Entergy

Entergy Nuclear Operations, Inc.
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September 15, 2008

10 CFR 50.73(a)(2)(i)(B)

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

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Licensee Event Report 08-004, Noncompliance with Technical Specification 4.3.1.1.b

Dear Sir or Madam:

Licensee Event Report (LER) 08-004 is enclosed. The LER describes a noncompliance with Technical Specification 4.3.1.1.b. The occurrence is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B).

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

Christopher J. Schwarz
Site Vice President
Palisades Nuclear Plant

Enclosure (1)

CC Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

ENCLOSURE 1

LER 08-004

Noncompliance with Technical Specification 4.3.1.1.b

5 Pages Follow

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 8/31/2010

Estimated burden per response to comply with this mandatory information collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Noncompliance with Technical Specification 4.3.1.1.b

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	DOCKET NUMBER
07	15	2008	2008	- 004	- 00	09	15	2008	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Laurie Lahti	(269) 764-2788

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	DB	RK	N430	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 15, 2008, with the plant in Mode 1 at 100% power, Entergy Nuclear Operations, Inc. personnel discovered that the Palisades Nuclear Plant region 1 spent fuel pool (SFP) storage racks contain less neutron absorber material than assumed in the SFP criticality analysis of record. This neutron absorber material is relied on to maintain the region 1 SFP storage racks within the Technical Specification (TS) 4.3.1.1.b criticality requirements. The TS reflects credit for the neutron absorber material in maintaining SFP criticality within limits. At the time of discovery, SFP boron concentration was 2732 ppm. TS 4.3.1.1.b requires that Keff for region 1 fuel racks be less than or equal to 0.95 if fully flooded with unborated water. With soluble boron required to maintain Keff less than or equal to 0.95 in the region 1 fuel racks, assuming nominal enrichment, PNP no longer complies with TS 4.3.1.1.b.

The degraded neutron absorber material did not involve an immediate safety concern at the time of discovery because the SFP boron concentration was 2732 ppm, and a SFP criticality operability assessment concluded that a soluble boron concentration of 150 ppm is required to maintain a Keff less than or equal to 0.95 in the region 1 racks. In addition, plant procedures required that SFP boron concentration be maintained at a minimum of 2550 ppm in Modes 1 through 4. In Modes 5 and 6, 1800 ppm was required. A past operability evaluation confirmed that SFP boron concentration had been maintained greater than 2550 ppm in recent years. Compensatory measures are in place. This condition does not represent a safety system functional failure. This is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by TS.

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EVENT DESCRIPTION

On July 15, 2008, Entergy Nuclear Operations, Inc. (ENO) personnel discovered that the Palisades Nuclear Plant (PNP) region 1 spent fuel pool (SFP) storage racks contain less neutron absorber material than assumed in the SFP criticality analysis of record. This neutron absorber material is relied on to maintain the region 1 SFP storage racks within the Technical Specification (TS) 4.3.1.1.b criticality requirements. The TS reflects credit for the neutron absorber material in maintaining SFP criticality within limits.

The degradation of neutron absorption material in region 1 was discovered during "blackness testing." This testing was conducted as a corrective action to assess the effect of previously observed fuel cell wall swelling in region 1 racks on the SFP criticality analysis. A qualitative review of preliminary test data indicated that at least half of the neutron absorber material remains in the racks.

A SFP criticality operability assessment concluded that, with credit taken for about half of the neutron absorber and a small amount of fuel burnup, a soluble boron concentration of 150 ppm is required to maintain a Keff less than or equal to 0.95 in the region 1 racks based on the most reactive fuel that has been used at the PNP. At the time of discovery, SFP boron concentration was 2732 ppm. TS 4.3.1.1.b requires that Keff for region 1 fuel racks be less than or equal to 0.95 if fully flooded with unborated water. With soluble boron required to maintain Keff less than or equal to 0.95 in the region 1 fuel racks, assuming nominal enrichment, PNP no longer complies with TS 4.3.1.1.b.

PNP also no longer complies with 10 CFR 50.68(a)(4). This regulation states that, if no credit is taken for soluble boron, Keff must not exceed 0.95 at a 95 percent probability, 95 percent confidence level with maximum fuel assembly reactivity if flooded with unborated water.

TS 3.7.15 requires that SFP boron concentration be maintained greater than or equal to 1720 ppm when fuel assemblies are stored in the pool. This bounds the 850 ppm soluble boron credited in the criticality analysis for the region 2 storage racks. The PNP current licensing basis does not address soluble boron credit for the region 1 storage racks. Therefore, ENO considers Technical Specification 3.7.15 to be nonconservative in accordance with Nuclear Regulatory Commission (NRC) Administrative Letter 98-10, "Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety." ENO implemented compensatory measures that included maintaining a boron concentration higher than the minimum required in Technical Specification 3.7.15 until the nonconformance is resolved. This condition does not represent a safety system functional failure. This is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by TS.

