U.S. NUCLEAR REGULATORY COMMISSION
REGION I

REPORT/DOCKET NO.	50-309/93-04
LICENSE NO.	DPR-36
LICENSEE:	Maine Yankee Atomic Power Company
FACILITY NAME:	Maine Yankee Nuclear Power Station
INSPECTION AT:	Wiscasset, Maine
INSPECTION DATES:	February 15-19, 1993; In office March 12, 1993

INSPECTOR: A. L. Della Greca 4/28/93

A. L. Della Greca, Sr. Reactor Engineer, Electrical Section, EB, DRS — Date

APPROVED BY: W. H. Ruland 4/28/93

W. H. Ruland, Chief, Electrical Section, Engineering Branch, DRS — Date

Areas Inspected: Routine, announced inspection by regional personnel to review the status of previously identified issues and to determine the adequacy of the licensee's actions to resolve these issues. Also included within the scope of this inspection were the licensee's control of design changes and modifications and the capabilities of the engineering organizations.

Results: Based upon the results of the inspection, an Unresolved Item was identified regarding the licensee's failure to address the identified discrepancies pertaining to the dynamic head developed by the low pressure safety injection and containment spray pumps. In conjunction with this issue, the inspector noted that the Plant Engineering Department was unaware that the issue was being reviewed, for different reasons, by the Corporate Engineering Department.

Corrective actions for five previously identified issues were reviewed. The four items related to pump minimum flow rates remain open pending further NRC review. A violation concerning failure to take appropriate corrective actions was closed. In addition, a review of the design modification program showed good control. Also good were the steps taken to address the weaknesses in engineering design basis evaluations, despite the minor discrepancies identified in this area.

DETAILS

1.0 SCOPE OF INSPECTION

The purpose of the inspection was to review the status of several issues identified previously, during NRC inspection of the licensed program, and to determine the adequacy of the licensee's corrective actions in resolving each issue. The review also evaluated the licensee's controls for design changes and modifications and the capability of the engineering and technical support staff.

2.0 DESIGN CHANGES AND MODIFICATION PROCESS IMPLEMENTATION

A sample of design changes and modifications were reviewed to ensure that they were performed in conformance with the requirements of the Technical Specification, the Code of Federal Regulation, and applicable plant procedures. The review also included technical quality of the modifications, thoroughness of the design analyses and safety evaluations. For these purposes the inspector reviewed the engineering and design changes (EDCRs) described below.

EDCR No. M90-54 SW System Performance Evaluation Instrumentation

This modification, performed and installed in accordance with the minor modification process, Procedure No. 17-21-8, entailed the addition of thermowells at the inlet and outlet legs of the RHR heat exchangers E-3A and E-3B. The purpose of thermowells was to provide a means to measure more accurately the temperature of the process fluid and thus evaluate the performance of the heat exchangers during operation.

EDCR No. 91-099 Alternate Power to Valve House Exhaust Fan

This modification was performed to restore ventilation in the Valve House during a postulated Station Blackout condition and ensure that the temperature of the area remained within the design limit of a compressor housed therein. The modification involved the addition of a new control enclosure for exhaust fan FN-25 and the change of the power source from motor control center MCC 10A to MCC 9B1. The latter MCC receives backup power from the Appendix R Diesel Generator 2. The EDCR was processed by the Maine Yankee (MY) engineering staff in accordance with MY procedure No. 17-21-2.

EDCR No. 92-79 Emergency Diesel Generator Breaker Lockout

This modification was performed to resolve a relay race that could result in the lockout of the emergency diesel generator breaker (EDG). The issue, discovered in October 1991, was reported to the NRC with Licensee Event Report (LER) 91-011-00. According to the LER, if a plant trip occurred concurrent with a loss of offsite power and while the EDG was connected to the bus, the coincident open and close signals could cause the breaker to lockout

because of its anti-pump feature. The modification entailed the substitution of relay contact 27Z1-5 with relay contact 27Y-5 in the trip circuit logic of DG-1A breaker. This change introduced a time delay of 3.6 to 5.6 cycles between the trip and close signals, thus preventing the actuation of the anti-pump feature. The modification was designed by the Yankee Nuclear Service Division of Yankee Atomic Electric Company, in accordance with their procedure No. 17-21-3, Revision 4.

