U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Report Nos. 50-387/85-16; 50-388/85-15

Docket Nos. 50-387 (CAT C); 50-388 (CAT C)

License Nos. NPF-14; NPF-22

Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna Steam Electric Station

Inspection At: Salem Township, Pennsylvania

Inspection Conducted: April 22 - May 8, 1985

Inspectors: Jack Strosnider for R. H. Jacobs, Senior Resident Inspector — 5/16/85 Date

Jack Strosnider for L. R. Plisco, Resident Inspector — 5/16/85 Date

Approved By: Jack Strosnider J. Strosnider, Chief Reactor Projects Section 1C, DRP — 5/16/85 Date

Inspection Summary: Special safety inspection by the Resident Inspectors (U1 - 38 hrs.; U2 - 27 hrs.) of the licensee reported event involving the inoperability of one loop (A) of the Emergency Service Water and Residual Heat Removal Service Water Systems due to open sliding links. This involves a violation of Technical Specification Limiting Conditions for Operation (LCO) 3.7.1.1 and 3.7.1.2. A separate violation involving three late surveillances on the Emergency Service Water System was also identified. One deviation from the FSAR and Regulatory Guide 1.106 was identified involving lack of indication when motor operator thermal overloads are not bypassed. An Enforcement Conference has been scheduled to discuss these matters further.

DETAILS

1.0 Event Summary

On April 21, 1985, at 1:15 a.m., with Unit 2 at 100% power and Unit 1 defueled, the licensee attempted unsuccessfully to place the unit common "A" loop of Emergency Service Water (ESW) in operation. The licensee subsequently found improperly positioned sliding links (TBA2-27/28) in Relay Panel 1C221A. The links were repositioned from open to shut, and the ESW "A" loop was placed in operation at 5:00 a.m.

2.0 Summary of Event Follow-up

This section highlights the significant findings from the licensee's event follow-up and the resident inspector's independent review.

2.1 The licensee determined that the 'A' loop of ESW/RHRSW was inoperable from April 4 to April 21, thereby exceeding the 72 hour Technical Specification Limiting Condition for Operation (LCO) for ESW/RHRSW operability. This is a violation. The remaining loop was not affected (Detail 3.1).

2.2 The open sliding links which caused the above system inoperability also affected a Division I auxiliary load shedding circuit and Division I bypass indication system for certain ESW valves. The effects of the loss of these circuits was not significant because of plant conditions (Detail 3.2).

2.3 Following identification of the open links, the licensee initiated a program to inspect all plant control panels for open links. All Q and some non-Q panels were inspected prior to Unit 2 startup and Unit 1 refueling. Approximately 800 panels have been inspected to-date (Detail 3.3).

2.4 From the above inspection, some additional links were found open. Significant effects of these additional open links were the 'A' train of the Standby Gas Treatment System (SGTS) operability and the unbypassing of certain ESW motor operated valve thermal overloads. It is unknown how long these conditions existed (Detail 3.4).

2.5 Inspector reviews of modification work affecting the ESW system did not identify any operational testing performed following modification completion to support ESW operability for Unit 2. This is unresolved (Detail 6.2).

2.6 The licensee identified controlled drawing deficiencies which led to the load shedding circuit (see 2.2 above) not being identified in the blocking and equipment release for modification work. This is unresolved (Detail 6.3).

2.7 Inspector review of bypass indication system schematics identified that there is no control room indication when certain valve motor overloads are unbypassed. This is contrary to Reg. Guide 1.106 and is a deviation (Detail 6.4).

2.8 The licensee identified that three surveillances for the ESW system were not performed within the allowable surveillance frequency. This is a violation (Detail 6.5).

3.0 Description of Event

3.1 Identification of Inoperable ESW/RHRSW Loop

On April 21, 1985, at 1:15 a.m., with Unit 2 at 100% power and Unit 1 defueled, the licensee attempted to place the "A" loop of Emergency Service Water (ESW) in operation in accordance with the normal operating procedure, OP-054-001. The control room operator started the "A" ESW pump, but the spray pond bypass valve failed to open in 30 seconds as designed. The operator allowed the pump to run for approximately two minutes, and then tripped the pump. The bypass valve operator circuit breaker and motor overloads were checked and verified to be operating properly, and a second attempt was made to start the system. Again, the bypass valve failed to open and the operator tripped the pump.

The operators then prepared Work Authorization (WA) S51053 to have Maintenance investigate the cause for the failed bypass valve. The operators entered Technical Specification Limiting Condition for Operation (LCO) 3.7.1.2 due to the "A" loop of ESW being inoperable. Investigation by Electrical Maintenance found a relay (62AX-20108) deenergized in the auxiliary control circuit which provides the automatic opening signal to the bypass valve on the start of an ESW or RHRSW pump. The relay was deenergized because the 125 VDC power from panel OCB651 was isolated due to open sliding links TBA2-27 and 28 in relay panel 1C221A. The links were closed, and the pump was successfully started at 3:58 a.m. The LCO was cleared at 5:00 a.m., April 21, 1985, and the licensee prepared Significant Operating Occurrence Report 2-85-112.

