UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

May 7, 2012

EA 11-221

Mr. Timothy S. Rausch
Senior Vice President and Chief Nuclear Officer
PPL Susquehanna, LLC
769 Salem Boulevard, NUCSB3
Berwick, PA. 18603

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION - ASSESSMENT FOLLOW-UP LETTER AND INTERIM NRC 95002 SUPPLEMENTAL INSPECTION REPORT 05000387/2012008

Dear Mr. Rausch:

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a supplemental inspection pursuant to Inspection Procedure (IP) 95002, "Inspection for One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area," at your Susquehanna Steam Electric Station (SSES) Unit 1 from February 13 through March 2, 2012. The enclosed inspection report documents the inspection results, which were discussed at a public exit meeting on March 21, 2012, with you and other members of your staff.

In accordance with the NRC Reactor Oversight Process Action Matrix, this supplemental inspection was performed to follow up on a White finding with low to moderate safety significance which occurred in the third quarter of 2010 and a White performance indicator (PI) for Unplanned Scrams per 7000 Critical Hours which crossed the threshold from green to white in the first quarter of 2011. The finding was previously documented in NRC Inspection Report 05000387/2010008. You informed the NRC staff on September 22, 2011, of your readiness for this supplemental inspection.

The objectives of this supplemental inspection were to provide assurance that: (1) the root and contributing causes for the risk-significant issues were understood; (2) the extent of condition and extent of cause of the issues were identified; and (3) corrective actions were or will be sufficient to address and preclude repetition of the root and contributing causes. This inspection also included an independent NRC review of the extent of condition and extent of cause for the issues and an assessment of whether any safety culture component caused or significantly contributed to the white finding and PI.

This report documents that the licensee adequately addressed the Unplanned Scrams per 7000 Critical Hours PI. The staff further concluded that the licensee failed to adequately address the corrective actions for the White finding. Specifically, you had not made sufficient progress on the procedure quality upgrade project for the internal flooding event for the NRC to evaluate its effectiveness. Additionally, your staff's assessment of the extent of condition for inadequately torqued flange bolts was narrowly focused, and your extent of cause assessment did not include torque checks of a sufficient sample of gasketed flanges on other plant equipment. Taken collectively, the issues associated with the White finding represented a significant weakness as

discussed in IP 95002, and your actions to date have not provided the assurance level required to meet the inspection objectives. Accordingly, the White finding associated with Notice of Violation 05000387/2010004-01, "Procedural Inadequacies Result in Reactor Scram and Loss of Normal Heat Sink," and this supplemental inspection will remain open until all inspection objectives have been met. When informed of your readiness, a future inspection will be conducted to verify that: (1) the concerns of extent of condition and extent of cause of inadequate procedures used to torque gasketed flanges are appropriately assessed and that adequate corrective actions are identified and implemented; and (2) to verify the effectiveness of the station's procedure quality upgrade project. Since the NRC concluded that the inspection objectives for the White PI were met, SSES Unit 1 will transition to the Regulatory Response Column (Column 2) of the NRC's Action Matrix as of the date of this assessment follow-up letter.

One self-revealing finding of very low safety significance (Green) related to integrated control system testing was identified during this inspection. The finding does not involve a violation of NRC requirements. If you contest the finding, you should provide a response within 30 days of the date of this inspection report, with the basis of your denial, to the Nuclear Regulatory Commission, ATTN.: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region 1; the Director, Office of Enforcement, U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Senior Resident Inspector at the SSES. In addition, if you disagree with the cross-cutting aspect assignment of any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis of your disagreement, to the Regional Administrator, Region 1, and the NRC Senior Resident Inspector at the SSES. The information you provide will be considered in accordance with IMC 0305.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of the NRC's Agencywide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

The remaining portions of the supplemental inspection associated with the white finding will be conducted once you formally inform the NRC staff of your readiness. Please contact Mr. Paul G. Krohn at (610) 337-5120 to notify the NRC of your readiness for the remaining portions of the supplemental inspection and with any questions you have regarding this letter.

Sincerely,

/RA/

Darrell J. Roberts, Director
Division of Reactor Projects

Docket No. 50-387
License No. NPF-14

Enclosure: Inspection Report No. 05000387/2012008
w/ Attachment: Supplemental Information

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discussed in IP 95002, and your actions to date have not provided the assurance level required to meet the inspection objectives. Accordingly, the White finding associated with Notice of Violation 05000387/2010004-01, "Procedural Inadequacies Result in Reactor Scram and Loss of Normal Heat Sink," and this supplemental inspection will remain open until all inspection objectives have been met. When informed of your readiness, a future inspection will be conducted to verify that: (1) the concerns of extent of condition and extent of cause of inadequate procedures used to torque gasketed flanges are appropriately assessed and that adequate corrective actions are identified and implemented; and (2) to verify the effectiveness of the station's procedure quality upgrade project. Since the NRC concluded that the inspection objectives for the White PI were met, SSES Unit 1 will transition to the Regulatory Response Column (Column 2) of the NRC's Action Matrix as of the date of this assessment follow-up letter.

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Sincerely,
/RA/
Darrell J. Roberts, Director
Division of Reactor Projects

Docket No. 50-387
License No. NPF-14

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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No.:	50-387
License No.:	NPF-14
Report No.:	05000387/2012008
Licensee:	PPL Susquehanna, LLC (PPL)
Facility:	Susquehanna Steam Electric Station (SSES) Unit 1
Location:	Berwick, Pennsylvania
Dates:	February 13, 2012 through March 2, 2012
Inspectors:	D. Schroeder, Senior Resident Inspector, Lead Inspector J. Greives, Resident Inspector A. Ayegbusi, Resident Inspector J. Ayala, Project Engineer A. Rosebrook, Senior Project Engineer K. Martin, Human Factors Engineer
Approved by:	Darrell J. Roberts, Director Division of Reactor Projects Region I

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SUMMARY OF FINDINGS

Inspection Report (IR) 05000387/2012008; 02/13/2012 – 03/02/2012; Susquehanna Steam Electric Station, Unit 1; Supplemental Inspection – Inspection Procedure (IP) 95002. Follow-up of Events and Notices of Enforcement Discretion.

A senior resident inspector, two resident inspectors, two region-based inspectors, and a headquarters human factors engineer performed this inspection. The inspectors identified one self-revealing finding having very low safety significance (Green), which is associated with a previous Unresolved Issue (URI). The inspectors determined the finding did not involve a violation of NRC regulations. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process (SDP)." Cross-cutting aspects are determined using IMC 0310, "Components Within the Cross-Cutting Areas." Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

Cornerstone: Initiating Events

The NRC staff performed this supplemental inspection in accordance with IP 95002, "Inspection for One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area," to assess PPL's evaluation associated with an internal flooding event and four individual scram events which resulted in one White inspection finding and led to a White performance indicator (PI). The White finding, originating in the third quarter 2010, was related to the inadequate maintenance and design of a condenser manway door, resulting in condenser bay flooding and a complicated reactor scram. Additionally, the White PI resulted from exceeding the White significance threshold for the Unplanned Scrams PI, in the first quarter 2011, due to unplanned scrams on April 22, May 14, and July 16, 2010, and January 25, 2011. It is important to note that the internal flooding event of July 16, 2010, resulted in the White finding and led to one of the four scrams contributing to the White PI. Therefore, this Summary of Findings and many sections in this report have two parts, one for the White PI and one for the White finding.

<u>White PI</u>
The inspectors determined that PPL adequately addressed the Unplanned Scrams PI. Specifically, PPL identified the issues and performed a comprehensive evaluation of individual and collective causes of the White PI. Two of the four unplanned scrams were caused by inadequate performance of maintenance, and the remaining two scrams occurred during the testing of a new Integrated Control System (ICS). Integrated Control System testing was performed without adequate measures to control feedwater flow and reactor pressure vessel levels to prevent automatic reactor scrams from occurring. Over reliance on simulator modeling, inadequate test procedures, and a lack of clear, conservative guidance to plant operators contributed to the ICS scrams.

In addition, PPL conducted a separate collective review of all the unplanned scrams and determined that the primary causes were: (1) less than adequate risk informed decision making; (2) less than adequate problem identification and resolution, including use of the CAP, operating experience (OE), and cause analysis; (3) less than adequate procedure quality use and adherence (PQU&A); (4) maintenance performance that was not adequate; and (5)

management oversight that provided less than adequate enforcement of standards and expectations.

White Finding

The inspectors determined that PPL failed to adequately address the White finding associated with inadequate maintenance procedures for condenser waterbox gasket installation. Although portions of PPL's problem identification, root cause evaluations (RCEs), and corrective actions for the White finding associated with condenser bay flooding were adequate, the inspectors noted that several iterations of root cause evaluations were required before the licensee identified the full complement of issues that led to the July 16, 2010, flooding event. PPL's initial assessment of the extent of condition for the as-found problems associated with the condenser waterbox was narrowly focused as it did not include a sampling of other gaskets that could have been similarly affected by inadequate maintenance procedures. This remained the case even after a subsequent spray leak of a reactor building chiller flange in October 2010 which presented the licensee with an opportunity to expand its extent of condition (and extent of cause) evaluation associated with the July 2010 flooding event.

PPL completed three RCEs for this internal flooding event. Recognizing deficiencies associated with its initial and second root cause evaluations and extent of condition reviews, the licensee performed a third, supplemental RCE which broadened the extent of condition to include all leaking flanged gaskets. Notwithstanding, the supplemental RCE still contained weaknesses. For example, a CAP database search performed as part of the supplemental evaluation covered a broad period of time and revealed 82 potential flange leaks. However, a subsequent CAP database search only covered a nine-month period following the October 2010 reactor building chiller leak and identified 12 flange leaks. As such, this review failed to consider leaks that may have existed prior to the licensee implementing corrective actions for the inadequate maintenance procedures, which now required a second torque check to account for gasket relaxation and creep during operations. In addition, torque checks of selected flanges on other plant equipment were not included as part of the extent of cause. Finally, because the licensee's efforts to upgrade station procedures as part of extent of cause were not scheduled to start until April 2012, and the NRC inspection was completed in early March 2012, the adequacy of the procedure upgrade efforts could not be evaluated during the inspection.

Ultimately, PPL's evaluations identified the root causes as less than adequate risk-informed decision making, less than optimal design of circulating water system equipment, and less than adequate procedure quality use and adherence. Plant operating and maintenance procedures were corrected, and design changes are planned for the waterbox inlet/outlet valves and the condenser manway doors. Additionally, the licensee has risk-informed its CAP to improve the evaluation, prioritization, and timeliness of station issues. Notwithstanding, the multiple iterations of RCEs and extent of condition/cause evaluations led to some of the root and contributing causes not being identified for more than 12 months after the initial event, which delayed implementation of broader corrective actions. PPL staff was actively expanding the extent of condition and extent of cause corrective actions for the White finding as the NRC inspection ended. Consequently, this inspection does not include an evaluation of the effectiveness of PPL's actions to address extent of condition/cause and some procedural quality improvements that had not begun at the time of the exit.

The inspectors considered that the issues associated with the licensee's determination of the extent of the performance issue and actions taken or planned to correct the issue did not provide the assurance level required to meet the inspection objectives defined in the IP 95002,

Section 95002-01 for closing the White finding. Taken collectively, these issues were considered to represent significant weaknesses as described in IP 95002, and as such, the White finding associated with NOV 05000387/2010004-01, "Procedural Inadequacies Result in Reactor Scram and Loss of Normal Heat Sink," will remain open pending a future inspection to verify that: (1) the concerns regarding the licensee's extent of condition and extent of cause evaluations for inadequate procedures used to torque gasketed flanges are appropriately addressed and that adequate corrective actions are identified and implemented; and (2) the licensee has developed and implemented an adequate procedure quality upgrade project. As discussed in Section 6.01 of NRC IMC 0305, "Operating Reactor Assessment Program," the White finding will be considered in the assessment process pending the completion of a future NRC inspection to verify satisfactory completion of actions as discussed above.

Findings

- Green: A self-revealing finding of very low safety significance was identified when Unit 1 automatically scrammed from 32 percent power on April 22, 2010, due to low reactor water level. PPL entered inadequate gain settings in the feedwater digital ICS for reactor feed pump turbine (RFPT) speed control as part of the ICS design modification, and the test procedure, which was in progress at the time, did not specify exit criteria that would have ended the test prior to an automatic scram. PPL completed corrective actions related to the direct cause by updating the RFPT speed control characterizer block gain settings. This issue was entered in PPL's CAP as condition report (CR) 1257781 (April 2010) and CR 1348940 (January 2011).