The review of the above modifications found the packages well-organized and to contain adequate design details, pertinent calculations, and required qualification documents. Design assumptions were considered reasonable and substantiated by applicable references and pertinent sections of the FSAR. Safety evaluations according to 10 CFR 50.59 were deemed to be good and to consider the FSAR position regarding the particular issue. Drawing control was also considered good.

In conjunction with EDCR No. 91-099, the inspector was concerned that the modification might have failed to address the need for the fan following a design basis accident as well as during a Station Blackout. However, discussions with the licensee indicated that the compressor in question was not required following an accident and that all accident mitigating equipment within the area had been qualified for the accident temperature profile.

The licensee also stated that, in the development of accident profiles, they had not taken credit for the fan operating since the fan was not safety-related and it was powered by a non safety-related source. Therefore, it could not be relied upon to be available following the accident. Following the inspection, on February 26, 1993, the licensee provided copies of qualification summary sheets and accident temperature profiles for the valve house. A review of the data provided showed that the accident thermal rating of the equipment adequately enveloped the applicable accident temperature profiles.

3.0 ENGINEERING DESIGN BASIS EVALUATION

In addressing the violation discussed in section 4.5, the licensee concluded that the examples were the result of weaknesses in their assessment process. To avoid further violations, they revised existing procedures and prepared a new procedure, No. 17-230, Engineering Design Basis Evaluation. The procedure, issued October 14, 1992, was to provide a screening method to determine the significance of potential safety concerns identified during engineering technical reviews.

To ensure that the procedure did not further complicate or dilute the deficiency evaluation process, the inspector reviewed the procedure and requested examples of where the procedure was applied. The procedure was found to provide good general guidance for properly evaluating findings. The implementation was also found to be acceptable with the following exception. The procedure requires that the engineering assessment be made in five working days. However, this time limit is imposed only on the Department Manager, thus

leaving open the time for the engineer's screening process. In addition, no space is provided on Form 1 for the engineer to date when his screening was done. Therefore, it is not possible to confirm compliance with the five-day limit, as in the case of design basis screen DBS-009 initiated to address the identification of 120 Vdc solenoid coils used in the 125 Vdc system.

In conjunction with this review, the inspector reviewed three issues that had been processed as Safety Issue Concern in accordance with Procedure 0-16-6. Although no safety concerns were identified with the process, it was not immediately evident how the process ensured that Close Out Plans had received the required Plant Operating Review Committee approval.

4.0 STATUS OF PREVIOUSLY IDENTIFIED ITEMS

4.1 (Open) Unresolved Item No. 50-309/90-23-01 pertaining to the high pressure safety injection system flow.

The NRC review of the high pressure safety injection system to verify that the licensee had taken adequate measures to address the issues discussed in IE Bulletin 88-04. During this review the inspectors identified two discrepancies in the licensee documentation:

1. In a letter to the NRC, dated January 2, 1990, the licensee identified the system worst-case operation as the fill and vent mode at 64 gallons-per-minute (gpm) for up to six hours a year. In a letter to the vendor, dated September 22, 1988, the licensee requested their evaluation of this mode of operation, stating that it would not exceed 1.5 hours per year.

2. The vendor's recommended minimum flow of 128 gpm in the alternate letdown mode was not being met; procedure 1-11-6, revision 27, limited the flow to 106 gpm.

Regarding the first issue, in a letter to the NRC, dated May 15, 1991, the licensee confirmed that the loop fill evolutions last approximately six hours. However, flow rates range between 75 and 100 gpm, with pumps run at 64 gpm continuously for no more than three hours. The 1.5 hour estimate was based on an average pump operation since three HPSI pumps are available. The licensee also stated that the vendor had reviewed the operating conditions and that the vendor's recommendations would be addressed in the appropriate maintenance procedures.

