From: "RILEY, Jim" <jhr@nei.org>
To: <ARK1@nrc.gov>
Date: 03/26/2008 9:02:17 AM
Subject: Draft Generic MSO Lists

Alex,

Attached for your information are drafts of the fire induced circuit failure MSO lists. These were prepared by the NSSS OGs and have gone through one cycle of review by the industry. The lists are the starting point for the industry's methodology for addressing multiple spurious fire induced circuit failures.

We intend to briefly discuss these lists at our MSO meeting this Thursday so it would be beneficial if you reviewed them in advance and were prepared to ask questions about the approach or their content.

Please treat these lists as drafts. We have already distributed them to the industry for a second round of comments and will also disposition any comments the NRC may have on them; so a revised version will be forthcoming.

Thank you,

Jim Riley
Director of Engineering

Nuclear Energy Institute
1776 I St. N.W., Suite 400
Washington, DC 20006
www.nei.org

phone: (202) 739-8137
cell: (202) 439-2459
fax: (202) 533-0193

CC: "RILEY, Jim" <jhr@nei.org>

Mail Envelope Properties (47EA4943.3F9 : 16 : 50169)

Subject:	Draft Generic MSO Lists
Creation Date	03/26/2008 9:01:09 AM
From:	"RILEY, Jim" <jhr@nei.org>
Created By:	jhr@nei.org

Recipients

nrc.gov
OWGWPO04.HQGWDO01
ARK1 (Alex Klein)

Post Office	**Route**
OWGWPO04.HQGWDO01	nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	2007	03/26/2008 9:01:09 AM
PWROG MSO List Rev E.XLS	84992	
BWR Generic MSO List rev 02D-no-names.xls	45568	
Mime.822	183208	

Options

Expiration Date:	None
Priority:	Standard
ReplyRequested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

PWROG GENERIC MSO LIST (WORKING DRAFT REV. E)

