

Table 1 BWR DHR Modifications Credited in the IPE

Plants		Enhanced Strategies		Core Damage Frequency		Plant Modifications			Modified CDF	
		Containment Venting	Alternate Injection	IPE Total CDF*	IPE DHR CDF*	Mod 1	Mod 2	Mod 3	IPE Revised Total CDF*	IPE Revised DHR CDF*
<i>1/2/3</i>	Millstone 1	X	X ⁽¹⁾	N/A	N/A				1.10E-5	N/A
	Nine Mile Point 1	X	X ⁽²⁾	N/A	N/A	Installed hardened vent			5.5E-6	3.5E-7 ⁽³⁾
	Dresden 2&3	X	X ⁽²⁾	1.85E-5	1.4E-5	Implemented procedure to align LPCI or CS pumps to CST when suppression pool cooling cannot be established			3.74E-6	N/A
	Oyster Creek	X	X ⁽²⁾	N/A	N/A	Installed hard-piped containment vent system	Incorporated into operator training the role of an operator in successful initiation of the CS system		3.7E-6	1.46E-7 ⁽⁴⁾
<i>3/4</i>	Quad Cities 1&2	X	X ⁽²⁾	N/A	N/A	Installed hard-piped containment vent system			1.2E-6	3.6E-7
	Pilgrim 1	X	X ⁽⁵⁾	N/A	N/A	Installed hardened wetwell vent			2.84E-5	8.8E-7 ⁽⁴⁾
	Peach Bottom 2&3	X	X ⁽⁵⁾	N/A	N/A	Installed torus hard piped vent			6E-6	3E-6
	Brunswick 1&2	X	X ⁽⁵⁾	2.7E-05	6.75E-06	Installed hardened wetwell vent			1.1E-5	1.8E-6

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3/4 (cont.)	Fermi 2	X	X ⁽⁵⁾	N/A	N/A	Installed hardened vent (much of vent path was already hard-piped to refueling floor)			5.6E-6	3.6E-6
	Browns Ferry 2		X ⁽²⁾	4.8E-5	3E-5				N/A	N/A
	Vermont Yankee	X	X ⁽²⁾	N/A	N/A	Installed torus hard piped vent			4.3E-6	1E-7 ⁽⁴⁾
	Hatch 1&2	X	X ⁽⁵⁾	N/A	N/A	Installed hard piped vent	Revised procedures to allow tripping of RHR/CS pumps upon loss of HVAC to insure operation of one pump without room cooling	Remove manually – operated common discharge valve in PSW system	U1: 2.1E-5 U2: 2.2E-5	U1: 5.0E-6 U2: 4.6E-6
	Monticello	X	X ⁽⁵⁾	1.95E-5	1.7E-5 ⁽⁶⁾				N/A	N/A
	Duane Arnold	X	X ⁽⁵⁾	N/A	N/A	Installed hard piped vent			1.5E-5	5.9E-6
	Cooper	X	X ⁽⁵⁾	7.97E-05	7.74E-6 ⁽⁶⁾				N/A	N/A
	Limerick 1&2	X	X ⁽²⁾						4.3E-6	6.9E-7
	Hope Creek	X	X ⁽⁵⁾	1.29E-5	5.45E-7 ⁽⁶⁾	Installed the hardened vent			N/A	N/A
	Susquehanna 1&2	X	X ⁽⁵⁾	1.1E-7 ⁽⁷⁾	N/A				N/A	N/A
	Fitzpatrick	X	X	1.92E-06	Less than 2% of Total CDF	Installed hardened vent	Increase the RCIC turbine exhaust pressure trip setpoint		N/A	N/A

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5/6	Clinton	X	X ⁽⁵⁾	5.5E-6	5.2E-06				N/A	N/A
	River Bend	X	X ⁽⁵⁾	1.55E-05	1.55E-5				N/A	N/A
	Perry 1	X	X ⁽⁵⁾	N/A	N/A		Reduction of out-of-service time for certain critical components such as HPCS	Fast firewater tie between fire protection and HPCS	1.17E-5	5.1E-6
	Grand Gulf 1	X	X ⁽⁵⁾	N/A	N/A	Bypass RCIC steam tunnel high temperature trip signal when PSW is unavailable and no steam line break has occurred			1.72E-5	N/A
	Nine Mile Point 2	X	X	3.1E-05	9.1E-06				N/A	N/A
	LaSalle 1&2	N/A	N/A	4.74E-05	N/A	N/A	N/A	N/A	N/A	N/A
	Washington Nuclear Power 2	X	X	1.75E-05	1.4E-06				N/A	N/A

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Notes:

