

**1995 LOSS OF FEEDWATER FLOW
INITIATING EVENTS**

PLANT	LER	PWR	FP	IPF	SCR	FI	L8	R	COMMENTS
Palisades	003	46	2T	LOF	M				Malfunction of MFP 'A' and MFP 'B' tripped on overspeed during the operator's attempt to stabilize SG level.
Diablo Canyon 1	015	50	2T	LOF	M				Only operating MFP tripped on high discharge pressure due to shorted speed probe that drove MFP steam valve full open.
ANO 1	004	40	2T	LOF	M				MFP 'B' OOS, 'A' MFP went to min speed (2000 rpm) due to computer chip programming error.
Brunswick 1	018	58	2T	LOF	A		Y		Air entered condensate/FW lines causing loss of all FW flow and tripping reactor on low level
Farley 2	005	30	2T	LOF	M				Failure of EH fluid supply line tripped only operating SGFP.
Farley 2	005	33	2T	LOF	M				Failure of EH fluid supply line tripped only operating SGFP.
Hatch 2	001	100	2T	XFW	A	LOF		N	Operator shorted power supply to level transmitter causing indicated low level. Feed pumps increased flow, tripping main turbine and MFW pumps.
Catawba 2	005	14	2T	LOF	M				Improper realignment of FW heaters isolated condensate flow, which tripped both MFW pumps.
Comanche 1	003	100	2T	LOF	M				During test, an inverter transferred to a de-energized bus, causing MFW pump low oil pressure signal that tripped both MFW pumps.

Key:

PWR: power level

FP: number and type of FW pumps

IPF: initial plant fault

SCR: type of scram - manual (M) or automatic (A)

FI: functional impact

L8: BWR normal transient response reached level 8

R: recoverable

LOF: loss of all FW flow

XFW: excessive FW flow

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Sequoyah 1	008	50	?	LOF	A				MFP 1B OOS, MFP 1A tripped due to personnel error.
Pilgrim	005	100	3M	GEN	A	LOF		N	All FW lost about 1 hour after scram (A pump developed an oil leak, B pump failed to start, C pump had a seal leak). RCIC used for level control.
Oconee 3	003	42	2T	LOF	A				Operating feed Pump failed due to equipment failure causing low hydraulic oil pressure and coincident low discharge pressure.
Oconee 3	002	100	2T	LOF	A				Blown fuses in the Integrated Control System tripped MFPs as designed, causing automatic reactor scram
Peach Bottom 3	005	100	3T	ELEC	A			Y	Inverter failure caused momentary loss of power, reactor feed pumps locked up and recirc pumps ran back causing high water level and reactor scram. RFPs used to restore level after level decreased.
Oconee 2	005	100	2T	LOF	A				Loss of power to the Integrated Control System due to tripped breaker tripped MFWPs as designed (indicating false high SG level) and caused turbine to trip and reactor to scram.
Oconee 2	002	54	2T	LOF	A				2B MFWP tripped on low oil pressure. Automatic control of 2A MFWP was erratic resulting in FW oscillations continuing on manual control. 2A MFWP tripped later on high discharge pressure.
Oconee 1	002	100	2T	LOF	A				Loss of power to the Integrated Control System due to inappropriate action tripped MFWPs as designed (indicating false high SG level) and caused turbine to trip and reactor to scram.
Big Rock Point	010	54	2M	LOF	M				Operating feedpump lost due to air drawn into to condensate system

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LOF: loss of all FW flow

GEN: generator fault

ELEC: electrical fault

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PLANT	LER	PWR	FP	IPF	SCR	FI	L8	R	COMMENTS
Palo Verde 2	004	85	2T	LOF	A				Non-class 1E 4.16 kV switchgear load shed, causing loss of 2 of 3 condensate pumps, trips of MFWPs and reactor scram on low level.
Comanche Peak 2	011	100	2T	IFW	A	LOF		N	Valve failure caused loss of heater drain system, MFP 2-B trip, turbine runback and reactor trip. While recovery in progress, MFP 2-A tripped for no apparent reason about an hour after scram.
Seabrook	001	100	2T	LOF	M				Inappropriate valve manipulations tripped both MFWPs on low suction pressure.
Salem 2	002	100	2T	LOF	M				An electrical short due to equipment failure produced erroneous maximum speed demand causing flow through the MFWPs to increase resulting in in the low suction pressure and the pump trips. Operator initiated manual reactor scram.
Surry 2	006	95	2 M	LOF	A				Electrical circuit failure caused all three Main Feedwater Regulating Valves to go shut, isolating feedwater flow to all three SGs. Low SG levels actuated reactor scram.
Peach Bottom 3	002	23	3T	LOF	A				Vibration levels of the C Reactor Feed Pump tripped the pump and stand by RFP B failed to respond. Reactor scrambled on low water level.
Salem 1	002	16	2T	TUR	M	LOF		Y	Turbine bypass controller failure caused bypass valves to open and SG level to swell to high-high level, resulting in turbine trip and feedwater isolation signal, which tripped the operating feedwater pump.

