U.S. NUCLEAR REGULATORY COMMISSION

REGION 1

Report No.: 92-09

Docket No.: 50-247

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Licensee: Consolidated Edison Company of New York, Inc.
4 Irving Place
New York, New York 10003

Facility: Indian Point 2 Nuclear Power Plant

Location: Buchanan, New York

Inspection Period: April 5, 1992 - May 9, 1992

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Approved by: _____ 5/29/92
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Inspection Summary: This inspection report discusses resident inspector safety inspections of plant activities in the following areas: plant operations; radiological controls; maintenance and surveillance; security; engineering and technical support; and safety assessment/quality verification.

Results: Inspection results are summarized in the attached executive summary.

EXECUTIVE SUMMARY

Indian Point 2 Nuclear Power Plant
NRC Inspection Report No. 50-247/92-09

Plant Operations: On April 13, a reactor trip occurred because condensate system hotwell 22B was improperly restored, in that the isolation valve was left shut, following maintenance. Operator response during the event was good. Several problems including logkeeping, watch station turnover and procedure compliance contributed to this event. Management is pursuing several programs to enhance personnel performance.

Radiological Controls: A radioactive spill occurred in the Unit 1 conventional building when water leaked from the Unit 1 nuclear boilers. Immediate response was good. No release to the environment or personnel contamination occurred. Corrective actions planned were comprehensive and indicated good management involvement.

Emergency diesel generator fuel oil storage tank contamination was determined to be caused by bacteria microbial contamination. Con Edison's corrective actions were appropriate.

Maintenance and Surveillance: Control power fuses for the intermediate range nuclear instruments blew when the reactor was at 25% power. The Instrumentation and Control Department's identification and implementation of corrective actions demonstrated good technical proficiency.

Con Edison identified that technical specification required instrument channel checks had not been performed within the required surveillance interval. The late surveillance was a violation. However, this violation was not cited because the criteria of section V.A of the Enforcement Policy were satisfied.

Security: The security program was effectively implemented. An alert security guard noted water dripping from a Unit 1 feedwater line and responded promptly.

Emergency Preparedness: An emergency preparedness exercise drill was effectively implemented. The post-exercise critique provided a good assessment of the drill.

Engineering and Technical Support: Following the reactor trip, 21 auxiliary boiler feed (ABF) pump tripped several times on low suction pressure. The 23 ABF pump failed to start after receiving an auto-start signal generated by the trip of the main boiler feed pump. Both ABF pump events were attributed to opening a valve in the condenser hotwell make-up line from the condensate storage tank. With this valve open, a low pressure condition existed at the ABF pump suction. Several previous problems caused by auxiliary feed system and condensate system interactions were reviewed which showed that Con Edison demonstrated a weak understanding of the auxiliary feedwater system and condensate system interactions.

An unresolved item was identified concerning the assumptions in the safety evaluation report (SER) on the seismic qualification of the auxiliary feedwater system.

Safety Assessment and Quality Verification: The inspectors determined that the corrective action process was not successful in resolving the longstanding issues associated with the auxiliary feedwater system and condensate system interactions. This was a violation of 10 CFR 50, Appendix B, Criterion XVI.

DETAILS

1.0 SUMMARY OF FACILITY ACTIVITIES

The plant operated at 100% power for most of this inspection report period. On April 13, following a load reduction from 100% power, the reactor tripped from 25% power as a result of a feed and condensate system transient. On April 14, the reactor was restarted and returned to full power. On May 8, reactor power was reduced to 67% as a result of heater drain tank dump valves failing open. The plant returned to full power on May 11.

2.0 PLANT OPERATIONS (71707, 71710)

2.1 PRA Based System Walkdowns and Plant Tours

The inspectors observed plant operation and verified that the facility was operated safely and in accordance with Con Edison procedures and regulatory requirements. Regular tours were conducted of the following plant areas:

- control room
- primary auxiliary building
- radiological control point
- electrical switchgear rooms
- auxiliary feedwater pump room
- security access point
- protected area fence
- intake structure
- diesel generator room
- turbine building

Control room instruments and plant computer indications were observed for correlation between channels and for conformance with technical specification (TS) requirements. Operability of engineered safety features, other safety-related systems and onsite and offsite power sources was verified. The inspectors observed various alarm conditions and confirmed that operator response was in accordance with plant operating procedures. Routine operations surveillance testing was also observed. Compliance with TS and implementation of appropriate action statements for equipment out of service were inspected. Plant radiation monitoring system indications and plant stack traces were reviewed for unexpected changes. Logs and records were reviewed to ascertain that entries were accurate and identified equipment status or deficiencies. These records included operating logs, turnover sheets, system safety tags, and the temporary modification book. Plant housekeeping controls were monitored including control and storage of flammable material and other potential safety hazards. The inspectors also examined the condition of various fire protection, and meteorological monitoring systems. Control room and shift manning were compared to regulatory requirements and portions of shift turnovers were observed. The inspectors found that control room access was properly controlled and that a professional atmosphere was maintained.

