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| Licensee: | PECO Energy<br>Correspondence Control Desk<br>P.O. Box 195<br>Wayne, Pa 19087-0195 |
| Facility Name: | Limerick Generating Station, Units 1 and 2 |
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Date

EXECUTIVE SUMMARY
Limerick Generating Station
Report No. 95-12 & 95-12

## Plant Operations

Operator response to a Unit 2 reactor scram was good in that they: responded to the level transient; attempted to recover from the feedwater control system malfunction; and were in the process of performing a manual scram when the automatic scram occurred. The plant was then placed in the hot shutdown condition in accordance with plant procedures (section 1.2). The operators' response to a stuck open Unit 1 safety relief valve (SRV) and clogged suppression pool suction strainer was excellent. The immediate actions in response to the open SRV were prompt and deliberate. Good consideration was given to the excessive cooldown rate and actions were taken to limit the cooldown as much as possible. Very good command and control on the part of shift supervision was noted by the inspector in the control room at the time of the event. The 1A residual heat removal (RHR) pump cavitation problem was quickly recognized by the operators and expeditiously returned to service, with the assistance of the system manager (section 1.2). A Unit 2 scram due to a failed relay in the EHC system, including an abnormally large vessel level spike (ringing), was thoroughly reviewed by plant management, and corrective actions taken were appropriate (section 1.4). Activities associated with the fuel bundle replacement and other fuel moves on Unit 1, were conducted in a well controlled manner, with good supervisory oversight noted (section 1.5).

The inspector observed control room activities right after Unit 1 was manually scrammed due to high drywell pressure and the loss of feed control to the vessel. Operators were stabilizing the plant, and subsequently declared an Unusual Event due to a plant shutdown required by technical specifications for failure to meet minimum reactor coolant system leakage limits. Operators performed very well, and plant management was in the control room providing oversight and concurrence for the declaration of the Unusual Event. The source of the leakage was determined to be from the N-7 flange on the reactor head vent. The flange joint was repaired and passed a hydrostatic test to verify no leakage (section 1.6). An observed drywell entry, to try to identify the source of the reactor coolant system leakage, received very good management attention and excellent support from health physics and security personnel (section 1.7).

Operators acted timely to determine the extent of the problems associated with the Unit 1 hydrogen recombiners and to identify the similar problem on Unit 2. Once recognized, the technical specification shutdown actions were immediately implemented. The operations, engineering, and instrument and controls (I&C) groups all worked together to resolve the problem in an organized, well managed process. The immediate/short term corrective actions for this event included: the suspension of all modification work on site; a review of all engineering projects to identify potential similar issues (the final review included 2273 items); performance of an independent review of the recombiner post-repair testing used to declare the recombiners operable on September 2; the use of Peach Bottom personnel in the root cause analysis who were familiar with a recent modification problem at Peach Bottom; and an independent review

EXECUTIVE SUMMARY (Continued)

of the initial screening process used to identify similar problems. Modification work, previously scheduled, was allowed to be performed only after rigorous review by engineering. The inspector observed the activities associated with the repair and testing of the recombiners and noted excellent plant management oversight of the event (section 1.9).

Maintenance

Work conducted on a butterfly valve and to identify and correct problems in the feedwater control system were well coordinated and conducted, with extensive corrective actions taken as appropriate (section 2.1). Review of a leaking head vent flange determined that prior corrective actions for a similar event were inadequately implemented, and some procedure steps were recently deleted from the procedure. Additionally, management expectations were not met, in that alignment pins were not used during the reassembly of the flange. This resulted in a noncited violation (section 2.2).

Surveillance

Operators conservatively removed the Unit 1 high pressure coolant injection (HPCI) pump from service when they received indications that the outboard bearing temperature had increased dramatically. A Unit 1 rod worth minimizer test received proper supervision, with very good interface with reactor engineering personnel. Equipment operators properly ensured that standby liquid control (SLC) pumps were returned to an operable status after testing, prior to testing other pumps (section 3.0).

Engineering

NRC Temporary Instruction (TI)-128 was closed out based on review of the reactor vessel instrumentation reference leg backfill system modification, which was adequately reviewed by PECO Energy personnel and is being properly controlled by plant personnel (section 4.1). The inspector determined that PECO Energy had taken extensive corrective actions in response to the August 8, 1995, momentary loss of power in the feedwater control system (FWCS), which resulted in a reactor scram. Although definite root causes could not be determined, PECO Energy had used a proper methodology to determine the most probable root cause. The inspector's review of three previous failures in the FWCS, two at Limerick Unit 1 and one at Limerick Unit 2, (none involved with reactor scrams), indicated that the corrective actions taken by PECO Energy in response to these FWCS failures were acceptable (section 4.2). Operators identified both Unit 1 hydrogen recombiners and one Unit 2 recombiner to be inoperable requiring initiation of plant shutdowns. A recent modification to the three temperature recorders resulted in this condition, and a plant investigation revealed numerous opportunities for the situation to have been corrected prior to placing the recorders back in service. The investigation was found to be very comprehensive with excellent corrective actions. These identified inadequacies are of significant concern because the design and testing process did not identify and prevent the errors that led to the inoperable recombiners. This resulted in a cited violation (50-352, 353/95-

12-01) (section 4.3). PECO Energy has adequately implemented the requirements of 10 CFR 50.59. Safety issues were adequately resolved and there were no significant deviations, deficiencies, or violations of NRC requirements. The required training is provided to the preparers, peer-reviewers, PORC members and alternates, and station qualified reviewers and approving superintendents for procedure changes (section 4.4).

Plant Support

Overall, very good external and internal exposure controls were implemented for the Unit 1 mini-outage to replace leaking fuel. A number of enhancements to improve performance (e.g., tool control, worker training, and temporary reduction of radiological controlled area egress points) were implemented to the radioactive material and contamination control program. Very good efforts were underway to evaluate the radionuclides present at the station to ensure optimum control and monitoring of radioactive material and contamination. Housekeeping and station material condition were considered very good. One violation associated with adherence to radiation protection procedures was identified (50-352/95-12-02). The violation reflected an apparent need to reenforce expectations regarding worker actions when job plans change. PECO Energy is providing such training to the work force (section 5.1).

Safety Assessment and Quality Verification

A plant-wide human performance standdown clearly demonstrated management's focus on human performance and the desire to reverse negative trends before they develop into a more serious problem (section 6.1). PORC meetings reviews were comprehensive, and a new self-assessment process was an excellent initiative to ensure that PORC is providing a positive influence with respect to nuclear safety (section 6.2).

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## DETAILS

### 1.0 PLANT OPERATIONS (71707)[1]

The inspectors observed that plant equipment was operated and maintained safely and in conformance with license and regulatory requirements. Control room staffing met all requirements. Operators were found alert, attentive and responded properly to annunciators and plant conditions. Operators adhered to approved procedures and understood the reasons for lighted annunciators. The inspectors reviewed control room logs for trends and activities, observed control room instrumentation for abnormalities, and verified compliance with technical specifications. Accessible areas of the plant were toured. Plant conditions, activities in progress, and housekeeping conditions were observed. Additionally, selected valves and breakers were verified to be aligned correctly. Deep backshift inspection was conducted on August 10, 11, 21, 27, September 2, and 17, 1995.

### 1.1 Operational Overview

Unit 1 was operating at full power at the beginning of the inspection period. On July 19, 1995, Unit 1 indicated power increased to approximately 110% and decreased to 60% of rated power, as a result of a 1B recirculation motor-generator set perturbation (section 1.3). Reactor power was reduced to 98% of rated and then further reduced to 95% to investigate the event. On July 20, 1995, power was reduced to 75% for control rod hydraulic control unit (HCU) maintenance. Power was further reduced on July 22, 1995, to 60% for condenser waterbox cleaning. Power was restored to 100% of rated on July 24, 1995. On August 8, 1995, the A reactor feedwater pump minimum flow valve failed open. This resulted in a reactor vessel level decrease of 15 inches; the B reactor feedpump tripped due to low suction pressure; and both reactor recirculation pumps ran back to their high flow limiter. The operators initiated off-normal procedures and appropriate actions were taken. An operator was dispatched to close the A reactor feedpump minimum flow line manual isolation valve and the unit was stabilized at 71%. The failure of the minimum flow valve was the result of a failed power supply. The unit was returned to 100% power on August 9, 1995. On August 20, 1995, the unit was shut down for a planned outage to replace a failed fuel bundle (section 1.5). On August 28, 1995, during startup activities, with the reactor pressure vessel at approximately 820 psig, an increase in drywell pressure was observed. Off-normal procedures were entered and reactor pressure was reduced. However, the reactor was manually shut down due to level control problems and an indication of elevated unidentified leakage in the drywell (section 1.6). The leakage was due to a misaligned reactor pressure vessel head vent flange connection following fuel replacement activities.