- * CDF is calculated in terms of a per year basis.
- (1) Fire water system can be used as an alternate low pressure injection source, but not credited in the IPE.
- (2) An additional system is used as an alternate low pressure injection source.
- (3) The DHR-related CDF does not include SBO.
- (4) The DHR CDF includes only the containment heat removal part of the DHR.
- (5) More than one system is used as alternate low pressure injection sources.
- (6) Based on the responses to the RAIs
- (7) Based on the 15-month cycle

Table 2 PWR DHR Modifications Credited in the IPE

Plants		Enhanced Strategies			Core Damage Frequency		Plant Modifications			Modified CDF	
		Primary F&B	2ndry Depress [†]	Alternate AFW Source	IPE Total CDF*	IPE DHR CDF*	Mod 1	Mod 2	Mod 3	IPE Revised Total CDF*	IPE Revised DHR CDF*
CE	San Onofre 2&3		X		3.0E-5	2.30E-5				N/A	N/A
	Millstone 2	X	X	X	1.1E-4	N/A	AFW system related (See table A-4)	Increase training on F&B and modified the PORV control circuit logic	Increase Testing of LPSI CVs for reverse flow	3.4E-5	N/A
	St. Lucie 1&2	X		X	U1: N/A	N/A	Implemented new AO procedure to have Ops fill CST from treated water storage tank			U1: 2.3E-5	<2E-5
					U2: N/A	N/A				U2: 2.6E-5	<2E-5
	Palisades	X	X	X	5.1E-5	3.0E-5				N/A	N/A
	Fort Calhoun 1	X		X	1.36E-5	N/A				N/A	N/A
	Palo Verde 1,2,&3		X		N/A	N/A	Provide backup source of control power for train N AFW pump circuit breaker	Change the source of power for the main steam and feedwater isolation valve logic cabinets	Install two 4.5 MW gas turbine generators	Mods 1&2 ⁽¹⁾ : 9.0E-5 Mod 3: 6.3E-5 ⁽¹⁾	Mods 1&2: 8.1E-5 ⁽¹⁾ Mod 3: 5.6E-5 ⁽¹⁾

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		Primary F&B	2ndry Depress [†]	Alternate AFW Source	IPE Total CDF*	IPE DHR CDF*	Mod 1	Mod 2	Mod 3	IPE Revised Total CDF*	IPE Revised DHR CDF*
CE <i>(Cont.)</i>	Arkansas Nuclear One 2	X ⁽⁶⁾	X	X	3.4E-5	3.0E-5				N/A	N/A
	Waterford 3		X	X	1.7E-5	1.4E-5				N/A	N/A
	Calvert Cliffs 1&2	X		X	3.2E-4	1.4E-4	Provided surveillance on AFW condensate related manual valves to ensure supply of water for AFW if CST is lost or is depleted.	Operator training on inadvertent actuation of ESFAS		2.4E-4	N/A
B&W	Oconee 1,2&3	X	X ⁽⁸⁾	X	1.8E-5	9E-6				N/A	N/A
	Arkansas Nuclear One 1	X		X	4.7E-5	4.7E-5				N/A	N/A
	Crystal River 3	X		X	1.4E-5	N/A				N/A	N/A
	Three Mile Island 1	X		X	4.2E-5	N/A				N/A	N/A
	Davis-Besse	X		X	6.6E-5	N/A				N/A	N/A

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Plants		<i>Enhanced Strategies</i>			<i>Core Damage Frequency</i>		<i>Plant Modifications</i>			<i>Modified CDF</i>	
		Primary F&B	2ndry Depress [†]	Alternate AFW Source	IPE Total CDF*	IPE DHR CDF*	Mod 1	Mod 2	Mod 3	IPE Revised Total CDF*	IPE Revised DHR CDF*
<i>W</i> 2 LOOP	GINNA	X	X	X	N/A	N/A	Changed TS to align pumps to RWST rather than boric acid storage tank while in standby			8.23E-5	3.7E-5
	Point Beach 1&2	X	X	X	1.2E-4	8.0E-5	Revised EOPs on Containment Sump recirculation.	Revised EOPs for aligning alternate AFW water sources from fire water system	Added quick connect mechanism to hook fire water hoses to CST	8E-5	4.6E-5 (less 10% EDG mod and DHR 67%)
	Kewannee	X		X	N/A	N/A	Modifications to improve reliability of turbine-driven AFW pumps			6.65E-5	3E-5 (no-SBO)
	Prairie Island 1&2	X		X	5E-5	N/A				N/A	N/A
<i>W</i> 3 LOOP	Beaver Valley 1	X	X	X	N/A	N/A	Depressurize RCS earlier when HHSI is unavailable	Gag closed a failed open SG safety valve during SGTR sequence to isolate ruptured SG		2.14E-4	N/A
	Beaver Valley 2	X	X	X	1.9E-4	N/A				N/A	N/A
	Robinson 2	X		X	3.2E-4	9.7E-5				N/A	N/A
	Turkey Point 3&4	X	X	X	4.4E-4	N/A				1E-4	N/A
	Shearon Harris 1	X		X	7E-5	7.7E-6				N/A	N/A
	Farley 1&2	X	X	X	1.3E-4	N/A				N/A	N/A