On April 21, the licensee commenced an investigation to determine the cause of the open sliding links and the condition of other sliding links throughout the plant. The licensee reviewed the modification packages that had the potential for entering the affected panels, interviewed operators and construction workers and reviewed the operating history and logs to determine the length of time the condition existed. The initial investigation revealed that the condition existed during the period April 4 - 21, 1985, thereby exceeding the 72 hour LCO. The licensee then notified the NRC via ENS in accordance with 10 CFR 50.72(b)(2)iii at 7:00 p.m. April 24, 1985.

3.2 Consequences of Open Sliding Links in Relay Panel 1C221A

The open sliding links TBA2-27/28, identified in relay panel 1C221A on April 21, 1985, resulted in the loss of the following circuits:

-- Division I Bypass Indication System (BIS) control room indication for the 'A' Diesel Generator cooler supply and return isolation valves from the 'A' ESW loop.

-- Division I Spray Pond Bypass Valve Auxiliary Control.

-- Division I Plant Auxiliary Load Shedding Initiation Circuit and Interlocks for Unit 1 and Common Loads.

The BIS is utilized, in accordance with Regulatory Guide 1.47, to provide automatic indication in the control room for deliberately induced inoperable status when any redundant portion of the safety systems or their supporting systems is not capable of performing its safety-related function. The specific portion of the affected circuit normally would have provided an "ESW Valves Control Power Loss" indication in the control room on a loss of power or motor operator thermal overload for the 'A' Loop ESW valves to the 'A' diesel generator coolers (HV-01112A, HV-01122A). No automatic active function was affected by the loss of this circuit.

The Spray Pond Valves Auxiliary Control Circuit includes the logic for the automatic opening of the spray pond bypass valves on start of either the ESW pumps or RHRSW pumps, and automatic closure on a pump trip. On an ESW pump start, either manual or automatic, a 30 second time delay relay (62AX1-20108) is actuated, which then initiates a bypass valve opening signal. Upon start of RHRSW pumps the bypass valve for that loop opens immediately. The 30 second timer for the ESW pump start is required to minimize water hammer effects. The timer had been set at 140 seconds prior to the installation of modifications to the ESW system during the Unit 1 refueling outage. (See Detail 6.2). When all four associated pumps (A & C ESW, 1A and 2A RHRSW) are tripped, the bypass valve and the spray pond header valves (HV-01223A1, A2) are automatically closed to prevent the header from draining. Therefore, with this circuit deenergized the 'A' Loop spray pond bypass valve would not have opened automatically on an automatic initiation of ESW as required during an accident condition, (i.e. LOCA, LOOP) rendering the loop inoperable. Manual operation of the valves from the control room was available, since this circuit was not affected by the open links.

The Division I Plant Auxiliary Load Shedding Initiation Circuit and Interlocks Scheme provides the load shedding logic for Unit 1 and common loads during various accident scenarios. The following functions were lost when the circuit was deenergized:

-- Division I input to the startup transformer to provide auto-boost signal under accident conditions. No credit is allowed in the voltage study for this circuit.

-- Load shed interlocks to ESW 480 VAC Motor Control Center (MCC) OB517, a common load, which provides power to the spray pond piping drain pump and lighting panel. Both a Unit 1 and Unit 2 LOCA signal are required to initiate a load shed for this load and the Unit 1 signal would have been disabled, preventing a load shed.

-- Division I LOCA input to 4.16KV buses 1A and 1C undervoltage auxiliary relay control. The Unit 1 LOCA signal (High Drywell Pressure or Low Water Level) would not have initiated a 10 second load shed on Unit 1 loads, as required.

-- Division I LOCA input to Non-Class 1E 13.8KV and 480V interlocks. The load shed logic would not have initiated for various balance of plant loads on a Division I LOCA signal, but would have actuated on a Division II LOCA signal.

The impact of the loss of this circuit was not significant since Unit 1 was defueled and the common loads affected were minimal.

3.3 Licensee Investigation and Corrective Action

Following identification of the open links in the ESW valve circuit, the licensee initiated a program to inspect all plant control panels for open sliding links. On April 26, two open links were found in panel OC877A. On April 29, the licensee identified that one of these links, TBC-60, affected the 'A' train of the Standby Gas Treatment System (SGTS) in that the Zone II (Unit 2 Reactor Building) differential pressure instrument was not providing an input to PDIC 07554A, pressure differential indicating controller. This controller modulates the recirculation plenum to SGTS damper to maintain the lowest differential pressure (dp) of Zones I, II and III at greater than or equal to 0.25 inches. Without the Zone II input, if Zone II had more inleakage than the other zones, the 'A' SGTS would not maintain Zone II at the required dp. Hence without this signal, the 'A' SGTS would be considered inoperable. The 'B' SGTS was unaffected.

At the time of this discovery, Unit 2 was in cold shutdown. On April 30, the inspector discussed with the Station Superintendent, his plans for ensuring that other safety systems were not affected by open links. The Station Superintendent stated that all control panels affecting Unit 1 or 2 operation would be inspected for open links and discrepancies resolved prior to changing Operational Conditions on Unit 1 or Unit 2. This statement was later clarified to include all Q listed panels and others impacting operability of

systems included in Technical Specifications. At the time of this report, approximately 800 panels have been inspected.