On September 2, 1995, with Unit 1 at 23%, and Unit 2 at 100% of rated power, unit shutdowns commenced due to the 1A, 1B and 2A primary containment hydrogen recombiners being declared inoperable, as a result of a deficient modification (section 1.9). Unit 1 had reduced power to approximately 7% of rated and was placed in the startup mode, and Unit 2 had reduced power to approximately 36% of rated, at the time the recombiners were declared operable and the power

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[1]The NRC Inspection Procedures used as guidance are listed parenthetically throughout this report.

reductions terminated. Both units were returned to full power the following day. On September 11, 1995, with Unit 1 at 100% power, the M main steam system safety relief valve failed open. The operators immediately implemented operational transient procedures and within two minutes initiated a manual reactor scram. At the end of the inspection period, Unit 1 was in cold shutdown for suppression pool cleaning activities.

Unit 2 was operating at full power at the beginning of the inspection period. On August 8, 1995, with Unit 2 at 100% of rated power, an automatic scram occurred due to the trip of the main turbine as a result of high reactor vessel water level of 54 inches. The cause of the transient was the result of a failed power supply in the feedwater control system. The power supply was replaced and on August 12, 1995, the unit was returned to 100% (section 4.2). On August 20, 1995, turbine control valves sporadically opened and closed; power was reduced to 51%. The control valves again closed and the unit scrammed on high reactor vessel pressure while the reactor mode switch was placed in shutdown (section 1.4). The most probably cause of the scram was that a high impedance had developed across a normally closed Electro-Hydraulic Control (EHC) relay contact that resulted in downstream relays momentarily deenergizing. The unit was returned to 100% power on August 23, 1995 and operated at full power through the end of the inspection period.

## 1.2 Event Reports

On July 20, 1995, a notification was made to the NRC after Units 1 and 2 received automatic actuations of the primary containment and reactor vessel isolation control systems, closing outboard primary containment isolation valves. The cause of the event was a fuse blown during a maintenance activity. A technician was replacing a keyswitch in a confined space, and inadvertently grounded the replacement keyswitch, causing the fuse to blow. The fuse was replaced, the isolations were reset, and the systems were returned to normal. Corrective actions included disseminating management expectations concerning work activities having a high potential for causing a ground condition in an electrical component, through meetings, bulletins, and procedure revisions.

On July 28, 1995, a notification was made to the NRC concerning various primary containment isolations on Units 1 and 2. The cause of the event was a fuse blown during the restoration of a surveillance test. Technicians inadvertently grounded a starter screwdriver to the case of an electrical relay while attempting to reconnect an electrical lead. The isolations were immediately bypassed or reset after the fuse was replaced, the systems were returned to normal, and the surveillance was satisfactorily completed. Corrective actions include planned physical modifications to minimize or eliminate the need to lift a lead and revising procedures as appropriate.

On August 8, 1995, the Limerick Unit 2 reactor scrammed automatically, following a main turbine trip due to a high reactor water level. Before the reactor scram, PECO Energy was troubleshooting random downward spikes (pulses) in the feedwater flow instruments. The feedwater control system (FWCS) was originally in a 3-element (feedwater flow, main steam flow and reactor water level) control mode. To isolate the feedwater flow instruments from the FWCS for further troubleshooting, plant personnel placed the FWCS in a 1-element (reactor water level) control mode and the A channel level instrument was selected as the input signal to the FWCS. The A channel level instrument receives its power from the 2K612 power supply. 2K612 also supplies power to the 2A reactor feed pump (RFP) control logic and 2A reactor recirculation pump (RRP) runback control logic. The RRP runback was set at 12.5 inches reactor water level. On August 8, 1995, 2K612 lost power for 250 milliseconds. This caused a temporary loss of the A channel level signal to the FWCS. The FWCS master level controller (MLC) swapped from "auto" to "manual" mode. This MLC controls the speed of all three RFPs. The 2A RFP control logic caused the 2A RFP to lock out at full speed. The loss of the reactor water level signal caused both RRPs to run back to the low speed setting. This increased-feedwater-and-reduced-reactor-power condition caused reactor water level to increase rapidly. About 42 seconds later, the main turbine tripped on high water level (+54 inches), resulting in a reactor scram.

The inspector reviewed the recorder traces of various parameters in the FWCS, and noted that these traces confirmed the above sequence. The operator response to this event was good in that; they responded to the level transient; attempted to recover from the feedwater control system malfunction; and were in the process of performing a manual scram when the automatic scram occurred. The plant was then placed in the hot shutdown condition in accordance with plant procedures. See sections 2.1 and 4.2 for further discussions of the follow-up actions to this event.

On August 20, 1995, a notification was made to the NRC after Unit 2 automatically scrammed due to a high reactor pressure condition caused by the closure of the turbine control valves. The turbine control valves closed due to EHC control problems related to a relay failure. This event is discussed in section 1.4 of this report.

On August 28, 1995, a notification was made to the NRC concerning a Unit 1 reactor core isolation cooling (RCIC) isolation, which occurred late on August 27, 1995. Operators were starting up Unit 1, and warming up the RCIC system, when RCIC isolated due to a low steam line signal. The cause of the low steam line signal was a minor pressure fluctuation during a water flow transient in the steam supply line when the warmup bypass valve was throttled open. The isolation was reset and the system warmup was completed without further incident.

On August 28, 1995, a notification was made to the NRC after Unit 1 was manually scrammed due to high drywell pressure and the loss of feed control to the vessel; additionally, an Unusual Event was declared due to reactor coolant system unidentified leakage in excess of technical specification limits. This event is discussed in section 1.6 of this report.

On September 11, 1995, at 12:47 PM, with Unit 1 operating at 100% of rated power, main control room personnel received alarms and plant indications that the M main steam system safety relief valve (SRV) was open. The operators immediately implemented operational transient procedure (OT)-114, Inadvertent Opening of a Relief Valve, and the appropriate emergency operating procedures. Attempts to close the SRV were unsuccessful, and within two minutes, the operators initiated a manual reactor scram as required by OT-114 and Technical Specification 3.4.2. At 12:50 PM, the Shift Manager declared an Unusual Event (UE) in accordance with emergency response procedure (ERP)-101, due to a failure of an SRV to close. The operators closed the main steam isolation valves at 550 psig to reduce the depressurization rate of the reactor vessel. At this pressure, condensate was available for reactor vessel inventory make-up. The SRV indicated closed at 1:07 PM when reactor pressure had decreased to 410 psig. At this point the cooldown rate was approximately 130 degrees F per hour, exceeding the technical specifications limit of 100 degrees F per hour. Suppression pool temperature reached a maximum of 124 degrees F during the event. Prior to the event, the A loop of the residual heat removal (RHR) system was in service for routine suppression pool cooling. The B loop of RHR was placed in service for suppression pool cooling, per OT-114, immediately after the SRV opened. Approximately 30 minutes into the event, the operators observed indications of cavitation on the A RHR pump, which included discharge pressure, system flow, and pump current fluctuations, and removed it from service. The system manager immediately responded to the pump room to check the 1A RHR pump. The pump was vented and returned it to service by slowly increasing the discharge flow rate to 8500 gpm. At 2:27 AM, on September 12, 1995, reactor pressure had been reduced to below 75 psig and one loop of shutdown cooling was placed in service. The UE was terminated at that time. At 4:30 AM, Unit 1 was in cold shutdown with a reactor coolant temperature of 194 degrees F.

