U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos.: 50-387/90-11
50-388/90-11

Docket Nos.: 50-387
50-388

License Nos.: NPF-14
NPF-22

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

Facility Name: Susquehanna Steam Electric Station, Units 1 & 2

Inspection At: Berwick, Pennsylvania

Inspection Conducted: May 16 - 18, 1990

Inspectors: W. Baunack for — 6/13/90
L. J. Wink, Reactor Engineer — Date

Approved by: W. Baunack for — 6/13/90
N. J. Blumberg, Chief, Operations Program Section, Operations Branch, DRS — Date

Inspection Summary: Inspection on May 16-18, 1990 (Combined Inspection Report Nos. 50-387/90-11 and 50-388/90-11)

Areas Inspected: Routine, announced inspection by one region-based inspector of compliance with the Anticipated Transients Without Scram (ATWS) Rule (10 CFR 50.62) including design implementation verification, surveillance test procedure and results review, quality verification measures evaluation, and review of licensed operator training.

Results: The ATWS mitigating systems (ARI, ATWS-RPT, and SLCS) installed at SSES Units 1 and 2 were determined to be in accordance with the design described in the FSAR and reviewed in the NRC SER. The quality assurance program applied to these systems complies with the requirements of 10 CFR 50, Appendix B. Operating procedures and licensed operator training have been appropriately revised to reflect the plant modifications made to comply with the ATWS Rule. A surveillance program has been developed and implemented to assure that the system will perform in a reliable manner. However, a deviation was identified (see Section 2.3.1) for the failure to functional test time delay relays in the ARI system in the surveillance program.

DETAILS

1.0 Persons Contacted

Pennsylvania Power & Light Company

*T. Dalpiaz, Assistant Superintendent, Outages
*A. Dominguez, Operations Senior Results Engineer
*L. O'Neil, Assistant Manager, Nuclear Quality Assurance Operations
*P. Rusanowsky, Compliance Engineer

U. S. Nuclear Regulatory Commission

*S. Barber, Senior Resident Inspector
*J. Stair, Resident Inspector

The inspector also contacted other members of the licensee's Operations, Technical, Quality Assurance and Training staffs.

*Denotes those present at the exit meeting on May 18, 1990.

2.0 Compliance with 10 CFR 50.62 - Anticipated Transients Without Scram (ATWS) Rule

2.1 Inspection Scope

The objective of the inspection was to determine if the design of the ATWS mitigating systems for the Susquehanna Steam Electric Station (SSES), Units 1 & 2, as described in their Final Safety Analysis Report (FSAR) and reviewed in the NRC Office of Nuclear Reactor Regulation Safety Evaluation (Letter, M. C. Thadani (U.S. NRC) to H. W. Keiser (PP&L), "Safety Evaluation related to compliance with ATWS Rule 10 CFR 50.62," October 18, 1988) has been implemented. At the SSES, the ATWS mitigating systems consist of an Alternate Rod Injection System (ARI), an ATWS Recirculation Pump Trip (ATWS-RPT) and a manually initiated Standby Liquid Control System (SLCS).

The inspection sought to determine that the quality verification functions for design, installation, maintenance and testing of the ATWS mitigating systems comply with Generic Letter 85-06, "QA Guidance for ATWS Equipment that is Not Safety Related," or with 10 CFR 50, Appendix B. In addition, the inspector reviewed the training provided on the ATWS mitigating systems for licensed personnel.

2.2 Design Implementation Verification

2.2.1 Alternate Rod Injection (ARI) System

The inspector reviewed the schematic diagram listed in Attachment A and performed a walkdown of the system to verify the installed configuration was in accordance with design.

The ATWS rule does not require the ARI system to be safety grade, but at SSES the ARI system has been installed as a Class 1E system. The inspector determined that the ARI system is electrically and physically separate and independent from the Reactor Protection System (RPS). The ARI contains its own logic and control circuits and scram air header exhaust valves which enable it to perform a function redundant to RPS and independent of it.