  The inspectors determined that inadequate procedures to perform post-modification testing on the digital ICS was a performance deficiency because the testing performed did not detect incorrect gain settings prior to a reactor scram. The inspectors screened the performance deficiency in accordance with IMC 0612, Appendix B, "Issue Screening." The performance deficiency was determined to be more than minor because the finding was associated with the Initiating Events cornerstone attribute of Design Control, and affected the cornerstone objective of limiting the likelihood of those events that upset plant stability and challenge critical safety functions during power operation. The inspectors evaluated the finding using IMC 0609, Attachment 4, "Initial Screening and Characterization of Findings," and determined the finding did not contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment would not be available. Consequently, the finding is of very low safety significance (Green).

  This finding has a cross-cutting aspect in the area of Human Performance, Work Control, because PPL did not plan and coordinate work activities consistent with nuclear safety. Specifically, PPL did not appropriately consider risk during the design modification and did not have adequate planned contingencies for the testing of the new digital ICS. (H.3(a)) (Section 4OA3.1)

REPORT DETAILS

4. OTHER ACTIVITES

4OA3 Follow-up of Events and Notices of Enforcement Discretion (71153)

.1 (Closed) Licensee Event Report (LER) 05000387/2010-002-02: Automatic Reactor Scrams Occur during Post-Modification Testing of the Digital Feedwater Integrated Control System

a. Inspection Scope

On April 22, 2010, at 10:51 a.m. hours, SSES Unit 1 experienced an automatic reactor scram, from 32 percent power, on low reactor water level. The low level condition occurred during planned testing of a new digital feedwater ICS, which included upgrades to the feedwater level control system, the reactor feed pump turbine speed controls, and the reactor recirculation speed controls. During testing at low power conditions, the second of three reactor feed pumps (RFP) was placed in automatic flow control mode for the first time with the goal of parallel automatic operation of two RFPs. A reactor water level transient occurred when the second RFP began adding water to the reactor. Operator action was taken as a result of rising water level, and the resulting concurrent flow reduction of both RFPs quickly lowered water level to the low level scram setpoint. Corrective actions were taken to adjust the ICS speed controller gain and master feedwater level controller gain settings.

In addition, at approximately 11:01 p.m. hours on May 14, 2010, Unit 1 automatically scrammed from 66 percent power due to a main turbine trip on high reactor water level. The high level condition occurred during further planned testing of the digital ICS, which involved the trip of one of the four condensate pumps. The high reactor water level transient was attributed to a large feedwater flow/steam flow mismatch caused by insufficient gain settings on the ICS master feedwater level control system master water level controller in response to large transient conditions. Corrective actions were taken to increase the system gains for large transients using “gap” control on the ICS level and flow controllers.

The root cause evaluations (RCEs) concluded the process used in the development and implementation of the ICS gains/tuning factors did not adequately use risk considerations, independent oversight, analytical tools and techniques, OE, and appropriate resource management. Also, the station’s post-event analysis of the April 2010 scram did not adequately evaluate the extent of condition or extent of cause and represented a missed opportunity to prevent the May 2010 scram. Corrective actions included providing guidance for developing and implementing control system tuning parameters, using the plant simulator for non-training purposes, and post-event analysis. There were no actual adverse consequences to the health and safety of the public as a result of these events. The reactor protection system responded as expected. All control rods fully inserted. The inspectors completed a review of this LER and identified a finding related to the April 22, 2010, scram that was not a violation of regulatory requirements. A Green, non-cited violation (NCV) associated with the May 14, 2010, scram was previously documented as NCV 05000387/2010004-04. This LER is closed.

b. Findings

The inspectors identified the following finding during review of the above LER and the closeout of URI 05000387/2010003-05, Configuration Control and Operation of ICS. PPL completed the supplemental RCE for this issue in November 2011.

Introduction: A self-revealing finding of very low safety significance (Green) was identified when Unit 1 automatically scrammed from 32 percent power on April 22, 2010, due to low reactor water level. PPL entered inadequate gain settings in the feedwater digital ICS for RFPT speed control as part of the ICS design modification, and the test procedure did not specify exit criteria that would have ended the test prior to an automatic scram.

Description: On April 22, 2010, Unit 1 automatically scrammed from 32 percent power due to low reactor water level. The reactor scram occurred during planned testing of a new digital feedwater ICS while performing test procedure TP-145-031, "System Acceptance Testing – ICS Startup and Tune-up in Condition 1 and 2."

During testing at low power conditions, a reactor water level transient occurred while the control room operators were placing the second of three RFPs in automatic flow control mode for the first time, with the goal of parallel automatic operation of two RFPs. As the water level began to rise during the test, plant operators placed the "B" RFP in idle and began to reduce flow in the "A" RFP, resulting in a flow reduction and lowering water level to the low level scram setpoint. There were no complications as a result of the scram and the plant was stabilized in accordance with emergency operating procedures.

Following the scram event, PPL conducted a RCE and concluded that the process used to initially set the ICS control settings did not adequately use risk considerations, independent oversight, and analytical techniques. In addition, PPL determined that OE and resources were not adequately managed.

Inspectors determined that ICS testing was inadequate because the incorrect gain settings were not discovered prior to the reactor scram. Specifically, functional testing was not performed in accordance with MFP-QA-2310, "Developing Test Criteria," Revision 1. MFP-QA-2310, Step 6.5.5 requires, in part, that Failure Modes and Effects Analysis (FMEA) results be utilized when developing test procedures which are used to satisfy system testing. The RCE determined that FMEAs were not used during the development of the test procedures. Additionally, PPL procedure NDAP-QA-0406, "Extended Power Uprate Test Program," was not applied to the test procedures for tuning the ICS and no overall test plan for establishing the tuning parameters for ICS was created. As a result, a Test Review Committee did not formally review the test procedures. A challenge board that was conducted did not adequately evaluate the procedures or how the gains were established. Furthermore, the test procedure lacked contingencies and appropriate abort criteria as required by NDAP-QA-0310, "Special, Infrequent or Complex Test/Evolutions," for a first-of-a kind evolution that affected reactivity. The combination of these deficiencies resulted in the feedwater level control system being tested with insufficient rigor.

PPL completed corrective actions related to the direct cause by updating the RFPT speed control characterizer block gain settings. This issue was entered in PPL's CAP as CR 1257781 and CR 1348940.

Analysis: The inspectors determined that performing post-modification testing on the digital ICS with inadequate procedures was a performance deficiency because the testing performed did not detect incorrect gain settings prior to causing a reactor scram. The inspectors screened the performance deficiency in accordance with IMC 0612, Appendix B, "Issue Screening." The performance deficiency was determined to be more than minor because the finding was associated with the Initiating Events cornerstone attribute of Design Control, and affected the cornerstone objective of limiting the likelihood of those events that upset plant stability and challenge critical safety functions during power operation. Specifically, inadequate analytical techniques were used to define and validate initial gain settings during startup testing and the test procedure lacked appropriate abort criteria. The gain setting error ultimately led to a low reactor water level and automatic reactor scram during ICS startup testing on April 22, 2010. The inspectors evaluated the finding using IMC 0609, Attachment 4, "Initial Screening and Characterization of Findings," and determined the finding did not contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment would not be available. Consequently, the finding is of very low safety significance (Green).

This finding has a cross-cutting aspect in the area of Human Performance, Work Control, because PPL did not plan and coordinate work activities consistent with nuclear safety. Specifically, PPL did not appropriately consider risk during the design modification and did not have adequate planned contingencies for the testing of the new digital ICS. (H.3(a)).

Enforcement: This issue does not involve enforcement action because no regulatory requirement was identified and ICS is not a safety-related system. Because this performance deficiency does not involve a violation and has very low safety significance, it is identified as a finding. **(FIN 05000387/2012008-01, Inadequate Gain Settings Result in Automatic Scram)**

.2 (Discussed) LER 05000387/2010-003-02: Unit 1 Manual Reactor Scram due to Leakage from the Unit 1 Circulating Water System and Subsequent Flooding of the Unit 1 Condenser Bay

On July 16, 2010, at approximately 4:41 p.m., the Unit 1 reactor was manually scrammed due to a large unisolable CW system leak in the main condenser area. All control rods fully inserted. Reactor water level lowered to -28 inches causing Level 3 (+13 inches) isolations. The ICS feedwater level control system detected the scram condition and automatically entered the setpoint setdown mode, which placed the non-lead RFPs in idle mode, and initiated transition to the startup level control mode. During this transition, ICS feedwater level control did not transfer to single element control due to a higher than expected steam flow signal, and concurrent feedwater flow oscillations resulted in an increase in reactor water level. Reactor water level reached Level 8 (+54 inches) which resulted in the trip of all three RFP turbines, the high pressure coolant injection (HPCI) system, and the reactor core isolation cooling (RCIC) system to shutdown. Reactor water level was subsequently restored and maintained within normal operating range using the RCIC system. The CW system was shut down and the main steam isolation valves (MSIVs) were manually closed. Pressure control was initiated using the HPCI system in the pressure control mode. All safety systems operated as expected. No steam relief valves opened. It was estimated that approximately one million gallons of non-contaminated circulating water leaked into the turbine building condenser bay area.

The cause of the unisolable CW system leak was due to the condenser waterbox manway gasket rolling out of position. The licensee's investigation concluded that the gasket reached the point where it could no longer maintain system pressure and rolled out of position due to gasket creep (i.e., inadequate gasket preload to maintain joint integrity). The gasket extrusion was the result of inadequate preload, rather than a system pressure transient or a material defect. Corrective actions taken for Unit 1 included inspection and replacement of gaskets.

The root causes were determined to be less than optimal system manway and isolation valve design, less than adequate risk informed decision making which resulted in the failure to adequately address previous CW system leaks, and inadequate PQU&A which resulted in the loss of CW pressure boundary integrity and inadequate mitigation of the CW leak. Planned actions to prevent recurrence included revising procedures to address gasket installation procedure deficiencies, revising procedures to address isolating individual waterboxes, and developing revisions to processes and procedures to improve risk informed decision making.

This supplemental LER was submitted because PPL determined that the original investigation of this reportable event did not comprehensively address the organizational, programmatic, and safety culture contributors to the event and, as a result, PPL established a root cause investigation team to supplement the original RCE. The inspectors did not identify any new issues or performance deficiencies during the review of this supplemental LER associated with the Unit 1 transient and unplanned scram that occurred on July 16, 2010. Notwithstanding, later sections of this report discuss weaknesses in the licensee's RCEs regarding extent of condition and extent of cause reviews.

.3 (Discussed) LER 05000387/2011-002-01: Unit 1 Manual Scram due to Unisolable Extraction Steam System Leak

On January 25, 2011, the Unit 1 reactor was manually scrammed due to an unisolable extraction steam system leak in the 1C Feedwater Heater Bay area. Reactor power was lowered from 98.4 percent to 65 percent prior to the scram. Non-safety-related electrical equipment exposed to the steam leak began malfunctioning. Attempts to isolate the source of the leakage were unsuccessful. Based on continued indications of an unisolable steam leak, the decision was made to shut down Unit 1. The mode switch was placed in shutdown. All rods inserted. Reactor water level lowered to -31 inches causing a Level 3 (+13 inches) isolation. The RCIC system automatically initiated on a -30 inch level signal and was manually secured after water level was restored. Reactor water level was subsequently maintained at the normal operating band using feedwater. No steam relief valves opened. All safety systems operated as expected.

The direct cause of the unisolable leak was the loss of a bleeder trip valve (BTV) cover plug. The two root causes were: (1) less than adequate management oversight of the work activity and work planning process, and (2) deficient work instruction and task assignment for the BTV repair task. Corrective actions were to replace and seal weld the cover plug on the affected valve and to seal weld the cover plugs on other valves of similar design. Other key corrective actions included planning procedure changes related to threaded pipe assemblies, evaluation and training of maintenance foremen, implementation of a more risk informed screening process, procedure changes and an

enhanced coaching card on procedure use and adherence, and management observations using the revised coaching card.

This supplemental LER was submitted because PPL determined that the original investigation of this reportable event did not comprehensively address the organizational, programmatic, and safety culture contributors to the event and, as a result, PPL established a root cause investigation team to supplement the original RCE. The inspectors did not identify any new issues or performance deficiencies during the review of this supplemental LER.

4OA4 Supplemental Inspection (95002)

01 Inspection Scope

The NRC staff performed this supplemental inspection in accordance with IP 95002 to assess PPL's evaluation associated with a white finding and PI which affected the Initiating Events cornerstone in the reactor safety strategic performance area. The inspection objectives were to:

- Provide assurance that the root and contributing causes of risk-significant issues were understood;
- Provide assurance that the extent of condition and extent of cause of risk-significant issues were identified and to independently assess the extent of condition and extent of cause of individual and collective risk-significant issues;
- Independently determine if safety culture components caused or significantly contributed to the risk-significant issues; and
- Provide assurance that PPL's corrective actions for risk-significant issues were or will be sufficient to address the root and contributing causes and to preclude repetition.

