U. S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NO: 50-271/95-15

LICENSEE: Vermont Yankee Nuclear Power Corporation
Vernon, Vermont

FACILITY NAME: Vermont Yankee Nuclear Power Station

DATE: August 28 through September 1, 1995

INSPECTOR: R Bhatia 10/13/95
R. Bhatia, Reactor Engineer Date
Electrical Section
Division of Reactor Safety

APPROVED BY: William H. Ruland 10/13/95
William H. Ruland, Chief Date
Electrical Section
Division of Reactor Safety

Areas Inspected: Announced inspection to review the status of previously identified issues, including one outstanding electrical distribution system functional inspection (EDSFI) issue, and determine the adequacy of the licensee's actions to resolve these items.

Results: The inspector concluded that the licensee has taken extensive action to resolve three previously identified issues:

- Vermont Yankee (VY) compared the results of an analytical model for emergency diesel generator transient loading with actual test results. This was the second test performed on the EDGs, this time using more accurate instrumentation. While the model now more closely follows EDG performance, VY plans additional testing to monitor and improve the EDG-1B frequency response. VY agreed to inform NRC, Region I, of any change in the planned testing scheduled for the 1996 mid-cycle outage. Based on the above actions, this item was closed.

- Semi-annual VY self-assessments of the root cause coding of maintenance work requests showed improved performance of maintenance personnel and a willingness of VY to study and correct problems. This item was closed.

- Vendor manuals were correctly updated and available to support maintenance. This item was closed.

DETAILS

1.0 INSPECTION SCOPE (TI 2515/111)

The inspector reviewed licensee actions for previously identified open issues at the Vermont Yankee Nuclear Power Station.

2.0 STATUS OF PREVIOUSLY IDENTIFIED INSPECTION ITEMS

2.1 (Closed) Unresolved Item 92-81-05 Pertaining to the Emergency Diesel Generator (EDG) Loading Analysis

During the EDSFI inspection, the team's review of the EDG load study identified two areas that required further evaluation by the licensee: (1) the EDG model used for the transient load analysis did not reflect the EDG design; and (2) the load calculation did not appear to envelop the worst-case loading condition. The team noted that the transient analysis predicted a maximum voltage dip during the first load addition, but the test data taken during the emergency core cooling system (ECCS) integrated automatic initiation tests indicated a maximum voltage dip during the second load step. The team also found that Operating Procedure OP-3122 allowed the manual loading of the EDG up to 800 kW in the event of a loss of normal power (LNP) without a loss of coolant accident (LOCA). However, the loads were not automatically shed if a LOCA signal was received subsequently. The load calculation had not considered this condition.

EDG Analytical Model

During the followup inspection in December 1994 (50-271/94-30), the NRC reviewed the additional test results of the 1992 diesel generator integrated tests, and noted again that the voltage drops measured during this test also differed from those predicted by the analytical model. In addition, the test results also showed that the frequency drop during load addition was considerably different from the manufacturer's supplied curves. For instance, the manufacturer curves predicted a frequency deviation of only 2% following the addition of 50% rated load on an unloaded diesel. The test results showed that DG-1B experienced a frequency deviation of approximately 10% after the addition of approximately 35% rated load. The test results showed that with 35% load on the diesels, the frequency of DG-1A and DG-1B dropped by approximately 5% and 7%, respectively, following a second step load addition of less than 30%. Based on these test results, the inspector concluded that both diesels deviated from the model, both in voltage and frequency. At the conclusion of the December 1994 inspection, the licensee was planning to monitor diesel response during the upcoming refueling outage in 1995.

During this inspection, the inspector noted that the licensee had completed diesel generator integrated tests during the 1995 refueling outage. This time, the licensee used more accurate recorders to monitor the diesel generator transient response during the ECCS integrated system testing. The inspector noted that the licensee had applied adequate plant loads during automatic loading sequence to simulate the ECCS safety loads. Then, the licensee compared the test results with the updated analytical model predicted voltage dip values, and found that the voltage dips in all cases as recorded were bounded by the predicted model values, with the exception of second step

loading sequence for the EDG-1B diesel generator. In this case, the voltage dip was 32.5% while the calculated dip was 30.1%. Per discussion with the licensee, the inspector determined that the licensee's simple analytical model predicts the voltage dip for each load step by assuming the rated lock rotor current of the load applied at the rated terminal voltage. Since their analytical model does not account for the actual voltage at the time of load application, the licensee then substituted the actual test recorded voltage values, obtained just prior to each load step in their analytical model, and determined that the analytical model conservatively bounded the performance in all instances with the exception of same Step 2 sequence step (the start of the second RHR pump) for the EDG-1B diesel generator. The new "adjusted dip" value was 31.9%, very close to the 32.5% measured value. Based on this small difference, the licensee concluded that the simple model to predict voltage dips for the diesel generators was adequate for their application.