The operators' response to this event was excellent. The immediate actions in response to the open SRV were prompt and deliberate. Good consideration was given to the excessive cooldown rate and actions were taken to limit the cooldown as much as possible. Very good command and control on the part of shift supervision was noted by the inspector in the control room at the time of the event. The 1A RHR pump cavitation problem was quickly recognized by the operators and expeditiously returned to service, with the assistance of the system manager. The NRC performed a special team inspection to independently assess management decision making, root cause analysis and corrective actions, and PECO Energy's analysis of the event. The results of this inspection are documented in NRC Combined Inspection Report Nos. 50-352/95-81 and 50-353/95-81.

## 1.3 Unit 1 Power Transient Due To Recirculation Perturbation

On July 19, 1995, at 1642 hours, with Unit 1 at 100% of rated power, the unit experienced a power transient due to the 1B reactor recirculation pump response following a decrease speed signal with the 1B motor-generator (MG) set stuck on its high speed electrical stop. The 1B MG set positioner broke free from its high speed electrical stop when the deviation signal to the positioner reached a sufficient magnitude to overcome the electric brake. This resulted in the positioner overshooting the desired position relative to the demand signal. Indicated APRM power dropped to approximately 60% and increased to 110% over a 28 second period. The operator immediately reduced reactor power to 98% and subsequently to 95% of rated using the 1A recirculation pump. PECO Energy's analysis indicated that actual peak heat flux was 103.4%. The event was bounded by the licensing basis of the core and no technical specification thermal safety limit violations occurred.

The cause of this event was personnel error in that the Unit 1 operator was unaware that the MG set was on the high speed electrical stop. There was some confusion in the communications between Reactor Engineering and Operations, earlier in the day, concerning the MG set high speed electrical stop settings. When Operations contacted Reactor Engineering about the stop settings, a limit based on core flow (i.e., 104%) was provided rather than MG set speed. For any given MG set speed, core flow can vary slightly depending on other factors. The RO increased core flow to approximately 103.8%. Although this value was less than the limit specified by Reactor Engineering, the MG set speed had actually engaged the high speed electrical stop. Additionally, there were no observable indications that the high speed stop had been encountered when core flow reached 103.8%.

An administrative limit of 100% core flow was established on July 20, 1995, pending evaluation of further corrective actions. In addition, a control rod pattern adjustment was subsequently performed to place the unit in the low end of its core flow window. The recirculation system operating procedures will be revised to provide a formalized mechanism for communicating MG set stop settings to Operations. PECO Energy made a 24 hour report and submitted a follow-up report to the NRC in writing (Licensee Event Report 1-95-003), as required by their Facility Operating License Condition 2.F, since this event resulted in non-compliance with 2.C.1, which authorizes Unit 1 to operate at a maximum reactor power level of 100%. The inspectors will review the corrective actions as part of the routine inspection program.

### 1.4 Unit 2 Scram Due To EHC Malfunction

On August 20, 1995, Limerick Unit 2 automatically scrammed from approximately 50% power. The reactor scrammed at 4:02 PM due to high reactor pressure caused by the closure of the turbine control valves. Approximately 12 seconds later, several ESF actuations occurred as a result of reactor vessel level signal spike or "ringing"; the ringing was due to a pressure transient caused by the turbine trip. PECO Energy personnel concluded that the cause of the reactor scram was an EHC system control malfunction. A normally closed and deenergized relay (KT106) was identified as the most probable cause of the transient. Through discussions with General Electric Company and review of other industry events, it was concluded that the impedance across the normally closed contacts increased, causing other relays to actuate spuriously, resulting in the cycling of the turbine control valves. This problem with the relay is suspected to be age related, and was a known potential problem at Limerick. A modification was previously planned to make the relay more reliable. Plant personnel sent the relay out for destructive testing, replaced the relay with a new one, implemented the modification (which installed a set of contacts in parallel with the existing contacts), and will evaluate and implement a preventative maintenance program for the relay. Additionally, the modification was implemented on Limerick Unit 1 during the August 20-27, 1995, mini-outage.

The vessel level ringing for this event resulted in a much larger magnitude, negative level spike than experienced in the past. PECO Energy personnel concluded that the larger spike was caused by the specific transient initiated by the EHC system malfunction. The vessel level ringing phenomenon has been experienced by Limerick and other BWRs, and is the result of a significant pressure transient in the reactor vessel. These types of transients typically result from a turbine trip (stop or control valve closure) or MSIV closure event. Valve closure causes a pressure wave to travel through the reactor vessel. The pressure wave is sensed by the vessel level reference leg first, transmitting the pressure wave through the reference leg. The pressure wave continues through the vessel and is subsequently sensed by the variable leg. Although short in duration, the timing difference results in changes in the differential pressure sensed by the level transmitter, resulting in a change in the sensed vessel level signal. The change in sensed level is manifested as a dampened cyclic output from the associated transmitter, known as ringing. The ringing dampens off in 3 to 6 cycles and sensed level returns to near the pre-event value. In 1990, the ringing phenomenon was investigated by PECO Energy and was found not to be a safety issue at Limerick.

For the event on August 20, 1995, the ringing phenomenon was exacerbated by the EHC induced transient. After the reactor scram, the control valves reopened, causing reactor pressure to decrease, resulting in the formation of more voids. When the turbine tripped, the resulting pressure wave was delayed more by the highly voided vessel water as it traveled to the vessel level variable leg. The larger time difference resulted in a larger pressure variation in the reference leg resulting in a significantly larger change in sensed reactor water level. Corrective actions for this larger sensed level were the actions taken to prevent a similar EHC induced transient as detailed above. Corrective actions taken after previous events primarily addressed the response of the HPCI system, and included retuning the HPCI system and adding a dampening circuit to the affected transmitters. For this event, the HPCI system was not affected.

The inspectors reviewed the event and concluded that the event was thoroughly reviewed, and corrective actions taken were appropriate.

### 1.5 Unit 1 Mini-outage For Fuel Bundle Replacement

Unit 1 shut down on August 20, 1995, for a planned outage to identify and replace a leaking fuel bundle. On August 24, 1995, the leaking bundle was identified and replaced. Additionally, 89 fuel moves were performed in order to redistribute power in the core and allow for a higher power distribution for the remaining cycle. Unit 1 startup commenced on August 27, 1995, but was halted on August 28, 1995, after a leak developed on the reactor head vent line (see section 1.6).

The inspectors observed activities associated with the fuel bundle replacement and other fuel moves, and observed portions of the startup. All activities observed were conducted in a well controlled manner, with good supervisory oversight noted. Additionally, the inspectors concluded that plant management did an excellent job of tracking and trending the affects of the leaking fuel. This enabled plant management to determine the best time to shut the plant down. The outage was carefully planed prior to the fuel leak developing into a problem which impacted the unit operation.

## 1.6 Unit 1 Manual Scram And Unusual Event

During the startup of Unit 1, on August 28, 1995, operators noticed that drywell pressure was somewhat high, so they placed additional drywell unit coolers into service. About two hours later, the A reactor feed pump was stopped due to indications of high bearing oil temperature, bearing metal temperature and thrust bearing temperature. Drywell pressure was still high and there was increased flow indication in the drywell floor drain leak monitor, with cooler flow also elevated. Suspecting that the A recirculation pump discharge valve stem leak had increased, operators asked that the camera monitoring the leak be turned on to investigate; no increased leakage was observed. The shift supervisor next directed the Unit 1 reactor operator to reduce reactor pressure to 500 psig. During the depressurization, vessel level started increasing when pressure was at the condensate pump discharge pressure (approximately 680 psig). At 54 inches, the B reactor feed pump tripped as designed, operators closed its discharge valve, and the level increase terminated at 57 inches. At this point, operators manually scrammed the reactor, due to the high drywell pressure and the loss of feed control to the vessel.

Approximately 20 to 30 minutes later, when the shift manager became aware that the unidentified leakage was greater than 3 gpm, he declared an Unusual Event. This was based on a shutdown initiated as required by the technical specification limiting condition for operation (LCO) for failure to meet minimum reactor coolant system leakage limits. Technical Specification 3.4.3.2 requires that reactor coolant system leakage shall be limited to a 2 gpm increase in unidentified leakage over a 24-hour period.