During the current inspection, a review of the vendor response (letter dated May 1, 1991) showed that they considered the pump operation at 64 gpm acceptable. The vendor recommendations for accelerated inspection of the pump, during repeated operations at low flow, had been reflected in the loop fill and vent procedure.

Regarding alternate letdown, in their May letter, the licensee stated that, under this mode of operation, the flow would be approximately 110 gpm in lieu of the recommended 128 gpm. However, upon inspections, the pumps had not exhibited excessive wear rates.

During the current inspection, a review of a calculation performed by the vendor in response to the licensee's questions in this area, showed that the minimum flow should be 122 gpm. The calculation also concluded that, given the licensee's success at the flow, operation of the pump at 110 gpm may be acceptable, but recommended monitoring. A review of the applicable procedure, No. 1-11-6, Revision 29, showed that a caution had been added. The caution note stated that, if the minimum flow rates versus time, e.g., 128 gpm for continuous operation, could not be achieved, pump bearing and casing temperatures should be closely monitored.

This item will remain open pending further NRC review of the licensee's approach to resolving this issue.

4.2 (Open) Unresolved Item No. 50-309/90-23-02 regarding the recirculation piping of the low pressure safety injection and containment spray systems.

A review of the low pressure safety injection (LPSI) system determined that the pumps recirculation lines merged with those of the containment spray (CS) pumps into a single six-inch line. The inspector discussed with the licensee the adequacy of the six-inch line when all four pumps, two LPSI and two CS, operated simultaneously in the minimum flow recirculation mode, but adequate documentation was not available at the time of the inspection.

During the review the licensee provided a calculation, MYC-1374, Revision 1, which showed that, during a four-pump operation, the LPSI and CS pump recirculation flows were 368 gpm and 269 gpm, respectively. The specified minimum recirculation flow was 350 gpm for the LPSI pump and 200 gpm for the CS pump.

In response to an observation by the NRC inspector that the licensee did not maintain records of engineering evaluations that demonstrated adequate full flow operation, the licensee agreed to revise procedure 3.1.15.3, Revision 17, ECCS Operation Flow and Check Valve Testing, to include collection of pump suction pressure during testing for pump performance evaluation. This agreement was confirmed by the licensee in their May 15, 1991, letter which stated that actual full flow tests would be completed and evaluated by the end of the cycle 12/13 refueling shutdown.

During the review the inspector confirmed that the procedure had been revised and the test results were being tracked for future comparison. However, an evaluation of the LPSI and CS pumps test had not been performed. This issue is addressed in section 5.0, below.

This item will remain open pending further NRC review of the licensee's approach to resolving this issue.

4.3 (Open) Unresolved Item No. 50-309/90-23-03 regarding minimum flow of the containment spray pump.

The review of the containment spray system showed that the measured recirculation pump flow (300 gpm) was well above the minimum specified by the vendor (200 gpm). However, the inspector questioned the accuracy of the documentation in this area, since in their letter dated July 7, 1988, the licensee had stated that the recirculation line was designed for 425 gpm.

In their letter of May 15, 1991, the licensee stated that the 425 gpm was based on a 1968 specification, but that an early design had reduced the line size by installing a smaller orifice plate. Records of the installed (1-1/16 inches) orifice plate were found in the manufacturer's drawings, but not the revised design flow. The licensee indicated that they had performed a technical evaluation providing the basis for the existing minimum flow rates and initiated a documentation revision.

To address this issue, the inspector reviewed Technical Evaluation No. 63-91, dated March 8, 1991, and calculation No. MYC 1374, Revision 1. This review showed that, with the installed orifice, and a measured minimum flow of 291 gpm (average) with one pump operation, the licensee calculated the minimum flow with four pump operation to be 269 gpm per pump. In addition, the licensee determined that at these low flow conditions the operating temperature of the pump would increase by 4°F in approximately ten minutes. The pump vendor confirmed that the minimum required flow was 200 gpm. Based on the above, the licensee concluded that the Design Basis Summary should be revised to identify 260 and 310 gpm as minimum and maximum recirculation flow. At the time of the inspection, revision of the Design Basis Summary was scheduled for June 1993.

