UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PENNSYLVANIA 19406-2713

November 18, 2013

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 - NRC SUPPLEMENTAL INSPECTION REPORT 05000388/2013011

Dear Mr. Rausch:

On March 20, 2013, your staff reported an unplanned scrams with complications performance indicator that crossed a threshold from Green to White. Based on your report, the U.S. Nuclear Regulatory Commission (NRC) assigned a white performance indicator Action Matrix input to the Initiating Events cornerstone in the fourth quarter of 2012. You were notified of the change to the ROP Action Matrix Column from the Licensee Response Column to the Regulatory Response Column in an assessment follow-up letter (Report 05000388/2013009) issued on April 1, 2013.

In response to this Action Matrix input, the NRC informed you that a supplemental inspection under Inspection Procedure (IP) 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," would be required. On June 24, 2013, you informed the NRC that Susquehanna Steam Electric Station (SSES), Unit 2 was ready for the supplemental inspection.

On September 19, 2013, the NRC completed the enclosed supplemental inspection and on October 4, 2013, the NRC inspection team discussed the results with Jon Franke, Site Vice President, and other members of your staff during a teleconference and exit meeting. The inspection team documented the results of this inspection in the enclosed inspection report.

The NRC performed this supplemental inspection to determine if (1) the root and contributing causes for the significant issues were understood, (2) the extent of condition and extent of cause for the identified issues were understood, and (3) your completed or planned corrective actions were sufficient to address and prevent repetition of the root and contributing causes.

The NRC concluded that your staff performed a comprehensive evaluation of the White performance indicator and the inspection objectives were met. Your staff's evaluation of the root and contributing causes associated with two reactor scrams with complications that occurred on November 9, 2012, and December 16, 2012, was appropriate. Your staff adequately identified the individual and collective performance issues associated with the White performance indicator and have appropriate corrective actions either implemented or planned to address these issues. The NRC has determined that completed or planned corrective actions were sufficient to address the performance that led to the White performance indicator.

One finding of very low safety significance (Green) is documented in this report. The finding did not involve a violation of NRC requirements. If you disagree with the cross-cutting aspect of the finding, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region I, and the NRC Senior Resident Inspector at the SSES.

Although successfully completing a supplemental inspection under IP 95001 typically would have allowed SSES Unit 2 to return to the Licensee Response Column from the Regulatory Response Column of the ROP Action Matrix when the associated PI returned to Green, SSES Unit 2 had an unplanned scram on September 14, 2013. Therefore on October 24, 2013, based on information provided by PPL, the NRC published a White performance indicator for the "Unplanned Scrams," performance indicator for the third quarter of 2013. This performance indicator result, in conjunction with the earlier White "unplanned Scrams with Complications" performance indicator required the issuance of an assessment follow up letter. This letter was issued as Inspection Report 05000388/2013014 on November 5, 2013. This letter describes the NRC plans to schedule and perform a supplemental inspection using Inspection Procedure 95002, "Supplemental Inspection for One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area," once you have notified us of your readiness for this supplemental inspection.

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 System (PARS) component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Fred L. Bower III, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket No: 50-388
License No: NPF-22

Enclosure: Inspection Report 05000388/2013011
w/Attachment: Supplemental Information

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Sincerely,
/RA/
Fred L. Bower III, Chief
Reactor Projects Branch 4
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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	50-388
License No:	NPF-22
Report No:	05000388/2013011
Licensee:	PPL Susquehanna, LLC (PPL)
Facility:	Susquehanna Steam Electric Station, Unit 2
Location:	Berwick, Pennsylvania
Dates:	September 16, 2013 through September 19, 2013
Inspectors:	Christopher Newport, Resident Inspector, Seabrook Jonathan Greives, Senior Resident Inspector, Susquehanna
Approved by:	Fred L. Bower III, Chief Reactor Projects Branch 4 Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000388/2013011; 09/16/2013 – 09/19/2013; Susquehanna Steam Electric Station (SSES), Unit 2; Supplemental Inspection – Inspection Procedure (IP) 95001; Follow-up of Events and Notices of Enforcement Discretion.

A senior resident inspector and a resident inspector performed this inspection. Inspectors identified one finding of very low safety significance (Green). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP), dated June 2, 2011. The cross-cutting aspects for the findings were determined using IMC 0310, "Components Within The Cross-Cutting Areas," dated October 28, 2011. Findings for which the SDP does not apply may be Green, or be assigned a severity level after Nuclear Regulatory Commission (NRC) management review. All violations of NRC requirements are dispositioned in accordance with NRC's Enforcement Policy, dated January 28, 2013. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG 1649, "Reactor Oversight Process (ROP)," Revision 4, dated December 2006.