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
1	Loss of all RCP Seal Cooling	Spurious isolation of seal injection header flow, ***AND*** Spurious isolation of CCW flow to thermal barrier heat exchanger	Scenario causes loss of all RCP seal cooling and subsequent RCP seal LOCA, challenging the RCS Inventory Control Function. Reference Westinghouse Tech Bulletin 04-22 Rev. 1 for summary of issue. Tech Bulletin references provide additional detail. Seal injection flow isolation can occur at main header or at supply to each individual pump. In addition, scenarios that cause loss of all charging (i.e., multiple pump failure due to loss of suction, non-spurious pump failures such as loss of power, etc.) can cause loss of seal injection. Loss of seal cooling to any individual RCP is a problem (i.e., does not have to occur on all RCPs to be a problem)		B&W CE W
2	Loss of all RCP Seal Cooling	Spurious opening of charging injection valve(s) causing diversion flow away from seals, ***AND*** Spurious isolation of CCW flow to thermal barrier heat exchanger	Scenario causes loss of all RCP seal cooling and subsequent RCP seal LOCA, challenging the RCS Inventory Control Function. Reference Westinghouse Tech Bulletin 04-22 Rev. 1 for summary of issue. Tech Bulletin references provide additional detail. Loss of seal cooling to any individual RCP is a problem (i.e., does not have to occur on all RCPs to be a problem)	TH analysis to show minimum seal injection can be maintained with charging injection full open?	B&W CE W
3	Thermally Shocking RCP Seals	Loss of all Seal Cooling to any RCP(s). See Scenarios 1 & 2, ***AND*** Spurious re-initiation of seal cooling (i.e., seal injection or CCW to TBHX)	Scenario causes RCP seal failure and subsequent RCP seal LOCA, challenging the RCS Inventory Control Function. Reference Westinghouse Tech Bulletin 04-22 Rev. 1 for summary of issue. Tech Bulletin references provide additional detail.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
4	Catastrophic RCP Seal Failure	Loss of all Seal Cooling to any RCP(s). See Scenarios 1 & 2, ***AND*** Fire prevents tripping, or spuriously starts, RCP(s)	Scenario causes catastrophic RCP seal failure and subsequent RCP seal LOCA, challenging the RCS Inventory Control Function. Reference Westinghouse Tech Bulletin 04-22 Rev. 1 for summary of issue. Tech Bulletin references provide additional detail.		B&W CE W
5	RCP Seal No. 2 Failure	Loss of all Seal Cooling to any RCP(s). See Scenarios 1 & 2, ***AND*** Spurious isolation of No. 1 seal leakoff valve(s)	Isolation of the No. 1 seal leakoff line during a loss of all seal cooling event would force the No. 2 RCP seal into a high pressure mode of operation at high temperature, which is beyond the design bases of the No. 2 seal. This could cause catastrophic failure of the No. 2 seal and increase RCS leakage. Reference Westinghouse Tech Bulletin 04-22 Rev. 1. Also reference Letter WOG-05-163 DW-04-004 "Isolation RCP#1 Seal Leakoff".		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
6	Letdown Fails to Isolate and Inventory Lost to CVCS	Spurious opening of (or failure to close) letdown isolation valve(s), ***AND*** Spurious opening of (or failure to close) letdown orifice valve(s)	Scenario causes loss of RCS inventory, challenging the RCS Inventory Control Function. In a typical PFSS Analysis, the CVCS system downstream of the letdown isolation valve(s) and upstream of the VCT isolation valve(s) is not evaluated, and the RCS inventory (letdown) is assumed lost and unavailable for makeup. In reality, additional failures downstream of the letdown isolation valves would have to occur for this RCS inventory to be unavailable for makeup. Also note that the letdown isolation valves and letdown orifice valves are often interlocked such that the isolation valves will not open without the orifice valves being open. Letdown failure to isolate can be a single spurious operation with interlocked valves. Note B&W plants don't have letdown orifice valves. Scenario applicable to B&W is spurious operation of multiple letdown isolation valves.	Quantify letdown flow for 20 minutes and impact on RCS inventory?	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
7	Letdown Fails to Isolate and Inventory Lost to PRT	Letdown fails to isolate (see Scenario 6), ***AND*** Spurious closure of downstream containment isolation valve	Scenario causes letdown flow to PRT through relief valve. This letdown flow is assumed unavailable for RCS makeup.		B&W CE W
8	Excess Letdown Fails to Isolate	Spurious opening of (or failure to close) multiple series excess letdown isolation valves	Scenario causes loss of RCS inventory to the CVCS system, challenging the RCS Inventory Control Function. The RCS inventory (letdown) is assumed lost and unavailable for makeup. In reality, additional failures downstream of the excess letdown isolation valves would have to occur for this RCS inventory to be unavailable for makeup. This scenario often requires three spurious operations.	Quantify letdown flow for 20 minutes and impact on RCS inventory?	B&W W
9	RCS Makeup Isolation	Spurious isolation of seal injection flow path, ***AND/OR*** Spurious isolation of normal charging flow path, ***AND/OR*** Spurious isolation of charging injection flow path	Scenario isolates all high head RCS makeup flow paths, challenging the RCS Inventory Control Function. Each flow path contains a number of series and/or parallel valves. P&ID review is required identify each relevant combination of valves. Note that isolation of all RCS makeup may also involve non-spurious failures. For example, the charging injection valves are normally closed, and a fire-induced loss of valve power (not a spurious) would cause these valves to fail closed. On the other hand, these valves could spuriously close after they have been opened.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
10	Charging Pump Inoperability	Initial condition is charging pump running with normal lineup taking suction from VCT. Spurious isolation of suction from VCT to running charging pump, ***AND*** Spurious isolation of (or failure to open) suction from RWST to running charging pump	Scenario causes charging pump inoperability, challenging the RCS Inventory Control Function. This is especially challenging if the credited charging pump is running at the time of the fire. Can be a single spurious if the RWST valves are normally closed and fail as is. Note that spurious starting of idle charging pump(s) may cause inoperability of additional pumps. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal. Potential Resolution: Valve interlocks may prevent scenario if they prevent VCT and RWST outlets from both being in closed position simultaneously.		B&W CE W
11	Charging Pump Inoperability	Initial condition is charging pump running and drawing suction from RWST. Spurious isolation of two parallel RWST outlet valves.	Scenario causes loss of charging pump suction, causing subsequent pump cavitation and inoperability. This challenges the RCS Inventory Control Function. Note that spurious starting of idle charging pump(s) may cause inoperability of additional pumps. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
12	Charging Pump Inoperability	Spurious opening (or failure to close) of multiple series VCT outlet valves	Scenario causes VCT drain down and hydrogen cover gas entrainment into charging pump suction, ultimately causing charging pump inoperability and challenging the RCS Inventory Control Function. This is especially challenging if the credited charging pump is running at the time of the fire. Note this scenario assumes that VCT makeup has been isolated (i.e., letdown isolated). Note that spurious starting of idle charging pump(s) may cause inoperability of additional pumps. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal. Potential resolution is comparison of charging pump suction header pressure provided by the RWST versus the VCT. Specifically, the RWST may provide sufficient pressure such that the check valve to the VCT remains seated and hydrogen is not entrained into the pump suction.		B&W CE W
13	Charging Pump Inoperability	Letdown fails to isolate (see Scenario 6), ***AND*** Spurious isolation of CCW cooling to the letdown heat exchanger	Scenario causes elevated charging pump suction temperature and subsequent pump inoperability. Charging pump inoperability challenges the RCS Inventory Control Function. This is especially challenging if the credited charging pump is running at the time of the fire. Starting of additional charging pumps can cause inoperability of additional pumps. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
14	RWST Drain Down via Containment Sump	Spurious opening of multiple series containment sump valves	Scenario causes RWST drain down to the containment sump. Since typical PFSS analyses do not credit alignment of containment sump, the RWST inventory becomes unavailable for RCS makeup, challenging the RCS Inventory Control Function. Scenario may be applicable to containment sump valves providing suction to the RHR pumps and/or containment spray pumps. Number of valves required to spuriously operate varies by plant.		B&W CE W
15	RWST Drain Down via Containment Spray	Spurious opening of containment spray header valve(s), ***AND*** Spurious starting of containment spray pump(s) and/or RHR pump(s)	Scenario causes a pumped RWST draindown via the containment spray ring. The RWST inventory ultimately settles to the containment sump. Since typical PFSS analyses do not credit alignment of the containment sump, the RWST inventory is assumed unavailable for RCS makeup, challenging the RCS Inventory Control Function. Note that either the RHR pumps or the containment spray pumps could cause this RWST pumped diversion to the spray ring. Note that the spurious pump starting can occur for several reasons, including fire damage to control circuitry or spurious ESFAS signal.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
16	Interfacing System LOCA	Spurious opening of multiple series RHR suction valve from RCS	Scenario causes interfacing system LOCA, challenging the RCS Inventory Control Function. The valve operators are typically maintained de-energized during normal plant operation. If so, spurious operation of each valve would generally require three proper phase hot shorts. Note B&W plants have three series valves. From a Fire PRA perspective, this interfacing system LOCA scenario generally screens if at least two series valves are normally de-energized. From a post-fire safe shutdown analysis perspective, this is classified as a high/low pressure interface and maintaining the valves de-energized generally complies with fire protection regulatory requirements.		B&W CE W