The results of this inspection identified that eight circuits in Unit 2 and common systems had open links requiring closure before startup. The systems affected by these open links are discussed in Detail 3.4. Seven circuits in Unit 1 were affected by open links requiring closure prior to Unit 1 startup. These circuits include MSIV closure trip bypass, drywell cooling, generator output breaker closure, condensate pump trip circuits and a feedwater valve. None of these circuits would affect fuel load although the licensee closed the links prior to entering Operational Condition 5 (at the time of discovery of these open links, Unit 1 was defueled). The licensee's inspection and disposition of open links in remaining non-Q panels is continuing.

The cause of all the open links had not been determined at the time of this report. However, in the case of the ESW spray pond bypass valve, it was determined that links had been opened by a contract electrician to perform scheme and megger checks on new leads installed for PMR 82-872B. Opening of these links was not authorized by the work plan and there was no documentation that they were opened. The licensee took action to require that a PP&L foreman be present during lead termination or de-termination by contract electricians in plant panels.

The station administrative controls that govern the operation of sliding links are provided in Administrative Directive AD-QA-502, Work Authorization System, and several Station Policy Letters. Policy Letter 6-84, Control and Verification of Operating Actions, states that when working within the bounds of Permit and Tag blocking, individuals other than Operations personnel are permitted to alter the state of components. In these cases, the worker is required to record on the work document that the component was altered and then restored. AD-QA-502 reiterates this policy and further states that work authorizations which have work plans shall include signoffs for both the performer and the verifier where verification is required.

Policy Letter 5-84 concerning operation of electrical isolation devices states that only electrical maintenance or I&C personnel normally and Operations personnel during surveillance procedures are permitted to operate sliding links under authorizing documents such as WA, Construction Work Orders (CWO's), Permit and Tag blocking, etc.

The inspector discussed with a Construction Department Manager the extent to which Construction Foremen and Catalytic workers were knowledgeable of the above policies. He indicated that these individuals had been briefed and were knowledgeable of the policy prior to this

occurrence. However, with the exception of AD-QA-502, this station policy had not been incorporated into other administrative procedures.

3.4 Consequences of Open States Links in Other Systems

As a result of the inspection of plant control panels, open links were found in the following circuits which required closure prior to changing Operational Conditions on Unit 2. The inspector reviewed applicable schematic diagrams to verify the impact of the open links.

-- ESW valves HV-01112C and HV-01122C, ESW loop 'A' supply and return valves to the 'C' diesel. Links in panel OC697 were found to be open which would prevent bypassing the motor operator thermal overloads for these valves as required by Technical Specification (TS) 3.8.4.2, in spite of the position of the overload bypass switch. This circuit is further discussed in Detail 6.4.

-- Zone II differential pressure input to the 'A' recirculation plenum to SGTS differential pressure controller. This circuit affected operability of the 'A' train of SGTS as discussed in Detail 3.3. Unless Zone II has the lowest differential pressure of the three zones, this discrepancy would be not discovered on a surveillance test because the pressure controller PDIC-07554A only controls on the zone with the lowest differential pressure. SGTS drawdown and Zone inleakage testing performed on April 26 and 27 was satisfactory because Zone II did not have the lowest differential pressure.

-- ESW valve HV-08693B, Control Structure Chilled Water ESW 'A' Loop Control Valve. This valve was installed during this outage as a portion of the ESW waterhammer modification, DCP 83-592C. The open links affected the motor thermal overload in the same manner described for ESW valves HV-01112C and HV-01122C discussed above.

   This overload must be bypassed per Technical Specification 3.8.4.2 following Unit 1 startup from this refueling outage (i.e., Amendment 6 to the Technical Specification which added the requirement is not effective until then).

-- Low flow switch for the 'A' Battery Exhaust fan. With the links open, the 'A' fan would not trip under low flow conditions if it had been started in manual. The Battery Exhaust fans are safety-related, but are not specifically required by the Technical Specifications. This low flow switch is apparently for equipment protection.

-- Safety Parameter Display System (SPDS) computer points for reactor vessel level (upset range) and 'A' RHR Service Water heat exchanger outlet radiation monitor. The normal indication for these parameters was available.

-- ESW loop 'A' supply header pressure indication (PI-01107A). The link was found only partially closed. However, there was continuity through the link and indication was available.

-- 'C' Service Water Pump. With the links open, the breaker interlock scheme with Bus 'B' is affected when the Bus 'A' breaker is in the TEST position. This is not a safety-related or Technical Specification function.

