

# CATEGORY 1

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ACCESSION NBR: 9807220051      DOC. DATE: 98/07/17      NOTARIZED: NO      DOCKET #  
 FACIL: 50-397 WPPSS Nuclear Project, Unit 2, Washington Public Powe      05000397  
 AUTH. NAME      AUTHOR AFFILIATION  
 PFITZER, B.      Washington Public Power Supply System  
 BEMIS, P.R.      Washington Public Power Supply System  
 RECIP. NAME      RECIPIENT AFFILIATION

SUBJECT: LER 98-011-00: on 980617, ECCS pump room flooding due to FP  
 sys pipe break was noted. Caused by inadequate design of FP  
 sys. Detailed review of FP sys design was conducted.  
 W/980717 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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July 17, 1998  
GO2-98-127

Docket No. 50-397

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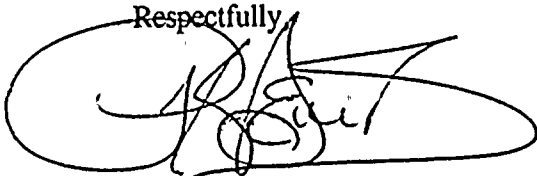
Gentlemen:

Subject: WNP-2, OPERATING LICENSE NPF-21  
LICENSEE EVENT REPORT NO. 98-011-00

Transmitted herewith is Licensee Event Report No. 98-011-00 for WNP-2. This report is submitted pursuant to 10 CFR 50.73 and discusses the items of reportability, corrective action taken, and action to preclude recurrence.

Should you have any questions or desire additional information pertaining to this report, please call me or P.J. Insera at (509) 377-4147.

Respectfully,



P.R. Bemis  
Vice President, Nuclear Operations  
Mail Drop PE23

Attachment

cc: EW Merschhoff - NRC RIV  
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# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) <b>Washington Nuclear Plant - Unit 2</b>	DOCKET NUMBER (2) <b>50-397</b>	PAGE (3) <b>1 OF 5</b>
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TITLE (4)  
**ECCS Pump Room Flooding Due to Fire Protection System Pipe Break**

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	17	98	98	011	00	07	17	98	N/A	

OPERATING MODE	3	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)									
POWER	0	20.402(b)			20.405(c)			50.73(a)(2)(iv)			73.71(b)
		20.405(a)(1)(i)			50.36(c)(1)			50.73(a)(2)(v)			73.71(c)
		20.405(a)(1)(ii)			50.36(c)(2)			X 50.73(a)(2)(vii)			OTHER
		20.405(a)(1)(iii)			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 <b>Bill Pfitzer, Licensing Engineer</b>	TELEPHONE NUMBER (Include Area Code) <b>509-377-2419</b>

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)										
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED	MONTH	DAY	YEAR
YES	(If yes, completed EXPECTED SUBMISSION DATE).			NO			

**ABSTRACT:**  
 At ~13:43 on June 17, 1998, with the plant shutdown in Mode 4 and RHR A in shutdown cooling mode, a significant water hammer event in the plant fire protection system piping resulted in the catastrophic failure of fire protection valve FP-V-29D located in the reactor building northeast stairwell. Water from the ruptured fire protection valve flooded the stairwell and the Residual Heat Removal C (RHR C) and Low Pressure Core Spray (LPCS) rooms located on elevation 422. Due to water covering the system keep-fill pumps, control room personnel started RHR B in suppression pool cooling mode to maintain system operability. After verifying no fire or threat of fire, Operations personnel shut off the operating fire protection pumps and terminated the source of flooding. An Unusual Event was declared, and supplemental fire protection personnel and equipment were called to standby on-site until the fire protection system operability could be reestablished.

The cause of event was determined to be inadequate design of the fire protection system. Several contributing factors exacerbated the event.

Just prior to the event the plant was shutdown, and during the event two systems (one from each electrical division) were maintained available for shutdown cooling at all times. Therefore, the safety consequence of this event was determined to be low.