In addition to normal utility working hours, the review of plant operations was routinely conducted during portions of backshifts (evening shifts) and deep backshifts (weekend and midnight shifts). Operators were alert and displayed no signs of inattention to duty or fatigue.

The inspectors used PRA-based inspection guidance in performing system walkdowns. This guidance helped focus NRC inspection resources toward risk significant items. During this inspection period, walkdowns were performed on service water, emergency diesel generator, auxiliary feedwater and safety injection systems. The systems were found to be properly aligned.

The inspectors observed an acceptable level of performance during the inspection tours detailed above.

2.2 Reactor Trip

On April 13, the reactor automatically tripped from a turbine trip at 25% power. The turbine trip was caused by a high level in 23 steam generator. The unit was placed in hot shutdown. Equipment malfunctions included both motor driven auxiliary feedwater pumps and both channels of intermediate range nuclear instrumentation.

Sequence of Events

At about 8:30 p.m. on April 13, 1992, a trouble alarm associated with 22 main boiler feed pump (MBFP) was received. Upon receiving this alarm, the operators reduced load in preparation for an expected trip of 22 MBFP. Plant power was reduced to 63% and plant conditions appeared to stabilize. At 9:30 p.m., the operators noticed that MBFP suction pressure was abnormally high and secured 23 condensate pump. With the condensate pump off, the oscillations noticed earlier in the feedwater system recommenced and 23 condensate pump was restarted. Another load reduction was initiated. At 10:03 p.m., the operators considered the possibility that low hotwell levels might be the cause of the feed system instabilities even though no hotwell level alarms were present, hotwell levels indicated normal values, and the condensate pumps appeared to be operating normally. Power was then reduced to 25% and 22 MBFP was secured. At 10:05 p.m., the operators commenced make-up flow to the hotwells using the condensate storage tank as the source of water. Upon initiation of make-up flow, the operators observed that MBFP suction pressure increased and the oscillations ceased. Both the 21 MBFP controller and the feed regulating valve controllers were in manual. When the MBFP suction pressure rose, the operators secured both running condensate pumps and attempted to reduce feed flow to the steam generators. Steam generator levels continued to increase and reached the high steam generator turbine trip setpoint. Since the unit was operating at 25% power, the turbine trip caused a reactor trip. Emergency Operating Procedure E-0, Reactor Trip or Safety Injection, was entered following the trip and the plant was placed in hot shutdown.

Equipment functioned as designed during the trip with the exception of 21 and 23 auxiliary boiler feedwater (ABF) pumps and both channels of the intermediate range nuclear instrumentation. The intermediate range nuclear instruments (IRNI) are discussed in section 4 of this report and the ABF pumps are discussed in section 7 of this report.

A Station Nuclear Safety Committee (SNSC) meeting was held on April 14, 1992, to evaluate reactor restart. The SNSC evaluated the cause of the trip and equipment malfunctions and approved a recommendation to restart the reactor. The SNSC review of the reactor trip is discussed in section 8 of this report.

Cause of Trip

Following the trip, operators found that valve CS-1-3, condenser 22 hotwell 'B' outlet, had been shut. The plant design includes a condenser and associated waterbox for each of the three low pressure turbines. Each of the waterboxes is divided into an 'A' and 'B' section. Valve CS-1-3 is the outlet of the 22 waterbox, 'B' side. All alarms associated with hotwell level come off this one waterbox. In addition, the hotwell level indicating system is designed such that a single level transmitter receives differential pressure inputs from all six divided waterboxes. If one waterbox is higher than the others, the level transmitter only senses this higher differential pressure. The level in 22B waterbox was artificially high because the low pressure turbine was exhausting into this condenser but no discharge path existed for the water to leave. The level sensing lines connecting the waterboxes are not large to allow hotwell levels to equalize. With valve CS-1-3 shut, the operators had no hotwell level alarms for the other waterboxes. In addition, the hotwell level as indicated in the control room reflected an artificially high level present in the 22B waterbox. Over the course of normal operation, the levels in all hotwells (except 22B) began to decrease. Eventually, hotwell levels became low enough to cause the problems the operators observed in the feed system.