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R: recoverable

LOF: loss of all feedwater flow

IFW: insufficient feedwater flow (FW flow decreases)

TUR: turbine fault

**1992 LOSS OF FEEDWATER FLOW
INITIATING EVENTS**

PLANT	LER	PWR	FP	IPF	SCR	FI	L8	R	COMMENTS
Wolf Creek	002	100	2T	LOF	A				Loss of safety-related bus caused MFW valves to close and MFW pumps to decrease speed. Reactor scrambled on low level.
Comanche Peak 1	019	100	2T	LOF	M				Spurious signal from SSPS caused trip of both MFWPs and closure of all feed reg valves and the FW isolation valve for SG 4.
Comanche Peak 1	014	100	2T	LOF	M				Spurious signal from SSPS caused trip of both MFWPs and closure of all feed reg valves and the FW isolation valve for SG 4.
Seabrook	017	12	2T	LOF	A				Changes in reactor power caused SG levels to oscillate, resulting in high level isolation of all FW flow and a turbine trip.
Nine Mile Point 2	017	55	3M	LOF	A				Personnel error caused overloading of condensate system, resulting in trip of the operating FW pump on low suction pressure.
McGuire 2	006	100	2T	LOF	M				Equipment failure caused trip of condensate booster pumps, resulting in trip of all MFWPs and a turbine trip.
Hatch 2	009	100	2T	LOF	A				Operator error caused loss of power to an essential 600 V bus that resulted in loss of all FW.
Trojan	028	60	2T	LOF	M				Operator error caused loss of suction pressure for the operating MFWP, resulting in a pump trip.
Fermi 2	012	98	2T	LOF	M				Operator error resulted in tripping both reactor feed pumps.
Calvert Cliffs 2	005	100	2T	LOF	M				Condensate pumps lost power when the feeder breaker cubicle door was closed. When the condensate pumps coasted down, the MFWPs lost suction pressure and tripped.
Oconee 3	003	100	2T	LOF	A				Loss of power to the ICS due to design and manufacturing deficiencies caused MFWPs to trip.

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Dresden 3	021	97	3M	LOF	A				Condensate booster pump internal motor fault caused trip of all running FW pumps. Stand-by FWP 3B started automatically. Reactor scrammed on low level. 3A FWP was restarted by the operator. Shortly after both 3A and 3 B pumps tripped on low suction pressure. 3B automatically restarted and restored level. 3B pump tripped on high water level

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**1991 LOSS OF FEEDWATER FLOW
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PLANT	LER	PWR	FP	IPF	SCR	FI	L8	R	COMMENTS
Monticello	019	100	2M	ELEC	A	LOF		N	Failed insulator caused lockout of station reserve transformer, which interrupted normal off-site power to feed water system.
Oconee 3	007	95	2T	LOF	A				Particles in a transfer switch caused failure of demineralizer master flow controller, tripping condensate booster pumps and feed water pumps.
Kewaunee	010	99	2M	LOF	A				When restoring lineup following maintenance, feeder breaker tripped open, closing both feed reg valves and tripping reactor.
Maine Yankee	006	12	2M	LOF	A				Operator error caused trip of only operating feed pump, standby pump failed to start; feed pump restarted shortly before plant scram
ANO - 1	005	100	2T	LOF	A				Circuit breakers for main feed water pumps control oil pumps that were cross-tied to support maintenance tripped on OC, tripping MFPs.
D. C. Cook 1	004	100	2T	ELEC	A	LOF			During generator reactive limits testing, reactor scrambled on low voltage on 2 of 4 RCP busses, causing isolation of all MFW pumps.
Calvert Cliffs 2	005	8	2T	LOF	A				Failure of a connector caused reduction in discharge pressure of loss of all feed water flow and reactor trip.
Hatch 1	007	100	2T	RECR	A	LOF		Y	Recirc pumps unexpectedly tripped, tripping all MFWPs on high level.
Hatch 1	017	100	2T	INSTR	A	LOF		N	Personnel error caused depressurization of level instruments, resulting in high level trip of main turbine and all feed water pumps, followed by reactor scram and turbine stop valve closure.
Millstone 2	004	100	2T	IFW	M	LOF		Y	Multiple trips of SGFPs resulted in manual scram.
Farley 1	010	100	2T	LOF	M				Degraded voltage in main turbine DEHC caused closure of turbine governor valves, load rejection, and trip of all main FW pumps.

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Limerick	009	100	3T	TURB	A	LOF		Y	Loss of 125 Vdc to main turbine EHC caused scram, B & C RFPs tripped to prevent overfilling, A RFP tripped on low suction pressure.
Farley 2	002	34	2T	LOF	M				Failure of EH fluid supply line tripped only operating SGFP.
Nine Mile Point 2	023	55	3M	LOF	A				Starting second FW pump caused transient that tripped all FW pumps.
Catawba 1	015	92	2T	LOF	A				Control air line to heater drain tank outlet control valve broke, causing valve to close, resulting in low suction pressure trip of all feed pumps.
Catawba 1	019	100	2T	LOF	A				Error in calibration caused FW control system to reduce SG level setpoint, resulting in closure of FW control and bypass valves, tripping all FW pumps on high discharge pressure.
Grand Gulf	004	35	2T	LOF	A				Condensate pump min flow valve failed to open during shutdown, resulting in loss of all FW flow.
Grand Gulf	007	100	2T	LOF	A				Vendor design error in load shedding and sequencing system caused BOP load shedding.
Seabrook	001	100	2T	TURB	A	LOF			Procedure error caused trip of main turbine EHC pumps and Rx scram followed by loss of all FW pumps on false indication of SG high level.

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ELEC: electrical fault

RECR: recirculation system fault

INSTR: instrumentation fault

TURB: turbine fault