This item will remain open pending further NRC review of the licensee's approach to resolving this issue.

4.4 (Open) Unresolved Item No. 50-309/90-23-04 relative to the minimum flow requirements for the emergency feedwater pump.

The inspector review of the emergency feedwater (EFW) system flow requirements determined that the vendor recommended a minimum flow of 20 gpm for start/stop operation, with a duration of 15 minutes or less. The inspector also observed that the monthly surveillance procedure did not strictly control the limitations recommended by the vendor regarding run time at 20 gpm. In their letter of May 1991, the licensee stated that measured flow rates ranged from 23 to 26 gpm and that, despite the limitations on time and flow recommended by the vendor to minimize potential detrimental effects, wear rates at low

flow could not be predicted. Therefore, reliance should be made on operation and maintenance. The licensee also stated that guidelines had been established and procedure changes made to discourage low flow operation.

During the current inspection, the licensee provided a memorandum, dated February 26, 1991, written to operations personnel. The memorandum specified recommended run times at various pump flows and, for 20 gpm EFW pump operation, it requested to minimize time. In addition, Section 4.7 of procedure No. 3-1-5.2, Revision 1, includes a caution regarding unusual noises, vibration, and excessive temperature and specifies a pump performance test, within 96 hours, if the pump was run continuously at minimum flow for more than 30 minutes. A review of several recent tests showed that the pump had been run for 17 to 23 minutes at approximately 25 gpm. In one case, the run time was 29 minutes. This item will remain open pending further NRC review of the licensee's resolution.

4.5 <u>(Closed) Violation Item No. 50-309/92-80-02</u> pertaining to the licensee's failure to take appropriate corrective actions to resolve identified deficiencies.

During an April 1992 Safety System Functional Inspection, the NRC team found two examples where the licensee failed to take action to document the identified deficiencies, determine their cause, correct them and report them to the appropriate level of management.

In the first example, the licensee failed to evaluate the results of a calculation showing that the voltage at the diesel generators (97.7 Vdc) was less than the minimum specified (98 Vdc). In addition, they failed to evaluate the voltage at the diesel generators when the batteries (1 and 3) are cross-connected, as allowed for seven days by plant procedure 1-22-2. In the second example, the licensee failed to address a generic issue of loose bolts when some were found on a battery room cable tray. The particular tray required seismic support to preclude damage to and ensure the operability of the safety-related batteries.

To address the first issue, the licensee issued orders not to cross-tie the dc buses without plant management approval. This requirement was then incorporated in revision 17 of Procedure 1-22-2 that, under step 4.5, states: "Cross-connecting DC Buses #1 and #3, shall not be done if the RCS is greater than 210°F and 400 psig." In addition, the licensee revised calculation MYC-1346 to address the new battery lead used for batteries 1 and 3; to update load and cable data for equipment design changes made during the 1992 refueling outage; and to evaluate voltages when the battery buses are cross-connected. A review of revision 1 of this calculation showed that the minimum voltages available at the starting circuits of the diesel generators DG-1A and 1B were 102.57 and 103.01 Vdc, respectively. The calculation also evaluated four cases when the dc buses were cross-connected. In each case, the voltage at the starting circuit was calculated to be above the minimum specified.

The calculation also showed that additional analysis was necessary for other circuits; therefore, cross-connection of buses was not recommended. The preparation of voltage drop calculations for the dc system is currently an unresolved issue tracked by the NRC as item No. 50-309/91-81-01.

To address the second issue, the licensee performed an analysis of (MYP-0454) of the observed condition, and concluded that isolated loose bolts in overhead tray supports were not a concern, because the trays were continuous and supported at regular intervals. In addition, the supports were continuously in tension. However, the analysis recommended a review on a sampling basis of floor-mounted supports. This review, performed under Work Order 92-2570, found no loose bolts on floor-mounted supports and only two of fifty overhead support bolts loose. The licensee believed that the bolts may have been loose from construction time. In view of the above corrective actions, this item is closed.

