LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Washington Nuclear Plant - Unit 2	0 5 0 0 0 3 9 7	1 OF 6

TITLE (4)

NONWATER TIGHT PENETRATION SEALS IN ECCS PUMP ROOMS COULD RESULT IN COMMON MODE FAILURE FROM FLOODING

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 NUMBERS(S)
0 7	1 3	9 2	9 2	-- 0 3 4	-- 0 2	0 6	2 4	9 3		0 5 0 0 0
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OPERATING MODE (9): 4

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

POWER LEVEL (10): 0 0 0

20.402(b)	20.405(C)	50.73(a)(2)(iv)	77.71(b)
20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.73(c)
20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	X 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)	

Part 21

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
R. E. Fuller, Licensing Engineer	5 0 9 3 7 7 - 4 1 4 8

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 (16)

On July 13, 1992, a Design Engineer determined that selected penetrations in all of the Emergency Core Cooling System (ECCS) pump rooms could fail to perform as a flooding barrier following a design basis flood. This could result in flooding of adjacent ECCS pump rooms. Review and identification of this condition occurred as part of the review process of Plant penetration seals being done per a commitment in LER 89-026. It was later determined that stairwell flooding could result in concurrent flooding of associated ECCS pump rooms due to door seal leakage and may result in common mode failure of the Residual Heat Removal (RHR) capability. This condition is also reportable per 10CFR Part 21 as a deficiency in the seal design of the ECCS pump room penetrations by the Plant Architect/Engineer (A/E), Burns and Roe, Inc.

Immediate corrective actions included hourly fire/flood tours and temporary installation of cameras in stairwells and ECCS pump rooms to provide early warning capability of an unlikely flood condition.

The root causes of deficient penetration seals were less than adequate change management of the penetration seal requirements and inappropriate performance requirements of the sealant material. The root cause of the potential loss of RHR from door seal leakage was management methods did not ensure sufficient information to determine the acceptability of concurrent flooding of the ECCS pump rooms.

ABSTRACT (Contd)

All of the identified inadequate penetration seals in the ECCS pump rooms except for the door seals have been reworked to be water tight.

The safety significance of this condition is negligible. The probability of a flooding event occurring without recognition by the Reactor Operators to mitigate the event is highly unlikely. Also, no event occurred during the period this condition existed that required the penetration seals to perform the flooding barrier function. This condition posed no threat to the health and safety of Plant personnel or the public.

Plant Conditions

Power Level - 0%
Plant Mode - 4

Event Description

On July 13, 1992, a Design Engineer determined that selected penetrations in all of the Emergency Core Cooling System (ECCS) pump rooms could fail to perform as a flooding barrier following a design basis flood. This could result in flooding of adjacent ECCS pump rooms. Review and identification of this condition occurred as part of the review process of Plant penetration seals being done per a commitment in LER 89-026.

There are six ECCS pumps that are in compartments surrounding Primary Containment at the 422-foot elevation. Flooding can occur from various events to an elevation of 466 feet. These events include a long term passive failure of an ECCS pump seal or valve bonnet following a LOCA, or moderate energy pipe cracks in the Reactor Building resulting in flooding of the stairwells or the ECCS pump rooms. The penetration seals protect against common mode failure of ECCS equipment from these flooding events.

During review of ECCS pump room pressurization due to flooding, some of the penetrations in the ECCS pump room walls were found to be fire barrier sealed with BISCO silicone foam SF-20. The silicone foam is not qualified or rated as a water tight seal by the vendor for pressures greater than 0.25-inches w.g. The FSAR states that the ECCS pump rooms are water tight compartments designed to withstand a static head of 44 feet w.g. Therefore, the potential exists for internal flooding among redundant ECCS pump rooms if the silicone foam is exposed to design basis flooding.