Further review showed that valve CS-1-3 had been shut when waterbox 22B was taken out of service using section 4.7 of Abnormal Operating Instruction (AOI) 20.2, "Condensate System High Salinity," on April 7, 1992. On April 9, the waterbox was returned to service but valve CS-1-3 was not opened as required by AOI 20.2.

Assessment of Operator Performance

Two additional inspectors were dispatched from Region I to assist the resident staff in evaluating the plant trip. The inspectors interviewed personnel on duty during the event and also looked at control room logs, personnel statements, the post trip review and evaluation report, and operating procedures and directives related to the event. The inspectors concluded that operator performance during the event was good and demonstrated a proper safety perspective. The crew responded properly to the indications available. However, the inspectors did have concerns regarding the policies for tracking the status of partially completed procedures and components in an off-normal position. Operations department management was interviewed with regards to

their expectations for watchstanding practices. Management expectations were that off-normal components should be tracked via logs, tags, written turnover, or procedure status. The inspectors noted that section 4.7 of AOI 20.2 was used as a guide for removing waterbox 22B from service and that no off-normal positions resulting from this procedure were tracked. When the waterbox was returned to service, operators neglected to open valve CS-1-3 as required by step 4.7.17 of AOI 20.2. The inspectors concluded that the lack of tracking the status of partially completed procedures and components in an off-normal position resulted in waterbox 22B being inadvertently isolated. In addition, AOI 20.2 was inadequate in that it did not properly identify the significance of valve CS-1-3 to the operation of the plant. Plant management corrected this deficiency with Temporary Procedure Change 92-121 which ensures that hotwell level instrumentation and alarms are always placed on a hotwell in service. In addition, if 22B waterbox is isolated, the procedure now ensures that compensatory actions will be taken. Although a human performance evaluation had been completed, the SAO 132, Analysis of Station Condition, report was still pending at the end of the inspection period. Accordingly, the NRC will address additional corrective actions in a future inspection.

The inspectors assessment was that operator performance during the events was adequate. Operator performance during the events leading up to and including the reactor trip response was evaluated as good. Several operator performance problems including logkeeping, watch turnover and procedure adherence contributed to the hotwell valve being inadvertently closed.

2.3 Operations Department Initiatives

The inspectors discussed with the operations manager his attendance at an INPO sponsored Senior Nuclear Plant Management Course. The course was 5 weeks long with an agenda which included briefs by senior NRC officials, INPO and industry executives and seminars. Partially as a result of the course, the operations manager initiated several programs to enhance human performance. These programs are in various stages of implementation and include a self-check concept, upgrade of the operator training and qualification process, and development of more teamwork, both within the operations department and between station departments.

3.0 RADIOLOGICAL CONTROLS/CHEMISTRY (71707)

3.1 Inspection Activities

Radiological protection activities were observed on a periodic basis. The activities observed included radiological work practices, radiation surveys, and compliance with radiological procedures and requirements. Based on the activities observed, radiological procedures and requirements were followed.

3.2 Unit 1 Spill From Uncapped Feedwater Line

On April 9, a security guard observed water dripping from a Unit 1 feedwater line located in the overhead in the Unit 1 conventional building. Sample analysis indicated the water contained 5.3 x 10 -5 uCi/cc of Cs-137 with trace quantities of Co-60. The spill volume was less than 1/2 gallon. No release to the environment or personnel contamination occurred. The spill area was isolated, radiologically posted and decontaminated.

A similar event had occurred on November 27, 1991 and was documented in NRC inspection 92-04. Because of the potential for an unmonitored release path, the event was determined to be an unresolved item, 92-04-01. For that event, Con Edison inspected the interface between Units 1 and 2 for additional uncapped lines and several were identified. However, the uncapped feedwater line was not identified, in part, because of the physical location of the line.

Con Edison initiated a Station Administrative Order (SAO) 132 report to determine the cause and corrective actions. The SAO 132 report was thorough with comprehensive corrective actions identified. Con Edison's review showed that the water had leaked through isolation valves from the Unit 1 nuclear boilers through a feedwater line which had been cut. The Unit 1 nuclear boilers had recently been filled to provide radiation shielding within the Unit 1 containment. Con Edison has completed several corrective actions including welding a cap on the Unit 1 feedwater line, draining the Unit 1 nuclear boilers below the feedwater line penetration and reverification of tagouts affecting interfaces with Unit 1. Con Edison has scheduled a more systematic walkdown of Unit 1 interfaces and reassessment of their response to NRC Bulletin 80-10, Contamination of Nonradioactive System and Resulting Potential for Unmonitored Uncontrolled Release to Environment.