5.0 DATA TRENDING

A review of the data trending performed by the Plant Engineering Department (PED) on the safeguards pumps total dynamic head (TDH) showed that, at the tested flow, the measured TDH of each pump was much lower than the one derived from the pump performance curves provided by the manufacturer, i.e., approximately 172 ft versus 300 ft for the LPSI pump and 202 ft versus 280 ft for the CS pump. Since pump curves are used not only to design fluid systems but also to calculate power requirements (e.g., diesel generator loading), the inspector expressed concern that the discrepancies had neither been evaluated nor entered in the licensee's tracking system for future evaluation. To address pump performance, the licensee provided PED records of the in-service tests performed quarterly on each pump. A review of these data showed that the differential pressure developed by each pump was within expected limits. Regarding the observed discrepancies, the licensee indicated that, based on preliminary measurements, they appeared to be the result of the physical location of the pressure-sensing loop. They committed to review all measurements and provide an evaluation within a week.

Following the inspection, in a memorandum dated February 26, 1993, PED attributed the discrepancies to the flow meters on the main control board and stated that the determination was based on preliminary calculations performed by the Corporate Engineering Department (CED). A review of the provided data showed that, when the measured flow was adjusted for recirculation flow and instrument errors, the measured TDH was close to the expected, pump-curve-based, TDH. However, the data also showed that the flow measurement errors were in the order of 20%, although in the conservative direction.

At the request of the inspector, on March 12, 1993, the licensee provided a copy of the CED preliminary calculation No. CALC-33-92, Derivation of Maximum Ideal Flow for Loops F-312, 322, 332. The calculation had been reviewed and signed on January 25, 1993. The inspector's review of this calculation showed that the flow indication errors were due to the

loops being calibrated for a maximum ideal flow of 3570 gpm, instead of the assumed 3000 gpm. These conclusions were based on the size of the orifice plate, physical parameters of piping and flow medium, current calibration span and industry-accepted flow equations. Errors inherent to the measuring devices used were not within the scope of the calculation and were not addressed. Further discussions with the licensee indicated that the errors had been identified by CED while performing loop accuracy calculations as part of their instrument setpoint program and not as a result of the trending by PED initiated following previous NRC questions in this area.

The lack of shared information between the two engineering departments (PED and CED) is indicative of inadequate communications between them. Also, the failure to document and review the observed TDH discrepancies and to report them to the appropriate level of management will remain unresolved pending further NRC review of this issue and the licensee's pump testing program. (50-309/93-04-01)

6.0 EXIT MEETING

The inspector met with the licensee personnel, denoted in Attachment 1, at the conclusion of the inspection, on February 19, 1993 and summarized the scope of the inspection and the inspection results. In particular, the inspector informed the licensee of his concerns regarding the engineering failure to evaluate the identified TDH discrepancies. The results of the in-office review of this issue were discussed in a telephone call with the licensee, on April 8, 1993.

ATTACHMENT 1

PERSONS CONTACTED

Maine Yankee Atomic Power Company

R. Blackmore	Plant Manager
* R. Grant	Engineering Section Head
* J. Hebert	Manager Licensing and Engineering Support
* G. M. Leitch	Vice President Operations
T. J. Martin	Electrical Engineer
* R. H. Nelson	Manager Corporate Engineering
* S. Nichols	Acting Plant Manager
* J. M. Taylor	Senior Nuclear Safety Engineer
+*J. Weast	Licensing Engineer
* D. Whittier	Vice President Licensing and Engineering
+C. R. Shaw	Plant Engineering Section Head
+W. Schubert	Plant Engineering Supervisor
R. C. Snow	Electrical Engineer

Yankee Atomic Electric Company

J. P. Bonner	Lead Electrical Engineer

U. S. Nuclear Regulatory Commission

* W. Olsen	Resident Inspector

* Indicates personnel present at the exit meeting of February 19, 1993.
+ Indicates personnel present at the telephone exit meeting on April 8, 1993.