4.0 Sequence of Events

The following event sequence occurred with Unit 2 in Operational Condition 1 at full power and Unit 1 defueled:

DATE	TIME	ACTIVITY
3/19/85	0001	LCO 3.7.1.2 (seven days) entered on 'C' ESW pump for modification work (PMR 83-592). ERF A34761 released to readjust bypass valve timer per PMR 84-592C. Permit 1-85-794 opened fuses 13/14 in panel 1C221A and opened valve breaker OB517-34 (HV-01222A), after bypass valve opened.
3/21/85	1735	'A' ESW pump started.
3/22/85	1950	'C' ESW pump started as part of modification retest.
3/22/85	2000	LCO 3.7.1.2 on 'C' ESW pump cleared.
3/26/85	0215	'C' ESW pump shutdown in preparation for applying permit.
3/26/85	0400	LCO 3.7.1.2 (seven days) entered on 'C' ESW pump for modification work (PMR 82-872B).
3/26/85	1950	Permit 1-85-705 applied to breaker 1D61421, isolating power to bypass valve auxiliary control circuit. The associated ERF A30904 stated a 72 hour LCO was applicable and consisted of two CWO's C41122 and C41450.
3/28/85		Catalytic employee opened sliding links TBA2-27/28 during modification work and did not re-close.

DATE	TIME	ACTIVITY
3/28/85		CWO's C41122 and C41450 for PMR 82-872B completed.
3/28/85	2135	Permit cleared on breaker 1D61421 and during retest of switch HSS-01651G (WA S50440), an E&S electrician noted that the links were open.
3/30/85	2104	LCO cleared on 'C' ESW pump.
4/4/85	1814	Operators shut down 'A' ESW pump, but the bypass valve did not automatically close as designed. Operations issued Work Authorization S50965 to investigate the anomaly.
4/11/85	0820	'C' ESW pump started. Interviews with operators determined that they opened the valve with the control room handswitch prior to determining the proper operation of the automatic function.
4/12/85	0120	Shut down the 'C' ESW pump (PCO log says 'A', but only 'C' pump was running and PCO turnover sheets indicate 'C' pump running on 0700 - 1500 shift).
4/21/85	0115	'A' ESW pump started, but operator shutdown pump after approximately two minutes when bypass valve did not open automatically. A second attempt was made after checking the valve operator breaker and overloads but it also failed. Operations submitted Work Authorization S51053 to investigate.
4/21/85	0125	Entered LCO 3.7.1.2 (three days) on 'A' ESW Loop due to inoperable bypass valve.
4/21/85	0358	'A' ESW pump started, after investigation by Electrical Maintenance found sliding links TBA2 27/28 open in panel 1C221A.
4/21/85	0500	Cleared LCO on 'A' Loop ESW after links closed and successful pump start.
4/24/85	1900	ENS call made IAW 10 CFR 50.72 to report the LCO violation.

Note: Logs indicate the 'B' Loop ESW was in service throughout the period March 27 - April 21, 1985.

5.0 Description of Affected Systems and Components

5.1 States Company Sliding Link Electrical Terminal Blocks

The States Company Sliding Link Electrical Terminal Blocks are used throughout the plant to provide for maintenance and easy insertion of test instruments into the associated circuits. It consists of a terminal post and slotted bar fastened on either side of a non-conductive block. The slotted bars are physically and electrically isolated from each other. The connection between the two bars on the terminal block is made by a "U" shaped sliding link and spacer located between the two bars. The top of the "U" link has a hole through which the locking bolt passes. The bottom of the link has a threaded hole to accept an 8-32 bolt. When the bolt is tightened, it binds together the "U" link, spacer and slotted bars to make an electrical connection. Loosening the bolt and sliding the link from between the bars breaks the connection.

5.2 Emergency Service Water System

The Emergency Service Water System is an engineered safeguard system designed to supply cooling water to the emergency diesel generators, RHR pumps, control structure chillers, and various room coolers required during normal and emergency conditions necessary to safely shut down the plant. The ESW system is designed to take water from the spray pond (ultimate heat sink), pump it to the various heat exchangers and return it to the spray pond through the spray headers or the bypass valves. The system consists of two loops with two pumps in each loop. Each of the two loops supplies both Unit 1 and Unit 2 loads.

The ESW system is required to supply cooling water to:

-- RHR pump room coolers, bearing oil coolers, and seal coolers ('A' loop supplies A & D pumps, 'B' loop supplies B & C pumps);

-- all diesel generator heat exchangers;

-- room coolers for Core Spray, HPCI, and RCIC;

-- control structure chillers and direct expansion unit;

-- Reactor Building and Turbine Building Closed Cooling Water Systems on loss of service water (manual shift); and

-- makeup to the spent fuel pools when all other available sources are not adequate (manual operation).

The ESW system has sufficient redundancy so that a single failure of any active component, assuming the loss of offsite power, cannot impair the capability of the system to perform its safety-related functions.

The ESW pumps are designed for remote operation from the control room or the remote shutdown panels. The pumps start automatically after the diesel generators receive their start initiation signal. The spray pond header valves (HV-01224A1, A2, B1, and B2) and bypass valves (HV-01222A and B) are individually controlled by dual push-button control switches located on control room panel OC653. The spray pond header valves and bypass valves automatically close upon shutdown of all pumps on that loop. Upon start of RHRSW pumps, the bypass valve for that loop opens immediately while upon start of the ESW pumps the opening of the bypass valve is delayed 30 seconds to minimize water hammer. Normally all four D/G cooling systems are supplied from ESW Loop 'A'. Should ESW loop 'A' flow decrease below 4800 gpm, an alarm circuit will annunciate a low flow alarm on control panel OC653 and the diesel generator cooler valves will transfer to loop 'B' after approximately 60 seconds have elapsed. Should ESW loop 'B' flow decrease below 1650 gpm an alarm circuit will annunciate a low flow alarm.

