



EXECUTIVE SUMMARY  
Limerick Generating Station, Units 1 & 2  
NRC Inspection Report 50-352/99-07, 50-353/99-07

This integrated inspection included aspects of PECO Energy operations, engineering, maintenance, and plant support. The report covers a six-week period of resident inspection.

Operations

- On September 23, 1999, PECO's staff appropriately classified and responded to the Unusual Event due to the presence of toxic gases within the site boundary. (Section O1.2)
- PECO's staff responded appropriately to the emergent challenges during Tropical Storm Floyd. (Section O1.3)
- Main control room equipment deficiencies were conservatively identified. There were no operability issues or conditions that would hinder the operator's ability to manage the plant during a transient. (Section O2.2)

Engineering

- LER 2-99-01 identified the unavailability of safe shutdown equipment in the event of a fire due to inadequate circuit breaker coordination. This condition was outside the design basis of the plant and a violation of the Operating License Condition 2.C.3. This Severity Level IV violation is being treated as a Non-Cited Violation (**NCV 50-352/99-07-01**), consistent with Appendix C of the NRC Enforcement Policy. This violation is in the licensee's corrective action program as PEP I0009383. (Section E8.1)
- PECO did not perform an adequate review of the procedure revision that implemented the bypassing of the reactor water cleanup leakage detection system isolation logic when the reactor water cleanup system was returned to service with the reactor pressurized. Consequently the isolation logic was bypassed on three occasions; defeating a required safety function and placing the plant outside of its design bases. Further, on one of those occasions, the applicable Technical Specification allowed outage time was exceeded as a result of an unrelated interpretation error. The failure to perform a 50.59 analysis for a procedure revision and failure to meet the Technical Specifications are apparent violations of NRC requirements. Processing of these apparent violations will await further NRC inspection of these issues including the root cause and corrective actions documented in the LER and associated PEPs I0009631 and I0009959. (Section E8.2)

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## Report Details

### Summary of Plant Status

Unit 1 and Unit 2 began this inspection period operating at 100%. Both units remained at full power throughout the inspection period with exceptions for testing.

### I. Operations

#### **O1 Conduct of Operations<sup>1</sup>**

##### **O1.1 General Comments (71707)**

PECO Energy (PECO) conducted at power activities at Limerick Units 1 and 2 safely. Routine operations, surveillance, and other plant-related activities were performed as per station procedures, in a deliberate manner with clear communications, and with effective peer-checking and supervisory oversight. Control room logs accurately reflected plant activities and shift turnovers were comprehensive. Operators implemented effective controls for work activities using conservative decision making.

##### **O1.2 Unusual Event Declared at Limerick**

###### **a. Inspection Scope (93702)**

The inspectors responded to an Unusual Event declared at the Limerick Generating Station. The inspectors observed the activities performed by plant staff and assessed the status of the facility.

###### **b. Observations and Findings**

At 8:00 pm, on September 23, 1999, shift management declared an Unusual Event due to the presence of toxic gases within the site boundary. The on-coming operators' noted an unusual odor in the plant prior to shift turnover. Subsequent sampling detected hydrogen sulfide and carbon monoxide gases at potentially harmful levels inside and outside of the turbine building. Shift management ordered an evacuation of the turbine building and initiated a manual isolation of the main control room ventilation system. No toxic gases were detected within the main control room. PECO was unable to identify the source of the gases, but believed that the gases came from outside of the site. The gases had dissipated by 10:40 p.m. and no detectable concentrations were found. Site personnel were then allowed back into the turbine building. The event was terminated at 11:12 p.m.

The inspectors determined that PECO's notifications of the event were made in a timely manner. The operator's actions taken to isolate the main control room and evacuate

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<sup>1</sup> Topical headings such as O1, M8, etc., are used in accordance with the NRC standardized reactor inspection report outline. Individual reports are not expected to address all outline topics.

personnel were appropriate as per Special Event procedure SE-2, "Toxic Gas/Chlorine." The actions taken by site team to detect the levels and determine the source of the gas were also appropriate. As a result, no station personnel were injured or became ill during the event. Although PECO did not identify the source of the gas, the corrective measure pursued ensured the site safety. Both units remained at 100% power throughout the event.

c. Conclusions

On September 23, 1999, PECO's staff appropriately classified and responded to the Unusual Event due to the presence of toxic gases within the site boundary.