**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Washington Nuclear Plant - Unit 2	50-397	98	011	00	2 OF 5

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

**Event Description**

At ~13:43 on June 17, 1998, with the plant shutdown in Mode 4 and RHR A [BO] in shutdown cooling mode, a significant water hammer event in the plant fire protection system [KP] piping resulted in the failure of fire protection valve FP-V-29D located in the reactor building northeast stairwell (floor level elevation 422). Subsequent investigation determined that the water hammer was due to a pre-action system actuation from smoke generated as a result of maintenance activities in a diesel generator room. Water from the ruptured fire protection valve flooded the stairwell to a level sufficient to cause deformation and failure of the fire door leading to an adjacent vestibule. From the vestibule, flood water entered the RHR C room through the water-tight door [DR] which had not been properly dogged closed prior to the event.

At ~13:44 alarms associated with the actuation of the pre-action fire protection systems and the auto start of the fire pumps alerted control room personnel to a potential fire in the diesel generator corridor. At ~13:45 high water level alarms for the RHR C room also alerted the control room to water leakage in the reactor building. Control room personnel entered into the Emergency Operating Procedures (EOPs) based upon this alarm.

Due to rising water level in the RHR C room, RHR-P-3 (the keep-fill pump for RHR B and RHR C) tripped on electrical fault. Control room personnel immediately started RHR B (located in a non-effected room) in suppression pool cooling mode to maintain the system piping full and system operational. RHR C pump room subsequently flooded to approximately elevation 439 feet (about 17 feet above the floor), submerging the RHR C pump motor and other equipment in the room.

As a result of the loud noise made by the water hammer, a Shift Support Supervisor in the area conducted a visual inspection and noted the flooding in the stairwell. The main control room was promptly notified, and at 13:59, after verifying that there was no fire or threat of fire, control room personnel secured the fire pumps, terminating the source of flood water.

At ~1401, high water level alarms for the Low Pressure Core Spray (LPCS) [BM] pump room annunciated in the main control room. Control room personnel also noted this as an entry into the EOPs. A floor drain isolation valve (FDR-V-609) [ISV] had failed to automatically close, providing a flow path from the RHR C room sump to the floor drains in the LPCS room. Water flowed through this pathway from the sump up through the drains in the LPCS pump room. Subsequent valve closure from the control room was unsuccessful.

With the water level rising in the LPCS room, LPCS-P-1 was started to maintain system piping full and the system operational, and LPCS-P-2 (the keep-full pump for LPCS and RHR A) was secured. At 14:14 the Shift Manager declared an Unusual Event due to the non-functional fire protection system. Both the Technical Support Center (TSC) and the Operations Support Center (OSC) were subsequently staffed to obtain additional assistance to coordinate plant response and recovery activities.



**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Washington Nuclear Plant - Unit 2	50-397	98	011	00	3 OF 5

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

At ~14:27 the Hanford Fire Department was notified, and responded with fire protection personnel and equipment on site at ~14:43. (This fire protection capability was retained throughout the event and until the fire protection system was restored to an operable status.)

Subsequently, due to the rising water level in the room, LPCS-P-1 was secured. The water level increase in the LPCS room was stopped by the use of portable submersible pumps and manual closing FDR-V-609 by manipulation of the remote pneumatic actuator. The water level in the LPCS room peaked at about 6 inches above the maximum safe operating level, or about 5 1/2 feet above the floor.

Action was initiated to pump the water from the flooded areas to the storm drains and radwaste system using portable submersible pumps. This effort resulted in a reduction of flood water to about 6 inches above floor level by ~22:05 that evening.

The TSC and OSC were deactivated about 28 hours after initiation of the event. The Unusual Event emergency classification was retained until the fire protection system was restored to service three days later.