5.3 Residual Heat Removal Service Water System

The Residual Heat Removal Service Water (RHRSW) System has a safety-related function and is an engineered safeguard system designed to supply cooling water to the Residual Heat Removal (RHR) heat exchangers of both units. The RHRSW system is designed to take water from the spray pond, pump it to the heat exchangers and return it back to the spray pond by way of a spray network that dissipates the heat to the atmosphere.

The system consists of two RHRSW loops (A and B) per unit, and each loop is cross-connected between units so that either unit can supply cooling water to either RHR heat exchanger. Both the cooling water discharging from the RHR heat exchanger and the cooling water headers to the spray pond discharging from the corresponding ESW system are returned to the spray pond in a common header.

The system is designed with sufficient capacity and redundancy so that a single failure of any active component, assuming the loss of offsite power, cannot impair the capability of the system to perform its safety-related functions.

The RHRSW pumps are designed for remote operation from the control room. One loop from each unit can be remotely operated from either of the two remote shutdown panels. The pumps are designed to be started manually at approximately 10 minutes after the diesel generator start during an accident condition. The pumps do not have an automatic start feature.

6.0 NRC Follow-up Review

6.1 Operability of ESW/RHRSW System

The inspectors reviewed control room logs, shift turnover status sheets, LCO logs, System Status Records, and applicable Surveillance Test procedures to determine the status of the ESW/RHRSW loops during the period between March 19 - April 21, 1985.

On April 4, 1985, at 6:14 p.m., the control room operators shut down the 'A' ESW pump, which had been operating since March 21. After tripping the pump, the operators noted that the associated spray pond bypass valve did not automatically close as designed. The operators submitted a Work Authorization (S50965) to have the bypass valve investigated, but did not recognize that the operability of the loop was affected. The operating procedure OP-054-001, Revision 3, Emergency Service Water requires the operators to ensure the spray pond bypass valves and spray header valves close on shutting down the pumps. The valve was shut manually using the control room hand-switch.

Work Authorization (WA) S50965 submitted by Operations did not specify that system operability was affected and, therefore, was given a low priority by Electrical Maintenance when they received the WA on April 8. The WA was not performed prior to the discovery of the open links on April 21, 1985.

On April 11, at 8:20 a.m., the 'C' ESW pump was started. Licensee interviews with the control room operators determined that they opened the bypass valve with the control room handswitch after waiting an unmeasured period of time for the automatic function. The operators did not submit a WA, write a SOOR, nor recognize the affect on system operability. The pump was shutdown on April 12 at 1:20 a.m.

The 'A' loop was idle from April 12 until April 21 when the bypass valve did not operate properly and an investigation found the slidings links open. (See Detail 3.1).

Based on inspector review of all available logs and data, the 'A' loop of ESW/RHRSW was inoperable from April 4, 1985, at 6:14 p.m., when the 'A' ESW pump was shutdown, until April 21, 1985, at 5:00 a.m., when the sliding links were reclosed, and the loop successfully tested. Although the automatic opening function of the bypass valve was defeated during the period between March 26 - April 4, the 'A' loop was operating with the 'A' ESW pump in service and the bypass valve open until April 4. Throughout the same period the 'B' ESW loop was operating with two ESW pumps running and its associated bypass valve open.

As part of the review, the inspectors reviewed the LCO log, system status log, and tag permits to determine if the proper LCO's were entered when systems were placed out of service for the performance of modifications. (The specific modifications are discussed in Detail 6.2).

On March 19, 1985, at 12:01 a.m., LCO 3.7.1.2 was entered because the 'C' ESW pump was made inoperable to perform modifications. The LCO entered was for seven days because only one pump was to be made inoperable. The inspectors reviewed the associated work packages to determine if the correct LCO was entered for the actual permits applied to the system. No unacceptable conditions were identified. Additionally, a modification not under this LCO was performed on the spray pond bypass valve time delay relay 62AX-20108 during this period. The work was performed under Construction Work Order (CWO) C40761 and Equipment Release Form (ERF) A34761 (PMR 83-529C) and consisted of readjusting the bypass valve timer from 140 seconds to 30 seconds. The blocking for the work deenergized the bypass valve auxiliary control circuit, but the bypass valve was opened and deenergized. Since the bypass valve remained open throughout the modification, the loop was considered operable and entering the LCO was not required. The auxiliary control circuit was deenergized from 11:20 a.m., March 19, until 6:21 p.m., March 20, 1985. The LCO for the 'C' ESW pump was cleared at 8:00 p.m. on March 22, 1985.

On March 26, 1985, at 4:00 a.m., LCO 3.7.1.2 was entered because the 'C' ESW pump was made inoperable to perform modifications. The LCO was again entered for seven days because only one pump was inoperable. On March 26, at 7:50 p.m., tagging permit 1-85-705 was applied to 125VDC circuit breaker 1D61421, isolating power to the bypass valve auxiliary control circuit, BIS and Division I LOCA load shed circuit and the associated ERF A30904 stated the applicable Technical Specification was a 72 hour LCO.

