U.S. NUCLEAR REGULATORY COMMISSION
REGION I

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License No.:	NPF-49
Licensee:	Northeast Nuclear Energy Company P. O. Box 270 Hartford, CT 06141-0270
Facility:	Millstone Nuclear Power Station, Unit 3
Inspection at:	Waterford, CT
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Approved by: John F. Rogge 12/14/93
John F. Rogge, Chief — Date
Reactor Projects Section 4A

Scope:

Special inspection of the circumstances surrounding the continuing design deficiencies of the auxiliary building filter system which precluded the supplementary leak collection and release system from developing the required enclosure building vacuum under certain post-accident conditions. The inspection covered the system design and testing deficiencies, their safety consequences and the licensee's remedial actions.

Results:

See Executive Summary

EXECUTIVE SUMMARY
Millstone Nuclear Power Station
Special Inspection 423/93-24

Plant Operations

During refueling outage testing on August 28, 1993, the licensee identified design deficiencies in the auxiliary building filter (ABF) system which rendered the technical specification required secondary containment draw down capability inoperable. A licensee event review task force was convened to review the system and provide assurance that the modified system would be capable of performing its safety function. One other design problem was found and corrected. The inspector determined that the inoperability of the ABF system was an apparent violation.

In order to accomplish a comprehensive system review in a short period, the task force members put in large amounts of overtime. There was adequate supervision to assure that the team's activities were not affected by fatigue, however, administrative procedures for prior overtime approval were not strictly followed. The licensee was cited for failure to follow procedures.

Maintenance/Engineering

The surveillance and post-modification testing of the ABF system did not detect system design defects because the tests were not conducted with the system in its actual post-accident condition. The licensee's poor understanding of the system design details and interactions contributed to the inadequate test procedures. Following a detailed system design review and modifications to correct identified deficiencies, the licensee conducted an extensive system confirmatory test program. The results of this testing were satisfactory to support system operability for plant startup.

NRC review of the ABF system surveillance testing methodology revealed other testing program deficiencies. Specifically, the surveillance tests did not verify that components in the ABF system start within desired parameters. The licensee is currently reviewing their surveillance testing methodology and is considering the performance of additional surveillance tests to verify component operability.

The licensee examined other systems in which the flow switches that caused ABF system problems are utilized. Systems which the licensee determined would be adversely affected by the slow flow switch response were modified prior to plant startup.

Safety Assessment/Quality Verification

The continuing problems with the ABF system performance were caused by inadequate understanding of the system design details and inadequate system testing. The licensee's evaluation and corrective action of previously identified system problems was too narrowly focused and did not sufficiently address the root causes such that recurrence of similar deficiencies was prevented. This was an apparent violation of NRC corrective action requirements.

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DETAILS

1.0 Introduction

A special inspection was performed of the circumstances regarding the failure of the auxiliary building filter (ABF) system to operate as designed during the performance of an eighteen month engineered safety features/loss of offsite power test. The ABF system has been subject to a continuing series of design deficiencies since its start-up test program. Engineering review and system testing was inadequate, and had not fully resolved these problems. The inspection consisted of interviews with personnel, review of plant modification packages, surveillance tests, and vendor technical manuals. The auxiliary building filter system was also walked down by the inspector.

2.0 System and Event Description

During routine plant operation, the auxiliary building filter (ABF) system at Millstone Unit 3 is designed to maintain the temperature of the auxiliary building within equipment environmental qualification limits by controlling the supply of outside air. During a design basis event, the ABF system will reposition dampers to filter any radioactivity in the auxiliary building prior to its release. Fan HVR*FN6A or HVR*FN6B will start and the air from the auxiliary building, which is normally exhausted unfiltered into the environment, will be redirected through charcoal filters. The filters ensure that any radioactive iodine and particulates which escape from systems in the auxiliary building are removed prior to discharge to the environment. The ABF system also assists the supplementary leak collection and release (SLCR) system in developing 0.25 inches of negative pressure in the buildings surrounding the containment within 60 seconds of a design basis event. This system design criterion is incorporated in plant Technical Specification (TS) 3.6.6.1 and 3.7.9. The negative pressure in these structures following a design basis event ensures that the leakage of radioactive iodine and particulates into the enclosure buildings, either from the containment structure or systems within the enclosure building which carry radioactive fluid, will be processed through charcoal filters prior to release into the environment. These post-accident filter operations are designed to ensure that dose limits at the site boundary remain within 10 CFR Part 100 limits.