The inspectors concluded that the initial response to the spill was good. Corrective actions were comprehensive. The failure to initially identify the cut feedwater line was a result of the physical location of the line and a poor systematic approach. The current plan to identify potential leakage paths is more rigorous. This spill will be included with the previous unresolved item, 92-04-01.

3.3 Followup on Emergency Diesel Generator Fuel Oil Storage Tank Contamination

On January 22 and February 26, 1992, bottom samples from the three emergency diesel generator (EDG) fuel oil storage tanks (FOST) exceeded the water and sludge analysis specification. The problem was found during routine quarterly sampling. The bottom samples were taken as a precaution in addition to the required composite sample. The EDGs were determined to be operable based on an acceptable EDG fuel oil composite sample and the sludge contamination was below the fuel oil transfer pump suction. The fuel which exceeded specifications was removed from the FOSTs and samples were sent to a laboratory for analysis. The analysis showed the majority of the sediment to be bacteria microbial contamination. Composite samples taken at the same time did not detect any microbial contamination.

Con Edison prepared an SAO 132, "Analysis of Station Condition" report to determine the cause and corrective actions. The inspectors reviewed the report and discussed the corrective actions with the chemistry manager.

Indian Point 2 has had no prior incident of fuel oil sludge contamination in the EDG FOSTs. In June 1989, all three EDG FOSTs were drained and cleaned for the first time since they were installed in 1970. Approximately one-inch of sludge was vacuumed from the bottom of each tank which represented the total sludge accumulation in 19 years. This sludge contained only traces of water. In addition, no accumulated water has been found during the station's routine tests of the lowest points of the EDG FOSTs.

Con Edison determined that the likely source of the contamination found during January and February of 1992 was a fuel oil delivery. Although each delivery was sampled prior to acceptance, Con Edison concluded that small contamination in the bulk delivery may not show until settling and concentration occurred. Con Edison is pursuing the purchase of a fuel oil stabilizer additive and is continuing to sample the EDG FOST weekly instead of quarterly in order to monitor sludge accumulation. The weekly sampling may be changed to monthly following indications that sediment is not a problem.

The inspectors concluded that the SAO 132 report and corrective actions associated with it demonstrated an appropriate action to identify a problem and minimize any possible consequences.

4.0 MAINTENANCE/SURVEILLANCE (61726, 62703)

4.1 Maintenance Observations

Maintenance activities were observed during this inspection period on safety-related activities to ascertain that these activities were being conducted in accordance with approved procedures, technical specifications and appropriate industrial codes and standards. Observation of activities and review of records included verifying required administrative authorizations and tagouts were obtained, procedures were adequate, certified parts and materials were used, test equipment was calibrated, radiological requirements were implemented, system prints and wire removal documentation were used and quality control hold points were established. Maintenance activities observed included:

WO 92-58410	Replace auto voltage control rheostat for EDG 23
PM 1794	Replace 23 EDG cylinder head exhaust manifold temperature indicator
WO 92-59379	Replace control rod drive fan shroud

The maintenance activities observed were effective with respect to meeting the safety objectives of the maintenance program.

4.1.1 Intermediate Range Nuclear Instrument Control Power Fuses

The control power fuses for intermediate range nuclear instrument (IRNI) channels N-35 and N-36 blew while the reactor was at approximately 25% power prior to the reactor trip on April 13, 1992. During the plant's ascent to full power operations, IRNI channel N-36 control power fuses blew again at approximately 25% power.

Plant technicians determined prior to reactor restart that the control power fuses were failing because of the proximity of the trip and reset setpoint values for the high level trip bistable. This bistable provides a trip signal to the reactor at approximately 25% power but is normally blocked by procedure when reactor power as indicated by the power range nuclear instruments (PRNI) is greater than 10%. The close proximity of these two setpoints caused rapid cycling of the bistable when the plant was operating at 25% power. Plant technicians recreated this control power fuse failure in the laboratory to demonstrate the credibility of this hypothesis. The plant engineering staff is currently preparing a test procedure to provide additional separation in the values of the two setpoints during the next shutdown. The safety significance of these failures is minor because failure of these fuses at power levels below 10% will cause a reactor trip. When the reactor is above 10% in power, protection is provided by the PRNIs.

The inspectors concluded that Con Edison responded adequately to the IRNI channel N-35 and N-36 control power fuse failures.