The inspector was in the control room right after the manual scram, and observed operators stabilizing the plant, and the declaration of the Unusual Event. Operators performed very well, and plant management was in the control room providing oversight and concurrence for the declaration of the Unusual Event. The source of the leakage was determined to be from the N-7 flange on the reactor head vent. The flange joint was repaired and passed a hydrostatic test to verify no leakage. The cause of the inadequate flange joint is further discussed in section 2.2 of this report.

## 1.7 Unit 1 Drywell Entry

On August 28, 1995, the inspector observed the planning for a drywell entry and the subsequent entry. The entry was to identify the source of the elevated drywell leakage which resulted in a Unit 1 shutdown earlier in the day. Although plant management wanted to make the entry while reactor pressure was still high enough for the leakage to be easily noticeable, the planning for the activity was not rushed. The inspector attended the drywell entry prebriefing which was conducted with personnel from maintenance, operations, health physics, safety, and outage management, with plant management in attendance. Personnel considered several options for the conduct of the entry, with safety as a major concern. Specific routes for the personnel to take and specific areas to inspect were identified and planned for. The inspector also observed the drywell entry, which received very good management attention and excellent support from health physics and security personnel. The inspector concluded that overall performance of the drywell entry was excellent.

### 1.8 Unit 1 Startup Observations

The inspector observed startup activities in the Unit 1 main control room on August 27, 1995. Reactor operators exhibited excellent communications, and oversight of the startup by reactor engineering personnel was very good. Operators used the appropriate procedures and control rod pull sheets very well, and a shift turnover near the point of criticality was well controlled and planned for by shift supervision. The inspector concluded that overall control of activities in the control room during the startup activities was very good and ensured that the appropriate operators easily gave full attention to the status of the Unit 1 reactor.

### 1.9 Inoperable Hydrogen Recombiners

On September 2, 1995, with Unit 1 at 23% of rated power, during the performance of surveillance test (ST)-6-057-200-1, Revision 28, Containment Atmospheric Control Valve Test, the primary containment hydrogen recombiner cooling water valves HV-057-110A and B failed to open as designed. PECO Energy's investigation identified that the valve failure was associated with a modification made to the systems that replaced the recombiner recorders. This modification had been performed on the 1A, 1B and 2A hydrogen recombiners per Mod P-290 (see section 4.3).

At 7:15 AM, the 1A, 1B and 2A primary containment hydrogen recombiners were declared inoperable after the Shift Manager directed the operators to attempt to run the recombiners using the normal system operating procedure. The recombiners were declared inoperable due to the inability to manually open the recombiner water inlet valve on each of the three recombiners. Technical Specification (TS) 3.0.3 was entered for Unit 1 and the action of TS 3.6.6.1 was entered for Unit 2. A power reduction commenced on Unit 1 at 7:43 AM and a one hour notification to the NRC was subsequently made. At 11:25 AM it was determined that the modification to the Unit 2 recombiner was installed on July 19, 1995, and that the recombiner had been inoperable for more than 30 days exceeding the action time limits of TS 3.6.6.1. At that time, plant management determined that TS 3.0.3 should be entered for Unit 2, and a second one hour notification to the NRC was made. A power reduction from 100% of rated power commenced on Unit 2 at 12:30 PM.

By 9:00 PM that night, repairs and testing of all three recombiners were satisfactorily completed, and following a management review of the corrective actions and testing methods, the recombiners were declared operable. Unit 1 had reduced power to approximately 7% and was placed in the startup mode, and Unit 2 had reduced power to approximately 36%, at the time the power reductions were terminated.

During the onset of this event, the operators acted timely to determine the extent of the problem with the recombiners and to identify the similar problem on Unit 2. Once recognized, the technical specification shutdown actions were immediately implemented. The operations, engineering, and instrument and controls (I&C) groups all worked together to resolve the problem in an organized, well managed process. The immediate/short term corrective actions for this event included: the suspension of all modification work on site; a review of all engineering projects to identify potential similar issues (the final review included 2273 items); performance of an independent review of the recombiner post-repair testing used to declare the recombiners operable on September 2; the use of Peach Bottom personnel in the root cause analysis who were familiar with a recent modification problem at Peach Bottom; and an independent review of the initial screening process used to identify similar problems, performed by the Chesterbrook engineering organization. Modification work, previously scheduled, was allowed to be performed only after rigorous review by engineering. The inspector observed the activities associated with the repair and testing of the recombiners and noted excellent plant management oversight of the event.

## 2.0 MAINTENANCE (62703)

### 2.1 Maintenance Observations

The inspectors reviewed the following safety-related maintenance activities to verify that repairs were made in accordance with approved procedures and in compliance with NRC regulations and recognized codes and standards. The inspectors also verified that the replacement parts and quality control used on the repairs were in compliance with PECO Energy's Quality Assurance (QA) program.

The following maintenance activities were reviewed:

- PMQ-500-105, Preventive Maintenance Procedure for Replacement of Drive Shaft Bearings in Q-Listed Clow Butterfly Valves, performed on the suppression pool purge air exhaust valve, on August 7, 1995.

For this maintenance activity, the inspector observed good coordination of work with health physics personnel. The maintenance technicians were knowledgeable of the valve operation and preventive maintenance they were performing. The carbon steel drive shaft bearings were being replaced with bronze bearings in accordance with vendor recommendations. All technicians were using proper safety equipment and good supervisory oversight was noted. The technicians were also cognizant of the fact that they were working in a Combustion Free Zone, and took the proper precautions.

Following the reactor scram on August 8, 1995, PECO Energy initiated various corrective actions to make the feedwater control system (FWCS) functional and to prevent problems from recurring. Their reported corrective actions included: 1) replaced 2K612 power supply and the 120 Vac supply fuse; 2) sent the old power supply unit and the old fuse to PECO Energy's laboratory for failure analysis; 3) replaced logic cards of FWCS master level control and 2A RFP turbine speed control; 4) cleaned the edges and edge connectors of all affected instrument control cards; and 5) inspected all terminations of the affected instruments to ensure that they were all tight. PECO Energy also installed high speed recorders to monitor the output signals of the 2K612 power supply and A channel feedwater flow square root extractor. The inspector reviewed the documents provided by PECO Energy and concluded that they had taken extensive corrective actions to resolve the momentary loss of power supply in the FWCS.

Following the reactor scram, PECO Energy had conducted extensive troubleshooting to find the root causes of the 250 millisecond loss of power. Since this problem could not be duplicated, personnel had difficulty in determining the definite root causes. A root cause evaluation working group was formed. This group assembled all possible causes, which included: momentary loss of ac input power to 2K612; open circuit/loose wire in the dc output circuit of 2K612; momentary short circuit on the output of 2K612; internal fault to 2K612; and human error (someone in the instrument panel). The laboratory test results of the old 2K612 power supply and the 120 Vac supply fuse indicated that both components were normal and functional. The root cause evaluation working group evaluated the above cases individually, using available data and determined that the most probable root cause was that a loose connection existed on the dc output of 2K612 power supply. Someone might have disturbed the outside of the instrument panel, causing momentary (250 milliseconds) disconnection of the circuit. This loose contact might have been tightened unknowingly during the early troubleshooting process and therefore was not specifically identified.

The inspector reviewed the pre- and post-event recorder traces of various parameters associated with the 2K612 power supply. The inspector also interviewed two members of the root cause evaluation working group. The inspector determined that PECO Energy had used an appropriate approach to deduce the most probable root cause. The inspector also saw the high-speed recorders that were installed to continuously monitor the condition of the 2K612 power supply, and concluded that they provided an appropriate contingency to detect the failure mechanism, should the power supply fail again.

### 2.2 Unit 1 Head Vent Flange Leak

On August 28, 1995, Unit 1 was manually scrammed after increased leakage in the drywell caused problems. The cause of the increased leakage was determined to be from the N-7 flange on the reactor head vent. This flange is re-connected each time the vessel head is placed onto the vessel. Problems with this flange were experienced in 1992, and corrective actions were taken. The 1992 event investigation recommended the following corrective actions for revising the appropriate maintenance procedure: add a step to direct removal of old gaskets prior to cleaning; expand QC acceptance criteria to include assurance that old gasket is removed; add steps which include alignment of the flange using the bolt holes; and add steps which include gap measurements of the assembled flange to ensure proper alignment and gasket crush. The recommended corrective actions were completed. However, the inspector concluded that the prior corrective actions were not adequately incorporated into the procedure in 1992, in that they were not specific enough to give adequate direction to the workers. Additionally, some of the procedural steps were deleted during a recent procedure rewrite, even though they were marked as a commitment.