Cornerstone: Initiating Events

- Green. A finding of very low safety significance (Green) for failure to evaluate and incorporate the operating experience PPL received regarding the integrated control system (ICS) was self-revealed when Unit 2 lost control of reactor vessel level on November 9, 2012, requiring insertion of a manual scram. The cause of the loss of level control was the lockup of one of the two ICS network core switches due to a data storm, a condition which had been described in various operating experience communications from April 2007 through September 2012. PPL's immediate corrective actions included entering the issue into their corrective action program as condition report 1640540, making changes to Unit 2's core switches to prevent a similar condition, and developing a procedure to allow operators to diagnose and respond to a similar condition in Unit 1.

  The performance deficiency is more than minor because it was associated with the equipment performance attribute of the Initiating Events cornerstone and affected its objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, in this case, had the operating experience been reviewed appropriately, compensatory actions could have been taken that would have reasonably prevented the scram with loss of main feedwater. The inspectors evaluated the finding in accordance with IMC 0609, "Significance Determination Process," Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, for the Initiating Events cornerstone. The Senior Reactor Analyst (SRA) used the SSES Standardized Plant Analysis Risk (SPAR) model, Revision 8.16, for Unit 2 and SAPHIRE 8 to conduct the detailed risk evaluation and determined the increase in core damage frequency (ΔCDF) for internal initiating events was 5E-7yr (Green). Specifically, to account for the increased chance for a loss of main feedwater, the initiating event frequency was increased by one order of magnitude. Additionally, model modifications were made to account for the plant specific depressurization strategy. The dominant sequence was a loss of main feedwater with a failure of all injection coupled with a failure to vent containment and control residual heat removal (RHR). The increase in risk from both external events and for a large early release was found to be negligible. This finding was determined to have

a cross-cutting aspect in the area of Corrective Action Program, Operating Experience (OE), because PPL staff did not systematically collect, evaluate, and communicate to affected internal stakeholders in a timely manner relevant internal and external OE. Specifically, PPL did not enter the vendor advisories into the station's OE program and therefore, management was unaware of the core switch issues, no formal evaluation was conducted, and no corrective actions were specified to mitigate the vulnerability. [P.2(a)] (Section 4OA3)

REPORT DETAILS

4. OTHER ACTIVITIES

4OA3 Follow-up of Events (71153 – 2 samples)

.1 (Closed) Licensee Event Report (LER) 05000388/2012-002-00: Unit 2 Manual Scram Due to Loss of the Integrated Control System

a. Inspection Scope

On November 9, 2012, operators manually scrammed Unit 2 and tripped all reactor feed pumps due to a loss of the ICS. All systems responded appropriately and there were no actual adverse safety consequences as a result of this event. Following the manual scram due to the ICS failure, a second scram signal was received due to low water level during recovery from the initial scram. These events were reported as a LER in accordance with 10 CFR 50.73(a)(2)(iv)(A).

The inspectors reviewed the licensee event reports (LERs) to determine if PPL's evaluations and associated corrective actions were appropriate. The inspectors also assessed the accuracy of the LER, the timeliness of corrective actions, whether additional violations of requirements occurred, and if potential generic issues existed. This LER is closed.

b. Findings

Introduction. A finding of very low safety significance (Green) for failure to evaluate operating experience for the ICS was self-revealed when Unit 2 lost control of reactor vessel level on November 9, 2012, requiring insertion of a manual scram. The cause of the loss of level control was the lockup of one of the two ICS network switches due to a data storm, a condition which had been described in various OE communications from April 2007 through September 2012.

Description. On November 9, 2012, a loss of the ICS prevented automatic control of reactor feed and reactor recirculation flow, resulting in lowering reactor vessel level. When reactor vessel water level decreased to +25 inches, reactor operators manually scrammed the reactor and tripped all three reactor feed pumps.

The ICS uses six fault-tolerant pairs of field control processors. These processors and their related input/output subsystems are used to control reactor recirculation pump and reactor feed pump speeds, and reactor vessel water level. To accomplish these control functions, it is necessary for the processor pairs to communicate with other processor pairs over a mesh control network. The mesh control network uses multiport network switches to provide multiple communication paths between any two devices on the network. The network design uses "core switches" and "zone switches". If there is a communications problem between two network devices, the mesh control network should automatically establish a different connection through a different path using a rapid spanning tree protocol.