4.1.2 24 Service Water Pump Test

The inspectors observed portions of post maintenance test PTQ-26B, Service Water Pump Tests, on May 5, 1992. The test was being conducted on 24 service water pump following an oil change on that pump. The inspectors concluded that the technicians conducting the test were knowledgeable of system design and that the post maintenance test was conducted according to procedure.

4.2 Surveillance Observations

Surveillance activities observed emphasized inspection of safety-related activities. Observations of activities and review of records included verifying required administrative approval was obtained, procedural precautions and limitations were observed, review of test data was accurate and timely, surveillances conformed to technical specifications, and required surveillance frequencies were met. Surveillance activities observed included:

P-MT 120 Motor Driven Auxiliary Feedwater Pump Actuation from Loss of 21 Main Feedwater Pump

The inspectors concluded that the above activity was effective with respect to meeting the safety objectives.

4.2.1 Licensee Event Report 92-05: Missed Surveillance Test for Instrument Channel Checks

On March 11, Con Edison determined that the channel checks required by Technical Specification Table 4.1-1 had not been performed within the required surveillance interval. The test had previously been performed on January 29 and was completed on March 11, therefore, exceeding the allowed interval by four days. The inspectors verified that the test was performed satisfactorily. The test, PT-M64, Channel Checks, is performed by the operations department and involves verification of containment pressure, reactor coolant system subcooling margin monitor, PORV and block valve position indication, acoustic monitor auxiliary feedwater flow and safe shutdown instrumentation. This issue was unresolved (50-247/92-07-02) pending review of corrective actions.

The inspectors reviewed LER 92-05 which was submitted on April 10, 1992 to assess the effectiveness of Con Edison's corrective actions. In addition, this LER was reviewed in accordance with the reporting guidelines of NUREG 1022, Licensee Event Report System. The inspectors verified that the LER was reviewed by the Station Nuclear Safety Committee as required by Technical Specifications, the LER was submitted within 30 days of the event as required by 10 CFR 50.73, the contents of the submittal were legible, the event was adequately described, safety significance was assessed, similar events were documented and corrective actions were described.

Con Edison's review of this late surveillance test showed two contributing causes. One problem was the failure to issue the test because of miscommunication within the surveillance test group. The corrective action to address this was to include an issue status column on the surveillance scheduling report. The second problem was miscommunication between the operations department and the surveillance test group concerning the status of the surveillance test. This problem was corrected by requiring a member of the surveillance test group to verify, by review of logs or the completed surveillance test, that the test was completed. Previously, verbal verification was acceptable. The inspectors concluded that the changes made to the surveillance schedule tracking program were appropriate corrective actions. However, the late surveillance was a violation. This violation was not cited because the criteria of section V.A. of the Enforcement Policy were satisfied. Accordingly, unresolved item 92-07-02 is closed.

4.2.2 PT-Q-13 ASME Section XI Inservice Valve Test

The inspectors reviewed PT-Q-13, ASME Section XI Inservice Valve Test, for PCV 1310B, main steam to auxiliary feed pump turbine valve. The valve is normally open and its safety function is to close automatically on a steam line break in the auxiliary feedwater pump room. The valve can be manually bypassed if it inadvertently closed.

During the test, the valve closed within the allowed time, but did not open as required. The valve was subsequently opened using the manual bypass. Con Edison postulated that the cause of the valve's failure to open was that steam leaks allowed a differential pressure to develop while the valve was closed. This pressure differential prevented the valve from opening.

Con Edison provided information which showed that the valve and actuator assembly are designed to perform a safety function to close at 1000 psi differential pressure. Consequently, the inspectors did not have any concerns about the valve's ability to perform its safety function. The inspectors reviewed the valve's operating history from Con Edison's power plant maintenance information system (PPMIS). This record review did not indicate any unusual failure history.

There are two valves for steam supply to the auxiliary feed pump turbine. The inspectors noted that insulation had been removed from one of the valves. The vendor manual recommends that the valve body be insulated to minimize variations in clearances between the seats. Con Edison initiated a work order to reinstall the missing insulation. The system engineer determined that the lack of insulation would not affect the valve closing characteristics because differential expansion would only occur with the valve shut.

The inspectors concluded that the valve was able to perform its safety function based on its design and operating history. The inspectors agreed that the lack of insulation on one of the valves would not affect its safety function.

5.0 EMERGENCY PREPAREDNESS (71707)

On May 6, Con Edison conducted an emergency preparedness exercise drill. The drill scenario involved a fire in the control cabinet for 23 emergency diesel generator. This was followed by reactor coolant system leakage and loss of offsite power resulting in fuel cladding damage and declaration of a site area emergency.