The initial review found approximately 377 penetrations through walls of the ECCS pump rooms where unqualified sealant materials were used. Further review identified an additional 234 penetrations requiring evaluation. The reasons for the additional penetrations included: (1) the flooding analysis calculated a two foot higher flood level than that stated in the FSAR; (2) long term integrity of the boots used to seal the exterior side of the exterior wall penetrations is questionable; (3) the Biological Shield Wall portion of the rooms were not considered in the original scope of problem barriers, and (4) testing of water seal configurations revealed that threaded connections previously considered to be water tight were a leakage path. The majority of the nonwater tight seals are internal conduit seals that contain cables. The majority of the penetration sizes of concern are less than four inches in diameter. Approximately 100 of the penetrations are sealed with a fire rated sealant, which is qualified and acceptable for use as a water pressure sealant. Therefore, approximately 500 penetrations required rework to install a qualified watertight seal.

Immediate Corrective Action

Hourly flood tours were initiated in appropriate areas of the Plant to ensure mitigation measures could be implemented before the operability of redundant ECCS equipment is compromised due to flooding. In addition, temporary cameras were installed in selected stairwells and ECCS pump rooms to provide additional early warning capability to the Reactor Operators in the unlikely event of a flooding condition. The camera monitors are continuously monitored by personnel for flooding conditions. ECCS pump room flood level instrumentation and corresponding Control Room annunciation were verified operable. In addition, non-Class 1 sump alarms in the ECCS pump rooms are also available to alert the Operators of a possible flooding condition. A Plant procedure was developed to give the Plant Operators direction on how to mitigate a variety of postulated accident conditions. Equipment was prestaged, such as ladders, portable lights, hoists over access hatches, etc., to expedite mitigation of postulated accident conditions. The lowest penetration height of approximately 8 feet above the floor of the ECCS pump rooms provides adequate time for the Operators to mitigate a flooding event and prevent flooding of an adjacent ECCS pump room. Practice exercises performed with the new procedure verified the time needed for the operators to implement the mitigating actions. These actions were completed prior to startup from the refueling outage.

Further Evaluation and Corrective Action

A. Further Evaluation

1. This event is considered reportable per 10CFR50.73(a)(2)(ii)(A) and (B) as a condition which was unanalyzed and was outside the design basis of the Plant. The BISCO silicone foam in selected ECCS pump room common wall penetrations would not prevent a common mode failure of safety related equipment from a design basis flooding event. This condition is also reportable per 10CFR50.73(a)(2)(v)(A), (B), and (D) as a condition alone that could have

prevented the fulfillment of the safety function of systems needed to shutdown the reactor and maintain it in a safe shutdown condition, remove residual heat, and mitigate the consequences of an accident.

The NRC was verbally notified on July 13, 1992, at 1614 hours PST per 10CFR50.72(b)(2)(i) as a degraded condition found while shutdown.

This condition is also reportable per 10CFR Part 21 as a deficiency in the seal design of the ECCS pump room penetrations by the Plant Architect/Engineer (A/E), Burns and Roe, Inc. The deficiency resulted in the possible inability of the ECCS pumping systems to perform their safety function in the unlikely event of a design basis flooding condition.

2. In 1978, the NRC issued IE Circular Number 78-06 which required divisional ECCS equipment installed in water tight rooms to preclude common mode flooding. Holders of reactor operating licenses were instructed to assure that pathways that could lead to common flooding of redundant equipment did not exist in their facilities. In 1978 the WNP-2 FSAR was issued stating, "The [reactor building] compartments, comprising interior walls and building exterior walls and doors and penetrations therein, are designed so that any one compartment at a time can withstand flooding to elevation 466'-3", slightly above the operating level of the suppression chamber pool, which is 44 feet above the top of the foundation mat." The current revision of the FSAR, Revision 44, contains this statement.

   The A/E's 1980 design specification for penetration seals to be installed at elevations below 471 feet in the Reactor Building required them to be water tight to a pressure of 35 feet w.g. This did not agree with the FSAR statement of 44 feet w.g. on flooding pressure. The design specification for the seals was changed later in the same year to 46 feet w.g. to account for increased pressure due to seismic sloshing. In December of 1982, the A/E inappropriately reduced the seal pressure requirement to 25 feet w.g. for seals installed between elevations of 461.5 feet and 436 feet. This requirement is less than what the actual pressure would be of 30 feet w.g. at 436 feet elevation with the water level at 466 feet elevation. At the same time the maximum pressure requirement for seals installed below 436 feet was also inappropriately reduced to 39 feet w.g., which is less than the 44 feet w.g. indicated in the FSAR. In February of 1983, the A/E deleted the water tight pressure requirement for penetration seals entirely. The basis for this change was not documented.