The inspector reviewed the 1992 recommended corrective actions in the older revision of the procedure, reviewed the new procedure, and discussed the events and management expectations with the appropriate personnel in the Nuclear Maintenance Division (NMD). The inspector determined that the steps that were deleted were not a firm commitment and were therefore not required to be tracked, and were not meant to be, based on the low significance of the 1992 event; in 1992 the leaks were identified during a hydrostatic test, rather than while the plant was operating, as occurred on August 28, 1995. For the August 1995, event, management expectations were also not met in that the alignment tools provided were not used.

The PECO Energy Nuclear Quality Assurance Plan 16.0, Corrective Action, requires in part that for significant conditions adverse to quality, the cause of the condition shall be determined and documented, and corrective action taken and documented to preclude repetition. The inspector determined that the corrective actions taken in 1992 were inadequate to preclude repetition, and that some of the actions taken were deleted from the procedure. Corrective actions for the most recent event include adding specific steps to the appropriate procedure for using the alignment tools and taking flange gap measurements. Additionally, a review of NMD procedures will be conducted to ensure that all steps are sufficiently specific and are in place. This violation meets the criteria for enforcement discretion of Section VII, of the NRC's Enforcement Policy and will not be cited.

## 3.0 SURVEILLANCE (61726)

During this inspection period, the inspectors reviewed in-progress surveillance testing and completed surveillance packages. The inspectors verified that the surveillance were completed according to PECO Energy approved procedures and plant technical specification requirements. The inspectors also verified that the instruments used were within calibration tolerance and that qualified technicians performed the surveillance.

The following surveillance were reviewed:

- ST-6-055-230-1, HPCI Pump, Valve and Flow Test, Revision 26, performed August 8, 1995.

For this surveillance activities, the inspector observed the test from the control room. The test was performed by an operator trainee for the first time. The trainee read each step aloud and pointed to each switch, waiting for the acknowledgement of the chief operator, prior to taking the action. The trainee and the chief operator also reviewed the entire procedure prior to beginning the test. The shift supervisor provided strong oversight of the activity with particular attention paid to the trainee. The Unit 1 reactor operator provided good input to the shift supervisor, in that she recommended putting a second loop of suppression pool cooling in service, since pool temperature had increased to 90 degrees F. During the test the reactor operator also noted that the HPCI outboard bearing temperature was rapidly increasing from 150 degrees F to 350 degrees F and informed the shift supervisor. A conservative decision was made to remove the pump from service based on that temperature indication. The trainee immediately stood back and let the chief operator secure the pump. A subsequent investigation indicated that the temperature indication was not valid due to a loose wire on the process computer terminal for the signal from the bearing thermocouple. The test was completed satisfactorily the following day.

- ST-6-073-320-1, Rod Worth Minimizer Operability Verification, revision 14, performed August 27, 1995.

The inspector observed performance of this test on Unit 1 from the main control room. The operator performing the surveillance was properly supervised, and interfaced very well with reactor engineering personnel. The inspector concluded that the test received the proper attention and was completed very well.

The inspector observed the activities associated with the reactor vessel pressurization of Unit 1 on August 29, 1995, using the condensate system. Operations received good support from engineering during this evaluation. Two new initiatives were noted by the inspector. The first was the use of a large white board in the control room to highlight the major steps of the evaluation, the operational limits and the abort criteria. The second was an operator aid placed on the control board with abort criteria and actions to be taken if reactor pressure control was lost. Both of these initiatives were very effective and maintained the operators' focus on the evaluation and its limitations. During the test briefing, the role and responsibility of each member of the crew was clearly defined and acknowledged. Additionally, lessons learned from a previous Peach Bottom hydro event were discussed. Overall, the evaluation was well controlled and performed without incident.

- ST-6-048-1, SLC Pump, Valve, and Flow Test, revision 7, performed August 30, 1995.

The inspector observed portions of this surveillance locally at the standby liquid control (SLC) system. The equipment operators performing this surveillance conducted the testing carefully using the procedure very well. Of particular note was that the operators ensured that each pump was properly returned to an operable status prior to starting testing of the next pump.

## 4.0 ENGINEERING

### 4.1 Vessel Level Modification

In NRC Inspection Reports 93-16 and 94-01, the inspectors noted that PECo (now PECO Energy) aggressively pursued the implementation of the reactor vessel water level modification in response to NRC Bulletin 93-03, and that the modification was well designed, installed and tested. Additionally, the inspectors noted that PECo was reviewing NRC Information Notice (IN) 93-89 to ensure that any related condition does not constitute an unreviewed safety question. IN 93-89 alerted licensees about a potential design problem associated with the modification involving pressurization of the reference leg due to isolation of a reference leg manual valve. Pressurization of the reference leg could result in a false low reactor vessel water level indication, causing multiple safety system actuations and a plant transient.

PECO Energy concluded that the above scenario is extremely unlikely due to the following: the manual valves are locked open and controlled; caution tags ensure that the valves are not operated unless the backfill system is secured; no procedure exists to operate the valves at power; and the valves are not easily accessible, with two of the four valves in radiation work permit (RWP) required areas. Therefore, PECO Energy concluded that additional actions are not required.

PECO Energy engineering personnel evaluated potential failures which would result in excess or reduced backfill system flow, and concluded that the modification does not involve an unreviewed safety question. The inspector reviewed the evaluation and had no further questions. Additionally, the evaluation stated that the safety-related check valves, which separate non-Q and Q systems, will be tested in accordance with the IST Program. Finally, the inspector reviewed procedure IC-11-00505, RPV Instrumentation Reference Leg Backfill System Operation Units 1 and 2, revision 5, and noted that it contained the appropriate steps for removing from/returning to service, filling/venting, and making flow adjustments to the reactor pressure vessel (RPV) instrumentation reference leg backfill system. System operation is monitored by operators and adjusted by I&C personnel. System out of service time control is such that if flows are outside an established band, then engineering personnel are to review instrument operability within 72 hours.

The inspectors concluded that the RPV instrumentation reference leg backfill system modification was adequately reviewed by PECO Energy personnel and is being properly controlled by plant personnel. Temporary Instruction (TI)-128 is therefore closed.

### 4.2 Unit 2 Feedwater Control Event

A Unit 2 feedwater control system problem led to a plant scram on August 8, as discussed in section 1.2. The Unit 2 feedwater total feedwater flow signal had been experiencing non-periodic downward pulses since July 28, 1995. These pulses appeared in the instrument's output signals at random intervals. All pulses had the same shape and each had a pulse width of approximately 1.5 milliseconds. PECO Energy troubleshooting determined that the pulses were strongest at the output of the three feedwater flow square root extractors, where the amplitude represented about 50% of full flow. However, the pulse amplitude attenuated to only about 2% at the output of the feedwater summer. At the time of this inspection, PECO Energy had not determined the exact cause of these pulses. However, they did determine that these pulses did not have an appreciable effect on the operation of the FWCS because the time constants of the downstream controllers and control elements (feedwater pump turbine speed controls) were much higher and the short duration pulses were filtered out. PECO Energy installed a high-speed recorder to continuously monitor the condition of these signal pulses. This recorder was capable of recording 100-microsecond pulses and was triggered by a preset pulse amplitude. The inspector reviewed previously recorded traces and observed the operation of the monitoring system, and concluded that corrective actions, in response to this issue, were appropriate.

The inspector reviewed the records of previous FWCS problems. According to the documents provided by PECO Energy, the inspector noticed that there were three previous problems involved with failure of power supplies in the FWCS. However, none of these problems caused a reactor scram. The first one occurred on October 12, 1994, when Limerick Unit 1 FWCS experienced a momentary loss of the 24 Vac power supply to the control logic of the feed pump speed control. This power interruption caused the 1B and 1C RFP controls to swap from the "auto" mode to the "manual" mode. The reactor water level increased to +39 inches, resulting in a high level alarm. No reactor scram was involved. PECO Energy performed troubleshooting of the power supply and the 120 Vac supply fuse, and did not identify any problem. PECO Energy installed a recorder to monitor the 24 Vac condition of the power supply unit for two weeks. PECO Energy also issued Action Request A0894454 to functionally check or replace all power supply units in the FWCS during the next forced outage or refueling outage. Unit 1, so far, had no forced outage. The next refueling outage was scheduled for February 1996. The power supply units for Unit 2 FWCS were replaced (including the power supplies in use during the August 8, 1995, event) during the last refueling outage early this year.