The inspectors reviewed the associated work packages to determine if the 72 hour LCO (one loop inoperable) was applicable and if an LCO would have been applicable for the RHRSW loop and the LOCA load shedding circuit. The inspectors determined that: loss of the LOCA load shedding circuit was not identified because of controlled drawing inadequacies (see Detail 6.3); and the 72 hour LCO for the loss of one ESW loop was applicable, but it was not exceeded during the period circuit breaker 1D61421 was open. LCO 3.7.1.1 for RHRSW should have also been entered since the bypass valve control circuit was deenergized, but it was not exceeded.

In summary, the appropriate LCO action statements were not entered as a result of the modification work associated with the bypass valve. On March 26, the licensee should have entered LCO 3.7.1.1 for an inoperable RHRSW loop and LCO 3.7.1.2 for an inoperable ESW loop

since the bypass valve auxiliary control circuit was deenergized. These LCO's require action to be taken within 72 hours, but the licensee did not exceed these action statements, because the 1D61421 breaker was open for a period less than 72 hours. Circuit breaker 1D61421 was open from 7:50 p.m., March 26 to 9:35 p.m., March 28, 1985. Although the auxiliary control circuit for the bypass valve was disabled, the 'A' ESW pump was in service during this period through the open spray pond bypass valve. The LCO on the 'C' ESW pump was cleared at 9:04 p.m. on March 30, and, as discussed above the 'A' ESW pump, was shut down on April 4.

6.2 Plant Modifications and Post-Maintenance Testing

During the Unit 1 first refueling outage which commenced February 9, 1985, several modifications were performed on portions of the common ESW system. These modifications included the following:

-- PMR 83-092 which repiped the ESW cooling water to the C and D RHR pump motor oil cooler, seal water cooler and room cooler so that the 'A' ESW loop supplies the B and C pumps. The modification corrected a previously identified problem concerning a loss of the ESW system to perform its intended safety function due to a single failure of the spray pond bypass valve. This modification only affected Unit 1 portions of the system and did not affect the common ESW system operability.

-- PMR 82-872 which installed 125VDC transfer switches so that common loads could be powered from either units batteries. During this modification, transfer switch HSS-0651G was installed to provide alternate power to the circuit previously supplied by circuit breaker 1D61421. CWO's C41122, C41450 and WA 550440 installed and retested the transfer switch. These work packages were directly involved in the affected logic and included sliding links TBA2-27/28 within the associated blocking. None of the work plans specified the opening of the sliding links.

-- PMR 83-592 which was designed to prevent draindown of the ESW system during most ESW operating modes, when a loss of offsite power occurs, in order to minimize the potential for a waterhammer event. This modification included adding vacuum breakers, check valves, and additional isolation valves to the high points of the ESW loops. The modification also included adjusting the bypass valve timers from 140 to 30 seconds and the 'A' ESW pump low flow timer from 170 to 60 seconds. CWO C40761, which readjusted the bypass valve timer, was involved with portions of the affected logic, but the blocking did not include the open links.

Several other modifications were performed on the ESW system and within relay panel 1C221A, but were not involved with the affected circuits.

The inspectors reviewed the work packages and associated documentation for the modifications that could have led to the opening of sliding links TBA2-27/28, and the post-maintenance testing that was performed after completion of the modifications.

CWO's C41122 and C41450 installed 125VDC transfer switch HSS-0651G (PMR 82-872). The work included terminating cable leads to TBA2-27/28 in panel 1C221A. Functional testing for the cable installation included scheme checks and cable meggering, but did not encompass the sliding links. WA S50440 provided the retest for the new transfer switch, but only tested the switch operation upstream of the sliding links and performed scheme checks. No discrepancies were noted by the workers in any of the packages, and no steps included opening the sliding links.

Review of the associated ERF A30904 and the system status record found no operational testing was designated or performed as a result of the transfer switch modifications.

CWO C40761 readjusted the spray pond bypass valve timer (62AX1-20108) from 140 seconds to 30 seconds (PMR 83-592). The fuses for the auxiliary control circuit (FU-13/14) were pulled for the blocking. Also the circuit breaker for the bypass valve (OB51734) was opened, after the bypass valve was opened, so an LCO was not required. A safety evaluation was prepared as part of the modification which stated that after portions of the modification had been completed, the bypass valve could be opened and left in that position, thereby maintaining operability of the loop. The CWO listed valve stroking as the functional test requirements, but the work plan did not document that this testing was completed. The system status record does not list any operational testing that was performed after this modification was complete.

In both cases noted above, modifications were performed on a common system that was required for Unit 2 operation, and operational testing was not performed after completion of those modifications. These modifications affected portions of the system that are normally tested in the periodic surveillances.

Additionally, as discussed in Detail 6.5, the periodic surveillances required to demonstrate operability of the system were not completed within the required frequency. It appears that increased management attention is required concerning the controls for common systems especially during outages. This item is considered unresolved. (387/85-16-01)

6.3 Controlled Drawing Deficiencies and Effects on System Blocking

The inspectors reviewed selected licensee controlled drawings to ascertain the adequacy of the licensee's configuration controls concerning the auxiliary control circuits for the affected components.