17	Multiple Pressurizer PORVs	Spurious opening of multiple (two or three) Pressurizer PORVs with corresponding block valves in normal, open position	Scenario causes loss of RCS inventory through the pressurizer PORVs, challenging the RCS Inventory Control Function. Scenario also causes pressurizer depressurization, challenging the RCS Pressure Control Function. Note B&W plants only have one PORV.		CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
18	Pressurizer PORV and Block Valve	Spurious opening of Pressurizer PORV(s), ***AND*** Spurious opening of block valve(s) after it has been closed.	Scenario causes loss of RCS inventory through the pressurizer PORV(s), challenging the RCS Inventory Control Function. Scenario also causes pressurizer depressurization, challenging the RCS Pressure Control Function. In this scenario, Operations may have closed the block valve either to 1) mitigate a fire-induced PORV LOCA or 2) pre-emptively prevent a PORV LOCA. The first spurious operation is the PORV and the second is the block valve that has been closed. Note that initial PORV LOCA, caused by spurious operation of PORV alone, is a single spurious since block valve is normally open.		B&W CE W
19	Reactor Head Vent Valves	Spurious opening of multiple series reactor head vent valves	Scenario causes loss of RCS inventory through open reactor head vent flowpath(s), challenging the RCS Inventory Control Function. Spurious operation of one head vent flowpath generally requires two spurious operations. Likewise, spurious operation of two head vent flowpaths generally requires four spurious operations. Note B&W plants only have one head vent flowpath. Hot leg vents should be also be evaluated for B&W plants. From a PRA perspective, note that this scenario may screen out due to the low RCS inventory loss rate through these flowpaths. The scenario may also screen if the head vent valves are normally de-energized. From a SSD perspective, a head vent LOCA may be acceptable if the available makeup mass flow rate exceeds the LOCA mass flow rate.	Quantify headvent flow for 20 minutes and impact on RCS inventory.?	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS INVENTORY CONTROL / RCS INTEGRITY					
20	Excess RCS Makeup	Spurious starting of additional high head charging pump(s), ***AND*** Spurious opening of additional RCS makeup flow paths (i.e., charging injection)	Scenario causes increasing RCS inventory, leading to a water solid pressurizer and PORV or safety valve opening. This scenario challenges both RCS Inventory and RCS Pressure Control Functions. Similar to spurious SI. Note that the spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.		B&W CE W
21	Primary Sample System	Spurious opening of RCS sample valve(s) (i.e., hot leg, PZR liquid space, PZR steam space, etc.), ***AND*** Spurious opening of inside containment isolation valve, ***AND*** Spurious opening of outside containment isolation valve, ***AND*** Spurious opening of downstream sample valve(s)	Scenario causes loss of reactor coolant through the primary sample system, challenging the RCS Inventory Control Function. From a PRA perspective, scenario will generally screen due to requirement of 3+ spurious operations and the small magnitude of the leak. Also note that existing TH evaluation of loss of coolant through head vents may bound loss of coolant via the primary sample system. Scenario can be screened from consideration if a manual isolation valve prevents the flow. Scenario may also screen if it is within a closed loop capable of withstanding expected pressure.	Evaluation of loss of reactor coolant through head vents should bound primary sample system.	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
DECAY HEAT REMOVAL					
22	Inadvertent Steam Dumping	Spurious opening of multiple atmospheric steam dump valves upstream of MSIV	Scenario causes RCS over-cooling. Also, the overcooling can cause RCS shrinkage, causing low pressurizer level, and challenging the RCS Inventory Control Function. Note that spurious operation of each individual steam dump valve may require multiple hot shorts. Note some B&W designs do not have MSIVs.		B&W CE W
23	Inadvertent Steam Dumping	MSIV(s) spurious opening, or failure to close, ***AND*** Spurious opening, or failure to close, of downstream steam loads (e.g., condenser steam dumps, turbine inlet valves, etc.)	Scenario causes RCS over-cooling. Also, the overcooling can cause RCS shrinkage, causing low pressurizer level, and challenging the RCS Inventory Control Function. Note that spurious operation of each individual MSIV may require multiple hot shorts. Note some B&W designs do not have MSIVs.		B&W CE W
24	Inadvertent Steam Dumping	MSIV bypass valve(s) spurious opening, or failure to close, ***AND*** Spurious opening, or failure to close, of down stream steam loads (e.g., condenser steam dumps, turbine inlet valves, etc.)	Scenario causes RCS over-cooling. Also, the overcooling can cause RCS shrinkage, causing low pressurizer level, and challenging the RCS Inventory Control Function. Note some B&W designs do not have MSIVs.		B&W CE W
25	Inadvertent Steam Dumping	Spurious operation of main steam header drain valve(s)	Scenario may cause RCS over-cooling. Also, the overcooling can cause RCS shrinkage, causing low pressurizer level, and challenging the RCS Inventory Control Function.	Quantify overcooling effect of open drain valve(s) for 20 minutes?	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
DECAY HEAT REMOVAL					
26	Turbine Driven AFW Pump Inoperability	Spurious isolation of redundant steam supply valves to turbine driven AFW pump	Scenario causes turbine driven AFW pump inoperability, which challenges the Decay Heat Removal Function.		B&W CE W
27	AFW Flow Isolation	Spurious closure of multiple valves in AFW pump discharge flow path(s)	Scenario isolates AFW flow to the steam generator(s), challenging the Decay Heat Removal Function. AFW flow isolation can occur due to several combinations of valve closures in the pump discharge and/or discharge cross-connect flow paths. Review P&IDs to identify specific valves.		B&W CE W
28	AFW Flow Isolation	Spurious closure of steam supply valve(s) to turbine driven AFW pump, ***AND*** Spurious isolation of AFW pump discharge flow path(s)	Scenario isolates AFW flow to the steam generator(s) and causes turbine driven AFW pump inoperability, challenging the Decay Heat Removal Function.		B&W CE W
29	AFW Flow Diversion	Combination of spurious valve operations in the AFW pump discharge flowpaths to the steam generators	Scenario causes AFW flow diversion to a non-credited steam generator(s), challenging the Decay Heat Removal Function. A steam generator may be "non-credited" by the SSA for a number of reasons including unavailability of instrumentation, inoperability of steam dumps on that loop, etc. Scenario may be a single spurious event in some cases. Also note that plants with unit-crossties may be subject to flow diversion to steam generators for another unit.		B&W CE W
30	AFW Pump Runout	Spurious full opening of multiple AFW flow control and/or isolation valves	Scenario may cause AFW pump runout and inoperability, challenging the Decay Heat Removal Function. Note that this scenario may occur even without spurious operations if the fail-safe position of relevant valves is full open.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
DECAY HEAT REMOVAL					
31	CST Diversion to Condenser	Spurious opening of valves between the CST and condenser hotwell	Scenario causes inadvertent draining of CST inventory to the condenser. This CST inventory becomes unavailable as an AFW source, challenging the Decay Heat Removal Function. In some plants, this requires spurious operation of multiple valves. In other plants, this only requires spurious operation of one valve. Other CST draindown paths may exist. P&ID review required. Potential Resolution: Some plants may have a standpipe that prevents the CST from draining below a certain level.		B&W CE W
32	Excess Feed Flow to Steam Generator	Scenario can occur due to various combinations of spurious AFW pump starts, spurious opening (or failure to close) of valves in AFW pump discharge flowpaths, and spurious opening of MFW isolation valves with MFW pump(s) running.	Scenario causes RCS over-cooling and/or steam generator overfill, both challenging the Decay Heat Removal Function. RCS over-cooling can cause RCS shrinkage and low PZR level. Steam generator overfill can affect operability of turbine-driven AFW pump. Note that the spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.	Quantify time to steam generator overfill. Note spurious operation duration max 20 minutes.	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
DECAY HEAT REMOVAL					
33	Steam Generator Blowdown	Spurious opening of, or failure to close, multiple series steam generator blowdown valves	Scenario causes drain down of steam generator inventory through the blowdown system, challenging the Decay Heat Removal Function. The number of valves required to spuriously open varies by plant design. B&W plants do not have a SG blowdown system, so this scenario is not applicable to B&W. Potential Resolution: Scenario screens if available AFW mass flow rate exceeds SG inventory mass loss rate through blowdown.	Quantify blowdown flow and show negligible over 20 min.	CE W
34	Secondary Sample System	Spurious opening of steam generator sample valve(s) inside containment, ***AND*** Spurious opening of isolation valve(s) outside containment, ***AND*** Spurious opening of downstream sample valve(s)	Scenario causes drain down of steam generator inventory through the sample system, challenging the Decay Heat Removal Function. From a PRA perspective, scenario will generally screen due to requirement of 3+ spurious operations and the small magnitude of leak. Scenario can be screened from consideration if a manual isolation valve prevents the flow or if the system is closed loop capable of withstanding expected pressure. B&W plants sample directly from the steam generator (i.e., not through blowdown system)	Quantify sample system flow and show negligible over 20 min. Also bounded by blowdown flow.	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