When a safeguards signal is generated in conjunction with a loss of offsite power (LOP), the operating ABF train fans will de-energize, and the direct ventilation exhaust path to the environment will isolate. When power is restored, certain fans which were previously operating will re-energize and supply air to the suction of the charcoal filters, and after a 2.5 second time delay, the inlet and outlet dampers for fan HVR*FN6A will modulate open. Once the dampers have moved to the full open position, fan HVR*FN6A will start. This damper modulation sequence should take approximately ten seconds. If fan HVR*FN6A fails to start, a pressure switch that is located on the 'A' train inlet plenum will detect the high pressure caused by the re-energized ABF supply fans. If the plenum pressure increases, which is indicative of improper 'A' filter train operation; the 'B' train fan will receive a start signal after a 30 second time delay. This is to prevent operation of both fans (HVR*FN6A and HVR*FN6B) so as not to collapse the ABF system ducting.

On August 28, 1993, during the performance of the required TS refueling outage LOP test on the 'A' safety train, licensee personnel noted that fan HVR*FN6A, started 45 seconds after a manual load shed signal was generated. Licensee personnel had expected fan HVR*FN6A to start in approximately ten seconds after power was restored. The delay was repeated twenty-four hours later during the engineered safeguards feature (ESF)/LOP test.

Licensee investigation of the event revealed that the slow start of fan HVR*FN6A following the LOP signal, was due to the slow response of flow element HVR*FS27B to sense no flow. This flow switch, which is located in the 'B' train of the ABF system, is designed to lock out the 'A' train ABF filter string when the 'B' train string is operating. This is accomplished through control of the position of the suction and discharge dampers for fan HVR*FN6A. If the flow switch senses flow in the 'B' train, it will not allow the fan HVR*FN6A inlet and outlet dampers to open, thus preventing fan HVR*FN6A from starting. The licensee determined that the slow response of the flow element occurred when the heating element cooled off because its power supply was momentarily de-energized during the LOP test. Once power was restored, the flow element sent a false high air flow signal (indicative that the fan HVR*FN6B was running) to the inlet and outlet dampers for fan HVR*FN6A which kept them closed and prevented the start of fan HVR*FN6A. Once flow element HVR*FS27B re-heated sufficiently to provide an accurate indication of air flow, the dampers opened and fan HVR*FN6A started.

Flow element HVR*FS27B was manufactured by Fluid Components International (FCI). The element consists of an AC bridge circuit and heating element which are both located in a ductwork thermowell. The element senses the amount of air flow based upon the change in electrical resistance of the AC bridge circuit which is caused by the heat from the heating element. The element works as follows: during high flow conditions, the resistance of the bridge circuit will not be changed since the heat that is generated by the element is quickly dissipated by the air. If a low flow condition exists, the resistance of one leg of the bridge circuit will be changed by the heat from the element. Consequently, a lack of heating element output causes a high air flow indication.

The licensee stated that the slow start of HVR*FN6A following a design basis event would only have had an adverse affect on the ability of the ABF system to assist the SLCR system in producing the TS required vacuum in the enclosure building when the 'B' filter train was not operable. For example, if the start of fan HVR*FN6A is delayed due to a slow response of flow element HVR*FS27B, filter fan HVR*FN6B would then sense a high ABF system exhaust duct ventilation pressure and start after a 30 second time delay. This is because fan HVR*FN6B starts based upon high exhaust plenum pressure and does not have a flow element in its starting sequence. The back-up start of fan HVR*FN6B would still ensure that the enclosure building vacuum could be met within TS requirements. As long as the 'B' filter train was operable, the delayed start of filter fan HVR*FN6A would not have prevented the TS required vacuum in the enclosure building from being achieved. The licensee reported this event in accordance with 10 CFR 50.73, as a condition prohibited by plant TS. To restore the full system redundancy, the licensee re-powered the flow element HVR*FS27B switch from a power supply which does not de-energize during an ESF/LOP event.