The second FWCS problem occurred in April 1995 at Limerick Unit 1 when the 1C RFP turbine steam supply valve control unit spuriously swapped from the "auto" mode to "manual" mode. PECO Energy determined that this was caused by the control card for the above control and replaced the control card.

The third FWCS problem occurred on June 28, 1995, when the Limerick Unit 2 FWCS experienced a loss of power. This power loss was later determined to be due to a loss of the uninterruptible power supply (UPS). This incident caused both RRPs to run back to low speed and also caused the 2A and 2B RFPs to run back due to loss of A, B, and C main steam line flow signals (steam flow/feed flow mismatch). Subsequently, the reactor was reduced to 40% power. This event did not cause a reactor scram. Investigation by PECO Energy indicated that, before this incident, a person was cleaning the FWCS panel, when he unknowingly turned the UPS power disconnect switch to the "off" position. Without ac power, the UPS was fed from the battery for some time until the battery drained. To prevent recurrence of this incident, PECO Energy placed warning signs on all three UPS units in the FWCS panel area.

A review of the above three incidents indicated that one event (October 12, 1994) may have had a similar cause to the August 8, 1995, scram. At that time, PECO Energy did not perform an analysis as detailed as the August analysis. However, due to the complexity of the FWCS and the difficulty in finding the cause of intermittent problems, the inspector determine that PECO Energy's corrective actions were acceptable. For the second and the third cases, PECO Energy identified the definite root causes and took appropriate corrective actions.

### 4.3 Hydrogen Recombiner Recorder Modification

PECO Energy conducted an investigation to determine the cause of the inoperable primary containment hydrogen recombiners as a result of the recorder replacement modification. The investigation, which began with the troubleshooting of the recombiner water inlet valves, identified the existence of incorrect programming of the high temperature trip/permissive logic in the recombiner temperature recorders. The modification installed new programmable temperature recorders into the 1A, 1B, and 2A recombiner subsystem. (The new recorder had not yet been installed in the 2B recombiner.) The permissive logic prevented the recombiner from being started below 250 degrees F. This error was found in the two temperature recorders on all three affected recombiners. Additionally, other problems were identified including: the contact configuration for the 1200 degrees F relay was different than originally designed (all three recombiners); and a jumper was landed on the wrong terminal (1A recombiner only).

The engineering staff performed a comprehensive investigation using both barrier analysis and event and casual factor charting, and identified 37 causes or contributors to this event. The inspectors met with the investigation team on a daily basis during this review. One of the main problems identified was an error in generating the new recorder calibration sheets in 1989, which was transferred to the upgraded recorder replacement Mod P-290 in 1995 and was found to be a cause of the incorrect programming of the high temperature trip/permissive logic. Two barriers that should have detected this error, as well as the other problems, were a specific modification acceptance test plan, which was never developed, and post maintenance modification testing that was inadequate, in that it did not test the logic output of the recorder.

On June 20, 1995, a modification related event occurred at Peach Bottom concerning the emergency diesel generators. The corrective action from that event included the development of procedure AG-123, Maintaining Configuration Control of Design Changes. Discussions between the engineering departments at Peach Bottom and Limerick determined that AG-123 could also be beneficial to Limerick. Unfortunately, the procedure was not used on Mod P-290, which may have prevented this event since it would have required an acceptance test plan. A decision was made to implement the procedure on all modifications approved on/or after July 10, 1995. Mod P-290 was approved in 1994.

The engineering investigation identified numerous opportunities and barriers that were missed in order for this event to have occurred. The inadequate design control and testing that led to the unknown degradation of the recombiner systems constitutes a violation of the NRC requirements set forth in 10 CFR Part 50, Appendix B, Criterion III. The NRC recognizes that the safety consequence of this event was low. Since the plant design basis assumes the use of only one recombiner to control post-LOCA hydrogen/oxygen concentrations 20 hours after an accident, and based on the troubleshooting and repair actually performed on September 2, it is reasonable to assume that a Unit 1 recombiner could have been available for service in the required time. Nonetheless, the modification issues are of significant concern to the NRC, because the design and testing process did not identify and prevent the errors that led to the inoperable recombiners. Therefore this, violation has been categorized at Severity Level IV. (50-352,353/95-12-01)

### 4.4 50.59 Reviews

An evaluation of the requirements of 10 CFR 50.59 was performed by the inspector that addressed three principal areas: (1) Procedures and Controls, (2) Training and Qualifications, and (3) Implementation, which involves the evaluation of changes to the FSAR to determine whether the changes represent an unreviewed safety question. The inspector reviewed relevant procedures and controls, training records, and other administrative controls. Attachment A provides a list of these documents.

The review of the evaluation documents included the screening of 114 safety evaluations implemented at Limerick between July 1, 1994, and June 30, 1995, and one item that was evaluated and implemented during July 1995. The inspector selected 10 reports for review. These reports included 5 modifications, 1 non-conformance report (NCR), 2 engineering change requests (ECR), 1 instrumentation setpoint-change request (ISR), and 1 core flow change Request. Attachment B provides a list and brief description of these 10 packages.

The inspector found that the formal procedures appeared to be very complete and provided adequate details. Also, these procedures were found to be consistent with 10 CFR 50.59 and industry guidance document NSDC-125, "Guidance for 10 CFR 50.59 Safety Evaluations."

The inspector concluded that the PECO Energy had adequately implemented the requirements of 10 CFR 50.59. Safety issues were adequately resolved and there were no significant deviations, deficiencies, or violations of NRC requirements. The inspector determined that the required training is provided to the preparers, peer-reviewers, PORC members and alternates, and station qualified reviewers and approving superintendents for procedure changes.

Further, the inspector noted some aspects of the PECO Energy's efforts toward self-assessment with regard to the 10 CFR 50.59 safety evaluations. The self-assessment efforts included a yearly self-assessment by engineering (April 1995), ISEG assessments (May 4, 1995), periodic assessments by Engineering's QA (May 1994 and June 7, 1996) and re-evaluation through the Performance Enhancement Process (PEP).

## 5.0 PLANT SUPPORT (71750)

### 5.1 Radiological Protection

During the inspection period, the inspectors examined work in progress in both units including health physics (HP) procedures and controls, ALARA implementation, dosimetry and badging, protective clothing use, adherence to radiation work permit (RWP) requirements, radiation surveys, radiation protection instrument use, and handling of potentially contaminated equipment and materials.

The inspectors observed individuals generally frisking in accordance with HP procedures. A sampling of high radiation area doors was verified to be locked as required. Compliance with RWP requirements was reviewed during plant tours. RWP line entries were reviewed to verify that personnel provided the required information and people working in RWP areas were observed as meeting the applicable requirements.

The inspectors reviewed selected areas of the radiological controls program. The principal focus of the inspection was the external and internal exposure controls for the Unit 1 mini-outage to replace leaking fuel and controls for personnel access to the Unit 1 drywell. The evaluation of and implementation of enhancements to the radioactive material and contamination control program were also reviewed.

**5.1.1 External and Internal Exposure Controls**

The inspectors toured the radiologically controlled areas of the plant and selectively reviewed posting, barricading and access control, as appropriate, to radiation, high radiation, and airborne radioactivity areas; personnel adherence to radiation protection procedures, radiation work permits, and good radiological control practices; use and placement of dosimetry devices; use of respiratory protection equipment; assessment of internal exposure (as appropriate); maintenance of individual DAC-hour tracking logs; and adequacy of radiological surveys to support on-going work. The review was with respect to criteria contained in applicable Limerick procedures and 10 CFR Part 20, Standards for Protection Against Radiation.