The inspector reviewed the related documentation and performance test data and found it to be adequate, with the exception of the above noted second sequence load step voltage dip. The licensee stated that this slight difference in voltage dip in Step 2 was due to the differences between the two EDGs voltage regulator transient responses rather than to the analytical model. Based on the review of the licensee's FSAR EDGs maximum voltage drop, specified for EDGs bus voltage values to be less than 40% and obtained values within those limits, the inspector concluded that the licensee had adequately demonstrated that the diesel generators voltage response corresponded to their analytical calculation model. Also, the licensee was planning to perform additional tests to adjust and improve the EDG-1B voltage regulator performance with the Coltec (vendor) representative during the mid-cycle outage in 1996.

EDG Loading Calculation

To address the EDG loading calculation concern (the initial EDSFI finding second issue), the licensee stated that this scenario was beyond the Vermont Yankee's licensed design basis. However, the licensee had evaluated this loading condition in their diesel generator loading calculation, VYC-836, Revision 7. The licensee assumed that two RHR pumps and one core spray pump would be the largest loads required to start if a design basis accident occurs subsequent to loss of normal power condition. Under this condition, the pumps would sequentially load on the diesel, as per the normal loss of power condition coincident with the accident. However, in this case, load shedding would occur automatically only on low voltage system loads. The licensee concluded that the load limit established in the Operating Procedure OP-3122, under this scenario, as a precaution, would ensure that the diesels were not overloaded during the automatic start of the ECCS pumps.

The inspector reviewed the above diesel generator loading calculation and found that the 800 kW load in Operating Procedure OP-3122 would keep EDG load within the 3000 kW, short-time 7-day rating of the Vermont Yankee diesel generators. Based on the above verification of the loading calculation, the inspector had no further question on this issue.

EDG Frequency Response

In regard to the EDGs frequency response concern identified in the subsequent EDSFI followup inspection, the inspector noted that the licensee's 1995 test showed that EDG-1A frequency generally remained within the acceptable frequency range of 95% of the nominal frequency per Regulatory Guide 1.9, Revision 3. However, the test data indicated that EDG-1B could not maintain the frequency within 95% of the nominal frequency during the sequencing of the ECCS loads. The inspector's review of the licensee's data indicated that the worst-case recorded frequency dropped to 92.6% (approximately 55.6 hertz of nominal 60 hertz) during the sequencing of the second step load of this generator. The licensee stated that EDG-1B has adequately performed its intended design function, but needs adjustment of the voltage regulator to improve its frequency response.

Based on the above review, the inspector concluded that the licensee had adequately addressed the original EDGs-associated concerns. Per discussion with the licensee on October 5, 1995, VY confirmed that the frequency response of the EDG-1B would be tested and adjusted as necessary in their upcoming mid-cycle outage test in 1996. In addition, the licensee agreed to inform NRC, Region I, of any change in test plans. Based on the above steps taken and planned by the licensee, the inspector concluded that this item is closed.

2.2 (Closed) Unresolved Item 93-20-01 Pertaining to the Inadequate Formal Process to Perform Root Cause Analysis and Corrective Action for the Maintenance Department Identified Issues

During the previous NRC inspection while observing an emergency diesel generator post-maintenance activities in October 1993, the NRC inspector identified a concern with the root cause determination method for maintenance activities. The inspector was concerned that the need for a formal root cause analysis in the licensee's maintenance work process was left up to the maintenance department, and the licensee had no formal process to capture the repeated errors. The inspector identified two examples of defective air pilot valves associated with the air distributor system of the EDG-1B, where, in both cases, the licensee did not perform any root cause analysis to determine the causes of unacceptable conditions.

To address the above concern, the licensee staff reviewed the applicable documentation associated with defective air pilot valves and further investigated the root cause. The licensee determined that the root causes of these defective air-operated pilot valves for the first case was due to the presence of dirt in the close tolerance fit between the valve plug and the distributor housing. In the second case, the problem occurred due to an improper installation of the valve plug and spring assembly. To alleviate the

recurrence of these type of errors, the licensee had included a "caution statement" and additional detailed instructions in their EDG maintenance Procedure VYOPF 5223.01 and in their work order procedural steps to alert the maintenance staff involved in this process. The licensee had also forwarded these identified concerns to their training department to include them in their continuing training program.

The licensee's maintenance department staff also reviewed the root cause determination process guidelines established in Procedure AP0200, "Conduct of Maintenance Activities," and concluded that an adequate formal process does exist to handle root cause analysis and corrective actions for problems initiated during maintenance activities. However, in these cases, the licensee found a problem with assigning a proper failure code in these work orders. Per discussion with the licensee, the inspector found that the licensee staff believes that, in the course of their overall work order package review process, this issue would have been identified and the proper root causes found and corrective actions taken. The licensee stated that they had taken additional corrective actions to raise the awareness of these issues with the engineering, craft and maintenance management personnel. In addition, the licensee's maintenance department also have been performing an ongoing semi-annual self-assessment of the completed maintenance work orders to evaluate their effectiveness to identify the proper failure code associated with these work orders.

