**Perry Nuclear Power Plant**
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June 27, 2024
L-24-155

10 CFR 50.73(a)(2)(v)(C)
10 CFR 50.73(a)(2)(v)(D)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Licensee Event Report Submittal

Enclosed is Licensee Event Report (LER) 2024-002, "Reactor Water Cleanup Leak Detection Loss of Safety Function." There are no regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Robert Oesterle, Manager – Regulatory Compliance, at (419) 321-7462.

Sincerely,

Rod L. Penfield

Enclosure:
LER 2024-002

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III Regional Administrator

Enclosure
L-24-155

Licensee Event Report 2024-002

NRC FORM 366 (04-02-2024) U.S. NUCLEAR REGULATORY COMMISSION

# LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/



| 1. Facility Name | | 2. Docket Number | 3. Page |
|---|---|---|---|
| Perry Nuclear Power Plant | ☒ 050 ☐ 052 | 00440 | 1 OF 5 |

**4. Title:**
Reactor Water Clean Up Leak Detection Loss of Safety Function

| 5. Event Date | | | 6. LER Number | | | 7. Report Date | | | 8. Other Facilities Involved | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Day | Year | Year | Sequential Number | Rev No. | Month | Day | Year | Facility Name | ☐ 050 | Docket Number |
| 05 | 16 | 2024 | 2024 | - 002 - | 00 | 06 | 27 | 2024 | Facility Name | ☐ 052 | Docket Number |

| 9. Operating Mode | 10. Power Level |
|---|---|
| 2 | 000 |

**11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)***

| | | | | | |
|---|---|---|---|---|---|
| **10 CFR Part 20** | ☐ 20.2203(a)(2)(vi) | **10 CFR Part 50** | ☐ 50.73(a)(2)(ii)(A) | ☐ 50.73(a)(2)(viii)(A) | ☐ 73.1200(a) |
| ☐ 20.2201(b) | ☐ 20.2203(a)(3)(i) | ☐ 50.36(c)(1)(i)(A) | ☐ 50.73(a)(2)(ii)(B) | ☐ 50.73(a)(2)(viii)(B) | ☐ 73.1200(b) |
| ☐ 20.2201(d) | ☐ 20.2203(a)(3)(ii) | ☐ 50.36(c)(1)(ii)(A) | ☐ 50.73(a)(2)(iii) | ☐ 50.73(a)(2)(ix)(A) | ☐ 73.1200(c) |
| ☐ 20.2203(a)(1) | ☐ 20.2203(a)(4) | ☐ 50.36(c)(2) | ☐ 50.73(a)(2)(iv)(A) | ☐ 50.73(a)(2)(x) | ☐ 73.1200(d) |
| ☐ 20.2203(a)(2)(i) | **10 CFR Part 21** | ☐ 50.46(a)(3)(ii) | ☐ 50.73(a)(2)(v)(A) | **10 CFR Part 73** | ☐ 73.1200(e) |
| ☐ 20.2203(a)(2)(ii) | ☐ 21.2(c) | ☐ 50.69(g) | ☐ 50.73(a)(2)(v)(B) | ☐ 73.77(a)(1) | ☐ 73.1200(f) |
| ☐ 20.2203(a)(2)(iii) | | ☐ 50.73(a)(2)(i)(A) | ☒ 50.73(a)(2)(v)(C) | ☐ 73.77(a)(2)(i) | ☐ 73.1200(g) |
| ☐ 20.2203(a)(2)(iv) | | ☐ 50.73(a)(2)(i)(B) | ☒ 50.73(a)(2)(v)(D) | ☐ 73.77(a)(2)(ii) | ☐ 73.1200(h) |
| ☐ 20.2203(a)(2)(v) | | ☐ 50.73(a)(2)(i)(C) | ☐ 50.73(a)(2)(vii) | | |

☐ **OTHER** (Specify here, in abstract, or in NRC Form 366A).