BACKGROUND

The region 1 racks, manufactured by NUS, were installed between 1979 and 1981 to increase SFP storage capacity. The racks consist of 422 storage cells that use a "flux trap" design. Each storage cell is approximately 12 feet in height with nominal 10-1/4 inches center-to-center spacing of the fuel assemblies. A cell is constructed of two concentric 1/8 inch Type 304 stainless steel cans, with an inside square cross sectional width of 8.56 inches, and with B_4C neutron absorber plates installed in the annular gap between the cans. The B_4C neutron absorber plates, which are credited in the criticality analysis, are 33.5" tall, 8.26" wide, and have a thickness of 0.21". The plates are stacked four high on each side to provide an absorber region that is 134" high. The top and the bottom of the two cans are closed by welding a spacer between the two cans on either end. Originally, the annulus was designed to be water tight, but cell wall swelling due to internal gas production from gamma exposure necessitated the drilling of 3/16 inch vent holes in the upper region of each cell.

The neutron absorber plates were manufactured by Carborundum. The manufacturing process bonded B_4C powder in a carbon matrix through a sintering process producing a hard ceramic-like material. The absorber is 50% B_4C by volume, with the remainder being carbon and voids. The absorber was fabricated into 0.21-inch thick plate, which was inserted in the annular space.

In 1988, difficulty was encountered while inserting a fuel assembly into one of the region 1 cells. The assembly could not be inserted because the north wall of the cell had experienced swelling. Since 1988, several other locations have been determined to be swollen. Most of these locations were identified because their fuel assemblies could not be removed. To date, fourteen cells have experienced swelling; eleven with fuel stored in them and three empty. When a stuck fuel assembly was identified in 2007, an apparent cause evaluation was performed. The evaluation identified that the swelling of the region 1 rack may be a cause/effect of degradation or reconfiguration of the B_4C plates. In response to this concern, a corrective action was issued to perform "blackness testing" of the region 1 SFP racks.

CAUSE OF THE EVENT

The apparent cause of this condition is a degradation of the B_4C plates due to the environment of the SFP. While the exact degradation mechanism is not clearly understood, it is likely that it involves changes in the physical properties of the B_4C plates that occur during prolonged exposure to the SFP environment. A major contributing cause is that the criticality analysis of record did not account for potential degradation of the B_4C.

CORRECTIVE ACTIONS

ENO submitted a letter to the NRC on August 27, 2008. The letter provided a discussion of the degraded SFP neutron absorber material, as well as a timeline for reestablishing compliance. The letter made the following commitments for compensatory measures:

1. The movement of fuel assemblies within the SFP that involve positive reactivity changes is prohibited until fuel storage requirements in Technical Specifications, 10 CFR 50.68, and the updated final safety analysis report are met.

2. The movement of fuel assemblies within the spent fuel pool that involve negative reactivity changes is prohibited until the Nuclear Regulatory Commission has concurred with the planned fuel movement.

3. The SFP will be maintained between 75°F and 125°F during normal operation in accordance with plant procedures.

4. Spent fuel pool boron concentration will be maintained greater than 2550 ppm at all times.

In addition, the letter discussed a license amendment request for revised criticality requirements that will be submitted in order to support 2009 refueling outage activities. Compensatory measures will remain in place until compliance is restored.

ASSESSMENT OF SAFETY CONSEQUENCES

The degraded neutron absorber material did not involve an immediate safety concern at the time of discovery because the SFP boron concentration was 2732 ppm, which was well above the required boron concentration to maintain Keff less than 0.95. In addition, plant procedures required that SFP boron concentration be maintained at a minimum of 2550 ppm in Modes 1 through 4. In Modes 5 and 6, only 1800 ppm was required. A past operability evaluation confirmed that SFP boron concentration had been maintained greater than 2550 ppm in recent years. Compensatory measures are in place to ensure the fuel remains subcritical.

PREVIOUS SIMILAR EVENTS

Connecticut Yankee (CY) Licensee Event Report (LER) 78-04, dated May 12, 1978, discussed a pressure buildup in the annular poison cavity of the SFP racks due to gas generation. At decommissioning, a visual inspection of one of the racks from CY determined that the majority of the B_4C was intact, although the material was very friable.

Kewaunee LER 80-39, dated December 19, 1980, identified swelling in the SFP fuel rack cells due to gas generation. A follow-up letter dated August 25, 1981, provided long-term corrective actions.

PNP LER 93-007 supplement 2, dated May 23, 1995, provided an update to the original LER and supplement 1, related to the degradation of boraflex neutron absorber in the surveillance coupons in storage racks in region 2 of the SFP.