SSES Unit 1 entered the Regulatory Response Column of the NRC's Action Matrix in the third quarter of 2010 as a result of one inspection finding of low to moderate safety significance (i.e., White). The finding was associated with PPL's maintenance procedure, which contained inadequate condenser waterbox gasket installation instructions. On July 16, 2010, the condenser manway gasket rolled out of position, resulting in a large leak, an internal flooding event, a manual reactor scram, and loss of the normal heat sink. The finding was characterized as having White safety significance based on the results of a Phase 3 risk analysis performed by a region-based senior reactor analyst, as discussed in NRC IR 05000387/2010004. The failure was attributed to inadequate maintenance procedures which caused insufficient torquing of the condenser manway bolts, and insufficient preparation of the gasket surfaces. The procedures directly associated with the event were corrected, and the gaskets for all of the Unit 1 condenser manways were replaced prior to restart.

SSES Unit 1 also experienced unplanned reactor scrams on April 22, May 14, and January 25, 2011. The NRC's review of SSES Unit 1 determined that the Unplanned Scrams per 7000 Critical Hours PI crossed the Green to White threshold (i.e., greater than three unplanned scrams per 7000 critical hours). SSES entered the Degraded Cornerstone column of the NRC's Action Matrix in the first quarter of 2011 based on two

inputs having low to moderate safety significance (i.e., White) in the Initiating Events Cornerstone.

PPL informed the NRC staff on September 22, 2011, of their readiness for the supplemental inspection. In preparation for the inspection, PPL conducted a common cause evaluation of the White PI associated with the four unplanned scrams to identify weaknesses that existed in various organizations, which allowed for the degraded reactor oversight cornerstone, and to document a combined causal evaluation. PPL conducted RCEs for each of the scram events, with the evaluation of the two ICS scrams combined, due to their closely related causal factors and relatively close proximity in timeframe. In addition, PPL commissioned an independent third-party team to review the licensee's RCEs, extent of condition and extent of cause, corrective actions, and safety culture considerations. These additional RCEs were finalized in November 2011, and some of the corrective actions associated with these additional RCEs were not yet complete at the end of the inspection.

The inspectors reviewed PPL's RCE for each issue, in addition to other evaluations conducted in support of and as a result of the RCEs. The inspectors reviewed the corrective actions taken or planned to address the identified causes. The inspectors also held discussions with PPL personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood and corrective actions taken or planned were appropriate to address the causes and prevent recurrence. The inspectors also independently assessed the extent of condition and extent of cause of the identified issues. In addition, the inspectors performed an assessment of whether any safety culture components caused or significantly contributed to the issues.

The inspectors noted that the scram that revealed the White finding related to internal flooding was also one of four inputs to the White PI. For ease of documentation, the remainder of the inspection report parallels the inspection requirements of IP 95002. For clarity, documentation of each inspection requirement has two subsections, one for the White PI and one for the White finding.

Definitions for some of the frequently used terms in this report include:

- RCE – an evaluation which determines the root causes (or basic reasons) for an event. Root causes for a problem are considered those issues, which if corrected, will prevent reoccurrence of that problem;
- Extent of Condition – the extent to which the actual condition exists with other plant processes, equipment, or human performance; and
- Extent of Cause – the extent to which the root causes of an identified problem have impacts to other plant processes, equipment, or human performance.

02 <u>Evaluation of the Inspection Requirements</u>

02.01 <u>Problem Identification</u>

a. *As directed by IP 95002, the inspectors reviewed PPL's evaluation of the issues to determine that it documented who identified the issues (i.e. licensee-identified, self-revealing, or NRC-identified) and the conditions under which the issues were identified.*

White PI

.1 ICS testing results in automatic scram on low reactor water level

On April 22, 2010, Unit 1 experienced an automatic scram from 32 percent power during testing of the newly installed ICS. This was a self-revealing event due to inadequate tuning of the ICS flow control and level control instrument loops. The testing conducted did not identify and correct this issue prior to uncontrolled level swings resulting in an automatic reactor scram. The inspectors determined that PPL's root cause analysis (RCA), (documented in CR/RCA 1348940, dated November 9, 2011 and RCA 1257781, dated July 15, 2010), appropriately documented the identification of the issues and the conditions under which they were identified.

.2 ICS testing results in turbine trip and reactor scram on high water level

On May 14, 2010, Unit 1 experienced an automatic scram from 66 percent power during the performance of a condensate pump trip test. Inadequate tuning of the flow control instrument loops caused slow response of the feedwater flow during a runback and rapid reduction in steam flow. This event was self-revealing, and PPL subsequently determined that the simulator model that provided confidence that the test would be successful was not accurately modeling the newly installed ICS in Unit 1. PPL combined the RCAs for the ICS scrams to address both events due to the close proximity of the events. The inspectors determined that PPL's RCAs appropriately documented the identification of the issues and the conditions under which they were identified.

.3 Steam leak in the "C" feedwater bay results in a manual reactor scram

On January 25, 2011, Unit 1 experienced a steam leak due to a threaded plug failing on a BTV that released steam which affected non-vital electrical equipment and resulted in a manual reactor scram. In response to this self-revealing event, PPL plant operators attempted to isolate the leak, but their actions were unsuccessful prior to the scram event. The inspectors determined that PPL's RCAs (CR/RCA 1348940, dated November 9, 2011, and RCA 1346952, dated March 21, 2011) appropriately documented the identification of the issues and the conditions under which they were identified.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

On July 16, 2010, Unit 1 experienced internal flooding caused by an extruded gasket creating a large CW leak into the turbine building condenser bay. Attempts to isolate the leak were unsuccessful and resulted in the extrusion of a second gasket, creating a second significant leak. In response to this self-revealing event, PPL plant operators reduced reactor power while attempting to isolate the leak, and manually scrammed the reactor in anticipation of losing vacuum in the main condenser. The inspectors determined that PPL's RCAs (CR/RCA 1389534, dated November 18, 2011;

CR 1318800, dated February 10, 2011; and CR 1282128, dated September 28, 2010) appropriately documented the identification of the issues and the conditions under which they were identified.

b. *As directed by IP 95002, the inspectors reviewed PPL's evaluation of the issues to document how long the issues existed and prior opportunities for identification.*

White PI

.1 ICS testing results in automatic scram on low reactor water level

In reviewing the April 22, 2010, Unit 1 scram for this inspection element, the inspectors noted that the ICS was installed in April of 2010 during the refueling outage, and the scram occurred during initial testing of the system. PPL's RCE properly identified the length of time that this issue existed, as the issue did not exist prior to installation of the new system. The RCE also documented prior opportunities for identification, which occurred during the design phase of the project, when the Foxboro simulator (FSIM) tool was not purchased for ICS validation in 2007. Lack of oversight of the new simulator modeling tool contributed to the event, which resulted in a tuning parameter being translated incorrectly (off by a factor of five). Successful testing of the ICS model in the simulator did not result in successful test performance in the plant. PPL did not establish conservative testing and abort criteria, which was an additional missed opportunity to discover the tuning problem prior to an automatic reactor scram. The inspectors determined that the ICS scram on low reactor water level was adequately documented regarding opportunities for prior identification and length of time that the issue existed.

.2 ICS testing results in turbine trip and reactor scram on high water level

The RCE for this May 14, 2010, event was the same evaluation used for the previous ICS testing scram on April 22, 2010. In addition to the opportunities for prior identification listed above, a near miss event on April 29 during ICS testing provided additional opportunities for prior identification of the deficient control settings used in the initial setup of the ICS as installed in Unit 1. The RCE documented that the post-event analysis of the April 22 scram did not result in an adequate causal analysis to determine the cause for the scram. The inspectors determined that the ICS scram on high reactor water level was adequately documented regarding opportunities for prior identification and length of time that the issue existed.

.3 Steam leak in the "C" feedwater bay results in a manual reactor scram

For the January 25, 2011, Unit 1 steam leak and reactor scram, the RCE documented that one of the causal factors existed since 2002. The threads for the BTV plug were likely damaged during valve maintenance, when the plug was removed and an eye bolt improperly installed as a lift point for the valve cover. The threads were found to be damaged when corrective maintenance was performed on April 6, 2010, to repair a steam leak at the BTV plug. Existing threads were partially repaired using a pipe tap and a new plug was installed. Work instructions did not describe that the Copaltite used as thread sealant was required to be heated to ensure an adequate seal. PPL determined that the BTV plug was only used for manufacturer testing, and has seal welded these plugs in place on similar valves to prevent recurrence of this issue. The

inspectors determined that the BTV issue was adequately documented regarding opportunities for prior identification and length of time that the issue existed.

.4 Collective Evaluation of White PI Causes

PPL's collective evaluation identified three of the causes common to the risk significant performance issues to be:

- Less than adequate problem identification and resolution, specifically regarding the use of OE and implementation of the CAP;
- Less than adequate PQU&A; and
- Less than adequate management oversight, specifically enforcement of standards and expectations.

The evaluation concluded that, after review of previous RCEs, these causes were identified as recurring causes since 2008. It concluded that previous corrective actions were ineffective at resolving the causes, in part, because they did not include comprehensive evaluation and correction of programs, station culture, and organizational issues. Based on the review, PPL conducted a separate RCE to evaluate and correct the issue of PQU&A (CR 1389530). Overall, the inspectors determined that PPL's RCEs were adequate with respect to identifying how long the issues existed and prior opportunities for identification and correction.

White Finding

.5 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

For the July 16, 2010 Unit 1 reactor scram, an inadequate manway gasket installation process was identified as the primary cause of the event and had existed for many years. The industry standard practice of retorquing neoprene gaskets one hour after installation to account for gasket creep was not included in PPL's gasket installation procedure. The supplemental RCE also identified the manway door design as being less than optimal. This condition has existed since original plant construction. The RCE documented two prior opportunities for identification of these deficiencies that were recorded in the CAP. There was a similar gasket extrusion leak on April 8, 2007, and a large hatch leak on March 28, 2008. Both of these events occurred while the plant was shutdown, and actions taken did not correct this issue in a manner that would prevent subsequent events. The inspectors determined that PPL adequately evaluated the internal flooding event regarding opportunities for prior identification and length of time that the issue existed.

c. *As directed by IP 95002, the inspectors reviewed PPL's evaluation documents of plant specific risk consequences, as applicable, and compliance concerns associated with the issues both individually and collectively.*

White PI

.1 ICS testing results in automatic scram on low reactor water level

PPL's RCE documented the consequences of the April 2010 ICS scram. Plant safety systems were challenged as a result of this event. Reactor vessel water level lowered to -30 inches, requiring the use of the RCIC system as well as the feedwater system to restore reactor water level to normal. Planned maintenance of the 11B auxiliary bus feeder breaker from the startup transformer resulted in the loss of the 11B bus and its associated 'B' recirculation pump and 'B' condensate pump. Reactor protective system response was as expected, and all control rods inserted into the reactor core. The MSIVs remained open and the reactor pressure was controlled by the main turbine bypass valve. The NRC documented a green NCV based on incorrect risk modeling through the Equipment Out of Service (EOOS) model in inspection report IR 05000387, 388/2010003. The breaker maintenance was not included in the model, which classified risk as green instead of yellow just prior to the scram event. The inspectors determined that PPL had appropriately evaluated the risk consequences as a challenge to safety systems and an increase in the initiating events frequency.

.2 ICS testing results in turbine trip and reactor scram on high water level

The RCE for the ICS scrams documented the consequences of the May 14, 2010, turbine trip and reactor scram on high level. A challenge to the plant safety systems were a result of the event. The reactor protective system performed as expected, and all control rods were inserted into the core. Reactor water level lowered to -30 inches, and RCIC was used to restore reactor water level to normal. The MSIVs remained open and the reactor pressure was controlled by the main turbine bypass valves. EOOS correctly modeled the online risk just prior to the event as green. The inspectors determined that PPL had appropriately evaluated the risk consequences as a challenge to safety systems and an increase in the initiating events frequency.

.3 Steam leak in the "C" feedwater bay results in a manual reactor scram

The RCE for the BTV steam leak on January 25, 2011, documented that the leak resulted in non-safety related equipment damage and a manual reactor scram. Reactor water level lowered to -31 inches causing an automatic RCIC initiation. After level was restored to normal, RCIC pump operation was secured and water level was maintained using the feedwater system. Safety systems functioned as designed during the event, and there were no impacts to safety-related equipment due to the steam leak. The NRC issued a green finding to document the deficient maintenance practice that caused the steam leak and resulted in the scram. The inspectors determined that PPL appropriately documented the risk consequences for this event in Section 4 of the RCE for the BTV scram.