#### Immediate Corrective Action

Problem Evaluation Requests were initiated for multiple aspects of the event including the failure of fire protection valve FP-V-29D, the water tight door which was found undogged, and the failure of FDR-V-609 to automatically close.

#### Further Evaluation

An investigation was initiated into the cause of the failure of FP-V-29D and the subsequent flooding. A review of plant data revealed that, as designed, the fire protection jockey pump was running to keep the system pressurized prior to the event. Due to smoke generated from maintenance activities in a diesel generator room, pre-action sprinkler system 66 [SRNK] actuated and charged the associated spray header piping. Actuation of system 66 resulted in a system pressure drop causing the automatic starting of three main fire pumps. The resulting fire protection system pressure increase caused the inadvertent actuation of pre-action system 81. About 30 seconds after start of the three main fire pumps, a fourth diesel driven fire pump auto started as designed. A detailed analysis was performed to determine the hydrodynamic cause of the water hammer. The analysis indicated that with only the jockey pump running, actuation of pre-action system 66 alone could have generated forces sufficient to cause the failure of FP-V-29D, and that the subsequent actuation of system 81 was incidental to this event.

As a part of the investigation of this event a comparison was made between this flooding event and the WNP-2 flooding analysis. It is estimated that during this event the flooding rate from the failed valve into the stairwell was approximately 8000 to 10,000 gpm, with the total water volume of the flood about 164,000 gallons.



**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Washington Nuclear Plant - Unit 2	50-397	98	011	00	4 OF 5

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

Review of the WNP-2 flooding analysis revealed that flooding of this magnitude is outside the plant's design basis. The maximum flow rate for the design basis flood for this area of the plant is about 300 gpm, which provides ample time for plant personnel to isolate the source of flooding or take other mitigating actions prior to reaching maximum safe water levels in the ECCS pump rooms, irrespective of water tight door integrity and floor drain valve operability.

Cause of Event

The cause of the event is inadequate fire protection system design. The system was configured and operated such that destructive forces may be generated during fire protection system actuations with only the jockey pump running, such as occurred during this event.

Further Corrective Action

A detailed review of the fire protection system design will be conducted to determine a long term resolution to the current inadequate design.

As interim measures, sufficient main fire pumps will be kept running and nitrogen gas cushions will be maintained in the top portion of fire protection system reactor building risers RB-1 and RB-2 to mitigate the effects of potential water hammer during times when the fire protection system is operable. Prior to plant restart this interim system configuration was tested and demonstrated adequate to prevent water hammer due to fire protection system actuation.

The testing was conducted per an approved plant procedure, and involved actuation of a single preaction system, and simultaneous actuation of two preaction systems. During the testing the system was monitored by a combination of video surveillance cameras, accelerometers, pressure guages and strain guages. No water hammer was observed and no excessive strain was recorded.

The root cause analysis for the event identified many contributing causes to the flooding of the two ECCS rooms, including inadvertent fire protection system actuation, preventative maintenance practices on water tight doors and floor drain isolation valves, and human performance issues. PERs are being dispositioned and have identified corrective actions to address these contributing causes.



**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Washington Nuclear Plant - Unit 2	50-397	98	011	00	5 OF 5

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

Assessment of Safety Consequences

Both RHR A (Div I) and RHR B (Div II) are in rooms which were unaffected by the flooding. The control room staff maintained the operability of RHR B by manually starting RHR-P 2B in the suppression pool cooling mode immediately after the keep-fill pump for that system was rendered inoperative by the rising water level. RHR A was previously running in shutdown cooling, and as such, the loss of the keep-fill pump for that system did not challenge it's operability.

Therefore, with the plant shutdown in Mode 4, and with two systems (one from each electrical division) available for shutdown cooling, adequate safety margin was maintained and the safety consequence of this event is considered low.

Similar Events

No other events of plant flooding due to broken fire protection piping have been reported at WNP-2.

LER 92-034 reported the potential for flooding in the ECCS rooms due to inadequate penetration seals and door seals.