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PBL-97-0060

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Document Control Desk
U.S. NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, D. C. 20555

Gentlemen:

DOCKET 50-266 AND 50-301
LICENSEE EVENT REPORT 97-006-00
POTENTIAL REFUELING CAVITY DRAIN FAILURE
COULD AFFECT ACCIDENT MITIGATION
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Enclosed is Licensee Event Report 97-006-00 for Point Beach Nuclear Plant, Units 1 and 2. This report is provided in accordance with 10 CFR 50.73(a)(2)(ii)(B), "a condition that was outside the design basis of the plant." This report describes a plant condition that could cause retention of a significant water inventory in the refueling cavity during a design basis loss of coolant accident.

If you require additional information, please contact us.

Sincerely,

Thomas G Malamoot

Doug Johnson
Manager - Regulatory Services
and Licensing

GDA

Enclosure

IE22

cc: NRC Resident Inspector
NRC Regional Administrator

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

LICENSEE EVENT REPORT (LER)

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

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Point Beach Nuclear Plant, Unit 1	05000266	1 OF 6

TITLE (4)

Potential Refueling Cavity Drain Failure Could Affect Accident Mitigation

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 NAME	DOCKET NUMBER
01	20	97	97	-- 006 --	00	02	19	97	PBNP Unit 2	05000301
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N
POWER LEVEL (10)	90

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Glenn Adams, Licensing Engineer	(414) 221-4691

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

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 15 single-spaced typewritten lines) (16)

On January 20, 1997, with Unit 1 operating at 90% power and Unit 2 in a refueling shutdown condition, licensee engineers discovered a plant condition that could cause retention of a significant water inventory in the refueling cavity during a design basis loss of coolant accident (LOCA); thereby diverting water that is assumed to accumulate in the containment sump. The condition was discovered during review of 1983 modifications which installed a flapper valve and remote cable operator over the refueling cavity drain for Unit 1 and Unit 2. The modifications also removed the original cavity drain grate in each unit and reduced the size of the drain line to a 2-inch nozzle. The design was not evaluated for seismic considerations or the effects on the containment sump level. If the drain failed during a LOCA, as much as 46,000 gallons could be retained in the refueling cavity, which would invalidate the assumptions in the design basis accident analysis. To accommodate the potential loss of this sump water inventory, the emergency operating procedures were revised to ensure that a greater amount of water is transferred from refueling water storage tank to the containment during the LOCA recovery.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Event Description:

On January 20, 1997, with Unit 1 operating at 90% power and Unit 2 in a refueling shutdown condition, licensee engineers discovered that the design of the refueling cavity drain in each unit was unqualified for the safety-related function assigned to it. Refueling cavity drain failure during a loss of coolant accident (LOCA) could cause retention of containment spray liquid in the refueling cavity and a potential shortfall in the amount of water transferred to the containment sump.

The unqualified design of the drain was discovered during a Quality Assurance (QA) review of 1983 plant modifications that installed a "flapper valve" and remote cable operator over the refueling cavity drain line for Unit 1 and Unit 2. The modifications also removed the original cavity drain grate in each unit and reduced the size of the drain line to a 2-inch nozzle. The modification packages were prepared under the QA program; however, neither the new design nor the old design had been evaluated with respect to the safety-related function of draining the refueling cavity to the containment sump during a design basis LOCA.

Recent design reviews concluded that, even if the drain were seismically qualified and the materials certified, there was no assurance that the single drain could be relied upon to drain the refueling cavity to the containment sump during a design basis accident. Because there is only one drain and the effective diameter is only 2-inches (the original diameter was 4-inches), there is a possibility that the drain could clog with debris prior to draining to the containment sump. If the drain failed during a LOCA, as much as 46,000 gallons could be retained in the refueling cavity. This volume corresponds to a 16.2% change in Refueling Water Storage Tank (RWST) level.

The current reload safety analyses for Unit 1 and Unit 2 assume that the RWST volume between 95% level and 28% level (plus consideration for instrument inaccuracies) would be transferred to the containment by injection through the ECCS and containment spray system. The safety analysis assumes that this entire volume would be available in the containment sump to supply a suction source for the ECCS recirculation phase. If approximately 46,000 gallons (16.2% of RWST level change) is retained in the refueling cavity, the water volume in the containment sump would be less than that assumed in the reload safety analysis.

To accommodate the potential loss of this sump water inventory, the emergency operating procedures were revised to ensure that a greater amount of water is transferred from RWST to the containment during the LOCA recovery. In effect, the loss of 46,000 gallons (16.2% of RWST level) to the refueling cavity is accommodated by ensuring that the RWST is drained down to a 6% level during the LOCA recovery. The additional volume (22% of RWST level) injected is greater than the volume retained in the cavity.

The IEEE Standard 803A-1983 component identifiers for this report are:

Pump (p)
Drain (DRN)

Component and System Description:

The refueling cavity is a reinforced concrete structure inside containment that forms a pool of water above the reactor and fuel transfer system equipment when it is filled with borated water for refueling. The upper refueling cavity is that portion of the refueling cavity which is above the reactor vessel. The floor of the upper refueling cavity is approximately nine feet above the floor of the lower refueling cavity. The floor of the upper refueling cavity is sloped so as to drain to the lower refueling cavity.

The lower refueling cavity is that portion of the refueling cavity which allows for the transfer of nuclear fuel between the spent fuel pool and the reactor vessel. The floor of the lower refueling cavity is below the elevation of the upper refueling cavity to provide the greater depth required for the fuel transfer system upending device. The lower refueling cavity can retain approximately 46,000 gallons before it overflows to the upper refueling cavity and spills to the containment sump via the reactor vessel annulus.