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<i>W</i> <i>3 LOOP</i> <i>(Cont.)</i>	Summer	X	X	X	2.0E-4	N/A				N/A	N/A
	North Anna 1&2	X	X	X	8.0E-5	N/A	Revise test procedures to verify the full flow recirculation valves are closed	Revise procedures to verify that Quench Spray or Recirculation Spray piping is restored after testing	Stagger LHSI pump testing about 45 days apart	Mod 1: 7.6E-5	N/A
										Mod 2: 7.8E-5	
										Mod 3: 7.8E-5	
	Surry 1&2	X	X	X	7.4E-05	N/A				N/A	N/A
<i>W</i> <i>4 LOOP</i>	Braidwood 1&2	X	X	X	2.74E-5	N/A				N/A	N/A
	Comanche Peak 1&2	X		X	N/A	N/A	Revised procedure for manual control of TDAFWP	Revise procedure for re-establishing MFW upon loss of AFW	Revise procedure so as to start standby chilled water train upon auto-start of MDAFW	5.72E-5	1.6E-5
	Indian Point 2	X		X	3.13E-5	N/A				N/A	N/A
	Salem 1&2	X	X	X	Unit 1: 5.2E-5	N/A				N/A	N/A
					Unit 2: 5.5E-5	N/A					
	Vogtle 1&2	X	X	X	N/A	N/A	Revise procedure to have operator manually operate AFW turbine driven pump upon loss of DC power			4.9E-5	N/A

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		Primary F&B	2ndry Depress [†]	Alternate AFW Source	IPE Total CDF*	IPE DHR CDF*	Mod 1	Mod 2	Mod 3	IPE Revised Total CDF*	IPE Revised DHR CDF*
<i>W</i> <i>4 LOOP</i> <i>(Cont.)</i>	Byron 1&2	X	X	X	3.09E-5	N/A				N/A	N/A
	DC Cook 1&2	X	X	X	6.26E-5	N/A				N/A	N/A
	Indian Point 3	X	X	X	N/A	N/A	Revise procedure to have operator open roll-up door upon failure of AFW pump room ventilation	Modify EOP to align city water supply to AFW pumps if CST outlet valves fail		4.8E-5 ⁽²⁾	N/A
	Seabrook	X		X	6.05E-5	N/A				N/A	N/A
	Watts Bar 1	X		X	3.3E-4	N/A				N/A	N/A
	Callaway	X	X	X	5.85E-5	N/A				N/A	N/A
	Diablo Canyon 1&2	X	X	X	8.8E-5 ⁽³⁾	N/A	SI pump suction valve control switch replacement			N/A	N/A
	McGuire 1&2	X	X	X	4E-5	1.6E-5				N/A	N/A
	Sequoyah 1&2	X	X	X	1.7E-4	N/A				N/A	N/A
	Wolf Creek	X	X	X	4.2E-5	N/A				N/A	N/A
	Catawba 1&2	X		X	4.3E-5	7.3E-6				N/A	N/A
	Millstone 3	X			N/A	N/A	Design change to improve cold recirculation	Increase training on AFW system, recovery of main FW and feed and bleed procedures		5.52E-5	N/A
	South Texas 1&2	X	X		4.3E-5	N/A				N/A	N/A

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Notes:

- † Secondary depressurization using condensate pumps.
- * CDF is calculated in terms of a per year basis.
- (1) The IPE provides the improvements in CDF if the following DHR related fixed are performed (PORVs: 6.8E-5 total CDF and 6.0E-5 for DHR; Gas Turbine Generators: 6.3E-5 total CDF and 5.6E-5 for DHR; a Procedure Change: 7.1E-5 total CDF and 6.4E-5 for DHR; and all three modifications: 4.1E-5 total CDF and 4.5E-5 DHR, a reduction of about 55%).
- (2) The original CDF reported in the IPE is 4.4E-5, however, due to some changes in HEP and CCF values the CDF was revised to 4.8E-5.
- (3) The total CDF includes Modification 1.