O1.3 Tropical Storm Floyd

a. Inspection Scope (71707, 93702)

The inspectors observed PECO's response to Tropical Storm Floyd. The inspectors observed the activities performed by plant staff and assessed the status of the facility.

b. Observations and Findings

PECO implemented special event procedure SE-9, "High Winds", on September 15, 1999, in preparation for the storm. All loose items around the site were properly secured. Winds were sustained at about 35 mph and gusted to 45 mph with a constant rain during the storm. The inspector noted that plant management postponed all maintenance and surveillance items which potentially could impact the operation of the plant. Shift management increased the number of plant operators on-site during the storm. The shift manager monitored the storm's position and intensity.

Throughout the storm, the site staff responded appropriately to emergent plant problems; following up as necessary to ensure proper equipment operation. The operators responded to and resolved storm-related issues with the Unit 2 "C" main transformer control panel becoming saturated with water and with the reactor enclosure ventilation system being adversely affected by the gusting winds. Maintenance technicians were assigned throughout the storm to continuously rake the suction screens for the circulating water pump to keep them clear of algae, which was accumulating in the cooling tower basin. The primary meteorological tower instrumentation building sustained flooding with water rising to within 1" of an energized terminal strip. Grounding of the terminal strip would have rendered the tower's instrumentation inoperable. Staff personnel pumped out the building and maintained the instrumentation operable. The shift management appropriately initiated a one-hour NRC notification when 49 out of 165 emergency preparedness sirens became inoperable due to power failures caused by the storm.

c. Conclusion

PECO's staff responded appropriately to the emergent challenges during Tropical Storm Floyd.

**O2 Operational Status of Facilities and Equipment**

O2.1 Facility Tours (71707)

The inspectors routinely conducted independent plant tours and walkdowns of selected portions of safety-related systems during the inspection period. These activities consisted of the verification that system configurations, power supplies, process parameters, support system availability, and current system operational status were consistent with Technical Specification (TS) requirements and Updated Final Safety Analysis Report (UFSAR) descriptions. System operability and material conditions were noted to be acceptable in all cases. The inspectors did not identify any substantive concerns or deficiencies as a result of these walkdowns.

O2.2 Main Control Room Deficiencies (71707)

a. Inspection Scope

The inspectors performed a review of deficiencies in the main control room. The inspector verified that tagged equipment was properly identified in the corrective maintenance system, whether the equipment affected system operability, and if the deficiency would hinder operator action during a transient.

b. Observations and Findings

The inspectors identified no operability issues or problems with the ability of operators to manage plant transients during a review of control room deficiencies. The inspector found that the equipment trouble tags did not hinder operators from performing their duties. Operators were found to be knowledgeable of the deficiencies and used the tags as an aid in operating plant equipment with known deficiencies. The inspector found that equipment deficiencies, in general, were conservatively identified. PECO has established goals of 10-15 non-outage deficiencies total with all non-outage deficiencies closed within 60 days. The inspector considered the goals aggressive and manageable. The inspector found that appropriate management attention was being given to control room deficiencies (e.g., periodically reviewed at leadership meetings). At the time of the inspection, PECO was above their goal (a total of 25 control room deficiencies) and the need to reduce the number of deficiencies was recognized.

c. Conclusion

Main control room equipment deficiencies were conservatively identified. There were no operability issues or conditions that would hinder the operator's ability to manage the plant during a transient.

**O6 Operations Organization and Administration**

O6.1 WANO Evaluation Report Review (71707)

The inspectors reviewed the report issued by the World Association of Nuclear Operators (WANO). The April 12, 1999, report documented the results of an onsite evaluation conducted on February 1-12, 1999. No safety issues were identified as a result of this review.

**O8 Miscellaneous Operations Issues (90712)**

O8.1 (Closed) LER 1-99-010: PECO's notification to the NRC for a manual actuation of the main control room chlorine isolation mode due to a faint chlorine odor in the reactor enclosure was untimely. On August 20, 1999, an equipment operator detected a faint odor of chlorine in the Unit 2 reactor enclosure. To preserve main control room habitability, the operations staff appropriately initiated manually the chlorine isolation mode of the control room ventilation system. The source of the chlorine odor could not be identified and chlorine levels were determined to be below detectable. During a review of the event on August 21, shift management recognized that the manual actuation of the ESF system was reportable to the NRC per 10CFR50.73(a)(2)(iv). The inspector performed an "in-office" review of this event and determined that no violation occurred as a result of the manual ESF actuation. The late report was a minor violation and not subject to formal enforcement. This LER is closed.

**II. Maintenance**

**M1 Conduct of Maintenance**

M1.1 General Comments on Maintenance Activities (62707)

The inspectors observed selected maintenance activities to determine whether approved procedures were in use, technical specifications were satisfied, maintenance was performed by knowledgeable personnel, and post-maintenance testing was appropriately completed.