PPL determined the direct cause of the scram to be a failure of the network switches that had a latent design deficiency related to repeated firmware updates dating back to installation in 2011. Specifically, the primary core switch locked up in such a way that prevented it from transferring to the back-up switch and prevented any communication on the network.

PPL's root cause analysis (RCA) identified the root cause of the event as "less than adequate evaluation of deficiencies associated with ICS core switch design, testing, and mitigating strategies resulted in delayed resolution without understanding the risk implications." In review of the event, PPL identified multiple sources of information, including vendor, regulator, and industry OE that were not adequately evaluated. Prior to installation of ICS, Information Notice 07-15, "Effects of Ethernet-Based, Non-Safety Related Controls on the Safe and Continued Operation of Nuclear Power Stations," was issued and communicated the potential issue of data storms. The ICS vendor included this OE in the "ICS Control Processor Loading Report," dated October 21, 2009, and detailed that since 2004, there had been three cases of data storms and network lock-ups reported.

Subsequent to installation, the vendor communicated potential issues to the station with these core switches via Customer Advisories and Notifications. Engineering personnel received these advisories via email and evaluated each at the individual contributor level. The two most recent advisories, which were received on August 15, and September 21, 2012, were directly applicable to this failure mode and recommended action.

On August 15, 2012, the vendor issued an advisory stating that previously issued firmware versions were disqualified and that firmware installed in Unit 1 at the time had issues that could lead to switch lockup. This advisory also stated that the newer firmware version installed in Unit 2 at the time was released to support loop protection algorithm (LPA) functionality and went on to explain that by deploying LPA, traffic flooding and data storms can be prevented. At the time, LPA was not enabled on Unit 2 and the firmware on Unit 1 did not allow for deployment of LPA.

On September 21, 2012, the vendor issued an advisory recommending deployment of LPA to prevent data loops/storms from disabling the network. As noted in the August 15, 2012, Customer Advisory, the firmware version installed in Unit 2 at the time was released to support LPA functionality. Also stated in the September 21, 2012, advisory was that LPA can be enabled without taking the system offline.

Engineers added the advisories to the scope of the next refueling outages, which was consistent with PPL's strategy of not performing firmware updates with the system online. However, the advisories were not reviewed under the station's OE review program and did not receive management review.

NDAP-QA-1213, "Control and Use of Vendor Technical Information," Revision 7, step 6.2.11 states that "any vendor information received…that is an industry operating experience or lesson learned and is deemed applicable, shall be identified and submitted per the Operating Experience Review Program procedure." NDAP-QA-0725, "Operating Experience Review Program," Revision 17, states that "all nuclear department personnel are responsible for ensuring action requests (ARs) are generated

when valuable information or lessons learned are identified during the receipt, review, or evaluation of industry OE." NDAP-QA-0725 requires the Management Review Committee to review the OE and generate an AR if it is applicable to SSES. Each AR is processed in accordance with the stations corrective action program, NDAP-QA-0702, "Action Request and Condition Report Process," to ensure the risk of the OE is considered.

With regard to the OE, inspectors determined that, had it been entered into the formal program as required, it would have been reasonable for management review to identify the risk of the failure and require compensatory actions to mitigate the consequences. Compensatory actions taken post-scram for Unit 1 included a procedure change to allow operators to diagnose the failure and take action to force the core switch to its backup. Inspectors determined that had this compensatory action been identified by the OE review and implemented prior to the scram, operators could have taken action which would have reasonably prevented the scram.

PPL's immediate corrective actions included entering the issue into their corrective action program as condition report 1640540, making hardware and software changes to Unit 2's core switches to prevent a similar condition, and developing a procedure to allow operators to diagnose and respond to a similar condition in Unit 1.

Analysis. The inspectors determined that PPL's failure to adequately review ICS related OE and take appropriate corrective actions was a performance deficiency that was within PPL's ability to foresee and correct, and should have been prevented. The performance deficiency is more than minor because it was associated with the equipment performance attribute of the Initiating Events cornerstone and affected its objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, in this case had the OE been reviewed appropriately, compensatory actions could have been taken that would have reasonably prevented the scram with loss of main feedwater.