RCS PRESSURE CONTROL					
35	RCS Pressure Decrease	Spurious opening of pressurizer spray valve(s), ***AND*** Inability to trip, or spurious operation of, RCP, ***AND*** Inoperability of PZR Heater(s)	Scenario causes a RCS pressure transient, challenging the RCS Pressure Control Function. Typical PFSS analyses address this issue; PRAs often consider scenario negligible since there is no real threat of core uncovery. Potential candidate for generic analysis to evaluate various spray / heater combinations and show no adverse impact on safe shutdown capability.	Quantify various spray / heater combinations and impact on safe shutdown capability?	B&W CE W
36	RCS Pressure Increase	Spurious operation of multiple PZR heaters, ***AND*** Inoperability of pressurizer spray or auxiliary spray	Scenario causes a RCS pressure transient, challenging the RCS Pressure Control Function. RCS pressure increase could cause PORV(s) and/or safety valve(s) to open.	Quantify various spray / heater combinations and impact on safe shutdown capability?	B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
REACTIVITY CONTROL					
37	Inadvertent Boron Dilution	Unborated water supply to the RCS can occur due to combinations of the following: -Spurious start of reactor makeup pump(s) (supplies unborated water to the VCT), -Spurious opening of valves between reactor makeup pump(s) and VCT, -Spurious full opening of the reactor makeup flow control valve, -Spurious closure of the boric acid flow control valve	Scenario decreases RCS boron concentration, potentially causing reactivity increase, and challenging the Reactivity Control Function. The reactor makeup flow control valve would normally provide the setpoint flowrate instead of being fully open. Potential Solution: The maximum flow from the reactor makeup pump may be limited due to the plant specific design (e.g., installation of a flow orifice to limit the pump's maximum flow, boron dilution protection system, etc.).	Quantity rate of boron dilution and show acceptable. Note 20 min max spurious operation duration.	B&W CE W
38	Fire Prevents Reactor Trip	Fire damage to RPS may prevent reactor trip. For example, hot shorts may prevent tripping of RPS MG sets.	BWRs have identified scenarios where fire-induced hot shorts could prevent all control rod groups from inserting when required. Reference NRC Information Notice 2007-07. No cases at PWRs were identified by the survey results that supported this MSO list. However, each plant should perform a review to determine if scenario is plausible at their plant. Note that this review may have already been performed in the disposition of Information Notice 2007-07.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
SUPPORT FUNCTIONS					
39	CCW Header Isolation	CCW flow can be isolated via several combinations of spurious valve closures. Pertinent valves include: -pump discharge valves, -pump crosstie valves, -CCW heat exchanger inlet valves, -CCW heat exchanger outlet valves, -CCW heat exchanger crosstie valves, -Etc.	Scenarios cause failure of CCW function to provide cooling to safe shutdown loads. Review P&IDs to identify relevant valve combinations.		B&W CE W
40	CCW to Redundant Loads	Spurious isolation of CCW cooling to redundant loads (including lube oil coolers, RHR heat exchangers, etc.)	causing safe shutdown equipment inoperability of redundant trains. For example, a plant may have two redundant charging pumps. Each charging pump may have a lube oil system that is cooled by the corresponding train of CCW. If CCW flow to both lube oil coolers spuriously isolates, then both charging pumps would become inoperable. All credited CCW loads should be reviewed.		B&W CE W
41	CCW Flow Diversion to Non-Credited Loop	Flow diversion can occur via several combinations of spurious valve operations in the CCW pump discharge and CCW loop crosstie flowpaths. Review P&IDs to identify relevant combinations.	Scenario causes CCW flow to be diverted to the non-credited loop. This ultimately prevents CCW cooling of credited safe shutdown loads.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
SUPPORT FUNCTIONS					
42	ESW Header Isolation	ESW flow to credited loads can be isolated via several combinations of spurious valve closures. Pertinent valves include: -pump discharge valves, -pump crosstie valves, -ESW heat exchanger inlet valves, -ESW heat exchanger outlet valves, -ESW heat exchanger crosstie valves, -Etc. Review P&IDs to identify relevant combinations.	Scenario cause isolation of ESW, which can fail cooling to the CCW system and other safe shutdown components directly cooled by ESW (e.g., EDG cooling). All credited ESW loads should be reviewed for spurious isolation.		
43	ESW to Redundant Loads	Spurious isolation of ESW cooling to redundant loads (including CCW heat exchangers, EDG cooling, etc.)	Scenario isolates ESW cooling to redundant loads causing safe shutdown equipment inoperability of redundant trains. For example, redundant EDGs may be cooled by ESW. If ESW flow to both EDGs spuriously isolates, then both EDGs would become inoperable. All credited ESW loads should be reviewed.		B&W CE W
44	ESW Flow Diversion to Non-Credited Loops / Systems	Flow diversion can occur via several combinations of spurious valve operations in the ESW pump discharge and loop crosstie flowpaths. Review P&IDs to identify relevant combinations.	credited loop or system. This ultimately prevents ESW cooling of credited loads. Review P&IDs to identify relevant valve combinations.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
SUPPORT FUNCTIONS					
45	Emergency Power	Additional components load onto credited diesel generator	Scenario causes diesel generator overloading and inoperability. Note: Scenario very site specific. Interlocks may prevent this from occurring.		B&W CE W
46	Emergency Power	Diesel generator overloading	Scenarios cause diesel generator overloading and inoperability. Note: Scenarios very site specific. Interlocks may prevent these from occurring. Overloading may occur if additional components spuriously load onto EDG. Overloading may also occur if proper load sequencing is bypassed via hot shorts, causing simultaneous loading of multiple components onto		B&W CE W
47	Emergency Power	Diesel generator spuriously starts without service water cooling.	The fire causes the startup of the Emergency Diesel Generator and spurious isolation of ESW cooling (See Scenarios 42 & 44). Running the Emergency Diesel Generator with a loss of cooling water could trip and/or damage the diesel on high temperature.		B&W CE W
48	Emergency Power	Non-synchronous paralleling of EDG with on-site and off-site sources through spurious breaker operations	closing into a live bus out-of-phase. Note: Scenario very site specific. Interlocks may prevent this from occurring.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
OTHER SCENARIOS					
49	Generic - Loss of Pump Suction	Spurious isolation of various combinations of pump suction valves	Suction flow paths for all credited pumps should be reviewed for MSO scenarios causing loss of suction and pump inoperability. An example of a pump suction MSO is identified under RCS Inventory in which both the VCT outlet valve(s) and RWST outlet valve(s) spuriously close. Another example involves pump suction cross-connect valves. For example, three pumps may be supplied from a common suction header that includes several cross connect valves. If two valves spuriously isolate, the pump drawing suction from the common header between the two isolated valves can lose suction and become inoperable. The spurious operation of idle pumps after suction has been spuriously isolated should also be considered. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.		B&W CE W
50	Generic - Pump Discharge Flow Path Isolation	Spurious isolation of various valves in pump discharge flow path	Discharge flow paths for all credited pumps should be reviewed for MSO scenarios that isolate those flow paths. One example is spurious isolation of two parallel charging injection valves. Another example involves pump discharge cross-connect valves. For example, three pumps may feed a common discharge header that includes several cross connect valves. If two valves spuriously isolate, pump flow feeding the common header between the two isolated valves will isolate.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
OTHER SCENARIOS					
51	Generic - Pump Shutoff Head	Spurious isolation of pump discharge flow, ***AND*** Spurious isolation of recirculation valve(s)	Scenario causes pump operation at shutoff head and subsequent inoperability. All credited pumps should be reviewed for this scenario. Note that spurious starting of idle pump(s), in combination with isolation of discharge flow and recirculation, may cause inoperability of additional pumps. Spurious pump starting can occur for several reasons, including fire damage to control circuitry or a spurious ESFAS signal.		B&W CE W
52	Loss of HVAC	Spurious isolation of HVAC to credited loads	Perform review to identify spurious failures that could cause isolation of HVAC to credited loads. Credited loads may include pump rooms, switchgear rooms, and rooms containing solid state control systems. Examples of spurious failures include spurious damper isolation and spurious isolation of cooling flow to chillers.		B&W CE W
53	Valve Inoperability	Spurious motor-operated valve operation, ***AND*** Wire-to-wire short(s) bypass torque and limit switches	General scenario is that fire damage to motor-operated valve circuitry causes spurious operation. If the same fire causes wire-to-wire short(s) such that the valve torque and limit switches are bypassed, then the valve motor may stall at the end of the valve cycle. This can cause excess current in the valve motor windings as well as valve mechanical damage. This mechanical damage may be sufficient to prevent manual operation of the valve. Scenario only applies to motor-operated valves. Note this generic issue may have already been addressed during disposition of NRC Information Notice 92-18. This disposition should be reviewed in the context of multiple spurious operations and multiple hot shorts.		B&W CE W