.4 Four scram events resulted in a degraded initiating events cornerstone

The collective cause evaluation of the four scram events was documented by PPL in the RCE, "Collective Evaluation of White Performance Indicator Causes." The timing of each of the events did not overlap in time, so the determination of cumulative risk through addition of each of the events delta-core damage frequency (CDF) would be very conservative. Thus, the overall impact of the four Unit 1 scrams was determined by

calculating changes to the initiating event frequencies applied to the probabilistic risk analysis (PRA) model. PPL performed a sensitivity calculation to apply preliminary revised Initiating Event frequency values to the existing PRA risk model basic events database. Results of the sensitivity analysis demonstrated that the changes to base CDF and large early release frequency are very small. The most risk significant of the scrams was the July 2010 flooding event that involved a loss of the normal heat sink and a complicated trip. The NRC issued a White finding to document this issue. The analysis of the three other scrams determined that they each had very low risk significance. The inspectors determined that PPL appropriately documented the risk consequences and compliance concerns associated with the issue.

White Finding

.5 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

The NRC previously determined that the circumstances leading to the July 2010 Unit 1 reactor scram represented a White finding, as documented in IR 05000387/2010008. PPL's RCE documented the consequences of the issue, which included:

- Internal flooding with 12 feet of water accumulated into the condenser bay;
- Insertion of a manual reactor scram;
- Isolation of the reactor and loss of the normal, condenser heat sink; and
- High reactor vessel water level which resulted in a trip of HPCI and a shutdown of RCIC.

This scram was counted as both an unplanned scram and a scram with complications for the associated Unit 1 PI. The licensee's risk analysis documented in the potential consequences section of the RCE concluded that there was an increased potential for core damage and for a large early release of radioactivity. The NRC's calculated increase in core damage probability is documented as 1.05E-06 in the RCE. PPL also appropriately documented that if the inadequate design, maintenance, and procedures were to remain uncorrected, there is a potential that future waterbox leaks could occur and that a subsequent flooding event could result in a similar or potentially greater amount of risk. The inspectors determined that PPL had appropriately evaluated the risk consequences associated with the internal flooding event.

d. Findings

No findings of significance were identified.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

For this section of the report, the two ICS scrams are combined into one section because PPL reviewed both ICS scrams in one RCE. Subsequently, PPL performed a supplemental RCE that further evaluated both ICS scrams. The supplemental RCE was performed to correct weaknesses identified by PPL in the original RCE.

a. As directed by IP 95002, the inspectors reviewed PPL's evaluations to determine whether the licensee used a systematic methodology to identify the root and contributing causes of the issues.

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

The first event occurred on April 22, 2010, during planned testing of a new digital feedwater ICS, which included upgrades to the feedwater level control system, the RFPT level controls, the RFPT speed controls, and the reactor recirculation pump speed controls. The second event occurred on May 14, 2010, during a condensate pump trip test to verify ICS runback capability. PPL performed a RCE and a supplemental RCE in accordance with procedure NDAP-00-0752, "Cause Analysis," and documented the results in CR 1257781 and CR 1348940.

PPL used the following systematic methods to determine the root causes of the event:

- Data gathering through interviews and document review;
- Events and causal factors (E&CF) charting;
- Management oversight and risk tree (MORT); and
- Safety culture supplement to the MORT.

MORT and E&CF charting are both acceptable methods for performing a comprehensive analysis specified in PPL's RCA procedure. The second RCE was performed because the original RCE did not comprehensively address the organizational, programmatic, and safety culture contributors to the ICS scram events. The inspectors determined that PPL evaluated the issues using a systematic methodology to identify root and contributing causes.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

This event occurred during power operations on January 25, 2011, as a threaded plug failed and allowed steam to escape from one of the BTVs. PPL performed a RCE and a supplemental RCE in accordance with procedure NDAP-00-0752, "Cause Analysis," and documented the results in CR 1346952 and CR 1348940. PPL determined that the initial RCE had not comprehensively addressed the organizational, programmatic, and safety culture contributors to this event.

PPL utilized the following methods to determine the root causes of the event in the supplemental (final) RCE:

- Data gathering through interviews and document review;
- E&CF charting;
- Why charting;
- Barrier analysis;
- Tap root;
- MORT; and
- Safety culture supplement to the MORT.

PPL's RCA procedure states that a minimum of two different comprehensive RCA methods shall be used for every root cause investigation. The comprehensive methods

used for this RCE were E&CF charting and MORT. The inspectors determined that PPL evaluated the issue using a systematic methodology to identify root and contributing causes.

.3 Collective Evaluation of White PI Causes

This evaluation performed an aggregate review of the collective risk significant performance issues that resulted in the degraded initiating events cornerstone. This evaluation did not identify any specific root or contributing causes, but focused on determining if any of the causes identified in the analyses of the individual events were common. The aggregate evaluation identified the following common causes:

- Less than adequate risk informed decision making;
- Less than adequate problem identification and resolution, specifically regarding the use of OE and implementation of the CAP;
- Less than adequate PQU&A;
- Less than adequate maintenance performance; and
- Less than adequate management oversight, specifically enforcement of standards and expectations.

Based on this evaluation and the evaluation of the White finding (CR 1318800), a separate RCE was performed to determine root and contributing causes associated with PPL's less than adequate PQU&A, which was identified as a contributor to both. PPL performed this RCE in accordance with PPL procedure NDAP-00-0752, "Cause Analysis."

PPL utilized the following methods to determine the root and contributing causes of less than adequate PQU&A:

- A timeline was developed through personnel interviews and document review;
- Fault Tree Analysis;
- Common Cause Analysis;
- HBT Analysis; and
- MORT.

PPL used multiple systematic analysis methods identified in PPL procedure NDAP-00-0752 as acceptable for use in performing the PQU&A RCE. The inspectors reviewed the RCE and determined that PPL evaluated the issues using systematic methods to identify root and contributing causes.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

This event occurred on July 16, 2010, approximately three months after completing a spring refuel outage. PPL performed a RCE for the event, a RCE for the White finding, and a supplemental RCE in accordance with procedure NDAP-00-0752, "Cause Analysis," and documented the results in CR 1282128, CR 1318800, and CR 1389534.

PPL utilized the following methods to determine the root causes of the event in the supplemental (final) RCE:

- Data gathering through interviews and document review;
- E&CF charting;
- Hazard-barrier-target (HBT);
- Fault tree analysis;
- MORT; and
- Safety culture supplement to the MORT.

MORT and E&CF charting are both acceptable methods for performing a comprehensive analysis specified in PPL's RCA procedure. HBT and fault tree analysis are listed as specific analytical methods used to supplement the E&CF chart. The inspectors determined that PPL evaluated the issue using a systematic methodology to identify root and contributing causes.

b. As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they were conducted to a level of detail commensurate with the significance of the issue.

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

PPL utilized two multi-disciplined teams to conduct the RCEs for these events. The supplemental RCE was conducted to a level of detail commensurate with the significance of the issue. Three root causes were documented in the RCE:

- The process used to set the ICS control settings did not adequately use risk considerations, independent oversight, analytical techniques, and OE and resources were not adequately managed. Consequently, inadequate gain settings resulted in an automatic reactor scram on April 22, 2010, and on May 14, 2010;
- The station management decision in 2007 to use the plant simulator to establish the gain settings and to not procure and use FSIM as an analytical tool was not risk informed and prevented its use to validate and identify appropriate gain settings. Consequently, ICS did not respond as expected which resulted in less than adequate plant responses on April 22, 2010 and on May 14, 2010; and
- The station's post event analysis of the April scram did not result in an adequate causal analysis to determine the cause of the scram. Cause techniques were not implemented and the analysis did not adequately evaluate the extent of condition or extent of cause. Consequently, the tuning parameters for the main feedwater level control system were not evaluated and the readiness for restart was not adequately verified.

The inspectors concluded that the RCE was conducted to a level of detail commensurate with the significance of the problem.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

Two RCEs were performed related to the BTV scram. A multi-disciplined team was used to perform each of these RCEs. The supplemental RCE was conducted to a level of detail commensurate with the significance of the issue. Two root causes were documented in the final RCE:

- Less than adequate management oversight of the work activity and work planning process resulted in degraded standards being applied to the preparation and performance of the BTV repair; and
- Deficient work instruction and task assignment for the BTV repair task, due to less than adequate understanding of maintenance "skill of the craft" capabilities by the work planning organization, resulted in inadequate corrective maintenance and the subsequent unisolable leak.

The inspectors concluded that the RCE was conducted to a level of detail commensurate with the significance of the problem.

.3 Collective Evaluation of White PI Causes

PPL's RCE of PQU&A was performed by a multi-disciplined team consisting of personnel from PPL's Maintenance, Operations, and Corrective Action and Assessment departments, as well as a RCA specialist consultant, utilizing multiple analysis methods. Additionally, the RCE team used data on procedure use and adherence collected by a multi-disciplined team assigned to address the issue in an apparent cause evaluation (ACE) (ACE 1333582). The ACE team consisted of personnel from the Regulatory Affairs, Security, Corrective Action and Assessment, Health Physics, Maintenance, and Operations departments. The RCE documented two root causes:

- Less than adequate station procedure control processes to identify and resolve procedure quality deficiencies due to failure to incorporate current industry guidance for procedure quality control; and
- Less than adequate management oversight in reinforcing the station expectations for procedure use and adherence.

Based on the extensive work performed by PPL for this RCE, the inspectors concluded that the collective evaluation was conducted to a level of detail commensurate with the significance of the problem.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

A total of three RCEs were written related the condenser bay flooding event, manual scram, and associated white finding. A multi-disciplined team was used to perform each of these RCEs. The supplemental RCE was conducted to a level of detail commensurate with the significance of the issue. Three root causes were documented in the final RCE:

- Less than adequate risk informed decision making resulted in the failure to adequately address previous CW system leak events;
- Less than optimal design of CW system equipment (condenser waterbox manway and waterbox inlet/outlet valves' motor compartments) resulted in the failure to maintain the CW system pressure boundary integrity and impacted the flood mitigation capability; and
- Less than adequate PQU&A for MT-043-001, MT-GM-031, and ON-142-001 resulted in the loss of CW pressure boundary integrity and inadequate mitigation of the CW leak.

The inspectors concluded that the RCE was conducted to a level of detail commensurate with the significance of the problem.

c. *As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they included a consideration of prior occurrences of the issues and knowledge of prior OE.*

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

The RCEs for the ICS scrams contained a review of both internal and external OE. The licensee's review of internal OE determined that no OE was identified that could have been used to definitely prevent one or both of the scrams. However, the inspectors observed that there were missed opportunities following the first scram that could have been used to reduce the risk of having a second scram, including a near miss level transient on April 29. While PPL's RCE recognized that the readiness for restart was not adequately verified as one of the root causes, this was not discussed in the OE section of the evaluation. PPL also searched the station's corrective action data base for relevant internal OE. The report concluded that internal operating experience contained issues that should have been considered in preparing the ICS test procedures.

PPL's root cause team reviewed external OE and identified several OE reports that provided potentially useful information. The review confirmed that OE was used effectively to ensure that the modification itself (hardware and installation) was designed properly. However, OE was available and not used for the development of the test procedures. The root cause team's review of external OE demonstrated that tuning parameters provide challenges to the plants and increased risk of a plant transient.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

PPL's supplemental RCE for the BTV event included a review of both internal and external OE. The review of internal OE included a search of the station CAP for related issues. A review of external OE did not result in any OE reports that provided information applicable to the BTV scram. The inspectors determined that the review of OE performed by the root cause team was adequate.

.3 Collective Evaluation of White PI Causes

PPL's collective evaluation (CR 1348940) and RCE for PQU&A (CR 1389530) included an evaluation of internal and external OE as well as a review of OE process effectiveness. As a result of this review, PPL determined that the process for fully evaluating and incorporating internal and external OE was less than adequate. Specifically, PPL determined that previous RCEs identified less than adequate PQU&A and management oversight as causes for station events, but previous corrective actions were ineffective, in part, because they did not include comprehensive evaluation and correction of programs, station culture, and organizational issues. This resulted in missed opportunities to correct programmatic weaknesses prior to a risk significant performance issue. Furthermore, PPL concluded that identified deficiencies in the OE program were symptomatic of the fundamental flaws in structure and execution of the CAP and that actions already underway to improve this area were sufficient. Regarding evaluation of external OE, PPL determined that many of the RCEs identified less than adequate evaluation of external OE as a root or contributing cause.

PPL identified two additional corrective actions to address less than adequate use of external OE. Specifically:

- Additional training of PPL personnel on the importance of rigorously evaluating OE and incorporating relevant information into station processes (CRAs 1451017 and 1451018); and
- Conducting a search of industry OE best practices related to the evaluation of "low-level" OE (i.e. OE not requiring formal evaluation by NDAP-QA-0725, "Operating Experience Program") to determine if actions are required to improve station processes (CRA 1451019).