The inspectors evaluated the finding in accordance with IMC 0609, "Significance Determination Process," Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, for the Initiating Events cornerstone. The inspectors answered "Yes" to the screening question, "Did the finding cause a reactor trip AND the loss of mitigation equipment relied upon to transition the plant from the onset of the trip to a stable shutdown condition (e.g. loss off condenser, loss of feedwater)?" Since the finding resulted in a scram and the loss of feedwater, a detailed risk evaluation was performed.

The SRA used the SSES SPAR model, Revision 8.16, for Unit 2 and SAPHIRE 8 to conduct the detailed risk evaluation and determined the increase in ΔCDF for internal initiating events was 5E-7yr (Green). Specifically, to account for the increased chance for a loss of main feedwater, the initiating event frequency was increased by one order of magnitude. Additionally, model modifications were made to account for the plant specific depressurization strategy. The dominant sequence was a loss of main feedwater with a failure of all injection coupled with a failure to vent containment and control RHR. The increase in risk from both external events and a large early release was found to be negligible.

This finding was determined to have a cross-cutting aspect in the area of Corrective Action Program, Operating Experience, because PPL did not systematically collect, evaluate and communicate to affected internal stakeholders in a timely manner relevant internal and external OE. Specifically, PPL did not enter the vendor advisories into the station's OE program and therefore, management was unaware of the core switch issues. No formal evaluation was conducted, and no corrective actions were specified to mitigate the vulnerability. [P.2(a)]

Enforcement. This finding does not involve enforcement action since no regulatory requirement violation was identified. Specifically, since the ICS is non-safety related and not credited in any accident analysis, implementation of PPL's procedure, NDAP-QA-0725, "Operating Experience Review Program," is not required to be implemented as part of SSES' 10 CFR 50, Appendix B, Quality Assurance Program. Because the finding does not involve a violation and is of very low safety significance, it is identified as a finding (FIN). (**FIN 05000388/2013011-01, Reactor Scram due to Loss of the Integrated Control System**)

.2 (Closed) LER 05000388/2012-003-00: Unit 2 Automatic Scram While Performing Turbine Control Valve Surveillance Testing

On December 16, 2012, Unit 2 reactor automatically scrammed during the performance of quarterly channel functional test of the turbine control valve fast closure channels of the Reactor Protection System (RPS). All systems responded appropriately and there were no actual adverse consequences as a result of this event. This event was reported as an LER in accordance with 10 CFR 50.73(a)(2)(iv)(A).

The inspectors reviewed the LER to determine if PPL's evaluations and associated corrective actions were appropriate. The inspectors also assessed the accuracy of the LER, the timeliness of corrective actions, whether additional violations of requirements occurred, and if potential generic issues existed. Based on this review, the inspectors did not identify any performance deficiencies or violations associated with this event. This LER is closed.

4OA4 Supplemental Inspection (95001)

.01 Inspection Scope

The NRC staff performed this supplemental inspection in accordance with IP 95001 to assess PPL's evaluation of a White performance indicator (PI) for unplanned scrams with complications, which affected the Initiating Events cornerstone in the Reactor Safety strategic performance area. The inspection objectives were:

- Provide assurance that the root causes and contributing causes of risk-significant performance issues are understood;
- Provide assurance that the extent of conditions and extent of cause of risk-significant performance issues are identified; and
- Provide assurance that the licensee's corrective actions for risk-significant performance issues are sufficient to address the root and contributing causes and prevent recurrence.

Susquehanna Unit 2 entered the Regulatory Response Column of the NRC's Reactor Oversight Process (ROP) Action Matrix because one performance indicator (PI) was of low to moderate safety significance (White) in the Initiating Events cornerstone. Specifically, the "Unplanned Scrams with Complications" PI exceeded the Green/White threshold value in the fourth quarter of 2012. The first complicated scram occurred on November 9, 2012, with power at approximately 90 percent, operators manually scrammed Unit 2 and tripped all reactor feed pumps due to a loss of the ICS. All control rods inserted and both reactor recirculation pumps tripped at -38 inches. Reactor water level lowered to -52 inches causing Level 3 (+13 inches) and Level 2 (-38 inches) isolations. High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) both automatically initiated. Following the manual scram due to the ICS failure, a second scram signal was received due to low water level during recovery from the initial scram. PPL performed a root cause analysis of the event. PPL's root cause analysis, RCA 1640540, "U2 ICS Scram Event", identified one direct cause, one root cause, and two causal factors for this event.