The inspectors observed this exercise to assess the emergency response program, the implementation of the emergency plan, the emergency implementing procedures and the training program. The inspectors observed the exercise from the control room, technical support center, operational support center and emergency operations facility. The inspectors also observed Con Edison's post-exercise critique and discussed the drill with the site protection manager.

The inspectors concluded that the drill was effectively implemented. The post-exercise critique provided a good assessment of the drill.

6.0 SECURITY OBSERVATIONS (71707)

The inspectors observed Con Edison's implementation of the security program. These observations included searches of personnel and packages entering the vital area; compensatory measures for defective safeguards equipment; display of photo identification badges of personnel within the protected area; tours of the protected area perimeter, vital areas, the central alarm station and secondary alarm station. Based on the activities observed during this inspection period, the security program was appropriately implemented.

A security guard on a routine tour observed water dripping from a Unit 1 feedwater line. (See section 3.2 of this report). The inspectors consider that the security guard's response demonstrated good awareness of the facility environment.

7.0 ENGINEERING AND TECHNICAL SUPPORT (71707)

7.1 Motor Driven Auxiliary Boiler Feed Pumps

Following the reactor trip on April 13, 1992, 21 auxiliary boiler feed (ABF) pump tripped several times on low suction pressure. In addition, 23 ABF pump failed to start after receiving an auto-start signal generated by the trip of the main boiler feed pump. Both ABF pump events are attributed to the opening of LCV-1128, a valve in the 12 inch condenser hotwell make-up line from the condensate storage tank (CST). With this valve open, a low pressure condition existed at the ABF pump suction which prevented their proper operation. Immediate corrective action was to block shut LCV-1128.

The low suction pressure condition existing in the suction line was caused by interactions between the auxiliary feedwater (AFW) system and the condensate system. This low suction pressure condition prevented 23 ABF pump from starting following the trip of 21 main boiler feed pumps (MBFP). In addition, 21 ABF pump started but tripped on low suction pressure. When the motor driven ABF pumps received a signal to start, operators were in the process of trying to correct low hotwell levels using the CST as the source of water. A 12 inch line connects the CST to 22 and 23 hotwells through valves LCV-1158 and LCV-1128. In addition, there is a 4 inch bypass line around LCV-1128 which contains LCV-1128A. LCV-1158 performs a safety function to isolate the CST from all systems except the auxiliary feedwater system in the event of low level in the CST. This ensures the CST contains sufficient water for decay heat removal. Valve LCV-1128 is used for condenser hotwell level control. When the operators opened LCV-1128 to provide make-up flow, large flow rates (on the order of 6000 gpm) existed from the CST to the condenser hotwells. This high flow rate caused a low suction pressure condition at the AFW pump suctions. When the operators closed LCV-1128, both pumps functioned normally.

To correct the low suction pressure condition a temporary modification was installed. This blocked closed LCV-1128 thereby reducing the maximum make-up flow rate to that achievable using the bypass line containing valve LCV-1128A. The inspectors observed a test performed to verify that full flow through valve LCV-1128A would not cause pressure in the suction line to the AFW pumps to fall below the pump low pressure suction setpoint.

Another test of the AFW pumps was conducted on May 8, 1992, verifying their ability to function following an automatic start signal. This test was performed when it was determined that 23 ABF pump's failure to start had not been fully analyzed. Although it was believed that low suction pressure prevented 23 ABF pump from starting, a malfunction in the automatic start circuitry could not be eliminated as a possible cause. Both pumps functioned normally during the test and no problems were identified in the automatic start circuitry.

The inspectors concluded that Con Edison's immediate corrective actions for the low suction pressure trip of 21 ABF pump were adequate. The test to verify the ABF pumps ability to function following an automatic start signal was performed satisfactorily.

7.2 Auxiliary Feedwater System Design

Following the low suction pressure trip of 21 ABF pump on April 13, 1992, the inspectors conducted a review of previous interactions between the AFW system and the condensate system. The inspectors found four previous interactions between these systems dating back to September 1988. Two of these incidents involved water hammer events and the other two involved low suction pressure trips.

A review of previous system interactions provided the inspectors with insight into the performance of the AFW system during the April 1992, reactor trip. A brief summary of applicable activities is provided below:

- In September, 1988, a water hammer event occurred and was documented in SAO 132 report 88-13. The cause was determined to be the rapid opening of LCV-1158 with the hotwell stops closed. This allowed water to rapidly fill an evacuated line and cause a pressure spike which damaged portions of the AFW system instrumentation. A special investigation team was formed to determine corrective actions. The most significant corrective action involved modifying LCV-1158 to open more slowly.