In addition to being independent and redundant to RPS, the ARI system must also be diverse from it. To accomplish this, the ARI system is provided with a 125 VDC powered supply (RPS uses 120 VAC) and employs AGASTAT relays for logic and control (RPS uses General Electric relays). The ARI system is designed as energize-to-function and uses VALCOR valves to accomplish its function. The RPS system is de-energized-to-function and employs ASCO valves. The ARI system was thus determined to be diverse from the RPS from sensor output to the final actuation device as required.

The inspector determined that adequate status indications and alarms have been included in the main control room for the ARI system. Manual initiation switches have been provided; and inadvertent actuation is minimized both by the use of an arm-and-depress feature for the switches, and by a logic design which requires that two manual initiation switches be depressed (one in each instrument channel) for system actuation.

The inspector reviewed the post-modification testing performed to verify the proper functioning of the ARI system (TP-153-011, listed in Attachment A). The ARI system was designed to meet scram time requirements by

initiating control rod injection within 15 seconds of monitored parameters exceeding their trip setpoints. The test demonstrated that, for the 6 Hydraulic Control Units (HCUs) furthest from the ARI scram air header exhaust valves, the scram inlet valves (conservative measure for the beginning of control rod motion) are fully open between 9.95 seconds and 12.59 seconds following system trip. To ensure the completion of protective action once it is initiated, the test demonstrated that the logic reset is inhibited for greater than 25 seconds (15 seconds to the beginning of rod motion, plus 7 seconds worst case control rod scram time by technical specifications, plus 3 seconds margin) from the last initiation signal. The ARI system was thus demonstrated to be capable of performing its intended function in a reliable manner.

2.2.2 ATWS Recirculation Pump Trip (ATWS-RPT)

The inspector determined that the ATWS-RPT was included as part of the original design of the units at SSES and conforms to the standard Monticello design. Since the design was verified as part of the pre-operational and startup test programs for both Units 1 and 2 and was included in their technical specifications, no additional design implementation verification was performed.

2.2.3 Standby Liquid Control System (SLCS)

The inspector determined that the SLCS was included as part of the original design of the units at SSES; was verified as part of the pre-operational and startup test programs for both Units 1 and 2; and was included in their technical specifications. The design implementation verification was thus focused on the modifications to the system required to meet the ATWS Rule.

The inspector reviewed the P&ID and elementary diagrams listed in Attachment A and performed a walkdown of the system to verify the installed configuration was in accordance with design. The inspector verified that each SLCS pump has a separate suction line from the SLCS storage tank to assure adequate net positive suction head. A manual control switch which initiates dual-pump operation, and adequate status indications and alarms have been provided in the main control room for SLCS operation.

The inspector reviewed the post-modification testing performed to verify the proper functioning of the SLCS (TP-153-007, listed in Attachment A). The test verified with dual pump operation that a flow rate in excess of 82.4 gpm was achieved at a discharge pressure in excess of 1190 psig. The SLCS

was thus demonstrated to be capable of performing its intended function in a reliable manner.

2.3 Surveillance Testing

2.3.1 Alternate Rod Injection (ARI) System

The inspector reviewed the surveillance procedures listed in Attachment A to verify that they are technically adequate; that they minimize the possibility of inadvertent actuation; and that they completely verify all aspects of system operation to ensure that ARI will perform in a reliable manner. The inspector found the procedures technically adequate. The possibility of inadvertent actuation is minimized by the logic design which is "two-out-of-two taken twice." In addition, actuation of the ARI scram air header exhaust and block valves can be bypassed by means of continuously alarmed key lock bypass switches during surveillance testing to prevent inadvertent actuation. However, the inspector could not verify that all aspects of system operation were tested.

Each Division of the ARI system is provided with a time delay relay (62x) which inhibits reset of the logic for 25 seconds to ensure the completion of the protective action once it is initiated (FSAR, Section 7.2.3.1.4.3, ARI Logic). The inspector could not identify any periodic surveillance which tested the proper functioning of these relays. This is contrary to a commitment made in the FSAR, Section 7.2.3.1.8, Test Methods to Ensure ARI Reliability, where it is stated that "Channel calibration, channel checks and channel functional tests will be performed periodically during operation." The failure to functionally test these time delay relays periodically during operation is considered a deviation (50-387/90-011-01 and 50-388/90-11-01).