The second complicated scram occurred on December 16, 2012, when Unit 2 automatically scrammed during the performance of the quarterly functional test of the turbine control valve fast closure channels in the RPS. Both the HPCI and RCIC systems automatically initiated. Following the scram, a second reactor scram signal was received due to reactor water level lowering to +13 inches during recovery from the initial scram. PPL performed a root cause analysis of the event. PPL's root cause analysis, RCA 1652377, "U2 Scram During Turbine Valve Cycling Surveillance", identified one root cause, and two contributing factors for this event.

Additionally, PPL performed a root cause analysis analyzing the complications that occurred during the November 9th and December 16th unplanned scrams. PPL's root cause analysis, RCA 1676146 "Unit 2 Unplanned Scrams with Complications", identified three root causes and three contributing factors for the complicating factors of the two events.

PPL staff informed the NRC staff on June 24, 2013, that they were ready for the IP 95001 supplemental inspection.

The inspectors reviewed these three root cause analysiss to look for trends in operator performance and as an input to assess the adequacy of the corrective actions taken in response to the two events. The inspectors also reviewed applicable corrective action program documents, interviewed operations crew personnel, performed a simulator and control room walkdown, and reviewed training materials and lesson plans. The inspectors also held discussions with licensing, engineering, and operations management personnel to ensure that the root and contributing causes were understood and corrective actions taken or in progress were appropriate to address the identified causes and to prevent recurrence of the original issue.

.02 Evaluation of the Inspection Requirements

02.01 Problem Identification

a. IP 95001 requires that the inspection staff determine that the licensee's evaluation of the issue documents who identified the issue (i.e., licensee-identified, self-revealing, or NRC-identified) and the conditions under which the issue was identified.

The inspectors determined that PPL's root cause analyses adequately described the conditions through which these self-revealed issues were identified.

The inspectors determined that PPL's three root cause evaluations effectively document who identified the issues and the conditions under which the issues were identified.

b. IP 95001 requires that the inspection staff determine that the licensee's evaluation of the issue documents how long the issue existed and prior opportunities for identification.

The inspectors determined that PPL's root cause analyses adequately documented how long the issues leading to the White PI for complicated scrams existed and that prior opportunities for identification were identified.

November 9, 2012 Complicated Scram

The November 9th scram was caused by a latent design deficiency associated with C2 series core switches in the feedwater digital ICS. The scram was complicated by Operations standards, policies, and administrative controls, procedures, and associated training.

PPL's root cause analysis determined that firmware issues associated with the ICS core switches had been identified as early as May of 2009. Multiple sources of information, including vendor, regulator, and industry OE had been available to PPL personnel since the installation of the digital ICS in U2 in 2011. The root cause analysis also determined that the Operation's department procedures and training failed to emphasize the importance of maintaining adequate margin to the reactor pressure vessel (RPV) level 3 RPS actuation point following initial recovery post scram. This was further complicated by the placement and availability of narrow range RPV level indication, and differences between plant and simulator instrumentation. A finding associated with this event was documented in report Section 4OA3.1.

December 16th, 2012 Complicated SCRAM

The December 16th scram was caused by an erroneous RPS Division 1 half scram signal being received during quarterly turbine valve cycling surveillance on the Unit 2 turbine control valves. This erroneous half scram signal, coupled with the RPS Division 2 half scram that was already generated as a result of the testing, resulted in an unanticipated full reactor scram of Unit 2. The scram event was complicated by the design control value for setpoint setdown not providing adequate margin to prevent operational overlap with the reactor low level scram actuation point. At the time of the event, a nominal three inch margin existed between the feedwater setpoint setdown setpoint and the reactor low level scram actuation setpoint. This was further complicated by an operator failing to reset setpoint setdown during the post scram recovery, as required by procedure. PPL's root cause analysis determined that industry best practices and OE associated with half scram reduction during surveillance testing had been available to PPL since 2001. Additionally, PPL's root cause analysis determined that the design control value for setpoint setdown was in place since the installation of the digital ICS in Unit 2 in 2011.

The inspectors determined that PPL's root cause analyses effectively documented that the operator performance issue had existed for several years and documented prior opportunities for identification.

c. IP 95001 requires that the inspection staff determine that the licensee's evaluation documents the plant specific risk consequences, as applicable, and compliance concerns associated with the issue(s).

November 9, 2012 Complicated Scram
PPL's root cause analysis (RCA 1640540) documents the safety consequences of this event. PPL concluded that in the case of the November 9th scram, all safety systems operated as expected, and therefore the potential consequences of the event, although complicated, were mitigated. PPL's risk modeling of the event (complete loss of ICS control) determined that probabilistic risk analysis (PRA) risk remained less than 1E-06 for core damage probability (CDP) and 1E-07 for large early release probability (LERP) significance thresholds as outlined in IMC 0609. These thresholds represent a very low safety significance (Green).