The inspector reviewed the above documentation related to the air distribution system valves and found it to be detailed and acceptable. The inspector also verified that the licensee's conduct of maintenance activities, Procedure AP0266, Section 3.d, "Work Completion," Subsection 6), clearly identifies the maintenance staff responsibilities to ensure that an adequate failure code be assigned upon completion of all maintenance work orders. The inspector reviewed a selected sample of several completed work orders of maintenance activities and found no concerns. Per discussion with the maintenance and instrumentation and control department staff members, the inspector determined that the staff members and supervision were well aware of this established coding process. The inspector reviewed the maintenance department last two semi-annual self-assessment data and found that the coding process was being adequately implemented by the maintenance staff. A trend of program improvement was evident. For example, 4 out of 57 work requests were coded incorrectly in the second half of 1994. The inspector concluded that the licensee's ongoing self-assessment of maintenance activities, specifically to determine failure causes, was a good measure to ensure the effectiveness of this process.

Based on the licensee's corrective actions and confirmation that adequate guidelines and awareness was in place, this item is closed.

2.3 (Closed) Unresolved Item 93-20-02 Pertaining to Update and Control of EDG Vendor Manual Concern

During the 1993 NRC inspection, a concern was raised that the licensee was not properly updating the vendor manual for their use in preventive maintenance activities. The inspector was concerned that the licensee had inadequate

control over this process. Specifically, the licensee's instrumentation and control (I&C) departments' EDG vendor manual was marked as a controlled copy; however, it was not on the master list of controlled documents and was missing current information.

Per discussion with the licensee's staff, the inspector determined that the mechanical maintenance department technician actually used an uncontrolled EDG vendor manual, located in the I&C area, presented to the NRC inspector for review during the 1993 inspection. The licensee further stated that a controlled copy issued to the mechanical maintenance department was properly being used by the maintenance workers during the 1993 EDGs overhauling process. The licensee also determined that there was no formal controlled copy issued to the I&C department at that time.

To address the above concerns, the inspector noted that the licensee document control department had issued a new controlled EDG vendor manual (VYEM 107) to the I&C department. In addition, the I&C department had clearly added a cover sheet on all uncontrolled vendor manuals kept in a separate area to alert all staff members, including the craft and technicians to use the applicable controlled copies when required to perform work activities. In addition, the licensee's ongoing training program instructions requires the use of the proper manuals for the station work activities. The licensee stated that these instructions are reinforced on an ongoing basis to all departments' staff members, including the technician and craft personnel to ensure the compliance of the established vendor manual use and the updating process.

Based on the above verification of the vendor manuals and the process in place to maintain vendor manual in all departments, the inspector concluded that the licensee has adequately addressed this concern. This item is closed.

3.0 MANAGEMENT OVERSIGHT OF CORRECTIVE ACTIONS

The inspector's review of the licensee management involvement in resolving previously identified electrical issues indicated good oversight. This was evident in their familiarity with the issues. The inspector noted that actions taken twice a year for the last 2 years, to assess the maintenance root cause process, was a good example to address these procedural implementation concerns identified in previous inspection. Overall, management was found involved with the outstanding open issues.

4.0 EXIT MEETING

The inspector met with the licensee personnel, denoted in the Attachment, at the conclusion of the inspection on September 1, 1995, and summarized the scope of the inspection and the results. During a telephone conversation on October 5, 1995, with Mr. B. Buteau, the licensee agreed to inform NRC, Region I, of any change in planned EDG-1B testing, scheduled for the 1996 mid-cycle outage, as discussed in Section 2.1 of this report. No proprietary documents were reviewed during the conduct of this inspection.

Attachment: Persons Contacted

ATTACHMENT

Persons Contacted

Vermont Yankee Nuclear Power Corporation

*F. Burger	Technical Project Manager
B. Buteau	Engineering Director
P. Corbett	EE&C Manager
L. Kelleher	I&C Department Technical Assistant
D. Johson	Maintenance Department Technician
B. Loomis	Maintenance I&C Sr. Engineer
S. Primerava	Supervisor, Maintenance Projects
*R. Sojno	OPS Superintendent
*W. Wittmer	CESD Project Engineer
J. Wojchick	Document Control Center Supervisor
*A. Wonderlick	QA

Yankee Atomic Electric Company

P. Johnson	Principal Engineer

U. S. Nuclear Regulatory Commission

* P. Harris	Resident Inspector

*Indicates those present at the exit meeting on September 1, 1995.