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June 8, 1990
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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket No. 50-440
LER 89.030/1

Dear Sir:

Enclosed is Licensee Event Report 89-030/1 for the Perry Nuclear Power Plant.

Sincerely,

M. D. Lyster

Michael D. Lyster
Vice President, Nuclear - Perry

MDL:njc

Enclosure: LER 89-030/1

cc: T. Colburn
NRC Resident Inspector

U.S. Nuclear Regulatory Commission
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Operating Companies
Cleveland Electric Illuminating
Toledo Edison

IE22
1/1

NRC FORM 366 (6-89) | U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Perry Nuclear Power Plant, Unit 1	0 5 0 0 0 4 4 0	1 OF 0 7

TITLE (4): Plant Entered Technical Specification 3.0.3 Due to Two Untrippable Control Rods

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
1 1	2 5	8 9	8 9	— 0 3 0	— 0 1	0 6	0 8	9 0		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 7 8	20.402(b)	20.405(c)	50.73(a)(2)(iii)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(iv)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Henry L. Hegrat, Compliance Engineer, Extension 6855	AREA CODE 2 1 6 2 5 9 - 3 7 3 7

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
E	A A	R S V	A 6 1 0	Y							

SUPPLEMENTAL REPORT EXPECTED (14)

	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO			

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On November 25, 1989 between 1413 and 1815 two control rods were inoperable due to being untrippable, requiring entry into Technical Specification (TS) 3.0.3. Laboratory analysis later determined that the failure of the two control rods was due to improper seat material in the associated scram pilot solenoid valves.

The root cause control rod failure was inadequate implementation of the Nonconformance Control Program. The scram pilot valves used for rods 34-47 and 34-51 had been recalled by the manufacturer in 1985 but were not returned to the supplier prior to their installation during the 1989 refueling outage. The root cause of the entry into TS 3.0.3 is personnel error. During scram time testing, control room personnel observed 2 failures of rod 34-47 and then declared the rod operable after 2 successful retests. It was not until after the subsequent failure of rod 34-51 that the operability of rod 34-47 was reevaluated. Control rod 34-47 should not have been declared operable without an adequate evaluation for the observed failures.

To prevent recurrence, surveillance instructions have been modified to address actions to be taken when rods fail testing. The operators involved in this event have been coached with respect to equipment operability and the conduct of testing and troubleshooting. The procedure for surveillance test control has been modified to include actions to be taken when unsatisfactory test results are encountered, as well as a requirement to analyze and evaluate the causes for the unsatisfactory results prior to declaring the component back in service. Additionally, all licensed operators have been trained on the lessons learned from this event and the philosophy of test control performance as implemented by the procedural changes described above.

On November 25, 1989 between 1413 and 1815 two control rods were inoperable due to being untrippable, resulting in conditions requiring entry into Technical Specification (TS) 3.0.3. At the time of the event, the plant was in Operational Condition 1 (Power Operation) with the reactor at 78 percent of rated thermal power. The Reactor Pressure Vessel [RPV] pressure was at saturated pressure and temperature conditions at approximately 990 psig.

During the first refuel outage, 59 of the 177 installed scram pilot solenoid valves were replaced as part of routine preventative maintenance for equipment qualification reasons. On July 30, 1989, during retest procedures following this replacement, control rods 34-47 and 34-51 each failed to satisfy scram time testing requirements on the initial attempt; however, because the control rod timing tests were satisfied on subsequent attempts, the rods were declared operable and returned to service. Although the rods were considered operable, system engineering personnel documented the event on a condition report, specifying the corrective actions to test these control rods during the next scheduled scram time surveillance.

As a result of this condition report's corrective actions, control rods 34-47 and 34-51 were specifically included in the test population for the November 25, 1989 surveillance activities. The following chronology describes the events of that testing as they specifically relate to control rods 34-47 and 34-51.