December 16th, 2012 Complicated Sram
PPL's root cause analysis (RCA 1652377) documents the safety consequences of this event. PPL concluded that in the case of the December 16th scram, all safety systems operated as expected, and therefore the potential consequences of the event were mitigated. PPL's risk modeling of the event (RPS automatic SCRAM non-isolation event) determined that PRA risk remained less than 1E-06 for CDP and 1E-07 for LERP significance thresholds as outlined in IMC 0609. These thresholds represent a Green significance level and are of "Very Low Safety Significance".

The inspectors determined that PPL's evaluation adequately documented the plant specific risk consequences and compliance concerns associated with the issue.

d. Findings

With the exception of the finding documented in report Section 4OA3.1, no findings were identified

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

a. IP 95001 requires that the inspection staff determine that the licensee evaluated the issue using a systematic methodology to identify the root and contributing causes.

November 9, 2012 Complicated Scram
PPL used the following systematic methods to complete the root cause analyses: event and causal factor chart, hazard barrier target analysis, and tap root analysis. PPL identified one direct cause, one root cause and two causal factors associated with the initiating event (lockup of digital ICS requiring a manual scram). PPL identified one root cause, and two causal factors associated with the complicating event (secondary RPS low level actuation during SCRAM recovery).

PPL determined the root cause of the initiating event to be: "Less than adequate evaluation of deficiencies associated with ICS core switch design, testing, and mitigating strategies resulted in delayed resolution without understanding risk implications."

PPL determined the root cause of the complicating event to be: "Operations and engineering did not emphasize the avoidance of a second scram on RPV Level 3 through standards, policies, and administrative controls, procedures, and associated training."

December 16, 2012 Complicated Scram

PPL used the following systematic methods to complete the root cause analyses: event and causal factor chart, WHY chart, and tap root analysis. PPL identified one root cause, and two causal factors associated with the initiating event (scram during turbine valve cycling surveillance). PPL identified two root causes, and one causal factor associated with the complicating event (secondary RPS low level actuation during scram recovery).

PPL determined the root cause of the initiating event to be: "Susquehanna failed to incorporate industry best practices with other impacted work groups for half scram reduction."

PPL determined the root causes of the complicating event to be: "Step 10 (Reset Setpoint Setdown) of OP-245-001-1, Rev 10, was not performed (based on best available evidence);" and, "the design control value (+18") for setpoint setdown did not provide adequate margin to prevent operational overlap with the Reactor low level scram actuation point (+15"). This lack of margin was the result of design requirements not being aligned with post scram expectations for NRC PI IE04, "Unplanned SCRAMS with Complications."

The inspectors determined that PPL had evaluated the issue using a systematic methodology to identify root and contributing causes.

b. IP 95001 requires that the inspection staff determine that the licensee's root cause evaluation was conducted to a level of detail commensurate with the significance of the issue.

PPL's root cause analyses included the use of a combination of root cause assessment methods that are complimentary. A collective review (RCA 1676146) of the root and contributing causes did not result in the identification of any additional fundamental issues.

The inspectors determined that PPLs' three root cause analyses were generally conducted to a level of detail commensurate with the significance of the issue.

c. IP 95001 requires that the inspection staff determine that the licensee's root cause evaluation included a consideration of prior occurrences of the issue and knowledge of Operating Experience (OE).

PPL's root cause analysis included an evaluation of internal and external OE. PPL also conducted a review for similar occurrences of this event at Susquehanna. PPL identified multiple examples of external and internal OE and vendor advisories that were applicable to the November 9th scram. PPL also identified several examples of external OE that were applicable to the December 16th scram. Each of the instances of identification of OE was appropriately identified and subsequently addressed in the root causes and causal factors section of the RCA.

The inspectors determined that PPL's root cause analyses included a consideration of prior occurrences of the issue and knowledge of OE.

d. IP 95001 requires that the inspection staff determine that the licensee's root cause evaluation addresses the extent of condition and extent of cause of the issue.

November 9, 2012 Complicated Scram

Extent of Condition. PPL's root cause analysis addressed the extent of condition for the event. Due to the fact that the Unit 2 ICS core switches were immediately replaced, the extent of condition identified was limited to the Unit 1 ICS core switches. The root cause analysis team considered the extent of condition for the complicated event and found no instances of post SCRAM performance challenges that placed the operators in a position that requires additional actions beyond those for an uncomplicated scram.