PPL determined through the search of OE best practices that the current station processes were at the same level or better than most stations contacted and thus no improvements were made to the OE process. Inspectors reviewed the results of the action and found the assessment reasonable. PPL had initiated an ACE to evaluate the less than adequate use of OE (CR 1499040). PPL determined that the OE process was not risk-informed such that safety significant OE is evaluated with the correct level of rigor. Additionally, PPL required a sample review of previously completed OE evaluations for adequacy and included a provision to expand the sample if deficiencies were identified.

Inspectors reviewed the ACE and determined that it was thorough and that actions specified were necessary to correct the deficiencies in OE evaluation identified in the RCEs associated with the risk significant performance issues. Based on feedback from inspectors, PPL updated the 95002 Recovery Plan to specifically include the corrective actions specified in the ACE for less than adequate use of OE. These actions had not been included in the scope of the original 95002 Recovery Plan.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

The supplemental RCE for the condenser manway flood included a review of both internal and external OE, as well as a review of previous corrective actions for manway leaks. PPL's root cause team concluded, based on a review of internal events, that the manway cover and gasket assembly is a recurring source of leaks and flood potential. Large condenser manway leaks occurred in 2007 and 2008, but causal evaluation of those leaks was not performed, in part because the Unit was not operating at power when the leaks occurred, and the events were not screened as risk significant by the CAP. The inspectors review concluded that there was an opportunity, based on previous events at the station, to prevent the condenser manway flood event from occurring.

The licensee's review of external OE on condenser flooding events revealed some weaknesses in the internal review and evaluation of industry OE. PPL's root cause team concluded that the use of external OE could be improved at the station, and generated a corrective action (CR 1451019) to improve OE implementation. The inspectors determined that the review of OE performed by the root cause team was adequate.

d. As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they addressed the extent of condition and extent of cause of the issues.

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

PPL's supplemental RCE considered the extent of condition associated with the ICS scram events. PPL determined that the extent of condition included other challenges to the reactor protective system during testing of systems for Units 1 and 2. PPL took actions that resulted in no scrams due to high or low reactor level during the post modification testing of Unit 2 following ICS installation. The inspectors concluded that the review of extent of condition documented in the supplemental RCE was adequate. Notwithstanding, subsequent to ICS installation there was a Unit 2 scram on August 19, 2011, due to a turbine trip during reactor protection system surveillance testing, even though the two of three trip logic was not satisfied.

PPL's supplemental RCE considered extent of cause associated with the ICS scram events. There was an extent of cause assigned for each of the three root causes. The extent of cause included other projects where test procedures were developed without use of analytical techniques, risk considerations, OE, and independent review. It included other procurement decisions involving procurement of equipment without adequate consideration of risk. The extent of cause also included analyses used to determine causes performed without procedure guidance and use of approved analytical techniques. PPL determined that no additional search of past analysis for this extent of cause was necessary based on procedure guidance and the existing requirement to perform effectiveness reviews for more significant cause analyses. However, the inspectors considered that the extent of cause search performed was narrowly focused

because previously completed RCEs were excluded from the review. PPL's exclusion of these analyses based on the performance of effectiveness reviews was considered a weakness in that an opportunity to verify the extent of cause for past RCEs was missed. Notwithstanding, PPL's collective evaluation of the White PI causes was considered adequate as discussed in paragraph d.3 below.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

PPL's supplemental RCE considered the extent of condition for the failure of a threaded plug in the steam system. PPL determined that the extent of condition includes other identified or existing leaks on non-safety related systems that could degrade and warrant a plant scram. PPL performed a walkdown of both units for steam system leaks and performed a CAP review of leaks to identify those that could impact risk significant equipment.

PPL's supplemental RCE considered the extent of cause for both of the root causes associated with the BTV scram. To address the inadequate performance and preparation for the previous repair, PPL included all work packages that were prepared without adequate considerations for management standards. To address the gap between skill of the craft capabilities and work orders prepared, PPL included other maintenance activities that rely on skill of the craft for work activities. The inspectors concluded that the supplemental RCE extent of condition and extent of cause were adequate.

.3 Collective Evaluation of White PI Causes

The purpose of PPL's collective evaluation (CR 1348940) was to identify any causes common to the four scrams that accounted for the white PI and ensure that corrective actions were adequate to ensure the extent of those causes was addressed. With regard to the five common causes that were identified, PPL listed corrective actions from all the RCEs that were necessary to correct the issues. PPL's collective evaluation considered the extent of cause of less than adequate risk informed decision making. Specifically, PPL recognized that the lack of a written policy for risk-informed decision making affected many station programs and corrective actions were taken to address this extent of cause.

Less than adequate problem identification and resolution, specifically use of OE and implementation of the CAP were identified as a cause in each of the issues that resulted in the White PI. However, PPL recognized that the cause extended beyond these specific issues and included corrective actions to improve the CAP, including training on the safety culture aspects to ensure that the proper rigor is used to evaluate issues based on their risk significance.

Based on the breadth of the issue of less than adequate PQU&A, PPL performed a separate RCE (CR 1389530) to evaluate the issue for separate causes and prescribe corrective actions. This RCE determined that the root cause of procedure quality issues was that PPL had failed to incorporate current industry guidance for procedure quality control. PPL determined that the extent of cause encompassed other station processes for which industry guidance has been developed, but not adopted by the station. PPL determined that actions taken to upgrade both the procedure and OE programs adequately defined the responsibilities of those serving as industry points of contact

throughout the station. Based on inspector feedback, however, PPL revised the RCE (CR 1389530), as part of the station's upgrade of its administrative program procedures, to examine the industry best practice guidance for each station program and ensure that the best practices are incorporated into revised station procedures.

PPL's collective evaluation considered the extent of the cause associated with less than adequate management oversight, specifically enforcement of standards and expectations. PPL identified that all other programs that were dependent on adequate management oversight for successful completion were included in the extent of cause. Corrective actions included establishing a coaching card and station fundamentals tools and requiring periodic coaching by management throughout the station. The inspectors concluded that the extent of condition and extent of cause contained in PPL's collective evaluation was adequate.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

PPL completed three RCEs for this internal flooding event. Each of the RCEs addressed extent of condition and extent of cause, and assigned corrective actions based on the identified extent of condition and extent of cause.

PPL's extent of condition for this event in the original RCE included components that exhibited uncontrolled leakage of water into areas of the plant through personnel access hatches or manways. Subsequently, PPL determined that the extent of condition specified in the original RCE was narrowly focused. The second RCE for this event determined that the extent of condition involved all operations and maintenance procedures that operate and maintain plant equipment. The supplemental RCE determined that the extent of condition included pressure boundary leakage from bolted joints in plant systems.

PPL's RCE considered the extent of cause associated with inadequate maintenance and design of the manway cover. PPL's supplemental RCE determined an extent of cause for each of the root causes identified. These included less than adequate risk informed decision making on other station programs or processes, control of design issues for non-safety related risk significant systems, and procedure quality and procedure use and adherence for all station procedures.

The inspectors determined that PPL failed to adequately address extent of condition and extent of cause for the white finding associated with inadequate maintenance procedures for condenser waterbox gasket installation, which was complicated and delayed by two inadequate off-normal procedures. Although portions of PPL's problem identification, RCEs, and corrective actions for the condenser bay flooding event were adequate, the inspectors identified significant weaknesses regarding PPL's extent of condition, extent of cause, and timeliness of corrective actions related to the event. PPL's assessment of extent of condition for the as-found condition of inadequately torqued bolts due to relaxation and creep of the neoprene gasket was narrow, and did not include a sampling of gaskets that could have been similarly affected by inadequate maintenance procedures. Moreover, a spray leak of a reactor building chiller flange in

October 2010 presented the station with another opportunity to correctly evaluate extent of condition and extent of cause for the condenser bay flood white finding.

The inspectors observed that the supplemental RCE broadened the extent of condition to include all leaking flanged gaskets. Subsequent actions included a search of the CAP database that covered a nine-month time frame following the reactor building chiller leak, identifying only 12 flange leaks. This period did not include the time prior to changing the maintenance procedures to include a second torque check to account for gasket relaxation and creep. A CAP database search performed as part of the supplemental RCE covered a longer period of time and revealed 82 potential flange leaks, however these leaks were not adequately evaluated for common causes or trends. In contrast, the second RCE included a database search over a much longer period of time that revealed waterbox manway leaks in 2004, 2007, and 2008, prior to the internal flood event in 2010. These events were used to determine that previous corrective actions for manway leaks were inadequate and that the design of the manway doors was less than optimal. Appropriately, PPL replaced all manway gaskets, including those that were not leaking. However, PPL determined that no action was required to check flanges that were not leaking, even though they may have been impacted by the inadequate maintenance procedures.

Furthermore, the inspection team concluded that the corrective actions taken for extent of cause were narrow because torque checks of selected flanges of other plant equipment were not included. PPL initiated actions, based on inspector observations, to perform breakaway torque checks during the performance of station maintenance in order to evaluate the population of affected flanges. Another important action assigned as part of the extent of cause was the upgrade of station procedures to address inadequacies that PPL identified. This action had not started and could not be evaluated during the inspection. Approximately 6000 procedures are included in the scope of this action. Two thousand of these procedures were screened by PPL as being risk significant. Seven hundred of these risk significant procedures were screened as high risk. The schedule presented for procedure revisions starts in April 2012, and concludes in 2016. The revision of the 700 procedures categorized as high risk was scheduled for completion in November 2013.

Consequently, the NRC was not able to effectively evaluate the robustness, adequacy, and effectiveness of future actions to address extent of condition and extent of cause, including procedure quality improvements. As a result, the White finding associated with NOV 05000387/2010004-01, “Procedural Inadequacies Result in Reactor Scram and Loss of Normal Heat Sink” will remain open pending a future inspection to verify that: (1) the concerns of extent of condition and extent of cause of inadequate procedures used to torque gasketed flanges are appropriately assessed and that adequate corrective actions are identified and implemented; and (2) to verify the effectiveness of the station’s procedure quality upgrade project.

A description of the methods used to select and evaluate a population of gasketed flanges should be included as part of the expanded extent of condition, as well as any conclusions regarding whether specific trends or common causes exist in the selected population. Also, all of the procedure revisions do not need to be completed prior to the NRC’s follow-up inspection. However, a sufficient population of the upgraded procedures should be completed so that the inspectors can evaluate whether this

corrective action is being effectively implemented and the inspection objectives defined in IP 95002, Section 95002-01 have been met.

Overall, the inspectors determined that PPL's extent of condition for the condenser bay flooding issue was not of sufficient breadth to identify additional issues similar to those for which the supplemental inspection was performed. Specifically, PPL's extent of condition did not evaluate the extent to which the condition of inadequately restoring pressure boundary bolted joints impacted other plant systems. PPL limited the extent of condition review to leaking bolted joints captured in the corrective action program. The inspectors determined that this review did not evaluate risk significant systems that were restored using less than adequate maintenance procedures and guidance. This is a contributor to the significant weakness, as described in IP 95002, which resulted in the White finding remaining open pending further inspection by the NRC.

e. Findings

No findings of significance were identified.

02.03 Corrective Actions

a. As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether: (1) PPL specified appropriate corrective actions for each root and/or contributing cause, or (2) an evaluation that states no actions are necessary was adequate.

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

Following the first Unit 1 scram on low reactor water level, PPL determined that there was a flat response or transition zone that caused the reactor feed pumps to react too slowly to changes in plant conditions, resulting in an automatic scram. PPL adjusted the feed pump controller gain to respond more quickly in the transition zone, and performed a reactor startup. Following the second reactor scram on high reactor water level, PPL determined that their initial causal evaluation and corrective actions had been ineffective. Additional investigation determined that the gain settings in the simulator had been off by a factor of five, and the successful simulator testing did not translate to successful testing of the ICS modification during implementation on Unit 1. PPL performed several procedure changes and extensive training that focused on risk based decision making and upgraded their CAP procedure to industry standards to prioritize work in accordance with their risk rankings for the work assigned.

Inspectors determined that there were minor weaknesses in the corrective actions taken by PPL that contributed to a scram of Unit 2 on August 19, 2011, during surveillance testing on the main turbine following the ICS modification. Specifically, although the tuning of the feed flow and level control portions of ICS incorporated the lessons learned from the Unit 1 ICS commissioning, the test plan for the Unit 2 ICS commissioning was not comprehensive because it did not test the two out of three logic for the turbine trips to ensure that a single trip signal did not trip the turbine. This minor weakness contributed to a Green finding discussed in NRC inspection report

0500387;388/2011005 regarding a failure to identify an improper termination in the high reactor water level main turbine trip circuit during post-modification testing.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

The steam leak was caused by an improperly repaired threaded plug on the cover of a large check valve. PPL performed corrective actions to prevent recurrence by seal welding these pipe plugs on the failed and similar valves. Training was conducted with maintenance technicians on the proper method to use to seal threaded connections, and training was conducted with planners to ensure that the quality of work orders improved. Spot checking of work orders was initiated to increase supervision of the planners during preparation of non-routine work orders. A minor weakness was identified by inspectors in the corrective action to develop and implement a program to look for leaks in areas not normally accessible due to environmental conditions during plant operation. Specifically, this action was closed and deferred to existing programs such as routine operator rounds and system engineer periodic walkdowns, which did not meet the intent of the corrective action assigned in the RCE.