**12. Licensee Contact for this LER**

| Licensee Contact | Phone Number (Include area code) |
|---|---|
| George Dujanovic, Staff Nuclear Engineering Specialist, Regulatory Compliance | (440) 280-5200 |

**13. Complete One Line for Each Component Failure Described in this Report**

| Cause | System | Component | Manufacturer | Reportable to IRIS | | Cause | System | Component | Manufacturer | Reportable to IRIS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

| 14. Supplemental Report Expected | | 15. Expected Submission Date | Month | Day | Year |
|---|---|---|---|---|---|
| ☒ No | ☐ Yes (If yes, complete 15. Expected Submission Date) | | | | |

**16. Abstract** (Limit to 1326 spaces, i.e., approximately 13 single-spaced typewritten lines)

On May 16, 2024, at 0840, with the reactor in Mode 2 and 0 percent rated thermal power, Operations declared the reactor water cleanup (RWCU) leak detection instrumentation Inoperable per Technical Specification (TS) 3.3.6.1. This was due to both RWCU differential flow channels spiking over the isolation setpoint and RWCU would isolate if the values were locked in for ten minutes. Operations decided to manually bypass the RWCU isolation for both channels, to avoid an isolation of RWCU, until the differential flow instrumentation could be filled and vented. The instrumentation was filled and vented, and the RWCU leak detection isolation bypass switches were placed back to Normal. RWCU leak detection instrumentation was declared Operable at 1210 on May 16, 2024, and TS 3.3.6.1 was met, within the time allowed.

The cause of the loss of safety function to RWCU automatic isolation was due to erroneous RWCU leak detection instrumentation signals which led to the decision to manually bypass the RWCU automatic isolation function.

Corrective actions are in place to address issues with the RWCU leak detection instrumentation.

This event is being reported as a loss of safety function, due to bypassing the RWCU leak detection isolation, under 10 CFR 50.73(a)(2)(v)(C) and 50.73(a)(2)(v)(D).

| 1. FACILITY NAME | | 2. DOCKET NUMBER | 3. LER NUMBER | | |
|---|---|---|---|---|---|
| | | | YEAR | SEQUENTIAL NUMBER | REV NO. |
| Perry Nuclear Power Plant | ☒ 050<br>☐ 052 | 00440 | 2024 | - 002 | - 00 |

NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

SYSTEM DESCRIPTION:

The reactor water cleanup (RWCU) system [CE] provides continuous purification of reactor water to reduce the fouling of heat transfer surfaces, minimize secondary sources of radiation (from the activation of corrosion and wear products), and maintain water clarity during refueling. The system also provides for:

- The discharge of excess reactor water during startup, shutdown, and hot standby conditions.
- Minimizing thermal stratification in the reactor vessel and recirculation piping during periods of no recirculation flow.
- Sample connections for continuous water quality monitoring.

The leak detection system [IJ] uses temperature, pressure, and flow detectors to detect and annunciate the escape of potentially radioactive steam or water from the reactor coolant pressure boundary. The leak detection system can determine the leakage rate and initiating action, through inputs to the nuclear steam supply shutoff system (NSSS) [JM], to isolate substantial leaks. This protects the nuclear fuel from damage due to a loss of coolant.

The RWCU System is monitored for leakage by temperature, differential temperature detectors, and differential pressure detectors. High ambient temperatures and differential temperatures are monitored in various RWCU equipment areas. In addition, the ambient and differential temperatures in the Steam Tunnel are used in this circuit.

Three sets of differential pressure detectors [PT] are employed to measure flow into and out of the RWCU System. The inlet flow is compared to the outlet flow and if the flow rates differ by 59 gpm or greater for more than 10 minutes, an alarm [ALM] is actuated in the control room, and a RWCU isolation signal is generated to isolate the inlet and outlet valves for RWCU.

Two RWCU Leak Detection Isolation Bypass Switches (one for each division, inlet and outlet) are provided to bypass the high differential flow rate and high temperature isolation signals.