- On January 10, 1990, another water hammer event occurred when operators were filling the evacuated portion of piping between LCV-1128 and the hotwell stops. SAO 132 report 90-01 identified this event as very similar to the 1988 water hammer event. Corrective actions included increased training for licensed operators and nuclear plant operators and a review of the design basis of the feed/condensate system. The objective of this review was to compare current operating practices to original design requirements and the as-modified design to determine if the current installed condition and operating

practices remained consistent with the original design philosophy. This review was completed on November 5, 1991. Two conclusions were reached. First, at least one hotwell stop should be left open to prevent another water hammer event. Second, because LCV-1128 is a 12 inch butterfly valve, it should be opened only slightly when used.

- On September 7, 1990, both 21 and 23 ABF pumps tripped on low suction pressure. The cause was determined to be the incorrect placement of the sensing line for the low suction pressure switches. Corrective actions identified in SAO 132 report 90-12 included a requirement to modify the sensing point location. This was completed September 8, 1991.

- On November 7, 1991, 23 ABF pump tripped on low suction pressure when valve LCV-1128 was returned to service following maintenance. The sequence of events started with the opening of LCV-1128. When LCV-1128 opened, LCV-1158 closed. When LCV-1158 was reopened, 23 ABF pump tripped. No SAO 132 report was initiated. This event resulted in unresolved item 91-26-01. Con Edison has not yet completed its analysis of this event.

The inspectors had several concerns resulting from the review of these AFW and condensate system interactions.

- The four events preceding the April 13, 1992 motor driven ABF pump problems illustrates the long standing nature of the adverse interactions existing between these two systems.

- Corrective action item 4 on SAO 132 report 90-01 was to conduct a review of the design for the feed/condensate system. This was completed on November 5, 1991, two days before a low suction pressure trip of 23 ABF pump. This event occurred in a manner not identified in the review. This event further demonstrated that the interactions occurring between these two systems were not clearly understood.

- A review of the design basis completed on November 5, 1991, made a recommendation that operators should only open LCV-1128 slightly to avoid water hammer events. Although operator training on water hammer events was conducted, the inspector noted that this recommendation was never implemented in system operating procedure (SOP) 20.2, Condensate System Operation. In addition, the potential for overfeeding a steam generator when making up from the CST using LCV-1128 was not addressed in the procedure.

- SOP 21.3, Auxiliary Feedwater System Operation, provides operators with no guidance concerning avoidance of water hammer events when cycling LCV-1158.

- No SAO 132 report was initiated for the November 7, 1991 low suction pressure trip. This is contrary to the guidance established in the revision of SAO 132, Analysis of Station Events, in use at the time. Section B, item 7 of that procedure establishes as a criteria for an event report each failure or malfunction of a safety-related system or component, including test failures. This lack of thorough analysis of the November ABF pump trip was a precursor of the April 13, 1992, ABF trip in that the impact of operating valves on the 12 inch make-up line was not fully understood.

The inspectors concluded that Con Edison demonstrated a weak understanding of the AFWS and the condensate system interactions. The corrective action process had been unsuccessful in resolving the long standing issues associated with the auxiliary feedwater system.

10 CFR 50, Appendix B, Criteria XVI, establishes guidance for implementation of corrective action programs. It requires, in part, that in the case of significant conditions adverse to quality, measures shall be established to assure that the cause of the condition is determined and corrective action taken to preclude repetition.

The failure of the corrective action process to develop a full understanding of AFWS and condensate system interactions contributed to the malfunctioning of the AFWS on the April 13, 1992, reactor trip. Sufficient history existed on these interactions such that corrective actions should have been in place to preclude another occurrence of an AFWS malfunction.

This failure of the corrective action process a violation **(50-247/92-09-02)**.

7.3 Auxiliary Feedwater System Licensing Basis

The inspectors reviewed a safety evaluation report (SER) on the seismic qualification of the auxiliary feedwater system. The SER was transmitted to Con Edison in a letter dated December 1, 1986. One of the issues raised was the ability of the auxiliary feedwater system to withstand a seismically induced break in the 12 inch line between LCV-1158 and LCV-1128. A failure of this section of pipe, which is seismic class III, during a seismic event with a single failure of LCV-1158 could jeopardize the capability of the CST to provide adequate water to the AFWS. One of the assumptions used in the analysis was that following a double-ended guillotine break in the piping, the operator would take thirty minutes to identify the problem and close LCV-1158 prior to the CST reaching its Technical Specification minimum level. The staff concluded that sufficient time existed to isolate the break in the unlikely event valve LCV-1158 failed to close automatically following a downstream pipe break. A temporary modification to block shut LCV-1128 was installed to prevent a low suction pressure trip of the ABF pumps. This reduces the flowrate from the CST to the hotwells to that allowed through the 4 inch bypass valve, LCV-1128A. LCV-1128A is also administratively controlled to minimize the valves operation.