On October 11, 1993, subsequent to the modification of the power supply to the flow switch, the licensee developed and performed inservice test (IST) 3-93-037, "FCI Flow Switch Retest for PDCR MP3-93-159." The IST was developed to verify that all the ABF system flow switches functioned properly to sense low flow, to start the opposite train fans, and to verify that the SLCR system could draw the required vacuum during a dual train ESF/LOP with the failure of the lead train power supply. Test results for the 'A' train were acceptable, however, testing revealed that the 'B' train was unable to draw the required vacuum (0.25"wg) within the allotted 60 seconds. Review of the test results identified that fan HVR*FN6B did not start until 90 seconds after the initiation of the ESF/LOP signal. The test revealed that the charging (CH) and reactor plant component cooling water (RPCCW) area ventilation supply and exhaust fans (HVR*FN14B and HVR*FN13B) did not start when expected, due to the 'A' train supply and exhaust fan coast down time and flow switch settings. The delayed start of the 'B' train supply and exhaust fans caused the 30 second time delay for fan HVR*FN6B not to begin until 60 seconds into the test. The delay in starting resulted in the enclosure building being at a positive pressure after 60 seconds since fan HVR*FN14B was supplying outside air to the enclosure buildings; however, fan HVR*FN13B did not have a discharge path available for 90 seconds due to the delayed start of fan HVR*FN6B. In response to NRC questions, the licensee identified an additional single failure vulnerability. Specifically, certain exhaust fan failures or flow switch failures could result in two supply fans and only one exhaust fan running, or all supply and exhaust fans running which could pressurize the auxiliary building and place the CH/RPCCW areas in an unanalyzed condition. The licensee reported this finding on October 17, 1993, in accordance with 10 CFR 50.72.

On October 13, 1993, in response to these findings, the licensee assembled a task force to address the cause of the deficiencies in the ABF system and determine if other un-analyzed failure modes existed. The task force consisted of representatives from the Probabilistic Risk Assessment, Project Services, Nuclear Licensing, and the Engineering Departments. They performed a limited failure modes and effects analysis (FMEA) for those significant components of the ABF system which impact the SLCR system performance, and developed a series of integrated tests to verify proper system operation during various electric supply failure scenarios. Task force efforts are discussed in more detail in section 5.0 below.

As a result of the task force findings, plant design change record (PDCR) MP3-93-200 was developed to improve the response time to start specific equipment on receipt of an accident signal coincident with a LOP event. These changes were made to ensure that the ABF system in conjunction with the SLCR system would achieve a draw down of the secondary containment boundary to a negative 0.25 inch vacuum as soon as possible following an accident signal. The modifications included:

* reducing the low flow setpoint for fans HVR*FN13/14 to achieve a desirable response time if the associated fan should fail;

* re-sequencing the Foxboro Spec 200 micro logic to commence the 30 second time delay for fan HVR*FN6B upon initiation of an ESF accident signal vice upon an accident signal coincident with high plenum pressure;

* reducing the time delay for fan HVR*FN13/14 starting from 20 to 10 seconds upon detection of the opposite train low flow signal; and

* changing the operating procedure to ensure that the control switches for both trains of fans HVR*FN13/14 are in 'AUTO' to eliminate the potential for operating more than one train of fans HVR*FN13/14 at a time.

After completion of these modifications, a series of tests were performed to verify that the bounding electric supply failure scenarios for the ABF system and SLCR system were satisfactorily addressed by the enhanced design provided in the PDCR. Testing was completed on October 27, 1993. No further discrepancies were identified.

3.0 **Previous System Modifications**

As a result of testing which was conducted on the ABF and SLCR systems during the July to September 1992 time period, the licensee had previously detected several design vulnerabilities and system interactions between the two systems. These deficiencies had not been detected during routine plant surveillance testing of the ABF and SLCR systems because the licensee had not tested these systems in the actual accident lineup. On September 29, 1992, the licensee determined that those system deficiencies had prevented the ABF and SLCR systems from developing the 0.25 inches of water vacuum in the enclosure building within 60 seconds after receipt of an ESF signal as required by plant TS. Accordingly, the licensee had declared the SLCR system inoperable and placed the plant in cold shutdown. During the ensuing shutdown period, the licensee identified numerous single failure vulnerabilities when the ABF and SLCR systems repositioned into an accident lineup upon receipt of an ESF/LOP signal. NRC followup of the ABF/SLCR system deficiencies was reviewed in NRC inspection reports 50-423/92-23 and 50-423/92-24. The inoperability of the ABF/SLCR system, as well as the inadequate system testing resulted in escalated NRC enforcement action for this problem.