3. During evaluations to consider additional flood monitoring instrumentation as required by Revision 0 of LER 92-034, a Design Engineer determined that the doors leading into selected ECCS pump rooms from the stairwells would not preclude leakage into the rooms. The condition of possible concurrent flooding from stairwell flooding is limited to the RHR "C" and Low Pressure Core Spray (LPCS) pump rooms, or the RHR "A" and the Reactor Core

Isolation Cooling (RCIC) pump rooms. This condition was previously recognized and was deemed acceptable because there would still remain redundant systems to bring the Plant to a safe cold shutdown. Part of the study to consider additional flood monitoring instrumentation will be to reevaluate this condition.

4. The root causes of inadequate penetration sealant in the ECCS pump rooms were: 1) Less Than Adequate Change Management because System Interaction Was Not Considered, and 2) Inappropriate Performance Requirements of Plant Equipment Design. With respect to the first root cause, the water tight pressure requirement for the seals was deleted without consideration by the A/E of common mode failure of ECCS equipment due to flooding. The second root cause is the result of inconsistent performance requirements of the sealant material and design with regard to the design basis requirements of the ECCS pump rooms.

   The root cause of the potential common mode failure of the RHR System due to concurrent room flooding from stairwell flooding was management methods were less than adequate to ensure there was sufficient information to support the acceptability of door leakage.

5. There were no other structures, components, or systems inoperable prior to the event which contributed to the event.

B. Further Corrective Action Taken

1. A contractor was retained to perform testing on a variety of sealant materials that will satisfy the water pressure requirements and compatibility with existing fire barrier sealant.

   Selection of the sealant materials was completed October 23, 1992.

2. Work on the wall penetrations in the affected ECCS pump rooms was completed June 11, 1993, to be water tight.

C. Further Corrective Action

1. An evaluation will be completed and corrective action plan established by November 30, 1993, to determine the best course of action to resolve the issue of potential flooding of the above described ECCS pump rooms through the nonwater tight doors.

2. With the rework of the penetration seals completed, it is no longer necessary to maintain a continuous surveillance camera watch to ensure adequate time for detection and mitigation of a flood. However, hourly flood watch tours have been implemented until further evaluation indicates that flooding consequences in the stairwells are acceptable or additional doors are installed to prevent flooding of associated pump rooms. The hourly flood tours in combination with the Class 1 leak detection provided in each room are considered adequate to ensure timely detection of any flood condition and to initiate the necessary mitigation actions.

Safety Significance

The safety significance of this condition is negligible. The source of flooding is from moderate energy line breaks rather than from high energy line breaks. Therefore, recognition of the condition before significant flooding occurs is more likely. In addition, there are Class I level indications in each of the ECCS pump rooms and sump pump monitors to provide reliable flooding information to the Reactor Operators. The probability of a flooding event occurring without recognition by the Reactor Operators to mitigate the event is highly unlikely. Also, no event occurred during the period this condition existed that required the penetration seals or the door seals to perform the flooding barrier function. This condition posed no threat to the health and safety of Plant personnel or the public.

Similar Events

LER 89-026 documents identification of selected Steam Tunnel penetration seals that could have failed to withstand the internal pressure from a design basis Main Steamline break. A commitment made in LER 89-026 to review Plant penetration seals for pressure requirements identified the condition of the ECCS pump room penetration seals. This review has been completed, and no other penetration seals were identified that would be needed to withstand pressure under accident conditions.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
High Pressure Core Spray System	BG	PEN
Low Pressure Core Spray System	BM	PEN
RHR/Containment Spray	BO	PEN
Reactor Core Isolation Cooling System	BN	PEN