The lower refueling cavity in each containment is provided with a single 3-inch drain that necks down to a 2-inch diameter diffuser inside the waste disposal system piping. A drain cover "flapper valve" is provided over the top of each drain and is operated remotely from a cable extending to the top of the refueling cavity. When the refueling cavity is filled for refueling operations, the "flapper valve" is closed to provide a redundant barrier to refueling cavity drainage. After a refueling, the flapper valve is opened and the lower refueling cavity is pumped and drained to the waste disposal system. The sediment directly below the refueling cavity drain is collected in a crud trap, and drained through a "clean-out flange" to a drum on the containment floor. The "clean-out" flange is left open and the flapper valve is latched open to ensure that the refueling cavity will drain to the containment floor during normal plant operation and accidents.

The Emergency Core Cooling System (ECCS) is comprised of the low-head and high-head safety injection systems that maintain primary system inventory, cool the reactor core, and maintain the reactor subcritical following a design basis accident. During the injection phase of a LOCA, the ECCS draws borated water from the RWST and injects it into the reactor coolant system. During the recirculation phase, the low-head safety injection pumps draw water from the containment sump and deliver it through the ECCS system and the containment spray system.

During a large break LOCA, the containment spray system will automatically actuate and spray borated water from the Refueling Water Storage Tank (RWST) and a caustic spray additive (sodium hydroxide) to the containment atmosphere. The containment spray will be heated by the containment atmosphere, evaporate, and then condense on the cooler surfaces inside containment. Ultimately, the condensate and unvaporized spray will accumulate in the containment sump. After the containment sump accumulates approximately 184,000 gallons of water from the reactor coolant break, safety injection borated water, and containment spray solution, the design basis requirements for initiation of the recirculation phase will be satisfied. This amount of borated water, along with the containment spray additive, was considered to perform the following functions: (1) provide adequate net positive suction head (NPSH) for ECCS pumps, (2) provide adequate sump pH for the retention of radioactive iodine, (3) provide adequate dilution of radioactivity to limit the offsite release of radioactivity, (4) provide adequate dilution of radioactivity in the recirculation flowpath to limit the dose rate in the primary auxiliary building and the environmental effects on equipment, and (5) provide adequate negative reactivity to assure core subcriticality during the recirculation phase of the LOCA.

Corrective Actions:

1. The design of the refueling cavity drains was reviewed with respect to their capability to withstand an earthquake. This review concluded that the mass of the assemblies was so small that earthquake loads were not a concern. Therefore, it was concluded that the drain cover ("flapper valve") would not close due to a design basis seismic event.

2. The Unit 1 emergency operating procedure EOP-1.3, "Transfer to Containment Sump Recirculation", was revised to ensure that sufficient RWST water is injected. The EOP instructs the operators to continue suction from the RWST until the RWST level reaches 6%. This amount will accommodate the inventory retained in the refueling cavity.

3. *Unit 2 EOP-1.3 will be revised prior to startup of Unit 2 from the current refueling outage (U2R22).*

4. *In the future, safety analyses will address the retention of water in the refueling cavity during a LOCA.*

Cause:

The cause of this condition was an inadequate evaluation of the original design and the design changes made in 1983. There were no provisions in the design to ensure the safety-related draining function would occur. The design was not seismically analyzed and there was no assessment for the need of a redundant drain or a qualified screen. Because the single drain does not meet the single failure criterion, and because there has

been no analysis to prove the reliability of the drain during a LOCA, the accident analysis should have accounted for the volume of water retained in the refueling cavity.

Reportability:

Due to the effect on the power operation of Unit 1, a 1-hour immediate report per 10 CFR 50.72 (b)(1)(ii)(B) was made to the NRC duty officer at 1650 CST on January 20, 1997. This same report included notification that Unit 2 was "degraded while shutdown" pursuant to the 4-hour prompt reporting requirements of 10 CFR 50.72(b)(2)(i). This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(ii)(B), "A condition that was outside the design basis of the plant."

Safety Assessment:

Had the reactor cavity drain failed during a design basis LOCA and had emergency response personnel not recognized a low sump level, the following consequences may have occurred:

(1) During the recirculation phase, less dilution of radioactivity in the sump water could lead to higher radiation emitting from the recirculation piping. This increase in radiation could adversely affect the habitability of the primary auxiliary building and the environmental qualification of equipment in the area.

(2) During the recirculation phase, less dilution of radioactivity in the sump water could lead to a larger release of radioactivity from any postulated leaks in the recirculation fluid boundary. This increase in radioactivity could adversely affect the habitability of the primary auxiliary building, control room, and the radiological release to the offsite environment.

(3) During the recirculation phase, the retention of boric acid in the refueling cavity could result in less neutron absorbers in the recirculated fluid and a failure to maintain a subcritical core.

The net effect of an inadequate sump level would be an increase in the radiological release in the event of a large break LOCA. To ensure adequate sump level regardless of refueling cavity drainage, the emergency operating procedures will ensure that RWST contents are transferred to the containment via ECCS or containment spray.

Operability evaluations concluded that the other effects of a reduced containment sump level would not result in a significant change in the consequences of the design basis accident. These other effects of reduced sump level include:

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

(1) Adequate NPSH would be available for ECCS pumps, even at the reduced sump levels postulated herein.

(2) Sump pH would be reduced (more acidic) due to the retention of caustic spray additive in the refueling cavity. However, the lower sump pH would not have adversely affected the environmental qualification of equipment subjected to containment spray during the recirculation phase and it would not have adversely affected the retention of radioactive iodine in the sump water.

Based on the procedure changes described above (corrective actions), we are presently assured that the containment sump level and pH will be adequate following a LOCA. Therefore, whether the reactor cavity drains or not, the current emergency operating procedures provide assurance that radiological consequences of LOCA will not be increased.

Similar Occurrences:

None.