did not properly account for vortex prevention in the calculation used to determine the usable volume in the diesel fuel oil storage tank, which could cause the pump to ingest air. The licensee was unable to locate a technical basis for this part of the calculation. The team independently calculated that 4.1 inches was necessary, compared to the 2.0 inches used in the calculation. The licensee performed a similar calculation and reached the same conclusion,

which reduced the tanks' unusable volumes by a little less than 1,000 gallons in this 50,000 gallon tank. Failure to properly account for the unusable fuel oil storage tank volume necessary to prevent vortexing was a violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." (Mechanical, a)

Green. A noncited violation was identified for inadequate design control, because Calculation STA-135, “Auxiliary Feedwater System,” Revision 2, which was intended to demonstrate that the auxiliary feedwater pumps have adequate capacity to meet their design basis, did not correctly identify the highest pressure under which the pumps needed to function. Specifically, the calculation did not account for the dynamic pressure loss between the feedwater inlet ring and the main steam safety valves. The licensee was able to perform an analysis that concluded the pumps had sufficient flow margin at the new pressure. Failure to properly translate the peak pressure against which the auxiliary feedwater pumps must deliver the required flow rate was a violation of 10 CFR Part 50, Appendix B, Criterion III, “Design Control.” (Mechanical, a)

Kewuanee

Green. The team identified a finding of very low safety significance for a failure to provide adequate relay setpoint calibration tolerances on safety buses 1-5 and 1-6 loss of voltage relays. The existing relay setting calibration tolerances would have allowed the loss of voltage relays to actuate spuriously during certain offsite electrical system disturbances and unnecessarily separate the safety buses from the offsite power system and result in a plant transient. (Electrical, a)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50.63, "Loss of All Alternating Current Power," for a failure to maintain procedural steps that minimized the likelihood and duration of a Station Blackout (SBO) event. The deleted procedural steps allowed for the cross-connection of the plant's two redundant safety buses should both the Reserve Auxiliary Transformer and the 1B Emergency Diesel Generator fail. These procedural steps, as originally employed, served to lessen the likelihood of the SBO occurring, and/or reduce the time of the SBO. (Operations-Electrical, b)

Green. The team identified a finding of very low safety significance for a failure to provide adequate electrical coordination of protective devices thereby ensuring that postulated electrical faults would be isolated upon detection. Specifically, the team identified that the lack of adequate electrical systems coordination between the undervoltage and overcurrent protection on 4160 Vac safety bus 1-5 would result in the loss of voltage relays actuating before the bus over-current relays. This design deficiency results in the failure to lock out safety bus 1-5 upon postulated electrical faults and subjects the postulated faulted safety bus 1-5 to be re-energized via an alternate offsite source. This design introduced a challenge to the safety equipment availability and reliability. (Electrical, a)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion II, "Quality Assurance Program," for a failure to identify potentially adverse conditions to the plant's fire protection safe shutdown analysis caused by known overduty conditions on non-safety related buses 1-1, 1-2, 1-3, and 1-4. While the overduty condition was known to have existed at least since 1992, the licensee never entered the issue into the plant's corrective action program, where a proper evaluation should have addressed 10 CFR Part 50, Appendix R, safe shutdown related effects. (Electrical, d)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for failure to implement adequate design controls of documents, inputs, and assumptions in the design of the two safety-related batteries. Specifically, the licensee did not perform and control battery sizing calculations, including consideration of temperature effects, to ensure that the batteries maintained sufficient capacity to perform the intended design function. The team determined that the failure to appropriately evaluate effects of battery room and cell temperatures also affected the cross-cutting area of Problem Identification and Resolution

because the subject of battery capacity versus battery temperature had been previously identified in a 1992 NRC inspection. (Electrical, d, e)

Severity Level IV. The team identified a finding involving a Non-Cited Violation of 10 CFR 50.59, "Changes, Tests, and Experiments." The finding involved a failure to perform an adequate review of operations procedure changes in accordance with 10 CFR Part 50.59 associated with the operation of motor-operated valves for the auxiliary feedwater suction source from the service water system. The team determined that the licensee's approval of changes to Procedure E-0-05, with the introduction of adverse effects, and a determination that 10 CFR Part 50.59 was not applicable was a violation of 10 CFR Part 50.59. (Operations-Mechanical, g)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for failure to establish the condensate storage tank (CST) level setpoint to transfer the auxiliary feedwater (AFW) pump suction supply from the CST to service water. The team determined that the calculation setpoint did not include an allowance for the manual operator actions required by emergency operations procedures. (Operations-Mechanical, f)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." The finding involved the condensate storage tank (CST) level setpoint to transfer the auxiliary feedwater (AFW) pump suction from the CSTs to service water. A calculation assumption stated that a flow would drain from the CSTs to the condenser for 10 minutes until the operators isolated the flow by closing manual valve MU-2A. The team determined that the actions could not be completed in the time assumed by the calculation. (Operations-Mechanical, f)

Green. The team identified a Non-Cited Violation of 10 CFR Part 50.63, "Loss of All Alternating Current Power." The finding involved the failure to establish a target reliability for the plant's alternate power source consistent with the reliability approved by the NRC staff in the licensee's Station Blackout submittal for 10 CFR Part 50.63. The non-conservative target reliability employed by the licensee resulted in the failure of the licensee to increase efforts to restore the Technical Support Center (TSC) Diesel Generator (DG) to its approved target reliability at an earlier date. (Electrical, g)

Unresolved. Auxiliary feedwater system vulnerabilities due to loss of suction. (Mechanical, a)

Inspection Finding Data By Program Area

Category	Code	Total Findings
Original Design	a	7

Category	Code	Total Findings
Caused by Modification	b	5
Lack of Analysis	c	2
Inadequate Corrective Action	d	8
Design Control Concern	e	3
Inadequate Operating Procedure	f	7
Other	g	4

Inspection Finding Data By Review Area

Finding Type	Total Findings
Electrical	10
Mechanical	12
Operations - Electrical	2
Operations - Mechanical	6