The inspectors observed portions of the following work activities:

- Unit 1, D11 Emergency Diesel Generator Field Ground Repair - August 9 - 20;
- Unit 1, Reactor Water Clean-up Pump Replacement - On-going during period;
- Unit 1, 1B SLC Pump Loss of Power Alarm Troubleshooting (LFIN) - August 27;

- Unit 1, Relocation of RWCU Room Temperature Thermocouple - Sept 21;
- Unit 2, High Pressure Coolant Injection System Outage - Sept. 20 - 24;
- Unit 2, Non- Safeguards Battery Replacement - Sept. 20 -23.

Observed maintenance activities were conducted well using approved procedures, and were completed with satisfactory results. Technicians used foreign material exclusion controls as necessary. Communications between the various work and support groups were good, and supervisor oversight was good.

#### D11 Emergency Diesel Generator Field Ground

On August 9, 1999, a generator field ground developed during the 24-hour endurance surveillance test performed following the D11 emergency diesel generator 18-month overhaul. Nuclear Maintenance Division personnel performed troubleshooting, using the AG-CG-50, equipment investigation and troubleshooting process, to determine the magnitude and location of the ground. The technicians located and repaired the ground on the electrical leads between the slip-rings and the pole pieces in the rotor. The ground did not return during subsequent testing. D11 was declared operable on August 20. The inspector noted good engineering support and management oversight throughout the troubleshooting and repair activities.

#### M1.2 General Comments on Surveillance Activities (61726)

The inspectors observed selected surveillance tests to determine whether approved procedures were in use, test instrumentation was properly calibrated and used, technical specifications were satisfied, testing was performed by knowledgeable personnel, and test results either satisfied the acceptance criteria or were properly dispositioned.

The inspectors observed portions of the following surveillance activities:

- Unit 1, ST-6-092-111-1, D11 Diesel Generator 24-Hour Endurance Test - August 9;
- Unit 1, ST-6-092-315-1, D11 Diesel Generator Fast Start Operability Test Run - August 19;
- Unit 1, ST-6-048-230-1, Standby Liquid Control Pump, Valve, and Flow Test - August 26;
- Unit 1, ST-6-051-233-1, 1C Residual Heat Removal Pump Valve and Flow - September 16.

Observed surveillance tests were conducted well using approved procedures, and were completed with satisfactory results. Communications among the various work and support groups were good, and supervisor oversight was good.



### III. Engineering

#### E8 Miscellaneous Engineering Issues (92902)

- E8.1 (Closed LER 2-99-01: PECO identified the unavailability of safe shutdown equipment in the event of a fire due to inadequate circuit breaker coordination for the 2B reactor enclosure cooling water (RECW) pump. In January 1999, PECO engineers identified that the circuit breaker time-current tripping coordination, between the RECW pump breaker and the load center breaker for the pump's motor control center (MCC), was set such that the load center breaker could trip prior to the pump breaker. A fire occurring in Fire Area 64 could create a "hot short," impacting the 2B RECW pump and causing loss of the associated MCC under certain conditions. The loss of the MCC would result in the loss of vital equipment necessary for safe shutdown during the postulated fire. The engineers found that this issue did not affect Unit 1 due to configuration differences between the units.

PECO determined that this issue was a condition outside the design basis of the plant as stated in the UFSAR, Section 9A.6.1.1, and a violation of the Operating License Condition 2.C.3. PECO immediately declared the 2B RECW pump inoperable and reset the MCC breaker trip setting to provide the proper breaker coordination and eliminating the potential loss of safe shutdown equipment. In addition, associated design calculations and the UFSAR figures were revised. The inspector performed an "in-field" review of the fire safe shutdown methodology for the postulated fire and determined that PECO would have been able to identify and correct the fault within the time necessary to achieve and maintain a cold shutdown condition. The inspector concluded that PECO had sufficiently addressed this issue. This Severity Level IV violation is being treated as a Non-Cited Violation (NCV 50-352/99-07-01), consistent with Appendix C of the NRC Enforcement Policy. This violation is in the licensee's corrective action program as PEP 10009383.