Extent of Cause. The root cause analysis team considered the extent of cause associated with the initial event. Using trend code searches encompassing a time frame representing ICS project development, the team identified several vulnerabilities in the areas of management systems, training, and procedures. The team determined the corrective actions developed in response to this and other similar events were adequate to address the extent of cause.

The inspectors determined that PPL's root cause analyses addressed the extent of condition and the extent of cause of the November 9th scram and complicating event.

December 16, 2012 Complicated Scram

Extent of Condition. PPL's root cause analysis addressed the extent of condition for the event. The team initially considered all surveillance testing that could introduce a half scram signal, but limited the extent of condition to eight surveillance procedures that do or could introduce a half scram signal due to the fact that the majority of the surveillances were previously identified by scram reduction efforts and were modified to incorporate the use of a RPS test box to eliminate actual half scram signals being input to RPS. The root cause analysis team considered the extent of condition for the complicated event and found no instances of post scram performance challenges that placed the operators in a position that requires additional actions beyond those for an uncomplicated scram.

Extent of Cause. The root cause analysis team considered the extent of cause associated with the root causes and causal factors for the initial event. The team determined that the extent of cause was bounded to include other recommendations from the 2005 Boiling Water Reactor Owners Group scram frequency reduction effort and performance improvement procedure revisions. The inspectors determined that PPL's root cause analysis addressed the extent of cause of the December 16th scram and complicating event.

e. IP 95001 requires that the inspection staff determine that the licensee's root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in IMC 0305.

PPL considered the safety culture aspects of Human Performance, Problem Identification & Resolution, and Continuous Learning Environment to be applicable to the two scrams and their associated complicated events. Corrective actions have been completed taking into consideration the input of the safety culture aspects.

The inspectors determined the root cause analyses included a proper consideration of whether the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components.

f. Findings

No findings were identified.

02.03 Corrective Actions

a. IP 95001 requires that the inspection staff determine that (1) the licensee specified appropriate corrective actions for each root and/or contributing cause, or (2) an evaluation that states no actions are necessary is adequate.

The three root cause analyses documented corrective actions for the root cause and causal factors and identified corrective actions for other issues. The inspectors reviewed all of the corrective actions to ensure that they addressed the identified causes. The inspectors found the completed and proposed corrective actions to be reasonable with regard to addressing the performance deficiencies identified with this event.

The inspectors found that PPL specified appropriate corrective actions for the root cause, causal factors, extent of conditions, and extent of causes listed in the three RCAs.

b. IP 95001 requires that the inspection staff determine that the licensee prioritized corrective actions with consideration of risk significance and regulatory compliance.

The inspectors reviewed the prioritization of the corrective actions and verified that the prioritization was based on consideration of risk significance and regulatory compliance. At the time of this inspection the majority of the corrective actions were closed.

The inspectors determined that PPL had established an appropriate schedule for implementing and completing the majority of the corrective actions.

c. IP 95001 requires that the inspection staff determine that the licensee established a schedule for implementing and completing the corrective actions.

PPL's corrective actions and proposed corrective action plan provided dates for completion of actions as described in the three root cause analyses.

The inspectors noted that a corrective action associated with the December 16th scram, RCA 1652377, was closed in PPL's corrective action program database without the required supporting documentation. Follow-up of the issue determined that the required actions had been completed (informal "tailboard" training sessions on the event to affected workgroups to increase awareness of the direct cause) in a timely manner. PPL noted the issue and issued CR 1747682 for follow-up.

The inspectors also noted that two actions associated with the Operations Department Training Intervention Plan were overdue without associated procedurally required due date extensions. PPL noted the issue and issued CR 1747717 for follow-up.

Both of the identified corrective action issues represent failures to follow applicable administrative control requirements. The inspectors determined that neither of the issues impacted the effectiveness of PPL's implementation of corrective actions associated with the two events. These failures to comply with licensee procedures constitute minor violations that are not subject to enforcement action in accordance with the NRC's Enforcement Policy.

The inspectors determined that the schedule for implementing and completing the corrective actions was reasonable and timely.

d. IP 95001 requires that the inspection staff determine that the licensee developed quantitative and/or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.