After reviewing the events surrounding the April reactor trip, the inspectors questioned the assumptions in the original SER. During the trip, the operators were sending water to the hotwells from the CST using valve LCV-1128. When the reactor tripped, valve LCV-1128 was in the open position. The differential pressure which existed between the CST and the hotwells with LCV-1128 open is significantly larger than would be the case for a double-ended guillotine break as analyzed in the safety evaluation. This is because vacuum existed in the condenser at the time of the trip. The inspectors determined that the flow rates established from the CST to the hotwells were much higher than those analyzed for in the safety evaluation. Therefore, with the assumption of single failure at LCV-1158 taking 30 minutes to discover and close, it was unclear whether or not sufficient water would remain in the CST for decay heat removal purposes. This issue will be left unresolved pending further analysis by both Con Edison and the NRC. **(Unresolved Item 92-09-01)**

8.0 SAFETY ASSESSMENT/QUALITY VERIFICATION (40500)

8.1 Post Trip Review Report

The inspectors reviewed the Post Trip Review Report prepared pursuant to Operations Administrative Directive (OAD) 23, Post Trip Review and Evaluation Procedure. The purpose of this report was to provide a systematic method for analyzing reactor trip events. The inspectors noted that the report contained no discussion of the performance anomalies associated with 23 ABF pump. The inspectors also noted that Operations Department management classified the reactor trip as a condition II event instead of a condition III event. OAD 23 provides guidelines for establishing these event conditions. There are three event conditions (I, II, and III) which define certain actions which must be taken by plant personnel before reactor restart can occur. A reactor trip should be classified as condition III when safety-related or other important equipment did not function properly during the trip and the cause of the malfunction has not been determined or corrected. With the respect to the reactor trip on April 13, 1992, the failure of 23 ABF pump to start or the IRNI control power fuse problem should have resulted in a condition III event classification. The inspectors determined that the safety significance of this error was minimal. The additional action required in OAD 23 for a condition III classification largely involved additional review by the Operations Manager and the Chief Plant Engineer. The inspectors did note these reviews were conducted by these individual. The reviews were found to be thorough and satisfied the intent of OAD 23.

Besides the two exceptions discussed above, the inspectors found that the Post Trip Review Report accomplished the objectives specified in OAD 23. The inspectors overall conclusion was that the Post Trip Review Report was adequate.

8.2 Station Nuclear Safety Committee Meetings

The inspectors had specific concerns with the SNSC meeting held on the afternoon of April 14, 1992, to evaluate the Post Trip Review Report and give approval to restart the reactor. Although the inspectors had no safety concerns with the decision to restart the reactor, the inspectors noted that SNSC members did not conduct a thorough review and evaluation of the Post Trip Review Report.

The inspectors concluded that SNSC on the whole accomplished its review and audit function. However, the SNSC's review of the Post Trip Review Report was evaluated as weak.

8.3 SAO 132 Report No. 92-06 Spill From Uncapped Unit 1 Feedwater Line

The inspectors reviewed SAO 132 report no. 92-06 which was performed in response to a spill from the uncapped feedwater line. This event is discussed in section 3.2 of this report. The inspectors concluded that radiation protection personnel conducted a thorough analysis of the event. In addition, the suggested corrective actions appeared well thought out and would provide some reassurance that a third occurrence of this type of event would not occur.

9.0 MANAGEMENT MEETINGS (71707)

9.1 Exit Meeting

The inspectors met with Mr. S. Bram and other Con Edison personnel periodically and at the end of the inspection report period to summarize the scope and findings of their inspection activities. Based on Region I review and discussions with Con Edison, it was determined that this report does not contain information subject to 10 CFR 2.790 restrictions.

9.2 Inspections Conducted by Region Based Inspectors

Date	Subject	Inspection No.	Inspector
4/30	Motor Operated Valves and Inservice Testing (Review of previous inspections)	92-08	L. Prividy

9.3 NRC Management Visits

During the inspection period, NRC Region I management visited Indian Point 2. The purposes of these visits were to meet with Con Edison management, tour the plant facilities and attend NRC exit meetings. NRC managers who visited the site during this period are listed below:

Date	NRC Manager/Title
4/8	T. Martin, Regional Administrator
4/27	S. Shankman, Acting Deputy Director, DRP