To ensure the TS required negative pressure could be met in the enclosure buildings, the licensee made several modifications to the ABF system in October 1992 which included system flow balancing and revising the start time of fans HVR*FN6A(B). Prior to the 1992 outage, the fans HVR*FN6A(B) would receive a start signal 35 (85) seconds after an ESF/LOP signal was generated. However, testing revealed that the SLCR system could not develop the negative pressure in the enclosure building within the TS time requirements with the previous ABF system sequenced start time. Accordingly, the start time of fans

HVR*FN6A(B) were reduced from 35 to 10 seconds and 85 to 40 seconds, respectively, by PDCR MP3-92-103. Additionally, the starting sequence for fan HVR*FN6B was modified to prevent hunting between the 6A(B) fans. This modification was accomplished by disconnecting the flow element for the 'B' filter train start on low flow in the 'A' train ductwork, and adding a 'B' train high pressure start switch in the inlet plenum to fans HVR*FN6A(B). Another modification was the addition of an electrical interlock between the ABF supply and exhaust fans to trip the supply fan if the supply breaker for the exhaust fan opens. This modification was needed because it was recognized that with two supply fans and only one exhaust fan running, the auxiliary building would eventually pressurize. These modifications are documented in NRC inspection report 50-423/92-28.

Once the modifications were completed, the licensee did not perform an integrated test of the system performance by completely deenergizing power to the SLCR and ABF systems as would occur during an actual ESF/LOP event, nor were the systems tested simulating the effects of various equipment failures or malfunctions. Rather, the licensee's retests consisted of individual tests to check fan/component performance. For example, to ensure fans HVR*FN6A(B) started within the revised design parameters, the licensee de-energized the fan by initiating an ESF/LOP test signal from the diesel sequencer cabinet. This test did remove power from the fan and restart it as designed, but it failed to de-energize the flow element which was powered off another circuit which is also de-energized on an actual LOP event. Also, all of the potential failures which could pressurize the auxiliary building were not investigated and tested. Therefore, the slow flow element response and the effect of various other equipment failures was not detected.

The licensee stated that complete de-energization of the ABF and SLCR systems electrical supplies was considered during final system testing following implementation of the PDCR . However, the testing was not performed because the engineers who considered more comprehensive testing did not adequately justify to their immediate supervisors why more extensive testing was warranted.

4.0 Affect of Other Flow Element Failures

To ensure systems containing similar flow elements were not susceptible to the same failure mechanism, on September 19, 1993, the licensee conducted a review of systems where these flow switches were located; these included the engineered safety features, fuel handling, and rod control switchgear ventilation systems. Based upon a review of applicable data bases, the licensee determined that 26 such flow switches are utilized in safety-related functions. Of the 26 locations, the licensee determined that six flow switches were subject to the same failure mechanisms. Four of these flow switches control other ventilation fans in the ABF system and two of them control ventilation fans in the ESF building. The flow switches in the ABF system control the auxiliary building supply and exhaust fans HVR*FN14A(B), and HVR*FN13A(B), respectively. The flow switches in the ESF building control the auxiliary feedwater pump area and ventilation mechanical rooms emergency ventilation supply fans, 3HVQ*FN5A(B). The flow switches on all three of these fan sets start the opposite train fan if low flow is sensed in the running fan.

The licensee determined that a slow response of the flow switches in fans HVR*FN13A(B) and HVR*FN14A(B) would prevent the non-operating fan from starting promptly when the previously operating fan fails to immediately start following receipt of an ESF/LOP signal. The resultant delay in air supply to the plenum may cause fan HVR*FN6A to cycle on and off due to low suction pressure until the upstream supply and exhaust fans (HVR*14A(B) and HVR*FN13A(B)) start when their flow element reheats. The failure of HVR*FN6A to run would delay the required SLCR system draw-down time. To eliminate this problem, the licensee elected to re-power the flow switches for fans HVR*FN13A(B) and HVR*FN14A(B) from non-interruptable power supplies.