ID #	SCENARIO	DESCRIPTION	NOTES	Generic Analysis Candidate?	PLANT DESIGN
OTHER SCENARIOS					
54	Fire-Induced Spurious ESFAS	Fire-induced spurious ESFAS signals (e.g., safety injection, containment isolation, etc), combined with other fire-induced failures, can adversely affect safe shutdown capability. An example of a fire-induced ESFAS signal is a fire causing open circuits on 2/3 main steam pressure instruments on one loop resulting in a spurious safety injection signal. ESFAS signals can result from open circuits, shorts to ground, and/or hot shorts. Fire-induced failure of instrument inverters may also cause spurious ESFAS signals. The plant should perform a systematic review to asses the potential for fire-induced spurious ESFAS to adversely affect safe shutdown capability. Below are some examples.			B&W CE W
54a	RCS Makeup Pump Inoperability	Spurious safety injection signal, ***AND*** Spurious isolation of makeup pump suction	Safety injection signal starts multiple RCS makeup pumps. Fire causes makeup pump suction valves to fail closed. Scenario results in cavitation / inoperability of multiple RCS makeup pumps.		B&W CE W
54b	Loss of all Seal Cooling	CCW to the thermal barrier heat exchangers for all RCPs, ***AND*** Spurious isolation of seal injection header flow	Scenario causes loss of all RCP seal cooling and subsequent RCP Seal LOCA.		B&W CE W
54c	Loss of all Seal Cooling	Spurious containment isolation signal isolates CCW to the thermal barrier heat exchangers for all RCPs, ***AND*** Spurious opening of charging injection valve(s) causing insufficient flow to seals	Scenario causes loss of all RCP seal cooling and subsequent RCP Seal LOCA.		B&W CE W
54d	RWST Drain Down	Spurious high containment pressure on multiple channels causing spurious containment spray signal	Scenario causes a pumped RWST drain down via the containment spray pumps and containment spray ring.		B&W CE W
54e	PORV(s) Open	Spurious high pressurizer pressure on multiple channels causes high pressurizer pressure signal	Spurious high pressurizer pressure signal causes PORV(s) to open and challenges the RCS Inventory and Pressure Control Functions		B&W CE W