.3 Collective Evaluation of White PI Causes

Corrective actions necessary for each of the scrams that account for the White PI are discussed above and in paragraph a.4 below for the scram that led to the White finding. The collective evaluation (CR 1348940) identified causes common to the four scrams and listed corrective actions from each of the RCEs necessary to address each cause. The RCE for PQU&A (CR 1389530) was used to address programmatic weaknesses that were identified as common to the scrams and were a key element to the White finding.

With regard to procedure quality, PPL identified that the station's procedure control process was less than adequate due to failure to incorporate industry guidance for procedure quality control. PPL performed a gap analysis between their procedure program, AP-907-001, "Procedure Process," and AP-907-005, "Procedure Writer's Manual," and current industry guidance. This guidance was incorporated into station practices through revision to NDAP-QA-0002, "Procedure Program," and NDAP-QA-0008, "Procedure Format and Content," and development of a new procedure NDAP-QA-0004, "Procedure Change Process." These changes were implemented in January 2012.

Inspectors reviewed the gap analysis and procedure program revision with minor issues identified. Specifically, inspectors determined that PPL failed to identify that the requirements for periodic reviews were inadequate such that some procedures were not being reviewed as required by NRC requirements. NDAP-QA-0002, "Procedure Program," requires a periodic review of "non-routine" procedures. The PPL procedure defines "non-routine" procedures by providing a list of procedures that meet the definition. This list does not include operating procedures. Notwithstanding, ANSI N18.7-1976, Section 5.2.15 states that procedures shall be reviewed "no less frequently than every two years." This requirement was modified for PPL by the NRC in a letter dated August 15, 1994 to state that any "event-driven procedure" shall be reviewed every two years. Inspectors identified that numerous "event-driven procedures" were located in Operating Procedures and therefore did not require periodic reviews by the station's procedure program. This issue was determined to be a minor violation because

the affected population of procedures was small relative to the total number of procedures receiving periodic reviews and there have been no actual consequences from this issue.

Additionally, PPL developed a risk-informed plan to assess and upgrade site procedures. Inspectors reviewed the plan and determined its approach was reasonable.

To address the root cause of less than adequate management oversight in reinforcing the station expectations for procedure use and adherence, PPL continued implementation of the station fundamentals, a program established to clearly communicate expected behaviors to the station. These fundamentals included a "Procedures" core fundamental focused on procedure use and adherence. Station fundamentals are integrated into the observation program, Observation Way, to allow supervisors to reinforce correct behaviors and coach personnel when weaknesses are identified. Additionally, NDAP-QA-0029, "Procedure Use and Adherence," was in the process of being revised to reflect current industry guidance. Inspectors reviewed corrective actions associated with management oversight of procedure use and adherence and found them reasonable in scope to adequately address the root cause.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

PPL performed immediate corrective actions to address the condenser bay flooding event. Manway gaskets were replaced for all Unit 1 manways prior to restart of the unit. Gaskets were inspected and a twist test was initiated to ensure that the gasket material was not cracked or degraded prior to installation. Metal surfaces that contact the gasket were inspected and surfaces prepared to the correct texture. PPL received guidance from the gasket manufacturer, and increased torque of the manway bolts from 60 to 110 foot-pounds (ft-lbs). Subsequent inspection of the gaskets revealed damage to the gaskets, and the torque was lowered to 80 ft-lbs. During a subsequent Unit 2 outage, all manway gaskets on Unit 2 were replaced.

Inadequate maintenance procedures and operations procedures were identified as root causes of the event during the RCE. Corrective actions to upgrade station procedures as part of the extent of cause had not started as of the end of the inspection, more than 18 months after the internal flooding event. In addition, corrective actions assigned based on the extent of condition were not adequate. For example, the licensee had conducted a search of flange leaks in the CAP, resulting in a list of 82 potential leaks. However, these leaks had not been evaluated properly prior to this extent of condition action from the initial White finding RCEs being closed. Rather, a separate search of the CAP database was conducted over a shorter period of time, resulting in a list of 12 flange leaks. PPL personnel used this smaller list of 12 leaks to determine that there was not a common cause for identified flange leaks. In a second example, during post maintenance testing in October 2010, a reactor building chiller developed a spray leak due to inadequate maintenance on a heat exchanger flange with an elastomeric gasket. The flange bolts had not been retorqued to account for the creep and relaxation associated with this elastomeric gasket. The inspectors noted that PPL did not assign a corrective action to check bolt torque associated with other flanges that may have similar gaskets that have not been retorqued. The inspectors concluded that the corrective

actions assigned to address the extent of condition and extent of cause for this event were not adequate. PPL's actions in this area will be reviewed during the future supplemental inspection that is outlined in the cover letter.

b. *As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they prioritized corrective actions with consideration of risk significance and regulatory compliance.*

This procedural element was reviewed for both the White PI and finding. Following the completion of the supplemental RCEs, PPL prioritized corrective actions with consideration of risk significance and regulatory compliance. The PPL recovery team integrated the actions from each of the supplemental RCEs to compile an integrated list of actions. However, this prioritized list was compiled in August 2011, seven months after the fourth of the four scrams had occurred that were included in the White PI. PPL procedures provide two months for completion of a RCE, and six months for completion of actions that are not classified as long term corrective actions, such as design modifications. Nonetheless, many corrective actions were delayed in completion. This issue was determined to be a minor violation because the two-month and six-month provisions in PPL's procedures were considered an internal administrative limit and delays in completion of corrective actions have not resulted in a failure of safety related equipment or a plant transient.

Regarding procedures, the inspectors determined that PPL established appropriate priorities for upgrading procedures based on sound criteria, including risk significance. PPL had completed many corrective actions associated with correcting the direct causes of the scrams. However, many corrective actions associated with the root causes of PQU&A were either recently implemented or awaiting implementation. Specifically, though the procedure program was revised to reflect industry guidance in January 2012, its implementation was limited at the time of the supplemental inspection. Based on the schedule provided to inspectors, major efforts to upgrade site procedures will not begin until April 2012, when the procedure upgrade group is staffed, and procedures identified as "high-risk" will not be revised until November 2013. PPL was re-evaluating the procedure upgrade program implementation timeline at the conclusion of the inspection.

c. *As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they had established a schedule for implementing and completing the corrective actions.*

<u>White PI</u>

.1 <u>ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level</u>

PPL assigned corrective actions to address the ICS testing scrams in both the original and supplemental RCEs. These actions included personnel training to recognize potential risk impacts prior to the performance of risk significant work. The CAP procedure was rewritten to industry standards, to ensure that deficiencies are screened and prioritized in accordance with risk and potential consequences. Use of the simulator to predict plant performance during testing has been restricted, and pre-job briefings for risk significant, infrequently performed evolutions has been improved. Furthermore, testing conducted during the ICS installation on Unit 2 was successful in preventing a reactor scram due to a level transient. Notwithstanding, there was a Unit 2 scram on

August 19, 2011, due to the mis-wiring of a protective circuit, which allowed a turbine trip when a trip signal was introduced on one of three channels. Also, nine of nine prevent recurrence corrective actions had been completed prior to the end of the inspection. Overall, the inspectors determined that PPL established an adequate schedule for implementing and completing corrective actions.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

PPL established a schedule for completing corrective actions associated with this event. Similar threaded connection plugs have been seal welded or are scheduled to be seal welded during the next refueling outage. Training has been conducted to improve the quality of work packages, and spot checks are being conducted by supervisory personnel to ensure that this training has been effective. A list of skill of the craft activities has been compiled and integrated into PPLs procedures to specify activities that may not require detailed work instructions to be accomplished. The procedure compliance and procedure quality aspects of this issue are also scheduled to be addressed. The inspectors determined that PPL established an adequate schedule for implementing and completing corrective actions.

.3 Collective Evaluation of White PI Causes

At the time of the inspection, PPL was at various stages of implementation of actions associated with PQU&A. Specifically, industry guidance for procedure programs was incorporated into the station's procedure program and made effective in January 2012, and procedure writer's training had been completed for approximately 90 station personnel. However, inspectors recognized that the implementation of the procedure improvement program was limited at the time of the inspection. For example, the program requirements for technical validation are only required to be used to validate the change that is being made. Though there were over 1000 open procedure actions, many are limited scope and only make minor changes to a procedure. Therefore, only the portions being changed would be reviewed with the new process. Procedures will be reviewed in their entirety and made to conform to the updated formatting requirements only if they are new procedures or more than 25 percent of the procedure is revised. At the time of the inspection, aside from the three administrative procedures that make up the station's procedure program, only two additional procedures have been rewritten and reformatted.

Regarding procedure use and adherence, it was recognized that revision of the station's administrative procedure NDAP-QA-0029, "Procedure Use and Adherence," was delayed two months from January 27, 2012, until March 30, 2012, when PPL determined that the changes required formal training to implement.

White Finding

.4 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

PPL assigned several corrective actions to address the condenser bay flooding event based on a supplemental RCE, which was finalized in November 2011. Several important corrective actions for this event have not been completed, and are untimely based on the period of time elapsed since the July 2010 event. For example, the

inspectors reviewed a corrective action completed on April 1, 2011, to improve procedure quality, and determined that it was ineffective. Specifically, the procedure change in the governing procedure did not result in an increase in the generation of CRs for procedures that could not be performed as written and required the technicians to stop work until the procedure quality issue was resolved. Also, many of the corrective actions assigned have had due date extensions, and some actions have been extended multiple times. An example of these delays is evident in the effectiveness reviews established for the condenser bay flood event. Two interim effectiveness reviews and a final effectiveness review were specified in the RCE, yet none of the three effectiveness reviews had been completed while the inspectors were on site conducting the inspection. The inspectors did observe, however, that the frequency of workers stopping to correct procedure quality issues increased dramatically during the inspection, based on recent worker training.

d. As directed by IP 95002, the inspectors reviewed PPL's RCEs to determine whether they had developed quantitative and/or qualitative measures of success for determining the effectiveness of the corrective actions to preclude repetition.

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

PPL has planned several effectiveness reviews and self-assessments for each root and contributing cause corrective actions to ensure that these actions prevent recurrence and are complete and appropriate. The supplemental RCE for the ICS scram scheduled an effectiveness review that will ensure that risk based decision making has been implemented into the CAP. Each root cause has quantitative or qualitative criteria assigned in the effectiveness review plan, which has been drafted in accordance with PPL's root cause analysis process. The inspectors determined that PPL had established adequate measures to determining the effectiveness of their corrective actions.

.2 Steam leak in the "C" feedwater bay results in a manual reactor scram

PPL has planned several effectiveness reviews and self-assessments for each root and contributing cause corrective actions to ensure that these actions prevent recurrence and are complete and appropriate. The supplemental RCE for the steam leak and manual scram event scheduled an effectiveness review and a focused area self-assessment to evaluate the corrective actions associated with the event. Each root cause has quantitative or qualitative criteria assigned in the effectiveness review plan, which has been drafted in accordance with PPL's RCA procedure. The inspectors determined that PPL had established adequate measures to determining the effectiveness of their corrective actions.

.3 Collective Evaluation of White PI Causes

The collective evaluation identified causes common to the four scrams and listed corrective actions from each of the RCEs necessary to address each cause. As such, it did not provide quantitative or qualitative measures of success for determining the

effectiveness of corrective actions. These measures were prescribed in the individual RCEs that were the subject of the collective evaluation and are discussed above.

The RCE for PQU&A (CR 1389530) was used to address programmatic weaknesses that were identified as common to several of the scrams and were a key element to the white finding. This RCE provided quantitative and qualitative measures of success for determining the effectiveness of corrective actions. An interim effectiveness review is scheduled for January 2013 and final effectiveness review for January 2014.

In addition to effectiveness reviews discussed above that are completed in accordance with NDAP-QA-0702, "Action Request and Condition Report Process," PPL has developed additional processes to ensure that each corrective action associated with root and contributing causes are adequately implemented. For example, NDAP-00-0790, "Susquehanna Recovery Plan Process," was developed to establish a consistent, systematic approach to effectively manage the station's major recovery initiatives. Corrective actions associated with recovery from the Degraded Cornerstone have been included in this process. Additionally, NDAP-00-0791, "Susquehanna Recovery Closure Review Process," is performed on corrective actions associated with root and contributing causes to provide additional technical rigor in documentation and review for completeness. This review is a supplement to the routine CAP process. Finally, NDAP-00-0792, "Susquehanna Recovery Effectiveness Review Process," was developed to implement an Effectiveness Review Challenge Board process by PPL senior management for all recovery plans. The process will provide, at minimum, quarterly progress and effectiveness reviews for corrective actions associated with the root and contributing causes. The inspectors determined that PPL had established adequate measures to determining the effectiveness of their corrective actions.