The licensee determined that the delayed response of the flow switches in fans 3HVQ*FN5A(B) may cause both fans to start simultaneously following receipt of an ESF/LOP signal. The simultaneous starting of both fans could cause both fans to cycle on and off. To prevent the potential for equipment damage caused by this cyclic operation, the licensee added a time delay for fan 3HVQ*FN5B which would delay the start of the fan by 90 seconds. The licensee believes that delayed starting time for fan 3HVQ*FN5B would not appreciably increase the heat load in the ESF building should that fan start be delayed following a failure of fan 3HVQ*FN5A.

5.0 Event Review Task Force

In response to the ABF system design concerns on October 13, 1993, the licensee formed an event review task force in an attempt to correct the deficiencies identified, determine why the delayed response of the flow switches was not detected earlier, and determine if other unanalyzed failure modes existed. The team conducted the investigation through interviews of personnel, review of ABF and SLCR system documentation which was generated from construction of the unit through the October 1992 outage, and development of a FMEA.

The team noted that the delayed response of the flow elements was not easily detected since the delayed response was not contained in the vendor technical manual, plant logic diagrams, or material specifications. It was noted by the team that during construction and subsequent operation of the unit, other problems with the flow elements did present an opportunity for the slow response of the instruments to be detected. However, the team hypothesized that delayed response was not identified at that time, because prior to the October 1992 modifications, the flow switches in the ABF/SLCR systems did not require a rapid response time. The team concluded that the root cause of the event was the lack of understanding of the flow switch response to a LOP and inadequate design of the ABF system. The ABF system was not designed to meet the SLCR system draw down criteria for all possible power source failures. To prevent recurrence of the event, the team developed several long and short term corrective action plans, several of which were already being implemented at the close of the report period. One of the planned actions was to develop a new set of routine surveillance procedures for the ABF/SLCR systems. These procedures are needed to complete subsequent TS required surveillance tests to assure that system degradation or malfunctions will be promptly identified in the future.

The inspectors reviewed the technical manual for the flow switches and noted that the delayed response of the instrument when it is de-energized was not mentioned in the manual. The inspector concluded that comprehensive testing of the component functions would have identified the delayed action of the flow switch but the licensee had not performed appropriate testing. The inspector also reviewed the licensee's FMEA for the Auxiliary Building Ventilation System. The licensee utilized an accelerated approach, completing the FMEA in approximately three days. The inspector reviewed the process and assumptions used by Probabilistic Risk Assessment (PRA) engineers, noting that the process for determining non-credible failures was informal and subjective. No specific criteria was used to determine if a possible failure mode was credible, relying on the expertise of plant personnel from various disciplines assisting the PRA engineers during the process, and their recollection of past events. The inspector also noted that a limited number of failure modes were considered for significant components. The inspector concluded that the FMEA completed was useful in helping to understand the system's major possible failure modes and determining the scope of the confirmatory system testing program. Overall, the FMEA lacked the formality and level of detail which would provide a high degree of confidence in the results. Nevertheless, the FMEA was an excellent effort considering the short amount of time in which it was completed.

The inspector considered the task force review of the specific events to be good. However, the inspectors noted that the team review was narrowly focused and missed other deficiencies in the surveillance test program. For example, the failure of the licensee to verify that the ABF/SLCR systems component start times were verified by the surveillance test program was not detected by the team. Additionally, previous surveillance program inadequacies which had been discovered by the licensee, such as the failure to perform overlap testing on the reactor protection system components were not examined to determine if a common cause was present.