TERMINOLOGY LEGEND	
AFW	Auxiliary Feedwater System. Provides feedwater for removing decay heat via the steam generators. B&W plants generally refer to this as Emergency Feedwater (EFW).
Charging	This is the RCS high head makeup system. B&W plants refer to this simply as the Makeup System
CVCS	Chemical and Volume Control System. System allows for RCS letdown, cleanup, chemical addition, and makeup. B&W plants refer to this as the Makeup and Purification (MU&P) System
RWST	Refueling Water Storage Tank. Provides borated water source for RCS makeup. Also referred to as Safety Injection Refueling Water Tank (SIRWT) or Refueling Water Tank (RWT). B&W plants refer to this as the Borated Water Storage Tank (BWST)
VCT	Volume Control Tank. Provides NPSH to high head charging pumps during normal operation. B&W plants refer to this as the Makeup Tank.

Table G-1
BWR Generic MSO List, Draft

MPL	#	Scenario Description	III.G.3 Only?	Generic Analysis Candidate?	Notes	Plant type
		Reactivity Control				
C71	1a	RPS SCRAM Circuits: For fires in the control room, a hot short between conductors to the mode switch could keep the associated trip channel logic energized. Two hot shorts without the occurrence of an open circuit or short to ground have the potential of affecting the scram function.	No	Yes	May be addressed by actions already included in the plant EOPs. This is an issue inside and outside of the Control Room. Refer to the BWROG "White Paper" on IN 2007-07. The "White Paper" explains that a single hot, should it occur in the right location in the right circuit, could prevent 1/4 of the rods from inserting. Similarly, two (2) hot shorts in the right location in the right circuit could prevent a full scram.	BWR4/5
		Reactor Coolant Makeup Control				
B21	2a	(Main Steam) Head vent valves (2) Spuriously Open.			Valve Numbers MS-V-1, MS-V-2 or similar. May require going to SDC earlier due to quicker depressurization. Scenario may be screened, depending on line size and criteria for steam line break. Refer to PRA criteria about how big of a steam line break is of concern, and use that to determine if the Scenario is of interest.	BWR4/5/6
B21	2b	(Main Steam) MSIV's hot short results in MSIVs failing to close or re-opening.			Valve numbers MS-V-22A-D, MS-V-28A-D or similar. The postulated scenario involves failure of redundant, normally open, Main Steam Isolation Valves (MSIV) in one of the four Main Steam Lines (MSL) to close on demand. Each MSIV has an AC and a DC solenoid valve. Both valves de-energize to close the MSIV. May need to look at MSIV reopening, if closed on a fire.	BWR2/3/4/5/6
B21	2c	(Main Steam), Main Steam Line Drain Shutoffs spuriously open.			Valve numbers MS-V-16, MS-V-19 (F016 and F019) or similar. May be an additional downstream manual valve MS-V-21 (F021) with an orificed bypass. Valve Motor may be removed or have power disconnected. May be able to analyze flow rate as an acceptable inventory loss.	BWR4/5/6
C11	2d	RPV coolant drain through the SDV vent and drain			This scenario is a MSO initiated drain of reactor coolant through the 2 inch SCRAM Discharge Volume to the Torus room sump. The scenario is triggered by MSO opening of the solenoid valves which supply control air to the air operated isolation valves. or deenergization of backup SCRAM DC relays. Resetting the SCRAM from the main control room terminates the drain. From outside the control room, it is necessary to de-energize RPS MG sets AC power.	BWR4
E12	2e	Inventory control Hi/Lo pressure interface valve spurious operation - (Residual Heat Removal) SDC Suction Isolation Valves			RHR-V-8, RHR-V-9 (F008, F009) or similar. Removal of DC Control Power Fuses may resolve. This is the traditional Hi/Lo pressure interface.	BWR3/4/5/6

Table G-1 BWR Generic MSO List, Draft						
MPL	#	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
E12	2f	Inventory control valve spurious operation - (Residual Heat Removal) Discharge to Recirc Loop Isolation Valves			Possible path includes the Warm-up line. Valves RHR-V-53A & B, RHR-V-50A & B (F015A&B, F017A&B) or similar. Testable check valve will go closed on DP. Need to consider whether RHR crosstie is open. T-H analysis of piping pressure/temperature may resolve. Power may be removed on Bypass.	BWR4/5/6
E12	2g	Inventory control valve spurious operation - (Residual Heat Removal) RHR Head Spray Valves			MOV -F022, MOV-F023 or similar. May be cut and Capped for some plants, or have a check valve to prevent back flow. **Note: Follow up with plant that submitted.**	BWR3/4
E12	2h	Spurious Operations that creates RHR Pump Flow Diversion from RHR/LPCI.			RHR flow can be diverted to the containment through the Containment Spray isolation valves (E11-F016A, B and E11-F021A, B or similar),	BWR4
	2i	Spurious Operations that creates RHR Pump Flow Diversion from RHR/LPCI, including diversion to the Torus.			RHR flow can be diverted to the containment through the Test Line isolation valves (E11-F024A, B and E11-F028A, B).	
	2j	Spurious Operations that creates RHR Pump Flow Diversion from RHR/LPCI, including diversion to the Torus.			RHR flow can be diverted to the containment through the Torus isolation valve (E11-F027A, B and F028 or similar) or RHR Warm-up Line (E11-F026B). F026 typically has power removed, and 53 is in line, typically normally closed.	
E12	2k	Spurious Operations that creates RHR Pump Flow Diversion from the RPV to the Suppression Pool.			Suppression Pool Spray lines isolation valve E11-F024A, B or similar. Repeat of 2H.	BWR4
E12	2l	Spurious operation (open) of valve RHR A DISCH TO RADWASTE INBOARD ISOLATION and RHR radwaste isolation valve			Valves F049, F040 or similar. F010 (Crosstie) spurious operation or if F010 is open may divert flow from opposite train. F010 may have power removed.	BWR4/6
E12	2m	Spurious opening of two series RHR unit cross tie valves			BFN Only	BWR4
E12	2n	Spurious opening of two series RHR loop cross tie valves			F010 valve or similar. Breaker power may be removed.	BWR4
E21	2o	Spurious Operation of normally closed Core Spray Discharge Check bypass valve (equalizing valve) or testable check valves, and core spray discharge valve F005.			Bypass Valve is normally down powered, DC MOV. 2 DC hot shorts can open the valve, resulting in an alignment of High Pressure RCS pressure to the Low Pressure Core Spray Piping. Testable Check valve should go closed upon DP across valve.	BWR5
E21	2p	Deleted				BWR4

Table G-1 BWR Generic MSO List, Draft						
MPL	**#**	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
E21	2q	Spurious Operations that Create Core Spray Pump Flow Diversion from the RPV			CS flow can be diverted to the Torus through the CS test line MOVs (E21-F015A, B or similar). Test Line is typically a 10" line with Orifice. This is a single spurious operation, so should already be addressed in SSA (unless the line includes 2 series valves). Should review for MSOs not addressed in SSA, such as combinations of CS test Line MOV opening and CS Discharge Valve Opening (Scenario 2M).	BWR4
E21	2r	Deleted				BWR4
E22	2s	Spurious HPCS/HPCI operation			Impair RCIC operation due to vessel overfill and water in the steam line. Can occur as a result of: a) Spurious valve Operation: Turbine Stop Valve and HPCI Discharge Shutoff Valve Spurious Operation (HPCI-F067, F006 or similar), b) Damage to Cabling for transmitters (two required to start HPCI), c) Damage to High Level Trip Circuitry, or d) HPCI pump controls hot short.	
E41	2t	Deleted				BWR4
E41	2u	Deleted				BWR4
E41	2v	Deleted				BWR4
E41	2w	HPCI drain to the sump failing open on loss of air pressure.			AOV F004/F005 (F028, F029, and bypass is F055.) or similar. Open drain flow path may not be sufficient to fail HPCI function.	BWR4
E41	2x	Spurious operation (open) of both of HPCI CST Test Return/Bypass valves.	Y		MSOs to the HPCI discharge test line valves can divert flow to the Condensate Storage Tank. If suction is from the Suppression Pool, the Suppression Pool inventory is diverted to the CST. Valves 1E22*MOVF010 (or F008) and 1E22*MOVF011, or similar.	BWR4
E51	2y	Spurious operation - Rx Core Isolation Cooling RPV Head Spray valves and Testable Check Valves			RCIC-V-66, 65 or similar. Limited to certain BWR vintages. **Note: Verify with submitting plant.**	BWR5
E51	2z	RCIC (Rx Core Isolation Cooling) , Discharge shut off valve, Turbine Stop Valve spuriously open.			Valve numbers RCIC-V-13, RCIC-V-45 ((F013, F045) or similar. **Note: Verify with submitting plant.**	BWR5