<u>White Finding</u>

.4 <u>Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink</u>

PPL has planned several effectiveness reviews and self-assessments for each root and contributing cause corrective actions to ensure that these actions prevent recurrence and are complete and appropriate. The supplemental RCE for the condenser bay flood scheduled an effectiveness review and two interim effectiveness reviews to evaluate the corrective actions associated with the flood event. The first interim effectiveness review was in progress at the time of the team inspection. Each root cause has quantitative or qualitative criteria assigned in the effectiveness review plan, which has been drafted in accordance with PPL's RCA process. The inspectors determined that PPL had established adequate measures to determine the effectiveness of their corrective actions.

e. *As directed by IP 95002, the inspectors reviewed the RCEs to determine whether PPL's corrective actions, planned or taken, adequately addressed a NOV that was the basis for the supplemental inspection, if applicable.*

The NRC staff did not issue a NOV to PPL; therefore, this inspection requirement was not applicable.

f. Findings

No findings of significance were identified.

02.04 Independent Assessment of Extent of Condition and Extent of Cause

As directed by IP 95002, the inspectors performed a focused inspection to independently assess the validity of PPL's conclusions regarding the extent of condition and extent of cause of the issues. The objective of this requirement is to independently sample performance, as necessary, within the key attributes of the Initiating Events cornerstone to provide assurance that PPL's evaluation regarding the extent of condition and extent of cause is sufficiently comprehensive.

In conducting this independent review, the inspection team interviewed station management and staff, reviewed program and process documentation, and reviewed existing station program monitoring and improvement efforts, including review of corrective action documents. The inspectors conducted walkdowns of the plant and executed portions of IP 90700, "Feedback of Operational Experience Information at Operating Power Reactors," and IP 42700, "Plant Procedures."

White PI

.1 ICS testing results in automatic scram on low reactor water level and ICS testing results in turbine trip and reactor scram on high water level

The inspectors performed an independent assessment for the extent of condition and extent of cause of the ICS scram events. The third root cause of the events determined by PPL was that there was a less than adequate post event analysis of the April 2010 scram. Inspectors focused on the extent of cause for this third root cause, which included analyses for evaluating causes for problem reports and events. The inspector's extent of cause review did not look at previously completed analyses and exempted RCEs with completed effectiveness reviews.

As an example of independent assessment, the inspection team reviewed the RCE for a chiller Freon leak and alert issue. The cause was determined to be a fatigue failure of copper tubing that was left unsupported, as a bracket was not re-installed following maintenance. The emergency diesel generators (EDGs) were not included in the extent of condition review for this issue, with no justification in the RCE as to why they were excluded. During walkdowns inspectors identified a one-inch stainless tubing run on an EDG that was not properly supported due to a broken bracket during the team's independent review of this issue. PPL provided an explanation that the EDGs were excluded because the tubing on the EDGs is stainless tubing, and less susceptible to fatigue failure than the copper tubing. The inspectors concluded that the tubing of the EDGs should be included. PPL subsequently performed extent of condition walkdowns of the EDGs. Other actions for extent of condition and extent of cause were determined to be adequate, and the inspectors concluded that the improperly supported tubing run was a minor weakness with PPL's evaluation because the broken bracket did not result in a loss of EDG operability.

.2 Steam leak in the “C” feedwater bay results in a manual reactor scram

Inspectors assessed the extent of condition and extent of cause associated with the steam leak and manual scram. The supplemental RCE specified that the extent of condition was other leaks in non-safety related systems that could cause a plant scram. A corrective action was assigned to develop and implement a program to periodically look for and identify leaks in areas not normally accessible due to environmental conditions during plant operation. However, this action was closed and deferred to existing tours and routine rounds conducted, which did not satisfy the intent of the action. The objective of the corrective action was to identify leaks before they become a challenge to plant operation. Other actions for extent of condition and extent of cause were determined to be adequate, and the inspectors concluded that the inappropriately closed action was a minor weakness with PPL’s evaluation because the missed walkdowns in normally inaccessible areas have not resulted in a plant transient.

White Finding

.3 Internal flooding through condenser waterbox manways results in manual scram and loss of the normal heat sink

The team performed an independent assessment of the extent of condition and extent of cause for the condenser manway flooding event. PPL completed three RCEs for this internal flooding event. Each of the RCEs addressed extent of condition and extent of cause, and assigned corrective actions based on the identified extent of condition and extent of cause.

The extent of condition in the initial flood RCE was too narrow, and was restricted to the condenser and Amertap manways. The second RCE for this event determined that the extent of condition involved all operations and maintenance procedures that operate and maintain plant equipment. The supplemental RCE extent of condition covered pressure boundary leakage from bolted joints in plant systems. This extent of condition excluded bolted joints that were not leaking, even though many of these flanges have not been retorqued to account for the gasket creep and relaxation that was a causal factor of the flood event. Gasket creep and relaxation was also a causal factor during a reactor building chiller spray leak in October 2010, where the torque value of the bolts was found at 40 ft-lbs after initial torque to 55 ft-lbs.

PPL’s review of the extent of condition was conducted without a sound methodology. For example, a search for leaks during the supplemental RCE determined that there were 82 flange leaks during the time period chosen. These 82 flange leaks were not evaluated for a common cause, history of repeat leaks, or other systematic means. A subsequent search only covered a nine-month period following the October 2010 reactor building chiller leak and identified 12 flange leaks. A review by PPL of these 12 leaks determined that there was no common cause for the 12 leaks despite a CAP search for manway leaks in the supplemental RCE which revealed three large leaks in a three year period.

A more comprehensive review of other flange leaks, over a longer period of time, may have resulted in PPL finding useful information about the condition of the station’s bolted flanges. Similarly, the actions for extent of condition and extent of cause did not include documented physical walk downs of leaking or leak tight flanges in the plant.

Observations from such a walkdown could include flange misalignment, visual extrusion of gaskets, cracking, improper material used for the gas or fluid application, or other useful information of the condition of plant systems that could minimize the impact of , or prevent, other initiating events and transients.

The inspectors determined that PPL's extent of condition for the condenser bay flooding issue was not of sufficient breadth to identify additional issues similar to those for which the supplemental inspection was performed. Specifically, PPL's extent of condition did not evaluate the extent to which the condition of inadequately restoring pressure boundary bolted joints impacted other plant systems. PPL limited the extent of condition review to leaking bolted joints captured in the corrective action program. The inspectors determined that this review did not evaluate risk significant systems that were restored using less than adequate maintenance procedures and guidance. This is a contributor to the significant weakness, as described in IP 95002, which resulted in the White finding remaining open pending further inspection by the NRC.

02.05 Safety Culture Consideration

a. Inspection Scope

As directed by IP 95002, the inspectors performed a focused inspection to independently determine that PPL's RCE appropriately considered whether any safety culture component caused or significantly contributed to any risk significant issue.

The inspectors independently assessed the relationship between safety culture aspects and the white finding and PI through the use of focus groups and interviews as well as reviewing self-assessment documents provided by PPL. The inspectors interviewed eleven focus groups consisting of 71 line workers and first line supervisors, 10 scheduled individual management interviews, and 2 additional group interviews with personnel involved in plant assessments. Plant staff members interviewed were selected from the Security, Operations, Radiation Protection, Chemistry, Maintenance, Training, and Engineering organizations.

As a result of the documents reviewed as part of the inspection, the focus groups and interviews were designed to gather information on the safety culture of SSES with some questions directed towards specific safety culture components. The questions covered the following general areas:

- Safety Conscious Work Environment;
- Safety Policies;
- Continuous Learning Environment; and
- Problem Identification and Resolution.

The areas that were the subject of directed questions included:

- Organizational Change Management;
- Benchmarking;
- Knowledge Transfer;
- Resources; and
- CAP.

PPL determined that the safety culture components of Human Resources-Procedure Quality, Human Resources-Procedure Use and Adherence, and Problem Identification and Resolution-Evaluations were the safety culture components which most contributed to the events leading to the white finding and PI. The team reviewed PPL's root cause and also asked the focus groups questions related to the corrective action put in place to address the weaknesses in these safety culture components. Many of the corrective actions were put in place in December 2011 or later. Examples of the corrective actions include risk based CAP program revisions, procedure upgrade projects and training, station focus on procedure adherence, and identifying procedure quality issues in existing procedures.

b. Assessment

The inspectors determined that the safety conscious work environment at SSES is not currently degraded. Interview comments indicated that the plant staff members are not deterred from reporting safety concerns using the condition reporting system. Plant staff members interviewed consistently expressed an awareness of the necessity of reporting safety concerns and frequently expressed their commitment to assuring that any reported safety concerns were clearly understood. While some plant staff members were aware of the availability of alternate reporting channels including the Employee Concerns Program, the vast majority indicated that these channels were infrequently used because the internal condition reporting system is generally the method used to resolve safety concerns. The inspectors determined from interview comments that individuals felt personally responsible for nuclear safety at the site. It was repeated throughout many interviews that current site management reinforces the message of safety.

This safety message was communicated through a shift in the way decisions are made with targeted messages about safety being more important than production and schedule. This shift represents an improvement over previous communications practices. The changes to procedural process with respect to adherence and updating and improving procedures have also been communicated throughout the site to individuals. Another message reinforced is for technicians to stop work whenever there is a problem with any step in a procedure and to contact a supervisor before proceeding. While this message was received by workers, it was found during the inspection that individuals sometimes continue when uncertain as described by the example of a source transfer event on December 5, 2011; the incorrect reassembly of the 'C' EDG fuel pump in September 2011; and a 'C' EDG valve mispositioning event during a post maintenance test in January 2012. In each case, although the workers knew the expectation to stop, they did not seek out the right level of assistance before recommencing the work activities.

The incorporation of the risk assessment protocol into the CAP is also a message reinforced by management. Site personnel are aware that there are changes but unaware of the details of the changes and how it may affect the individual's work. During the inspection, it was concluded that it is a common perception of plant staff that resource management limits various areas, which affect safety culture throughout the organization. These areas include training, staffing resources, and maintenance activities. There was an abundance of focus group comments, indicating that resources for personnel and knowledge transfer practices are currently a weakness in the safety culture at SSES. There were also many affirming comments, which led the inspection

team to conclude there is an overall perception that conditions in this area are improving under the new management for most work groups.

Concerning the CAP, the inspectors determined that the changes to the RCA process and prioritizing of the issues entered into the CAP program have been communicated effectively and this is slowly improving the overall CAP process. After issues with the site's training programs and NRC findings, the incorporation of benchmarking and OE into training and pre-job briefs have been noticed site wide and was generally well received as management improvements site wide.

During the interviews it was determined that upper management is largely aware of the perceptions of the plant staff, however there was an issue with management communication in selected areas including resources dedicated to staffing plans, the process of correcting operator workarounds, the Observation Way Program, knowledge transfer planning, and the Responsible Behavior program. Nonetheless, individuals have a significant level of trust and confidence in decisions made with respect to nuclear safety at the plant.

Overall, it was determined that components of safety culture identified by PPL did not contribute to the White PI or finding, and that the recently implemented corrective actions appear to being well received by the work force.

02.06 Evaluation of IMC 0305 Criteria for Treatment of Old Design Issues

PPL did not request credit for self-identification of an old design issue; therefore, the risk-significant issues were not evaluated against the IMC 0305 criteria for treatment of an old design issue.

4OA6 Meetings

Exit Meeting Summary

On March 21, 2012, the inspectors presented the inspection results at a public meeting (ML12066A077)[2] to Mr. Timothy Rausch, Chief Nuclear Officer, and other members of his staff, who acknowledged the findings. The inspectors asked PPL if any of the material examined during the inspection should be considered proprietary. PPL did not identify any proprietary information.

On March 21, 2012, the NRC also conducted a regulatory performance meeting after the conclusion of the exit meeting discussing the inspection results. The regulatory performance meeting was held between PPL and the NRC to discuss the corrective actions associated with PPL's safety-significant finding and performance indicator. The purpose of the meeting was to provide a forum in which to develop a shared understanding of the performance issues, underlying causes, and PPL's planned actions for each safety significant assessment input.