TECHNICAL SPECIFICATION (TS) 3.3.6.1:

TS 3.3.6.1, Primary Containment and Drywell Isolation Instrumentation, provides as a Limiting Condition of Operation (LCO), the primary containment and drywell isolation instrumentation for each function in Table 3.3.6.1-1 shall be Operable. RWCU system isolation instrumentation is included in the table.

Condition A, requires one or more required channels of reactor water cleanup leak detection to be operable while in Modes 1,2, or 3. With one or more channels inoperable, the Required Action is to place the channel(s) in trip with a Completion Time of 12 hours.

Condition B for one or more automatic Functions with isolation capability not maintained, the Required Action is to restore isolation capability with a Completion Time of 1 hour.

| 1. FACILITY NAME | | 2. DOCKET NUMBER | 3. LER NUMBER | | |
|---|---|---|---|---|---|
| | | | YEAR | SEQUENTIAL NUMBER | REV NO. |
| Perry Nuclear Power Plant | ☒ 050<br>☐ 052 | 00440 | 2024 | - 002 | - 00 |

**NARRATIVE**

Condition C, if the Required Action and Completion Times Condition A or B are not met, then the Required Action is to enter the Condition referenced in Table 3.3.6.1-1 for the channel (the table references Condition F), with a Completion Time of immediately.

Condition F is as required by the Required Action C.1 and referenced in Table 3.3.6.1-1, with a Required Action to isolate the affected penetration with a Completion Time of 1 hour.

Condition H is if the Required Action and associated Completion Time of Condition F is not met, then the Required Action is to be in Mode 3 with a Completion Time of 12 hours AND be in Mode 4 with a Completion Time of 36 hours.

EVENT DESCRIPTION:

On May 16, 2024, at 0840, with the plant in Mode 2 and 0 percent power, Operations shift personnel declared the Reactor Water Cleanup (RWCU) differential flow leak detection instrumentation Inoperable due to spiking instrumentation signals. Limiting Condition of Operation (LCO) for Technical Specification (TS) 3.3.6.1, Primary Containment and Drywell Isolation Instrumentation, was not met. LCO 3.3.6.1 states that the primary containment and drywell isolation instrumentation for each Function in Table 3.3.6.1-1 shall be Operable.

Not wanting RWCU to isolate on high differential flow, which is 59 gallons per minute (gpm) with a 10-minute time delay, the Shift Manager directed the Operator to place the RWCU Leak Detection Isolation Bypass switches from Normal to Bypass on both the Division 1 and Division 2 channels, while the Instrumentation and Control section was informed to fill and vent the instrumentation.

The RWCU differential flow instrumentation was filled and vented per procedure, and at 1210 on May 16, 2024, the instrumentation was declared Operable. The RWCU Leak Detection Isolation Bypass switches were then placed back to Normal and the LCO for TS 3.3.6.1 was met.

Due to both channels of isolation being bypassed concurrently for RWCU leak detection, this was determined to be an event or condition that could have prevented fulfillment of a safety function, and the NRC was notified on May 16, 2024 at 2053, under 10 CFR 50.72(b)(3)(v)(C) for control the release of radioactive material, and 10 CFR 50.72(b)(3)(v)(D) for mitigate the consequences of an accident.

INVESTIGATION:

The plant was in Mode 2 and starting up the reactor on May 16, 2024, coming out of a planned outage from replacing the shaft seal on one of the Reactor Recirculation water pumps [P] in Containment Drywell. RWCU pump A was shutdown in support of the plant startup at 0815 on May 16, 2024. After RWCU pump A was shutdown, RWCU leak detection differential flow readings increased on both A and B channels to the isolation setpoint of 59 gallons per minute (gpm), and with a time delay of 10-minutes, both the inlet and outlet valves for RWCU would then isolate.