The inspectors' review indicated that overall, very good radiological controls were implemented for the outage. The inspectors noted that outage activities were appropriately reviewed and planned from an ALARA standpoint. In addition, properly qualified and experienced personnel were providing radiological controls coverage and there was generally good supervisory oversight of on-going work activities. The inspectors noted that PECO Energy evaluated the radiation dose gradients within the reactor cavity and required personnel to move dosimetry to the point of highest anticipated whole body exposure, as appropriate. Further, PECO Energy performed appropriate evaluations of potential airborne radioactivity associated with leaking fuel during removal of the reactor vessel head. No significant airborne radioactivity was identified. The inspectors noted quality assurance personnel presence on the refueling floor for monitoring of radiological controls activities. The PECO Energy implemented effective radiological controls for limited personnel access to the Unit 1 drywell.

During tours of the refueling floor, the inspector noted water vapor (vapor clouds) emanating from the opened reactor (head removed). The inspector also noted individuals leaning over the reactor vessel into the vapor cloud. The inspector questioned personnel as to the potential tritium exposure of personnel and the need to post the area as an airborne radioactivity area. The radiological control personnel monitoring the work activity were not able to inform the inspector as to the potential concentrations of tritium in the reactor water or the expected tritium concentration values within the vapor cloud. Subsequent PECO Energy reviews indicated that potential tritium exposure was not a concern.

Also during the tours of the refueling floor, the inspectors noted that personnel were using a portable vacuum cleaner to vacuum the reactor cavity in preparation for flooding of the cavity. Although plant personnel controlled unauthorized personnel access to the vacuum cleaner, radiation protection personnel pushed the vacuum cleaner around to different locations in the reactor cavity. The inspector noted that the vacuum measured 1.6 R/hr on contact and about 400 mR/hr at one foot distance. The inspector questioned whether this activity should be reviewed from a radiation exposure reduction perspective since the average general area radiation dose rates within the cavity were about 30 mR/hr. PECO Energy personnel indicated this matter would be reviewed. The inspector did note that radiation protection personnel exposure was low due to short duration exposure to the radiation emanating from the vacuum cleaner.

While observing workers on the refuel floor, on August 22, 1995, at about 11:00 AM, the inspector observed two individuals attempting to remove the inner O-ring from the Unit 1 reactor vessel head. The workers were wedging putty knives into the O-ring and knocking pieces of the O-ring out of the head with a hammer by banging on the putty knife. The inspector noted one of the individuals to be lying directly under the overhead work area with the O-ring about two feet above his face. The inspector questioned the potential for an intake (via ingestion or inhalation) of radioactive material by the worker. The radiation protection personnel on the refueling floor informed the inspector that contamination on the O-rings ranged from about 14,000 disintegrations per minute per 100 centimeters squared (dpm/100cm$^2$) to about 30,000 dpm/100cm$^2$ with a maximum of about 300,000 dpm/100cm$^2$ in a small area. The radiation protection personnel also informed the inspector that the workers had been previously informed (before start of the work) not to lay on their backs without a face shield. The inspector noted that procedure A-C-100, Revision 0, requires in section 5.4.2 that workers obey oral radiological controls instructions. Failure of the worker to adhere to radiation protection procedures is a violation of Technical Specification 6.11 (50-352/95-12-02).

The inspector noted that the other worker appeared frustrated in his attempts to remove the O-ring and had stopped attempting to remove the O-ring. The inspector questioned why the workers' supervisors had not been informed of the need to potentially change the manner of removal of the O-ring. PECO Energy informed the inspector that the worker acknowledged that he had been informed to wear a face shield if working under the reactor vessel head. They indicated the worker apparently became involved in the work activity and unknowingly worked without the prescribed face shield. Management also informed the inspector that the assigned radiation protection technician would have identified the concern when checking on the work activity.

Subsequent to the inspector's identification of the violation of the oral instructions, management informed the inspector that work on the refuel floor was stopped and workers were re-instructed in the need to use face shields when working on the O-ring while lying with their faces directly under the O-ring. Management also discussed, with the workers' supervisor and manager, the need for workers to adhere to radiation protection instructions. The radiation protection manager also sent a letter to station directors regarding the matter and the need to inform their personnel of the need to adhere to written and oral radiation protection instructions. As long-term corrective actions, the event and its importance will be communicated to each work group during the remainder of 1995 as part of the radiation worker awareness plan. Radiation protection personnel and nuclear maintenance personnel will meet prior to the next refueling outage to review activities and radiological controls as well as discuss the event and its significance. Management also met with radiation protection personnel and discussed the need to inform workers of the need to contact radiation protection personnel if job plans change. In addition, the tooling used to remove the O-ring would be evaluated. The inspector noted that this event was considered an isolated instance of workers not adhering to radiation protection instructions. PECO Energy informed the inspector that the workers did not sustain any personnel contamination.

The inspector reviewed the adequacy and effectiveness of radioactive material, contaminated material, and contamination controls at Units 1 and 2. The principal focus of the inspection of this area was enhancements to the monitoring and control of radioactive material and contamination following identification of contaminated material outside the radiological controlled area (See NRC Combined Inspection Report No. 50-352/95-10; 50-353/95-10).

The inspector's review indicated that very good efforts were underway to evaluate the radionuclides present at the station to ensure optimum control and monitoring of radioactive material and contamination. PECO Energy developed and implemented a comprehensive action plan, with due dates and assigned personnel responsibilities, for review of essentially the entire radioactive material and contamination control program, including instrument adequacy and detection efficiencies (both personnel and material monitoring), procedures, and personnel training. The inspectors selectively reviewed the evaluations and noted them to be of good quality (e.g., small articles monitoring capabilities). As of the date of this inspection, PECO Energy had closed down at least one RCA egress point, and reenforced management expectations regarding tool control and monitoring to station personnel.

The inspector noted that personnel had revised the procedure for use of the small articles monitor to include improved guidance for monitoring of material leaving the RCA. The inspector noted a guidance step in this procedure which indicated that material with less than 1/8 inch of steel may be monitored. Management was not able to provide a technical justification for the statement or indicate how one assured that metal was only 1/8 inch thick. PECO Energy subsequently changed the procedure to remove the above specific guidance and trained personnel on the change.

The inspector noted that personnel performed a detailed evaluation of the expected counting efficiency of hand-held friskers. Analysis indicated efficiencies ranged from about 4.4% to about 10%, depending on how the particular sample was counted. PECO Energy had been using an efficiency of 10%. The inspector indicated that personnel should evaluate those applications (e.g., radioactive waste shipping) where the lower efficiencies may be applicable and implement timely changes to efficiencies used, if appropriate. PECO Energy was reviewing this matter. The evaluations will be reviewed during a subsequent inspection.

No violations were identified in this area.

### 5.2 Security

Selected aspects of plant physical security were reviewed during regular and backshift hours, to verify that controls were in accordance with the security plan and approved procedures. This review included the following security measures: guard staffing, vital and protected area barrier integrity, and implementation of access controls including authorization, badging, escorting, and searches. No deficiencies were identified.

## 6.0 SAFETY ASSESSMENT/QUALITY VERIFICATION (71707)

### 6.1 Plant-wide Human Performance Standdown

During the June, July 1995, time period senior plant management noted an increasing trend in plant events associated with a lack of attention to detail, maintaining a questioning attitude, and relying on assumptions during work performance. Although the consequences of these events have been minor, they could represent precursors to more significant occurrences. In response to this observation, a plant-wide work standdown was sponsored by management to assess these recent performance issues. A list of performance issues was provided to the work groups to facilitate the discussions. The inspector attended two performance standdown an August 3, 1995, with operations and maintenance departments. During these meetings, a list of issues over the two month period was reviewed. Management hopes to identify barriers to successful human performance, both from the standpoint of individual behaviors and organizational attributes. Other topics covered during the meeting included: what was being done well; how they could improve; what was management's expectations of workers; and what are the obligations of a worker. The inspector noted that the plant staff actively participated in the discussions and gave candid responses. All conclusions and recommendations were collected and forwarded to the department managers. The inspector concluded that this initiative clearly demonstrated management's focus on human performance and the desire to reverse negative trends before they develop into a more serious problem.