- E8.2 (Open) Apparent Violations 353/99-07-02 & 03 (Closed) LER 2-99-003 Bypass of the Reactor Water Cleanup Leak Detection System Isolation Function

a. Inspection Scope (37551)

On June 7, 1999, PECO made a 4 hour report to the NRC Operations Center that described three occasions in which the automatic isolation logic for the reactor water cleanup (RWCU) system was inappropriately defeated. The inspector performed an "in-field" review of the associated LER issued July 7, 1999, and supporting information.

b. Observations and Findings

On June 7, 1999, PECO reported that on three occasions between July and September 1998, they had inappropriately defeated the leakage detection system (LDS) automatic isolation logic for the RWCU system containment isolation valves when the reactor was pressurized. The leak detection system was defeated by the installation of electrical jumpers while the RWCU system was being returned to service. PECO determined that

the previous practice of defeating the RWCU leak detection logic while the RWCU system was being returned to service with the reactor pressurized had not been properly reviewed and represented a condition that alone could have prevented the fulfillment of a safety function of a system needed to mitigate the consequences of an accident and control the release of radioactive material.

In July 1998, PECO began the practice of defeating the RWCU leak detection logic in response to several automatic isolations that were caused by the leak detection logic while the RWCU system was being returned to service. These automatic isolations were events that were reportable to the NRC. There were no actual leaks during the prior automatic isolations, the isolation signals were the result of flow perturbations during system startup. PECO considered that a short term (less than the TS allowed outage time) bypassing of the isolation logic during system startup would be acceptable, avoid the isolations, and avoid the need to make a report to the NRC.

To accomplish the short term bypassing of the LDS isolation logic, on July 20, 1998, PECO revised an existing RWCU system procedure to install electrical jumpers to bypass the isolation logic during system startup. This revision was processed under PECO's temporary change process. This procedure revision subsequently became a permanent procedure change in August 1998. PECO did not perform a 10 CFR 50.59 determination or a safety evaluation for the procedure revision because they considered the procedure revision as a non-intent change. The administrative procedure that controlled the non-intent change at that time did not require a 10 CFR 50.59 determination to be performed.

On March 25, 1999, an engineer from PECO's Nuclear Quality Assurance organization initiated a performance enhancement program (PEP) evaluation to address defeating a RWCU isolation without a 10 CFR 50.59 determination/safety evaluation. This PEP (10009631) was initiated following several weeks of discussion with the applicable engineering personnel. As a result of this PEP, and following interactions with NRC inspectors, PECO made the June 7, 1999 report to the NRC. Subsequent to the report made to the NRC, PECO initiated another PEP (10009959) to address the broader implication of the missed 10 CFR 50.59 reviews.

PECO determined that an inadequate review and approval of a revision to the system operating procedure were the primary causes for the inappropriate bypassing of the LDS safety feature. PECO also identified contributing factors including: the inappropriate use of the temporary procedure change process, the failure to recognize the activity as a change to the facility, the incorrect application of Technical Specifications, and the operation of the RWCU system with a design deficiency. The inspector confirmed that PECO has stopped the practice of bypassing the LDS logic and was addressing related issues in the corrective program.

The purpose of the LDS logic, as described in the UFSAR, Section 7.6.1.3.3.4, is to monitor the RWCU components and isolate the system should a leak of sufficient magnitude occur. The LDS logic includes RWCU system high differential flow and the RWCU area high temperature and differential temperature subsystems to provide the

isolation signals. UFSAR, Section 3.6.1.2.1.5, also credits the automatic isolation of the RWCU for a RWCU line break outside of containment. The inspector determined that by temporarily defeating the LDS logic functions for a non-maintenance activity, PECO made a change to the facility as described in UFSAR which had not been reviewed to determine if unreviewed safety question existed. This is an apparent violation (**EI 353/99-07-02**) of 10 CFR 50.59, "Changes, Tests, and Experiments."

On July 23, 1998, when the isolation logic was required to be operable, the TS allowed outage time was exceeded the first time the LDS jumpers were installed. As a result of a mis-understanding of the logic and the applicable TS, operators used the wrong action statement and allowed outage time for the activity. Consequently, the applicable allowed outage time was exceeded resulting in an apparent violation (**EI 353/99-07-03**) of TS 3.3.2. The licensee's and the inspector's conclusions regarding this violation are based on a reconstructed best estimate time-line since the actual TS action statement entry and exit times were not recorded. The licensee identified and corrected the inappropriate application of TS prior to the defeating the LDS function a second time.

c. Conclusions

PECO did not perform an adequate review of the procedure revision that implemented the bypassing of the reactor water cleanup leakage detection system isolation logic when the reactor water cleanup system was returned to service with the reactor pressurized. Consequently the isolation logic was bypassed on three occasions; defeating a required safety function and placing the plant outside of its design bases. Further, on one of those occasions, the applicable Technical Specification allowed outage time was exceeded as a result of an unrelated interpretation error. The failure to perform a 50.59 analysis for a procedure revision and failure to meet the Technical Specifications are apparent violations of NRC requirements. Processing of these apparent violations will await further NRC inspection of these issues including the root cause and corrective actions documented in the LER and associated PEPs I0009631 and I0009959.