The inspector also reviewed the results of the surveillances listed in Attachment A. With the exception of the failure to test the time delay relays noted above, the inspector determined that the surveillance results indicated that ARI is capable of performing its function in a reliable manner.

2.3.2 ATWS Recirculation Pump Trip (ATWS-RPT)

The inspector reviewed the surveillance procedures listed in Attachment A to verify that they are technically adequate and encompass all technical specification surveillance requirements. The inspector found the procedures to

be technically adequate and to contain all technical specification requirements for operability.

The inspector also reviewed the results of the surveillances listed in Attachment A. The inspector determined that the surveillance results indicated that the ATWS-RPT is capable of performing its function in a reliable manner.

2.3.3 Standby Liquid Control System(SLCS)

The inspector reviewed the surveillance procedures listed in Attachment A to verify that they are technically adequate; that they encompass all technical specification surveillance requirements; and that they require a minimum concentration of 13.6 weight percent sodium pentaborate solution be maintained. The inspector found the procedures to be technically adequate and to contain all technical specification requirements for operability. The inspector also found that, while not incorporated as a technical specification requirement as recommended in the SER, the minimum sodium pentaborate concentration is administratively controlled in the monthly technical specification surveillance procedures for the chemistry control of the Unit 1 and 2 SLCSs.

The inspector also reviewed the results of the surveillances listed in Attachment A. The inspector determined that the surveillance results indicated that the SLCS is capable of performing its function in a reliable manner.

2.4 Operations Procedures and Licensed Operator Training

The inspector reviewed the valve lineup procedures, operating procedures and alarm response procedures listed in Appendix A to verify that they had been appropriately revised to reflect the plant modifications required to comply with the ATWS rule. The inspector also reviewed the training provided to licensed operators to verify that they received appropriate training on the ATWS mitigation systems.

The inspector determined that the plant procedures had been appropriately revised to reflect the ATWS modifications. The licensed operator systems training units listed in Appendix A incorporate appropriate information on the ATWS mitigation systems. The inspector verified that these units are a required part of both the RO and Instant SRO Training Programs. In addition, the inspector determined that the mitigation of ATWS events has been incorporated into the Emergency Operating Procedures Training and is required in the RO, Instant SRO, and Upgrade SRO Training Programs. The inspector also

verified that training in ATWS mitigation is provided in the requalification program and that the Reactivity Manipulation Records Sheet requires annual manipulations in ATWS mitigation and Emergency Operating Procedures Level/Power Control.

The inspector also witnessed a demonstration of the ARI system and the SLCS on the plant simulator and verified that the simulator had been modified to reflect the actual plant configuration and response.

2.5 Quality Verification for ATWS Mitigating Systems

The ATWS-RPT and the SLCS are both covered by plant technical specifications and are subject to the quality assurance program required by 10 CFR 50, Appendix B. While ARI is not covered under technical specification, it has been installed at SSES at a Class 1E system and is subject to the same QA program as safety related equipment.

The inspector reviewed the Nuclear Department Instruction for Quality Classification (NDI-QA-15.1.2, Revision 3) and determined that information concerning the quality classification of equipment is maintained in the Susquehanna Equipment Information System (SEIS) Data Base. The inspector selected four valves that are part of the ARI system for Unit 1 and witnessed the retrieval of the information on these valves from the SEIS Data Base. The inspector verified that the information retrieved from the data base contained the correct quality classification of these components.

2.6 Conclusion

The inspector's review of ATWS Mitigating Systems (ARI, ATWS-RPT, and SLCS) installed at SSES determined that they are in accordance with the design described in the FSAR and reviewed in the NRC SER. The quality assurance program applied to these systems complies with the requirements of 10 CFR 50, Appendix B. A surveillance program has been developed and implemented (except as discussed in Section 2.3.1) to ensure that the system will perform in a reliable manner. Operating procedures and Licensed Operator training have been appropriately revised to reflect the plant modifications made to comply with the ATWS Rule.