### 6.2 PORC Meetings

On August 4, 1995, the inspector attended a Plant Operation Review Committee (PORC) meeting chaired by the Plant Manager. During the meeting a PORC Self-Assessment was presented to the PORC members following the completion of the normal business. The assessment was completed by a member of the Events Assessment group and included strengths, weaknesses, watch areas, and opportunities for improvement. After the findings of the assessment were presented, the chairman lead an open and candid discussion of the findings. Each of the participants were given the opportunity to speak on the issues and comment on the findings. A final report was issued at a later date, which incorporated comments received at this meeting. This self-assessment of PORC was a new initiative for Limerick and the first comprehensive internal review of the process. Previous assessments of PORC have been performed by outside organizations such as ISEG, NRB, and NQA, but no recent self-assessments. The inspector concluded that this was an excellent initiative and a prospective look to ensure that PORC is providing a positive influence with respect to nuclear safety.

The inspector attended the August 21, 1995, PORC meeting, where members reviewed the August 20, 1995, Unit 2 transient and scram, and reviewed the power ascension justification. PORC members asked detailed, challenging questions of the engineering personnel concerning the EHC relay failure and the subsequent vessel level ringing. PORC concluded that the most probable cause of the event was determined, that corrective actions were appropriate, and that Unit 2 power ascension may proceed. The inspector concluded that the PORC review was comprehensive, with appropriate recommendations concerning plant startup.

The inspector attended the August 24, 1995, PORC meeting, where members reviewed, among other topics, the Unit 1 core operating reload analysis (COLR) and a potential request for enforcement discretion. Of particular note was that the PORC chairman questioned PORC members concerning their ability to adequately review the COLR because of their knowledge background, and had two other PORC members called into the meeting, for a more challenging review. Additionally, the PORC chairman clearly described PORC's responsibility concerning the potential request for enforcement discretion. Finally, at the conclusion of the meeting, the PORC chairman conducted a critique of the meeting, which included some of the comments mentioned here. Overall, the inspector concluded that PORC conducted detailed reviews, and that the critique was a very good initiative to capture positive initiatives to further improve on the PORC review process.

### 6.3 Nuclear Review Board Meeting

The inspector attended the meeting of the Limerick Nuclear Review Board (NRB) on August 23, 1995. The inspector verified that the NRB reviewed those items required by the technical specifications, and that the composition and quorum requirements were met. In general, the inspector found the discussions candid and open, with safety as a priority concern. The inspector concluded that the NRB adequately met its responsibilities as defined in the technical specifications.

## 7.0 REVIEW OF LICENSEE EVENT AND ROUTINE REPORTS (90712, 90713)

### 7.1 Licensee Event Reports (LERs)

The inspectors routinely reviewed LERs and performed follow-up inspections to PECO Energy's actions regarding the disposition of corrective initiatives. The inspectors reviewed the following LERs and found that the events were described accurately, PECO Energy had identified the root causes, implemented appropriate corrective actions and made the required notifications.

LER 1-95-003, Unit 1 maximum power level of 100% exceeded by 3.4% due to an unanticipated response of the 1B Reactor Recirculation pump following a decrease speed signal, Event Date: July 19, 1995, Report Date: August 18, 1995.

This event is reviewed in section 1.3.

LER 1-95-004, Actuations of the Unit 1 and Unit 2 PCRVICS resulting from a blown fuse when an I&C Technician inadvertently grounded a starter screwdriver, Event Date: July 28, 1995, Report Date: August 28, 1995.

This event is reviewed in section 1.2.

LER 2-95-007, Actuations of the Unit 1 and Unit 2 PCRVICS Resulting from the Inadvertent Grounding of a Keyswitch during its Replacement, due to Unclear Management Expectations, Event Date: July 20, 1995, Report Date: August 18, 1995.

This event is reviewed in section 1.2.

LER 2-95-008, Reactor Scram due to a High Reactor Vessel Water Level Main Turbine Trip Caused by a Momentary Loss of Power to the Feedwater Control System, Event Date: August 8, 1995, Report Date: September 7, 1995.

This event is reviewed in section 4.2.

The inspectors found that the LERs listed above met the requirements of 10 CFR 50.73 and had no further questions regarding these events.

### 7.2 Routine Reports

Routine reports submitted by PECO Energy were reviewed to verify the reported information. The following reports were reviewed and satisfied the requirements for which they were reported.

> Station Monthly Operating Reports for June 1995, dated July 13, 1995 and July 1995, dated August 10, 1995.

## 8.0 MANAGEMENT MEETINGS

### 8.1 Exit Interviews

The inspectors discussed the issues in this report with PECO Energy representatives throughout the inspection period, and summarized the findings at an exit meeting with the Plant Manager, Mr. R. Boyce, on September 18, 1995. PECO Energy personnel did not express any disagreement with the inspection findings. No written inspection material was provided to licensee representatives during the inspection period.

ATTACHMENT A

Procedures, Training Programs, Forms, and Direction for
10 CFR 50.59 Review at Limerick Generating Station, Units 1 and 2

| Item | Title | Effective Date |
|---|---|---|
| CNP-0010 | Indoctrinations of CNP LR-C13 10 CFR 50.59 Lesson Plan | 10/27/94 |
| LR-C-13, Rev. 4 | 10 CFR 50.59 Reviews | 7/10/95 |
| LR-C-13-1, Rev. 4 | 50.59 Reviews Format and Directives | 7/10/95 |
| AC-CG-4, Rev. 2 | PORC Administration/SQR & Chesterbrook Review and Approval of Documents | 2/21/95 |
| AG-CG-4-1, Rev. 1 | PORC/SQR/Chesterbrook-Review & Approval Form | 2/21/95 |
| A-C-4, Rev. 0 | Plant Operations Review Committee | 7/20/95 |
| A-C-4-2, Rev. 1 | Station Qualified & Quality Reviewer Program | 2/21/95 |
| A-C-901, Rev. 6 | Control of Non-Conformances | 1/17/95 |
| MOD-CD-3, Rev. 3 | MOD Process Design | 9/15/95 |
| MOD-C-7, Rev. 1 | Temporary Plant Alterations | 9/8/94 |
| MOD-C-8, Rev. 0 | Setpoint Changes | 1/16/95 |
| MOD-C-9, Rev. 3 | Controls and Processing of Engineering Change Requests (ECR) | 9/4/94 |
| MOD-C-14, Rev. 1 | Minor Physical Change Process | 3/1/95 |
| MOD-C-16, Rev. 1 | Small MOD Process | 5/13/95 |
| MOD-C-15, Rev. 1 | Evaluation of Plant Items | 5/23/95 |
| Training Record | 10 CFR 50.59 Review Process-Training/ Qualification Listing | 6/13/95 |
| PIMS Printout | NNGAP0010 & NNGAP0010RS Courses | |

ATTACHMENT B

LISTING & DESCRIPTION OF TEN REPORTS REVIEWED DURING
THE 10 CFR 50.59 INSPECTION

Modifications 50.59

- Modification P00212 Evaluation of the Removal of HPCI and RCIC Unit coolers From Support of System Technical Specification Operability

- B MG Set Temperature switch TPA of 7/17/95

- Modification P00140 Involves Upgrades to LGS, Unit 1 and 2, Main Steam Isolation Valves (MSIVs)

- Modification P-167-0 Valve Pits in Spray Pond Pump House Yard (Rev. 1)

- Modification P00017 Elimination of the Main Steam Isolation Valve Leakage Control System

NCRs 50.95

- NCR 94-00024 Diesel Generating Steady State Voltage Technical Specification Change

ECRS 50.59

- ECR 94-07332 Improve the Loss of Coolant Accident Trip Design on Load Center Circuit Breakers D114-24, D124-24, D214-24 and D224024

- ECR 94-05848 Evaluates the Addition of a Redundant Air Supply to the Emergency Diesel Generator Aft Main Bearing Booster Pumps.

OTHER 50.59

- Change Feedwater Flow Co-Efficient per AT ISRs #A0779794 and A0781365 Based on a New Calculated Feedwater Flow Uncertainty Data Input Into Core Thermal Power Determination Calculation EE-094, Rev. 9

- Operations with Increased Core Flow to 110% of Rated and For Operation with a Final Feedwater Temperature Reduction of 105°F During Coastdown Operation to a Minimum Coastdown Power of 40%