November 25, 1989

0600 A power reduction was initiated to facilitate scram time testing in accordance with Surveillance Instruction (SVI-C11-T1006) "Control Rod Maximum Scram Insertion Time".
0631 The power reduction was completed. Reactor power at 78%.
1337 Rod 34-47 was tested and failed to move.
1340 Rod 34-47 was tested again, failing to meet scram time criteria.
1356 Rod 34-47 was tested satisfactorily.
1404 Rod 34-47 was tested satisfactorily.
1413 Rod 34-51 was tested and failed to move.
1433 Rod 34-51 was retested and failed to move.
1439 Rod 34-51 was declared inoperable.
1458 Rod 34-51 was hydraulically disarmed at position 48 (full out) to satisfy action requirements of TS 3.1.3.1.a.1.b.
1502 Rod 34-51 was verified to be separated from other inoperable control rods by at least two control cells as required by TS 3.1.3.1.a.
1503 Scram time testing was suspended.
1503 General Electric Company (GE) was requested to complete a shutdown margin calculation for the current conditions, assuming control rod 34-51 stuck at position 48 and the most reactive rod fails to scram.
1730 GE responded that shutdown margin for current conditions was insufficient to satisfy TS requirements.
1810 Rod 34-51 was rearmed.
1815 Rod 34-51 was hydraulically inserted to position 00 and disarmed.

2130 Rod 34-47 was declared inoperable; Operations supervision began evaluation of compliance with Technical Specification and potential required entry into TS 3.0.3.
2208 Rod 34-47 was inserted to position 00 and disarmed.

November 26, 1989

0341 Hydraulic Control Unit (HCU) 34-51 was restored after replacing the scram pilot valve.
0437 Rod 34-51 was declared operable after unisolating and satisfactorily completing scram time testing.
0505 HCU 34-47 was restored after replacing the scram pilot valve.
0517 Rod 34-47 was declared operable after unisolating and satisfactorily completing scram time testing.
~ 0600 Operations Section management confirmed the failure of the operators to enter TS 3.0.3 for two untrippable control rods.
~ 0700 Operations Section manager contacted the Resident Inspector.

In review of the timeline provided above, it should be noted that prior to the performance of the tests, control room supervisory personnel were not aware of the specific reasons for inclusion of the two subject control rods in the test population. As a result, the initial failures of rod 34-47 to satisfy surveillance requirements were attributed to faulty test switches which were used to initiate the single rod scram functions tested in this activity, and the rod was not immediately declared inoperable. After the failure of control rod 34-51 to insert, the control rod was declared inoperable due to being untrippable. Only after discussion with Lead Reactor Engineering personnel performing the testing did control room supervisory personnel realize the significance of the failures documented on July 30, and declared control rod 34-47 inoperable due to being untrippable.

TS 3.1.3.1 describes actions to be taken when control rods are inoperable. Because the number of control rods inoperable due to being untrippable is limited to one, the plant was in a condition governed by TS 3.0.3 during the time when both control rods 34-47 and 34-51 were withdrawn and inoperable due to being untrippable. Because rod 34-47 should have been considered inoperable from initial failure at 1337 until inserted at 2208, this condition existed from the time of failure of rod 34-51 at 1423 until insertion of rod 34-51 at 1815. Upon review of the event, Operations Section management personnel recognized the failure to enter TS 3.0.3 and notified the NRC Resident Inspector. Although the one-hour requirement to initiate action was not satisfied, control rod 34-51 was fully inserted and TS 3.0.3 was exited prior to the time the unit would have been required to be in Startup. It should also be noted that all requirements were satisfied for those TS which control room personnel considered applicable during the event.

On November 27, 1989, after plant management reviewed the event, actions were initiated to verify the operability of the remaining control rods. An additional 55 control rods were scram-time tested on November 27-28, including all control

rods reworked during the refuel outage which had not been satisfactorily tested during previous activities conducted on November 25, 1990. Included in this sample were the two control rods which had failed previously and had been repaired. Direction had been provided to operations personnel to commence a plant shutdown if any rod failed to scram or to satisfy scram time test criteria due to malfunctioning scram pilot valves. All control rods tested demonstrated satisfactory scram times.