6.0 Adequacy of the Surveillance Test Program

The inspector reviewed the licensee's surveillance testing program for the ABF system. The inspector noted that the licensee's testing program does not adequately verify that components in the system perform within the desired parameters. Specifically, the licensee does not verify that fans HVR*FN6A(B), HVR*FN13A(B), and HVR*FN14A(B) start within the range that was required as part of PDCR MP3-92-103. Rather, the licensee verifies correct system performance in a three step sequence. First, the licensee verifies that tne fans have been sent a start signal within a prescribed interval from the sequencer (surveillance procedure SP 3448E51, "Diesel Sequencer Train A Actuation Timer Test"). Verification of actual component start (without response time) is accomplished in procedure SP 3646A17, "Train 'A' ESF with LOP Test," and verification of draw down in the enclosure building in procedure SP 3614I.3, "Supplemental Leak Collection and Release System." Verification of actual start time from initiation of the ESF/LOP signal to component start for the ABF and SLCR system fans is not performed. This is in contrast with how the licensee verifies the performance of other safety-related components such as the safety injection (SI) pumps. When testing these pumps, the licensee verifies the response time of the component through measurement of individual component response times from initiation of the accident signal to start of the SI pumps.

During the review of the ABF system surveillance testing program the inspector noted other examples where the correct performance of system components is not verified. Specifically, the inspector noted that procedure SP 3646A.17 did not require the licensee to verify that fans HVQ*FN5A(B) and 3HVR*ACU1A (the air-conditioning unit for the rod control and cable vault area) start when an accident signal was generated.

The failure of the surveillance test program to adequately ensure system components will perform as required in a design basis event has been a previous weakness at Millstone Unit 3. NRC inspection reports 50-423/92-31 and 93-07 have documented the failure of the licensee to perform complete (overlap) testing of plant systems to ensure they are operable. The failure of the licensee to detect the slow performance of these flow elements when they are de-energized during an accident is another example of a surveillance test program weakness.

Following a review of the inspector's observations, the licensee commenced a review of the computer generated sequence of events printouts which were produced during the recent ESF/LOP tests of the 'A' and 'B' safety trains. The purpose of the review was to verify that all safety-related components started within design parameters. The licensee also performed additional integrated testing of system components at the end of the outage. At the close of the report period, the licensee had concluded that all other components have performed as expected.

The inspector reviewed the licensee's confirmatory testing program for the ABF system. The testing consisted of a series of integrated tests to demonstrate that the ABF and SLCR systems could achieve a timely enclosure building draw down from its various operational modes and assuming various power supply failures. The testing program was not designed to identify or verify system single failure vulnerabilities. The inspector concluded that although not every possible test scenario was performed, the confirmatory testing was comprehensive and useful in helping to understand system interaction/operation. A review of the test results revealed that not all of the enclosure building areas could achieve the 0.25 inch negative pressure within the current 60 second time requirement. The tests clearly demonstrated, however, that sufficient secondary containment draw down was achieved within two minutes.

7.0 Licensee Amendment Approval/Plant Startup

As a result of the inability to meet the 60 second draw down criterion in all cases, the licensee issued a proposed TS amendment to allow increasing the draw down time from 60 seconds to two minutes. To support this extension, the licensee proposed a proportionate decrease in the overall allowed containment leak rate required by TS. The licensee stated that reducing the allowed containment leakage and increasing the allowed SLCR system drawn down time would result in a small net reduction in the off-site doses. After verifying proper ABF and SLCR system operation, a meeting between the NRC and licensee was held on October 25 at which time the licensee presented the results of their event review task force. The licensee requested enforcement discretion to allow the plant to enter mode 2 to perform low power physics testing. The NRC staff subsequently granted enforcement discretion on October 25 for the plant to enter mode 2 not to exceed seven days. Mode 2 was entered on October 30. Low power physics testing was completed and the plant returned to Mode 3 on November 1. The TS amendment and request for enforcement discretion which would allow the plant to enter mode 1 was revised a number of times due to concerns regarding the methodology used for off-site dose calculations. Another meeting between the NRC staff and the licensee was held on November 3. Enforcement discretion was granted and the plant entered mode 1 on November 5, pending formal processing of the final TS amendment.