As discussed in Detail 6.1, several drawing inadequacies were identified by the licensee after the event, which led to insufficient blocking/system control during some of the modification work. Drawing E-16 Sheet 4, Unit 1 250/125/24VDC Circuit Breaker Interruption Impact Diagram, indicates that the only circuits supplied by the 1D61421 breaker (and the TBA2-27/28 links) are the bypass valve auxiliary control and BIS system, but as noted in Detail 3.2, the Unit 1 Division 1 LOCA load shedding circuit was also disabled. The drawing deficiency led to the load shedding circuit not being considered in the blocking and equipment release. The same situation also existed for the 'B' ESW loop circuits. The E-16 drawings were used to specify the blocking for the modifications.

Since previous problems have been noted on controlled drawings concerning DC control power, the licensee is evaluating proposals to have new drawings drafted so that they correctly reflect the "as-built" system configuration. This item is unresolved pending NRC review of licensee corrective action. (387/85-16-02)

6.4 Bypass Indication for ESW Valves

As noted in Detail 5.4, open links were found in panel OC697 which prevented bypassing the motor operator thermal overloads for ESW valves. During review of electrical schematics E-146 Sheet 9 and E-185 Sheet 29, the inspector noted that the bypass indication system (BIS) status light in the control room would not illuminate if the thermal overloads were unbypassed by operating the corresponding TEST/OPERATE switch on panel OC697. With the switch in the TEST position, the thermal overloads of a motor operated valve are no longer bypassed and the operator would have no indication of this condition. Thermal overloads in safety-related motor operated valves are required to be continuously bypassed in accordance with Technical Specification 3.8.4.2 and Regulatory Guide (RG) 1.106 Revision 1 to which the licensee is committed. Section 6.1 states, among other things, that the bypass indication system circuitry should conform to the criteria of Section 4.13 of IEEE Std 279-1971. Section 4.13, Indication of Bypasses, states that "If the protective action of some part of the system has been bypassed or deliberately rendered inoperative for any purpose, this fact shall be continuously indicated in the control room". In addition, FSAR Section 7.3.1 states that it is possible to bypass (sic) overloads for the diesel generator cooler inlet/outlet valves via a bypass switch in the control room and that this condition would be automatically indicated on the BIS panel.

The OC697 panel contains switches to allow unbypassing the thermal overloads for 45 motor operated valves in the ESW, RHRSW and containment isolation systems. A sampling review of the BIS schematics for these valves shows that the bypass circuit is similar to that used for the ESW valves (i.e., a light is indicated only if power or control power is removed). Not providing indication when the thermal overload is not bypassed, is a deviation. (387/85-16-03).

The inspector also noted that the proper lineup of these switches is not included in the respective system checkoff list, although they are checked every 18 months per surveillance SO-000-020. Inspector review of the switches on panel OC697 indicated that they were in the correct position to support Unit 2 operation.

6.5 Missed Surveillances on ESW System

On April 25, the licensee identified that three surveillances affecting the ESW system were performed late. These surveillances are SO-054-001, ESW System Monthly Alignment Check, SO-054-002, ESW Valve Exercising performed quarterly and SO-054-003, ESW Quarterly Flow Verification. The reasons for not performing these surveillances within the specified time intervals were an oversight by Operations personnel and abnormal system lineups required during modification work on Unit 1 portions of the system. The violation dates for these surveillances were April 23 for the monthly test and April 22 for the two quarterly tests. Following the discovery on April 25 that they were overdue, the licensee entered Technical Specification Limiting Conditions for Operations and the quarterly tests were satisfactorily performed on April 25 and the monthly on April 26.

The inspector reviewed the surveillance results and administrative controls for surveillances and discussed this occurrence with licensee personnel. ESW is a common system which, during this time frame, was required for Unit 2 but not Unit 1. Common systems are controlled and surveilled by Unit 1 operators. During this period, the ESW System was in an abnormal configuration in that the 'A' loop Unit 1 Reactor Building portion of the system was isolated for modification work, and the 'B' loop was supplying additional loads, i.e. Turbine Building closed cooling water and Reactor Building closed cooling water heat exchangers. At the time the surveillances were first scheduled, they could not be performed completely because of procedure problems and portions of the system were out-of-service. When procedures were modified, conflicting work prevented their completion, and as the violation dates approached, Operations did not bring the problems to management attention. Failure to perform these surveillances within the required time period is an apparent violation.