Table G-1 BWR Generic MSO List, Draft						
MPL	**#**	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
E51	2aa	RCIC Test flow to CST Stop and throttle valves flow diversion			Valve numbers F022 and F011 or similar. The throttle valve and isolation valve in the return line to the Condensate Storage Tank are normally closed and at least one of the valves must remain closed to prevent flow diversion from the RCIC pump to support the reactor inventory control function, especially during suppression pool cooling.	BWR6
E51	2ab	RCIC Drain Pot Drains failing open on loss of air pressure			AOV F025/F026 (RCIC) on the drain to the sump failing open on loss of air pressure. Does not appear to be a concern. 1inch steam line leak, assuming the drain POT fails open. Trap would limit the flow. Diversion would also require F0054 bypass to open. Diversion may be too small to be a concern.	**BWR4**
E51	2ac	RCIC Pump Diversion through Mini Flow Line to the Suppression Pool or test return Line.			The RCIC pump discharge can be diverted through the test return line to the CST through a MOV isolation valve and the common HPCI AOV throttle valve. RCIC min flow line MOV E51-F019 is another path and a path from the pump suction to the suppression pool through MOVs E51-F029 and E51-F031. These paths are one of the boundaries of the RCIC system and considered E51 valves in the App R safe shutdown analysis. Re-write to focus on test return line.	BWR4
E51	2ad	Spurious operation (open) of both of RCIC TEST RETURN TO CONDENSATE STORAGE TANK valves with suction on the Suppression Pool may route the RCIC inventory to the CST and render the system inoperable.	Yes		Valves 1E51*MOVF022 and 1E51*MOVF059 and a Spurious startup signal or valves RCIC PUMP DISCHARGE TEST LINE ISOLATION E51-F022, RCIC PUMP TORUS SUCTION INBOARD ISOLATION E51-F03, RCIC PUMP TORUS SUCTION OUTBOARD ISOLATION E51-F029, and HPCI/RCIC TEST RETURN REDUNDANT SHUTOFF VALVE E41-F011 or similar	BWR6
E51	2ae	Spurious closure of BOTH ICS VACUUM BREAKER ISOLATION VALVE OUT valves may result in eventual RCIC turbine inoperability, as the result of turbine exhaust line binding.			Valves 1E51*MOVF077 and 1E51*MOVF078 (or valves F0104 and 105) or similar. Follow-up with River bend.	BWR6

Table G-1
BWR Generic MSO List, Draft

MPL	#	Scenario Description	III.G.3 Only?	Generic Analysis Candidate?	Notes	Plant type
E51	2af	RCIC Suction Valves	Yes		(F010, F031 or similar) CST and Suppression Pool Suction Valves - For fires in an alternate shutdown area were the RSP is utilized there is a potential to isolate the injection paths from the CST and Suppression pool to the RCIC pump. Upon transfer of control to the RSP the control circuit will be isolated from the fire-damaged areas and be available. The controls cable routing for both valves is similar from the MCC to the Remote Shutdown Panel (RSP) and continued on to the relay/control room. III.G.3 only	BWR4
G33	2ag	Spurious operation (open) of BOTH REACTOR WATER CLEAN-UP ISOLATION Valves may route RPV inventory into the RWCU system.		Yes	1G33*MOVF001, 1G33*MOVF004 or similar. Closed loop system, but may be a concern due to high temperature in the piping.	All
G33	2ah	Spurious operation of RX Water Clean Up valves			Valves RWCU-FCV-33, and RWCU-V-34 or RWCU-V-35, or similar. Would require additional MOVs open to RWC; MOV 1 or 4 (or similar).	BWR3/4/5
G38	2ai	Suppression Pool Drain down: One example: Suppression Pool Water Management system suction flow is diverted or that the return flow is diverted			May be unique flow paths for each BWR, involving any drain down path from the suppression pool. One example: If the one of two Torus Water Management System pumps are either running or spuriously starts, and one of two normally closed suction isolation MOVs open, and the normally closed condenser isolation valve opens, then Suppression Pool water is pumped to the condenser. Torus Cleanup may be locked closed for many plants. Drain to the Condenser typically a 3" line.	BWR4
N21	2aj	Spurious Operations that Create Standby Feedwater (SBFW) (AC Driven FW Pump) Flow Diversion from RPV	Yes		Applicable to BWRs with SBFW system or other motor driven FW pump.	BWR4
N21	2ak	Spurious operation a feedwater or booster pump and a level control valve may cause uncontrolled feedwater injection into the RPV.			Valves 1FWS-P1A(B, C), 1FWS-MOV26A(B, C), 1C33-LVF001A(B, C, D) 1C33-LVF002 or similar. Booster Pump operation would required decreased vessel pressure. Feedwater pumps may not be a concern if steam driven.	BWR6
P11	2al	Loss of CST Inventory to Hot Well	Yes		Several paths exist that can cause a gravity drain of the CST to the Hotwell. The condition can happen due to spurious operation of MOVs alone, and if the normal hotwell pump or emergency hotwell pumps spuriously start, the condition is worsened. Standpipes for drain paths may limit the minimum level in the CST. Should review Fire SSA assumptions for minimum level and effect of drain down	BWR4

Table G-1
BWR Generic MSO List, Draft

MPL	#	Scenario Description	III.G.3 Only?	Generic Analysis Candidate?	Notes	Plant type
P11	2am	CST supply to Condensate Return Tank (CRT) supply shutoff MOV spurious operation	Yes		This MSO involves spurious operation of MOVs in the piping connecting the CST and CRT. If either of two valves spuriously open, a gravity transfer can occur which can lower the water level significantly in the CST. See discussion above on Standpipes. Scenario not applicable to plants with out a CRT or equivalent.	BWR4
P11	2an	CST discharge to Radwaste system shutoff MOV spurious operation	Yes		Spurious operation of two MOVs in the Condensate system can set up a gravity drain path from the CST to the radwaste system. The water loss may need to be evaluated to support the time line to reach such a step in a manual action feasibility study. See discussion above on Standpipes	BWR4
		Reactor Coolant System Pressure Control				
B21	3a	Potential opening of all SRVs		Yes: GE Calc. available on SRV openings.	Plant 3 (2 conductor to conductor shorts in 2 cables) because the cables route in the same area. , Plant 2 Pressure switch instrumentation rack contains all the switches for the SRVs. The cables are also routed in the same conduit and trays. Therefore with multiple spurious can have a portion or all of the SRVs open	BWR4/5/6
B21	3b	Multiple ERV (SRV) opening			Safety Relief Valve-Two or More Spuriously Open "this failure requires two or more sustained fire induced failures in cables or within a control room panel to open more than one SRV."	BWR2/4/5
B21	3c	Spurious ADS: Safety Relief Valve-Failure of ADS Initiation Logic, opening SRVs simultaneously due to energization of relays			This postulated scenario features a failure that will open multiple SRVs simultaneously and requires energization of relays K6Aand K7A or K6B and K7B in a two out or two taken twice logic scheme (ref. APED-B21-018<2>). As such this failure requires two sustained fire induced failures within the control room panel with no damage to the individual SRV control circuits to initiate ADS. It should be noted that the individual SRV control circuits are powered from and contain control logic within the panel. See NEI 00-01 guidance of application of MSOs to III.G.3 areas.	BWR4
C73	3d	Deleted				BWR4
C73	3e	Deleted				BWR4
C73	3f	Deleted				BWR4
C73	3g	Deleted				BWR4
C73	3h	Deleted				BWR4
C73	3i	Deleted				BWR4
		Decay Heat Removal				