The leak detection differential flow instrument readings became inaccurate, following placing the RWCU system in reduced Feedwater temperature control. At this time, during reactor startup, the RWCU system was being used to reject water to maintain reactor water level in band. This is required due to Reactor heat-up causing expansion of the reactor pressure vessel (RPV) [RPV] water inventory, and with the Control Rod Drive Hydraulic system

NARRATIVE

(CRDH) [AA] adding approximately 60 gpm of inventory. During a cold reactor start up, no other method for reducing RPV inventory is available until steam production overcomes the inventory added by CRDH.

At 0839, an Operator narrative log entry documents the decision to bypass RWCU leak detection isolation as follows:

"RWCU differential flow readings increased after turning off RWCU A pump in Mode 2. RWCU A and B differential flow readings are erratic. Current delta flow readings are A: 60 gpm, B: 80 gpm. Since both channels are spiking over the isolation setpoint, RWCU would isolate if these values remained locked in for 10 minutes.

Bypassing RWCU E31 leak detection isolation would be a tech spec entry: T.S. 3.3.6.1. This is one hour to restore the function (3.3.6.1. Condition B) and one hour to isolate the flowpath (3.3.6.1. Condition F). If these are not completed, a plant shutdown is required. Additionally, isolating RWCU would lower RWCU differential flows. This might cause a Reactor Water Chemistry issue during plant startup.

The Radwaste Operator reported that all Containment and Auxiliary Building sumps were cycling at the normal rate.

Operations determined that RWCU differential flow instrument issues are not due to an actual RWCU system leak. RWCU leak detection isolation will be bypassed, and Maintenance will be requested to fill and vent RWCU leak detection instrumentation."

At 0840, The RWCU Leak Detection Isolation Bypass Switches A and B were placed in the Bypass position.

After the completion of the A and B instrumentation filling and venting, RWCU differential flows improved to 7 gpm from 60 gpm on A, and to 11 gpm from 70 gpm on B.

At 1210, RWCU Leak Detection instrumentation was declared Operable, after the RWCU Leak Detection Bypass Switches A and B were placed back to Normal per procedure, and TS 3.3.6.1 LCO was now met.

CAUSE OF EVENT:

The cause of the loss of safety function to RWCU automatic isolation was due to erroneous RWCU leak detection instrumentation signals which led to the decision to manually bypass the RWCU automatic isolation function.

CORRECTIVE ACTIONS:

Completed Action:

The RWCU leak detection isolation bypass switches for Divisions 1 and 2 were placed back to Normal on May 16, 2024 at 1210, after the instrumentation was filled and vented and the differential flows returned to normal flow rates.

NARRATIVE

Scheduled Actions:

- Plant Health Committee to review the replacement of current RWCU flow measurement devices (venturis, orifice plates, diaphragm pressure sensors, and associated circuitry).
- Determine the feasibility of breaking vacuum on the RPV via the first and second head vents during cold shutdown when vessel disassembly is not required. This may only be feasible when drywell entry is pursued.

EVENT ANALYSIS:

A detailed risk evaluation was performed as a sensitivity to demonstrate the low risk for the RWCU isolation valves. The sensitivity study results found that the delta CDF (Core Damage Frequency) is less than 1.0E-6 and the delta LERF (Large Early Release Frequency) is less than 1.0E-7, therefore the corresponding safety significance of this event would be categorized as very low safety significance.

PREVIOUS SIMILAR EVENT:

In November 2022, Condition Report 2022-08472, Performance of IMI-E006-009 RWCU Differential Flow Instrumentation delayed Mode change to Startup Condition, documented difficulties with obtaining proper venting for both channels of RWCU differential flow instrumentation just prior to a Mode change to plant startup. The issue ultimately delayed plant startup and initiated troubleshooting to investigate system performance. The cause of not being able to obtain proper instrumentation venting was attributed to there being a vacuum present on the reactor pressure vessel. The vacuum was removed from the reactor vessel and proper venting was able to be established on the instrumentation. This instance did not lead to bypassing both RWCU leak detection isolation signals concurrently.