In addition to the scram-time testing activities, inspection and failure analysis was initiated for the scram pilot solenoid valves removed from the Hydraulic Control Units (HCU) for rods 34-47 and 34-51. Initial inspection showed that the elastomer seat material in the suspect valves (ASCO Model Number HV176-816-1) appeared by physical characteristics to be urethane, rather than Viton, which is specified for this application. After initial inspection, the valves were transported to an independent laboratory for further analysis and preliminary results indicated that the material was urethane. Further investigation revealed that the subject scram pilot solenoid valves were included in a shipment which was recalled by ASCO in 1985 because of the possibility that the seat elastomer may not have been properly upgraded from urethane to Viton. In all, 34 valves were recalled from Perry, of which 22 were returned for refurbishment. The remaining 12 valves were apparently returned to stock without being rebuilt. In addition to the 2 which failed on November 25, research of documentation and an inspection of all 177 control rod HCU's determined the location of five additional recalled valves which were installed during the 1989 refueling outage. Although functioning properly, these five valves were replaced on November 29, 1989 with appropriate replacement parts, and were transported to an independent laboratory for further analysis. The remaining five recalled valves have been identified and are either being used for training aids or had been discarded during the refuel outage after failing preoperational testing due to air leaks.

Initial analysis indicated elastomer parts within the valve bodies of the two failed valves were not Viton, the seat material for which the valve was qualified. This was apparent when red exhaust port seats were discovered in the valves which failed. Further, when the next five valves were dismantled, three of the elastomer seats were green and two were black. Color is an indicator of material type for elastomers, green and red are atypical for Viton. Discussion with the valve vendor indicated it was possible that the red material was a urethane. Laboratory analysis of the seven elastomer samples determined five to be urethane. The red elastomer is possibly a soft, polyester urethane; the green seat material shows some characteristics of a harder, isocyanate based urethane, or cathene. The black elastomer material is Viton.

Microscopic observation and analytical results determined that the failure of the valves was a result of the urethane seat material adhering to the brass exhaust port. The presence of a sticky yellow foreign material, the degradation of the elastomer, and the migration of valve metals into the elastomer residue found on the exhaust port support this conclusion. This result is consistent with the use of urethane, since these elastomers are extremely susceptible to chemical attack from oils, lubricants or solvents which have been used in the manufacture of solenoid valves.

The root cause of the failure of control rods 34-47 and 34-51 to satisfy criteria for scram times was inadequate implementation of the Nonconformance Control Program. ASCO issued a letter to General Electric (GE) on April 29, 1985 in which they indicate that 40 valves shipped to GE may not have been rebuilt with Viton-A material for the disc holder assembly. GE subsequently determined that 34 of these valves had been shipped to Perry. Quality Control personnel at Perry generated a nonconformance report (NR) on June 7, 1985 to control the circumstances of the recall. However, only 22 of the 34 valves were listed on the NR since a GE site internal letter initiated on the same date indicated that the remaining 12 valves were rebuilt with kits supplied by ASCO. The NR was closed concurrent with the return of the 22 valves on December 13, 1985. Investigation has determined that no documentation exists that would confirm that the 12 valves omitted from the NR were in fact refurbished in 1985. If the program had been implemented correctly, work documents would have been provided by GE with their NR disposition to confirm the refurbishment. The absence of this evidence should have resulted in the initiation of an additional NR for the 12 suspect valves. In conclusion, the NR disposition provided by GE was unsubstantiated and project personnel should have ensured that the work documents were available and complete to support the GE NR disposition.

The root cause of the entry into TS 3.0.3 is personnel error. Control rod 34-47 should not have been declared operable after repeated failures to satisfy scram-time criteria without an adequate evaluation of cause for the two observed failures. Additionally, all personnel involved with the scam-time testing, including licensed control room operators, should have been fully aware of the circumstances requiring surveillance testing of control rods 34-47 and 34-51 on November 25, 1989. The documented evidence of previous failures of these control rods under similar or identical circumstances was critical to the licensed control room operators in the determination of operability. With the proper determination that control rod 34-47 was inoperable at the time of the initial failure, action requirements of TS 3.1.3.1 could have been satisfied, and entry into TS 3.0.3 could have been avoided.