Table G-1 BWR Generic MSO List, Draft						
MPL	#	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
E12	4a	1)RHR A suppression pool cooling loop fire related failure in conjunction with either 2a) RHR B Suction (6B) Spuriously opens & interlock closure of 4B, or 2b) RHR B fails due to Reactor Head Spray RHR V-23 fails open, 3)Spurious Closure of Instrument Air Isolation A to Containment (30A - fails air to MSIVs, and can't open MSIVs), 4) Spurious Closure of IA B Isolation (30B)			Containment Failure due to loss of suppression pool cooling causes HPCS (HPCI)/RCIC Failure, IA Failure fails MSIVs, ADS SRVs, Initial Fire Damage causes loss of feedwater. Reactor head Spray Valve is a cooling flow diversion for RHR B. **Need Plant Review on this issue.**	ALL
T23	4b	Containment Over Pressure (COP), NPSH loss due to spurious initiation of containment sprays.			A General Review of NPSH and Containment Over Pressure should be performed to look for other pathways such as containment inerting system or other containment isolations, other than the 3 listed here. COP is only an issue for plants that credit COP for NPSH concerns.	Mark I (BWR3/4)
T23	4c	Containment Over Pressure (COP), NPSH loss, Spurious opening of Containment Vent.			Spurious opening of Containment Vent, resulting in Containment depressurization, following a loss of Suppression pool cooling. Containment vent through pathways not including the rupture disc.	Mark I (BWR3/4)
T23	4d	Containment Over Pressure (COP), NPSH loss, Spurious opening of the drywell floor drain sump valves.			This case is one that was non-obvious: Spurious opening of the drywell floor drain sump, since it isn't directly connected to the airspace.	Mark I (BWR3/4)
T23	4e	Mark I containment with Torus Ring Header: too much flow through the ring header. Spurious operation of multiple pumps from the ring header.			NPSH Issue for the operating/credited pump. May be caused by a false LOCA signal.	
Support Systems						
E12	5a	Additional components load onto credited diesel generator			Scenario causes diesel generator overloading and inoperability.	BWR4
G38	5b	Spurious operation (open) of both SUPPRESSION POOL CLEAN-UP ISOLATION Valves.	Yes		Drain down of suppression pool below minimal level. 1RHS*AOV62, 1RHS*AOV63 or similar	BWR6
G41	5c	Spurious operation (open) of FUEL POOL COOLING RETURN TO COOLING PUMPS INBOARD ISOLATION VALVE and FUEL POOL COOLING RETURN TO COOLING OUTBOARD ISOLATION VALVE may align the upper refueling pool inventory to the SFPC pumps suction.			1SFC*MOV120, 1SFC*MOV122 or similar. **Note: this item needs to be followed up to determine why this is an issue. Open item.**	BWR6

Table G-1 BWR Generic MSO List, Draft						
MPL	#	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
P41	5d	Spurious Service Water pump operation at shutoff head - including RHR Service Water and/or Emergency Service Water.	Yes		III.G.3 only. Prior to isolation of the circuits and component control at the remote shutdown panel, the Control Room fire causes a start of the Emergency Service Water (ESW) Pump followed by a spurious closure of the ESW Pump Discharge Valve. The ESW Pump would be operating with no flow until isolation is achieved. See NEI 00-01 for treatment of MSOs for II.G.3.	BWR6
P41	5e	Spurious operation (open) of both RHR SERVICE WATER ISOLATION (Crosstie) valves in a loop may result in diversion of service water flow from the RHR heat exchangers.			1E12*MOVF094 AND 1E12*MOVF096 or similar	BWR6
R43	5f	Non-synchronous paralleling of EDG with on-site and off-site sources through spurious breaker operations			Scenario causes damage to diesel generator by closing into a live bus out-of-phase. Note: Scenarios are very site specific. Interlocks may prevent this from occurring.	All
R43	5g	Non-Synchronous Paralleling - inadvertent cross tie breaker operation between opposite divisions (e.g., 4160V, 480V) of Div 1(2) EDGs through Spurious Operation of 480 V Breakers or the Divisional Cross-Tie through 4160 V Maintenance Tie Breakers			Note: Scenarios are site specific. Interlocks may prevent this from occurring.	All
R43	5h	Spurious Diesel generator operation without cooling water			The fire causes the startup of the Emergency Diesel Generator, Spurious closure of the ESW Pump Discharge Valve or trip of the ESW Pump, would stop the cooling water supply to the Emergency Diesel Generator. Running the Emergency Diesel Generator with a loss of cooling water could trip the diesel on high temperature. If the fire has resulted in the actuation of a LOOP or LOCA bypass of the high jacket temperature trip, the diesel could continue to run until damage from over-temperature conditions stop it.	All
	5i	Deleted				
R43	5j	Spurious operation (open) of both cross-connection valves would cause an uncontrolled loss of service water to the opposite division.			1SWP*MOV505A, 1SWP*MOV505B or similar, for RHR Service Water, F119A/B or similar would have to open.	All

Table G-1 BWR Generic MSO List, Draft						
MPL	#	**Scenario Description**	**III.G.3 Only?**	**Generic Analysis Candidate?**	**Notes**	**Plant type**
N/A	5k	Spurious motor-operated valve operation, **AND** Wire-to-wire short(s) bypass torque and limit switches			General scenario is that fire damage to motor-operated valve circuitry causes spurious operation. If the same fire causes wire-to-wire short(s) such that the valve torque and limit switches are bypassed, then the valve motor may stall at the end of the valve cycle. This can cause excess current in the valve motor windings as well as valve mechanical damage. This mechanical damage may be sufficient to prevent manual operation of the valve. Scenario only applies to motor-operated valves. Note this generic issue may have already been addressed during disposition of NRC Information Notice 92-18. This disposition should be reviewed in the context of multiple spurious operations and multiple hot shorts.	
Process Monitoring						
	6a	No generic Scenarios identified				