ATTACHMENT: SUPPLEMENTAL INFORMATION

[2] Designation refers to an ADAMS accession number. Documents referenced are publicly available using the accession number in ADAMS

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

T. Rausch	Chief Nuclear Officer, PPL
F. Kearney	Site Vice President
J. Helsel	Plant Manager
D. Filchner	Recovery Team Shift Lead, Day shift
G. Treven	Recovery Team Shift Lead, Afternoon shift
A. Kissinger	Root Cause Team Lead ICS, BTV
A. Soden	Root Cause Team Lead PQUA
C. Flyte	CAP and Engineering Team Lead
T. Price	Performance Improvement Supervisor
J. Jennings	Operations Procedure Group Supervisor
R. Fry	Shift Manager
S. Kudrick	System Engineer
R. Moore	PPL Consultant
J. Novak	System Engineer
C. Saxton	Root Cause Team Leader

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Closed

05000387/2010003-05	URI	Configuration Control and Operation of ICS (Section 4OA3.1)
05000387/2010-002-02	LER	Automatic Reactor Scrams Occur during Post-Modification Testing of the Digital Feedwater Integrated Control System (Section 4OA3.1)

Opened/Closed

05000387/2012008-01	FIN	Inadequate Gain Settings Result in Reactor Scram (Section 4OA3.1)

Discussed

05000387/2010-003-02	LER	Unit 1 Manual Reactor Scram due to Leakage from the Unit 1 Circulating Water System and Subsequent Flooding of the Unit 1 Condenser Bay (Section 4OA3.2)
05000387/2011-002-01	LER	Unit 1 Manual Scram due to Unisolable Extraction Steam System Leak (Section 4OA3.3)

LIST OF DOCUMENTS REVIEWED

Root/Apparent Cause Analyses
CR 1257781, ICS Scrams Event Root Cause Analysis Report (RCAR), July 29, 2010
CR 1348940, ICS Scrams Event RCAR, October 24, 2011
CR 1282128, Condenser Bay Flood Manual Scram RCAR, September 16, 2010
CR 1318800, NRC White Finding RCAR, February 10, 2011
CR 1389534, Flooding Event/White Finding RCAR, November 18, 2011
CR 1346952, Extraction Steam Leak and Manual Scram RCAR,
CR 1348940, Manual Scram and Extraction Steam Leak RCAR, November 21, 2011
CR 1348940, Collective Evaluation of White PI Causes RCAR, November 18, 2011
CR 1450534, RCIC Inoperable Event RCAR, January 11, 2012
CR 1361274, HPCI Declared Inoperable – Inoperability of HV 15F002
CR 1453671, Unit 2 Scram during Feedwater Surveillance

Information Notices
89-07, Failures of Small Diameter Tubing in Control Air, Fuel Oil, and Lube Oil Systems which Render Emergency Diesel Generators Inoperable

Licensee Event Reports
50-387/2010-003-03, Unit 1 Manual Reactor Scram due to Leakage from the Unit 1 Circulating Water System and Subsequent Flooding of the Unit 1 Condenser Bay
50-387/2010-003-02, Unit 1 Manual Reactor Scram due to Leakage from the Unit 1 Circulating Water System and Subsequent Flooding of the Unit 1 Condenser Bay
50-387/2010-002-02, Automatic Reactor Scrams Occur during Post-Modification Testing of the Digital Feedwater Integrated Control System
50-387/2011-002-01, Unit 1 Manual Scram due to Unisolable Extraction Steam System Leak

Engineering Change Packages
738280 935640 935913 1278873 1495957 1503146
1516828

Procedures
TP-245-031, SAT-ICS Startup and Tuneup in Condition 1 and 2 less than 40% RTP, Rev 0
TP-145-031, SAT-ICS Startup and Tuneup in Condition 1 and 2 less than 40% RTP, Rev 1
TP-145-031, SAT-ICS Startup and Tune-up in Condition 1 and 2, Rev 0
NDAP-00-0562, Susquehanna SES Skill of the Craft Activities
ON-142-001, Circulating Water System Leak, Rev 22
MI-PS-001, Work Package Standard, Rev 34
NDAP-QA-0002, Procedure Program, Revision 28
NDAP-QA-0004, Procedure Change Process, Revision 0
NDAP-QA-0008, Procedure Format and Content, Revision 11
NDAP-QA-0029, Procedure Use- Standards and Expectations, Revision 15
NDAP-00-0035, Station Engagement and Accountability Process, Revision 0
NDAP-00-0036, Management of Observations, Revisions 3 and 4
NDAP-00-0038, Station Fundamentals Tool Kit, Revision 0
NDAP-QA-0725, Operating Experience Review Program, Revision 16
EP-TP-001, EAL Classification Levels, Revision 4

AR-015-001, 13.8/4 KV Switchgear Distribution and Diesel Generators A, B, & C 0C653, Revision 36
SC-070-010, Calibrations of the Standby Gas Treatment System PAVSSS Radiation Monitoring Channels, Revision 12
OP-002-001, Station Portable Diesel Generator, Revision 15
MT-024-024, Diesel Engine Analysis and Load Balancing, Revision 7
NDAP-00-0562, Susquehanna SES Skill of the Craft Activities, Revision 0
TP-054-076, ESW Flow Balance, Revision 10
EP-DS-004, Primary Containment and RPV Venting, Revision 4
ON-104-201, Loss of 4 KV Bus 1A (1A201), Revision 15
SO-100-008, Weekly Surveillance Operating Log, Revision 26
SE-024-B01, Diesel Generator B Integrated Surveillance Test, Revision 4
MT-183-004, Main Steam Relief Valve Removal and Installation, Revision 13
OP-149-004, RHR Containment Cooling, Revision 23
SO-155-004, 24 Month Control Rod Scram Accumulator Surveillance, Revision 10
MT-153-001, Unit 1 SBLC Explosive Valve Removal and Replacement, Revision10
SM-258-001, RPS M-G Set 'A' Electrical Protection Assembly 24 Month Channel Calibration and Functional Test, Revision 13
MT-RC-060, EPA Assembly Calibration Procedure (Logic Card Style 148C6118 GXXX, Revision 5

MT-024-007, Emergency Diesel Fuel Injection Nozzle Removal Testing and Installation, Revision 13
SO-054-004, Unit 1 – Quarterly ESW/TBCCW and ESW/RBCCW Isolation Valve Exercising, Revision 17
MT-050-003, RCIC Pump Turbine Disassembly and Reassembly, Revision 13
EO-000-100, Cautions, Revision 6
EO-000-113, Level/Power Control, Revision 9
ON-145-004, RPV Water Level Anomaly, Revision 18
NDAP-00-0562, Susquehanna SES Skill of the Craft Activities, Revision 0
MT-043-001, Main Condenser Leak Detection Tube Pulling Waterbox Inspection and Cleaning, Rev. 17, 18, 19, 20
MT-GM-015, Torquing guidelines, Rev. 24
MT-GM-031, Immersed Component/Heat Exchanger Internals Epoxy Lining/Cladding, Rev. 15
MT-GM-025, Heat Exchanger-Cleaning and Inspection, Rev. 19
MT-GM-078, SSES Heat Exchanger Tube Plugging, Rev. 9
NDAP-QA-0702, AR and CR Screening Team Guidance, Rev. 35
NDAP-QA-0002, Procedure Program, Rev. 28
NDAP-QA-0502, Work Order Process, Rev. 24
NDAP-00-0415, Post Event Analysis Issue Response Team, Rev. 0
NDAP-00-0752, Cause Analysis, Rev. 14
NDAP-00-0333, Operational Decision Making, Rev. 9
ON-142-001, Circulating Water System Leak, Rev. 23
ON-169-001, Flooding in Turbine Building, Rev. 5

<u>Calculations & Analysis</u>
EC-042-1008

Work Orders(PCWO) (*denotes NRC identified during this inspection)

1532977*	1150080	1166422	1176645	1229377	1282131
1287722	1287727	1287728	1308745	1321736	1339224
1346228	1364273	1370417	1370418	1371007	1372342
1381436	1403754	1501725	1508160	1508160	

Action Requests (*denotes NRC identified during this inspection)

1533034*	1533068*	1533165*	1534162*	1534175*	1534196*
1532650*	1535943*	1533116*	1534195*	1535952*	872976
886984	894090	898062	911366	931890	1017829
1037593	1039318	1041955	1102128	1174535	1273658
1283638	1297445	1348461	1374555	1374556	1411621
1451017	1451018	1490610	1490620	1494520	1496608
1514994	1514997	1517846	1533091	1534694	1535206
1537569					

Condition Reports (*denotes NRC identified during this inspection)

713395	894090	1156877	1223194	1224039	1232972
1237925	1237926	1283638	1284048	1314219	1315095
1324632	1324863	1333057	1354673	1361274	1436382
1446306	1450988	1451007	1451019	1453671	1484320
1499040	1501191	1501208	1515111	1516147	1525725
1525730	1525814	1525840	1526378	1526406	1526905
1527267	1528948*	1529887	1530151	1530156	1530157
1530159	1530163	1531782*	1531805*	1532219*	1532310
1532315*	1532763*	1532790*	1533033	1533097*	1533116*
1533147*	1533175*	1533176*	1533177*	1534154*	1534539*
1534802*	1534809*	1534814*	1534816*	1534818*	1534819*
1535807*	1535818*	1535824*	1536079*	1536273	1536274
1536275	1536773*	1536892*	1536922*	1536953*	1536974*
1536994*	1538416*	1538462*	1538465*	1538469*	1543779*
1561877					

Corrective Actions

1301602	1446223	1446279	1446280	1446305	1446308
1490520	1533373				

Assessments and Audits

AR 1042701, SSES Unit 1 Degraded Cornerstone Informal Benchmark Report, RCA and CAP Review

Drawings

FF-106470 Atwood & Morrill Bleeder Trip Valve

E177054, Sheet 2, Unit 1, 2 and Common P&ID Post Accident Vent Stack Monitoring and Sampling, Revision 10

E106239, Sheet 1, Common P&ID A-D Diesel Auxiliaries Fuel Oil, Lube Oil, Air Intake and Exhaust and Jacket Water Cooling Systems, Revision 49

Vendor Manuals

IOM 1027, Atwood and Morrill Instruction Manual for Bleeder Check Valves

Work Orders
ERPM 1054903

Miscellaneous
SA-2010-000102, PM WO Review for TDAFW Pump Latent Deficiencies, dated 05/11/2010
Technical Report 94108-TR-01, Investigation of Gate Valve Pressure Locking/Thermal Binding, Rev. 2
95002 TDAFW Pump Status, Presentation by E. Larson and P. Swift, dated 07/12/2010
PRAER-G1-2009-010, PRA Evaluation Request, Rev. 0
Ginna FSAR, Chapter 10 Section 10.5, Auxiliary Feedwater Systems, Rev. 21

GEK 46508D, Extraction System Check Valves Design Recommendations, December 1993
GEI 79466A, Relay Dump Valve for Air-Operated Extraction Check Valves, February 1992
SD-129-1, Cooper Bessemer Engineering Standard for Tubing Installations, Revision 2
Observation Way Data and Observations performed on Procedure Use and Adherence Fundamentals, September 2011 through February 2012
PLI-78567, Susquehanna Steam Electric Station Implementation Activities to Eliminate Biennial Procedure Reviews of Plan Procedures, dated September 27, 1994
Susquehanna Steam Electric Station Request for FSAR/Quality Assurance Approval, Letter from NRC to PPL dated August 15, 1994
PLA-4142, Susquehanna Steam Electric Station Request for FSAR/Quality Assurance Change Approval, dated July 14, 1994
SSES FSAR Section 17.2.2, Quality Assurance Program

ANSI N18.7-1976, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants
Journal Report System 43: Condenser and Air Removal
CR Screening Team Review Information dated February 14, 2012
MRC Review of Screening Recommendations dated February 14, 2012
MRC Review of Screening Recommendations dated February 15, 2012

LIST OF ACRONYMS

ACE	Apparent Cause Evaluation
ADAMS	Agency-Wide Documents Access and Management System
BTV	Bleeder Trip Valve
CAP	Corrective Action Process
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
CR	Condition Report
CW	Circulating Water
E&CF	Events and Causal Factors
EDG	Emergency Diesel Generator
EOOS	Equipment Out of Service
FMEA	Failure Modes and Effects
FSIM	Foxboro Simulator
Ft-Lbs	Foot-Pounds
HBT	Hazard-Barrier-Target
HPCI	High Pressure Coolant Injection
ICS	Integrated Controls System
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IR	Inspection Report
LER	Licensee Event Report
MORT	Management Oversight and Risk Tree
MSIV	Main Steam Isolation Valve
NCV	Non-Cited Violation
NOV	Notice of Violation
NRC	U.S. Nuclear Regulatory Commission
OE	Operating Experience
PARS	Publicly Available Records
PI	Performance Indicator
PPL	PPL Susquehanna LLC
PQU&A	Procedure Quality, Use, and Adherence
PRA	Probabilistic Risk Analysis
RCA	Root Cause Analysis
RCE	Root Cause Evaluation
RCIC	Reactor Core Isolation Cooling
RFP	Reactor Fuel Pump
RFPT	Reactor Feed Pump Trip
SDP	Significance Determination Process
SSES	Susquehanna Steam Electric Station
URI	Unresolved Item