The inspectors determined that each root cause analysis included an effectiveness review plan for the associated corrective actions that was adequate to prevent recurrence. The effectiveness review plan for the November 9th scram included an interim review that is scheduled to be complete by November 2013, and a final review that is scheduled to be completed by November 2015. The effectiveness review plan for the December 16th scram included a review that is scheduled to be complete by December 2013. The effectiveness review plan for the complications RCA included an interim review that was to be completed in September 2013, and a final review that is scheduled to be completed by January 2014.

The inspectors determined that PPL has successfully developed and implemented an effectiveness review plan for the corrective actions associated with the three root cause analyses.

e. IP 95001 requires that the inspection staff determine that the licensee's planned or taken corrective actions adequately address a Notice of Violation (NOV) that was the basis for the supplemental inspection, if applicable.

The White PI that was the subject of this inspection was not associated with a NOV. Therefore, this inspection aspect was not applicable, and as a result, was not reviewed.

f. Findings

No findings were identified.

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

This part of IP 95001 was not implemented as PPL did not request credit for self-identification of an old design issue and the performance issue did not meet the requirements of IMC 0305 paragraph 04.18 for consideration as an old design issue.

At the conclusion of the on-site portion of the inspection, the inspectors debriefed the inspection results to Mr. Timothy Rausch, Site Vice President, and other members of his staff. On October 4, 2013, after in-office NRC management review, the inspectors conducted a formal exit via teleconference to Mr. Jon Franke, Site Vice President, and other members of his staff, who acknowledged the results.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel
C. Hoffman, Engineering Manager
C. Mangas, Licensing
J. Scranton, Engineering
J. Bella, Engineering
M. Lingenfelter, Engineering
K. Buck,Security
C. Young, Operations
L. Oberrender, Operating Experience
J. Glasser, Engineering
F. Purdy, Engineering

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened/Closed

05000388/2013011-01	FIN	Reactor Scram due to Loss of Integrated Control System (Section 4OA3)

Closed

05000388/2012-002-00	LER	Two Control Room Floor Cooling Systems Inoperable (Section 4OA3)
05000388/2012-003-00	LER	Both Trains of Control Structure (CS) Chillers Inoperable (Section 4OA3)

LIST OF DOCUMENTS REVIEWED

Procedures:
MFP-QA-2310, Engineering Change Testing, Revision 9
NDAP-00-1600, Technical Task Risk/Managed Defenses Assessment, Pre-Job Brief, Independent Third Party Review, and Post-Job Brief, Revision 1
NDAP-00-0752, Cause Analysis, Revision 20
NDAP-QA-0725, Operating Experience Review Program, Revision 17
NDAP-QA-1213, Control and Use of Vendor Technical Information, Revision 7
NSEP-AD-0001, Station Engineering Business Conduct, Revision 18
ON-200-101, Scram, Scram Imminent, Revision 29
SO-293-001, Quarterly Turbine Valve Cycling, Revision 41

Condition Reports:

1640540	869191	1652377	1659749	295306	1670075
1670422*	1640845	1640540	1643133	1646579	1652338
1652377	1659749	1665479	1681556	1668553	1668966

1670015	1670075	1672418	1676146	1693177	1714624
1724281	1724646	1743169	1743173	1739146	1729459
1747717*	1747682*	1745765*	818999		

Miscellaneous:
EG234, Role of the Nuclear Power Plant Engineer Training, Revision 0
EG319, Principles for a Strong Technical Conscience Culture for Engineering Support Personnel Training, Revision 0
ICS Failure Modes and Effects Analysis dated January 20, 2010
Laboratory Examination of Main Turbine Control Valve No. 1 Components dated February 20, 2013
Engineering Change 1694052, Integrated Control System Enhancements, Revision 0

LIST OF ACRONYMS

AR	Action Request
CDF	Core Damage Frequency
CDP	Core Damage Probability
HPCI	High Pressure Coolant Injection
ICS	Integrated Control System
IMC	Inspection Manual Chapter
IP	Inspection Procedure
LER	Licensee Event Report
LERP	Large Early Release Probability
LPA	Loop Protection Algorithm
NOV	Notice of Violation
OE	Operating Experience
PI	Performance Indicator
PPL	Pennsylvania Power & Light
PRA	Probabilistic Risk Analysis
RCA	Root Cause Analysis
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RPS	Reactor Protection System
RPV	Reactor Pressure Vessel
SDP	Significance Determination Process
SPAR	Standardized Plant Analysis Risk
SRA	Senior Reactor Analyst
SSES	Susquehanna Steam Electric Station