#### IV. Plant Support

##### S8 Miscellaneous Security and Safety Issues

- S8.1 (Closed) LER 1-99-009: PECO did not properly implement plant procedures that required specific compensatory measures for inoperable safeguard monitoring systems. On August 2, 1999, PECO deactivated certain security monitoring capabilities to support maintenance activities. Security personnel should have been posted in the area as per the procedure. PECO determined that multiple personnel errors contributed to this event. The security operators did not reference the required procedure and the security supervisor provided incomplete instructions regarding the equipment being removed for the maintenance. The inspector determined that although the area was not posted, normal surveillance and monitoring of the area was still in effect. Upon discovery, security personnel immediately corrected the deficiency. Other corrective actions were implemented including upgrading the usage level of the procedure from a Level III (refer to periodically) to a Level I (use in-hand procedure) and placing a security barrier in the

area. The inspector performed an "in-field" review of this event and determined that the issue was minor violation and not subject to formal enforcement. This LER is closed.

## **V. Management Meetings**

### **X1 Exit Meeting Summary**

The inspector presented the inspection results to members of plant management at the conclusion of the inspection on October 13, 1999. The plant manager acknowledged the inspectors' findings. The inspectors asked whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

### **X2 Year 2000 Readiness of Computer Systems**

PECO management announced on September 24, 1999, that all modifications to the mission critical computer systems at Limerick Generating Station have been completed. The inspector reviewed the remediation actions completed the core performance monitoring system and determined that the required modification were completed.

## INSPECTION PROCEDURES USED

IP 37550:	Engineering Inspection
IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observation
IP 62707:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities
IP 73753:	Inservice Inspection
IP 81700:	Physical Security Program for Power Reactors
IP 83750	Occupational Radiation Exposure
IP 90712:	In-office Review of Written Reports
IP 90713:	Review of Periodic and Special Reports
IP 92904:	Followup - Plant Support
IP 93702:	Prompt Onsite Response to Events at Operating Power Reactors

## ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

EEl 353/99-07-02	Unreviewed Change to the Facility during Temporarily Defeating LDS Logic Functions for a Non-Maintenance Activity. (Section E8.2)
EEl 353/99-07-03	Allowed Outage Time Exceeded while Defeating LDS Logic Functions. (Section E8.2)

Opened/Closed

NCV 352/99-07-01	Unavailability of safe shutdown equipment in the event of a fire. (Section E8.1)
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Closed

LER 50-352,353/1-99-09	PECO did not properly implement plant procedures that required specific compensatory measures for inoperable safeguard monitoring systems. (Section S8.1)
LER 50-352,353/1-99-10	Untimely NRC notification of an ESF actuation. (Section O8.1)
LER 50-353/2-99-01	Unavailability of safe shutdown equipment in the event of a fire. (Section E8.1)
LER 50-353/2-99-003	Bypass of the Reactor Water Cleanup Leak Detection System Isolation Function (Section E8.2)

## LIST OF ACRONYMS USED

ALARA	As Low As is Reasonably Achievable
AR	Action Request
ARW	Advanced Radiation Worker
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
CREFAS	Control Room Engineering Fresh Air System
CS	Core Spray
EDG	Emergency Diesel Generator
ESF	Engineered Safety Feature
ESW	Emergency Service Water
FW	Feedwater
GE	General Electric
GL	Generic Letter
HP	Health Physics
HPCI	High Pressure Coolant Injection
IR	Inspection Report
LCO	Limiting Condition For Operation
LER	Licensee Event Report
LGS	Limerick Generating Station
NCV	Non-Cited Violation
NMD	Nuclear Maintenance Division
NQA	Nuclear Quality Assurance
NRB	Nuclear Review Board
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
PA	Protected Area
PAB	Protected Area Boundary
PECO	PECO Energy
PEP	Performance Enhancement Process
PORC	Plant Operations Review Committee
QA	Quality Assurance
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RPS	Reactor Protection System
RT	Routine Test
RWCU	Reactor Water Clean-up
SLC	Standby Liquid Control
SRV	Safety Relief Valves
ST	Surveillance Test
TRM	Technical Requirements Manual
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved Item
VIO	Violation