3.0 Exit Interview

On May 18, 1990, an exit meeting was held with licensee personnel (identified in Section 1.0) to discuss the inspection scope, findings and observations as detailed in this report. At no time during the inspection was written material provided to the licensee by the inspector. Based on the NRC Region I review of this report and discussions held with licensee representatives during the inspection, it was determined that this report does not contain information subject to 10 CFR 2.790 restrictions.

ATTACHMENT A

Documents Reviewed

Drawings

D107306, ATWS Alternate Rod Injection Schematic Diagram

E106253, Standby Liquid Control Piping and Instrumentation Diagram

FE121010, Standby Liquid Control Elementary Diagram

Post-Modification Test Results

TP-153-007, Standby Liquid Control Vessel Injection, Performed September 29, 1987

TP-155-011, ATWS-ARI Test, Performed October 26, 1987

Surveillance and Maintenance Procedures

MT-053-002, Standby Liquid Control Explosive Valve Removal and Replacement, Revision 3

SC-253-101, Chemistry Surveillance of Unit II Standby Liquid Control System, Revision 6

SI-164-203, Monthly Functional Test of ATWS-RPT Actuation and ARI Trip System Reactor Vessel Low Low Level Channels LIS-B21-1N025A,B,C,D, Revision 4.

SI-164-204, Monthly Functional Test of ATWS-RPT Actuation and ARI Trip System Instrumentation (High Vessel Pressure) Channels PS-B21-1N045A,B,C,D, Revision 4

SI-164-303, 18 Month Calibration of ATWS-RPT Actuation and ARI Trip System Reactor Vessel Low Level Channels LIS-B21-1N025A,B,C,D, Revision 4

SI-164-304, Quarterly Channel Calibration of ATWS-RPT Actuation and ARI Trip System Instrumentation (High Vessel Pressure) Channels PS-B21-1N045A,B,C,D, Revision 4

SI-164-503, 18 Month Logic System Functional Test of ATWS-RPT System and ARI System, Revision 4

SO-100-006, Shiftly Surveillance Operating Log, Revision 10

Surveillance and Maintenance Procedures (con't)

SO-100-007, Daily Surveillance Operating Log, Revision 12

SO-100-008, Weekly Surveillance Operating Log, Revision 7

SO-155-006, Monthly ARI Manual Trip Channel Functional Test, Revision 0

SO-253-002, 18 Month Standby Liquid Control System Initiation and Injection Demonstration, Revision 5

SO-253-003, 18 Month Standby Liquid Control System Operability Demonstration, Revision 7

SO-253-004, Quarterly Standby Liquid Control Flow Verification, Revision 1

Operating Procedures

AR-207-001, CRD, SLC, Drywell Sumps 2C601, Revision 13

CL-253-0012, Unit 2 Standby Liquid Control System Mechanical, Revision 3

OP-253-001, Standby Liquid Control System, Revision 9

Surveillance Results

SC-153-101, Chemistry Surveillance of Unit I Standby Liquid Control System, Performed March 9, 1990

SI-164-303, 18 Month Calibration of ATWS-RPT Actuation and ARI Trip System Reactor Vessel Low Level Channels LIS-B21-1N025A,B,C,D, Performed May 22, 1989

SI-164-304, Quarterly Channel Calibration of ATWS-RPT Actuation and ARI Trip System Instrumentation (High Vessel Pressure) Channels PS-B21-1N045A,B,C,D, Performed March 10, 1990

SI-164-503, 18 Month Logic System Functional Test of ATWS-RPT System and ARI System, Performed May 20, 1989

SO-153-002, 18 Month Standby Liquid Control System Initiation and Injection Demonstration, Performed April 21, 1989

SO-153-003, 18 Month Standby Liquid Control System Operability Demonstration, Performed April 27, 1989

SO-153-004, Quarterly Standby Liquid Control Flow Verification, Performed January 16, 1990

Surveillance Results (con't)

SO-155-006, Monthly ARI Manual Trip Channel Functional Test, Performed March 4, 1990

Licensed Operator (SY017) Training Units

C-3, Standby Liquid Control System

K-2, Control Rod Drive Hydraulic System

L-5, Reactor Protection System

PP002, Emergency Operating Procedures Training