The Control Rod Drive Hydraulic [AA] (CRDH) system provides the hydraulic driving head for insertion, withdrawal, and scamming of control rods. Within this system are HCU's which provide the reactor scram function. The CRDH System provides water at 1720 psig to the HCU. The HCU is equipped with a hydraulic cylinder with an internal free floating piston. The piston separates water on top from nitrogen gas underneath. The HCU is precharged with N_2 gas to a pressure of about 1200 psig. Charging water pressure compresses the precharge to about 1720 psig.

The scram signal is generated by instrumentation in the Reactor Protection System [RPS] and transmitted to the CRDH System affecting the positions of several air-operated valves. The scram signal results in a loss of electrical power to the scram pilot valve solenoids, de-energizing them. It also energizes the backup scram valve solenoids. This causes the scram pilot and backup valve inlet

ports to close and exhaust ports to open. The scram pilot valves are arranged so that the trip signal from RPS busses A and B must be removed from both coils before the valves operate. This prevents the inadvertent scram of a single Control Rod Drive Mechanism [AA] (CRDM) in the event of a failure of one of the pilot valve coils. The scram pilot valves open both the scram inlet and the outlet valves. The backup scram valves vent the entire scram air header to assist in scram valve operation. The Redundant Reactivity Control System (RRCS) also provides a means of venting air pressure from the scram air header by causing the opening of additional vent and drain valves on selected signals or manual initiation.

When the inlet and outlet scram valves open, water in the scram accumulator and charging line is admitted underneath the CRDM drive piston, and the water above the piston is vented to the scram discharge volume. The large differential pressure between the accumulator and the SDV produces a large upward force on the control rod thus forcing it into the core region. In addition to the accumulator, reactor pressure can also be used to scram the control rods. Upon a scram, the accumulator provides the pressure to insert the control rod. As the accumulator discharges, its pressure drops rapidly. If the accumulator pressure drops below the reactor pressure, reactor pressure forces a ball check valve in the CRDM to unseat, blocking accumulator pressure and allowing reactor pressure to complete the drive stroke. At reactor pressure greater than 600 psig, reactor pressure alone is capable of scramming the drive.

The inoperability of Control Rods 34-47 and 34-51 was based on the partial inability to respond to a reactor scram signal due to potential misoperation of the associated Scram Pilot valves. A problem with operability of these valves, would impede timely rod insertion in the event of an initiation of RPS until the backup scram valves or RRCS depressurized the entire scram air header. Since the backup scram valves and RRCS were available, the scram functions for those rods would have occurred in the event of an RPS actuation. All remaining control rods had demonstrated acceptable scram functions during rod timing tests on August 6, 1989 during post-refuel outage startup testing. The scram function, therefore, would have satisfactorily shutdown the reactor in the event of a scram. Additionally, during the entire event operators had the ability to insert all control rods using normal drive pressure. Approved Off-Normal and Plant Emergency Instructions are in place to provide direction to the operators during any event in which a control rod does not insert on an RPS actuation. This event, therefore, is not considered to be safety significant.

To determine if the inaccurate disposition of the 1985 NR was an indication of a negative trend or an isolated case, the project initiated an NR review for the time period from 1981 to 1985, during which GE had NR disposition review responsibility. In all, 876 NR's were reviewed, of which 45 were identified which concerned vendor supply problems. Particular emphasis was placed on the NR's in this category. No anomalies were identified during this review and this inaccurate disposition of the subject NR is considered an isolated event. Current site procurement procedures require full evaluation and documentation of actions taken in response to such issues.

To prevent recurrence, SVI-C11-T1006 has been revised to direct the operators to immediately declare a control rod inoperable and comply with Technical Specification requirements if a rod fails to satisfy scram time testing criteria. The operators involved in this event have been coached with respect to equipment operability and the conduct of testing and troubleshooting. Plant Administrative Procedure (PAP-1105) "Surveillance Test Control" has been modified to include actions to be taken when unsatisfactory test results are encountered as well as a requirement to analyze and evaluate the causes for the unsatisfactory results prior to declaring the component back in service. All licensed operators have been trained on the lessons learned from this event and the philosophy of test control performance as implemented by the procedural changes as described above.

Energy Industry Identification System Codes are identified in the text as [XX].