Part of the reason for missing the surveillances is due to the administrative controls on the surveillance system. When a periodic surveillance has not been completed by its due date, it appears on a Plant Maintenance Information System (PMIS) printout for past due surveillances. This printout is generated daily for management and work group surveillance coordinators. When the above surveillances could not be performed by the due date, Operations designated the surveillances in an "Out-of-Service/Out-of-Mode" condition. This causes the surveillances to no longer appear on the past due report and be tracked on an "Out-of-Service/Out-of-Mode" report. However, unless specific status of equipment is known, management or the station surveillance coordinator are unlikely to identify that a surveillance has extended past its violation date. This is particularly true in an outage when there are numerous surveillances which cannot be performed due to plant status, all of which are also on the "Out-of-Service/Out-of-Mode" printout. These surveillances were being manually tracked by Operations personnel on a surveillance schedule provided to the Unit Supervisor. However, the surveillances only appeared on the Unit 1 Supervisor's schedule and because there were more than twenty surveillances on that schedule that had not been performed due to plant status, the ESW surveillances did not standout.

These problems highlight the difficulty and the need for careful planning when working on a system common to both units with one unit in an outage. Specific administrative controls to address this common system surveillances need to be developed.

7.0 Technical Specification Adherence

Technical Specification Limiting Condition for Operation (LCO) 3.7.1.2 requires that during all operational conditions, two independent Emergency Service Water (ESW) system loops shall be operable with each loop comprised of two operable ESW pumps and an operable flow path capable of taking suction from the spray pond and transferring the water to the associated safety-related equipment. With one ESW loop inoperable, in Operational Condition 1, 2 or 3, the loop is to be restored within 72 hours or the plant is to be in hot shutdown within the next 12 hours.

Technical Specification LCO 3.7.1.1 requires that, during all Operational Conditions, two independent Residual Heat Removal Service Water (RHRSW) system subsystems shall be operable with each subsystem comprised of one operable RHRSW pump and an operable flow path capable of taking suction from the spray pond and transferring the water through one RHR heat exchanger. In Operational Condition 1, 2 or 3, with one RHRSW subsystem inoperable, the loop is to be restored within 72 hours or be in hot shutdown within the next 12 hours.

Contrary to the above, from approximately 6:14 p.m., April 4, 1985, until 5:00 a.m., April 21, 1985, the 'A' Loop of ESW and RHRSW were inoperable in that power was isolated from the Spray Pond Valve Auxiliary Control preventing automatic operation of the RHRSW Spray Pond Bypass Valve.

Technical Specification 4.7.1.2 requires performance of a valve alignment for the ESW system every 31 days. Technical Specification 4.0.5 requires performance of quarterly pump flow tests and valve exercising tests for pumps and valves in the ESW system. Per Technical Specification 4.0.2 these surveillance intervals may be exceeded by 25 percent.

Contrary to the above, the ESW monthly valve alignment was not performed from March 17 until April 25, 1985, a period of 39 days exceeding the allowable surveillance interval. In addition, the quarterly ESW pump and valve tests were not performed from December 31, 1984, and January 1, 1985, respectively, until April 25, a period exceeding the allowable surveillance interval.

8.0 Safety Significance

8.1 ESW/RHRSW

The Emergency Service Water System, as discussed in Detail 5.2, provides cooling water to various safety-related components, the most significant of which is the Emergency Diesel Generators. With the auxiliary control circuit for the spray pond bypass valve disabled, the 'A' ESW/RHRSW loop was inoperable between April 4 - 21, 1985, and, therefore, not capable of automatically providing sufficient cooling water flow to the diesel generators and other loads. The 'A' ESW loop logic, however, incorporates a low flow switch which transfers the diesel generators to the 'B' loop when the 'A' loop flow is less than 4800 gpm and the 'B' loop pumps are running. The 'B' loop does not have an auto-transfer scheme.

Although the bypass valve automatic opening logic was disabled by the open links, the valve could have been operated from the control room by the handswitch, since this function was not affected. Additionally, the RHRSW is a manually initiated system and could have been placed in service. The FSAR states that the loss of one RHRSW/ESW loop does not affect the capability of the second loop to safely shut down either or both units during emergency conditions.

The open sliding links rendered only one train of the ESW/RHRSW system inoperable, and the 'B' ESW/RHRSW loop was operable with both ESW pumps operating, so there was sufficient cooling capacity available.

In summary, the open links effectively rendered the ESW/RHRSW system prone to single failure, but the alternate train was operating throughout the period.

8.2 Standby Gas Treatment System (SGTS)

As noted in Detail 3.4, operability of the 'A' SGTS train was affected because open links prevented the 'A' Zone II (Unit 2 - Reactor Building) differential pressure signal from being sensed at the differential pressure controller. The SGTS is required to be able to drawdown and maintain the Unit 1 and Unit 2 Reactor Buildings at greater than 0.25 inches of vacuum in a specified time period in order to minimize offsite release in the event of an accident. Without this pressure signal, if Zone II had more inleakage than the other zones and only the 'A' SGTS train was in operation, SGTS would not be able to perform its intended fuction for Zone II. Hence, there was a loss of redundancy in the SGTS system. This condition was determined on April 29 and it is unknown how long the condition may have existed. Because Zone II did not have the highest inleakage, drawdown and inleakage surveillances performed April 26 and 27 were successful and previous surveillances have also been successful.

9.0 Exit Meeting

The inspectors summarized the inspection findings with licensee management on May 9, 1985.

Based on NRC Region I review of this report and discussions held with licensee representatives on May 9, it was determined that this report does not contain information subject to 10 CFR 2.790 restrictions.