8.0 Control of Personnel Overtime

The inspector monitored the task force efforts and noted a high use of personnel overtime. The inspector reviewed the overtime controls for licensee personnel involved in the SLCR system task force and identified that prior authorization to exceed established overtime goals was not given in all cases. Administrative Control Procedure (ACP) 1.19 "Overtime Controls for Personnel Working at the Operating Nuclear Stations," requires supervision to complete a form (Authorization to Exceed Established Overtime Limits), and obtain appropriate management approval prior to exceeding any established overtime limits. The inspector reviewed overtime authorization forms and time sheets for engineering personnel working at the site on the auxiliary building filter system modifications and testing and identified that management approval was not obtained prior to exceeding the established overtime limits in all cases. For instance, the inspector noted that a plant engineer exceeded the allowed 24 hours overtime in a 48 hour period on October 6, and the authorization form was not approved until October 9. Also, a project engineer exceeded 24 hours in a 48 hour period on October 12, and the authorization form was not approved until October 16. In addition, many overtime authorization forms were not fully completed prior to completion of the authorized overtime.

The inspector did note that, although management had not preapproved exceeding certain overtime limits, there was constant supervisory oversight of those individuals working long hours. The inspector did not observe nor did licensee management report an instance where an individual was unfit to perform their assigned task due to fatigue. However, the failure to approve overtime prior to exceeding established limits potentially compromised management's responsibility to evaluate the impact of overtime on plant activities and provide other alternatives, if appropriate. This is a **violation** of technical specification 6.2.2.g and administrative procedure ACP 1.19. **(VIO 50-423/93-24-01)**

9.0 Conclusion

Depending on the initiating conditions and the failure mechanisms assumed, either train of ABF system could have experienced a delay in draw down time or possibly a pressurization of the auxiliary building. Therefore, in the event of a LOCA, with the delay/failure of the ABF system to assist the SLCR system in developing the TS required negative pressure, the thyroid doses to the low population zone and exclusion area boundary would have increased. The failure of the ABF and SLCR systems capability to draw and maintain a vacuum in the enclosure building is an **apparent violation** of technical specifications 3.6.6.1 and 3.7.9. **(EEI 50-423/93-24-02)**

The inspector reviewed the safety significance of the licensee-identified deficiencies in the ABF and SLCR systems. The licensee had previously calculated in licensee event report 50-423/92-22 that a delay in enclosure building draw down time of up to two minutes significantly increased the analyzed post-accident dose at the exclusion area boundary (EAB). However, the projected EAB dose remained slightly below the 10 CFR Part 100 limits for that case. The inspector confirmed that the ABF/SLCR system performance between November 1992 and August 1993 was generally bounded by those results. The inspector concluded that the recently determined adverse secondary containment draw down performance was limited to accident scenarios involving loss of off site power and the failure of specific additional components. For instance, the delayed flow switch response would not degrade the draw down time unless fan HVR*6B or its power supplies failed. However, some of the equipment failures postulated by the licensee could have resulted in more than one set of ABF system supply and exhaust fans (HVRs*14A(B) and 13A(B)) operating at the same time. This scenario had the potential to overcome the combined discharge capacity of the SLCR and ABF systems, which could severely degrade (or reverse) the secondary enclosure draw down and would likely have exceeded the offsite dose requirements of 10 CFR Part 100.

The inspectors concluded that the delayed action of the flow switch and ABF system fan interactions could have been detected during the October 1992 outage, if the licensee had properly analyzed or tested the ABF/SLCR system under accident and various component/power supply failure conditions. The inspector noted that the licensee had not identified earlier the ABF and SLCR system deficiencies which were discovered in 1992, because the systems had not been tested in their accident configuration and because the licensee's understanding of the complex system design was not comprehensive. The failure to completely test both systems following installation of the 1992 modifications, under conditions (as close as practicable to) which could exist following an accident was attributable to the same root cause as the previous event. Consequently, the ABF and SLCR systems vulnerabilities/defects which existed since the startup of the unit and which remained following the 1992 modifications were not detected and corrected. This is an **apparent violation** of 10 CFR 50 Appendix B, Criterion XVI, which requires that the root cause of significant conditions adverse to quality must be identified and corrective action taken to preclude repetition. **(EEI 50-423/93-24-03)**

10.0 Management Meetings

Following the inspection, an exit meeting was held on November 19, 1993, to discuss the inspection findings and observations with station management. Licensee comments concerning the issues in this report were documented in the applicable report section. No proprietary information was covered within the scope of the inspection. No written material regarding the inspection findings was given to the licensee during the inspection.