

Mark I and Mark II BWRs Containment Venting Systems Guidance for Order EA-13-109 and Accident Management Rulemaking

July 22, 2013



Agenda

- Introductions
- Opening remarks
- Schedules
- NEI/Industry presentation – Guidance development
- NEI/Industry presentation – Filtering strategies for BWR Mark I and Mark II containments rulemaking and selection of accident scenarios
- Public questions and comments
- Toll free number: **888-390-5220** and pass code: **47150**



Schedule - ISG

- ISG issuance endorsing NEI 13-02 – October 2013
- ACRS Full Committee – October 3, 2013 (Tentative)
- ACRS Sub Committee – Sept. 18, 2013 (Tentative)
- ISG public comment period ends – Sept. 18, 2013
- ISG issued for public comment – August 19, 2013
- ISG draft completion target – August 9, 2013
- Public and industry interactions – June to August 2013



Schedule - Rulemaking

- Technical basis for rulemaking – March 2014
- Proposed rule – March 2015
- Final rule – March 2017



NEI Presentation
Guidance Development
(Section 2, “Boundary Conditions for Vent Design and
Operation,” Section 4.1, “Design Considerations,” and
Section 5,” programmatic Controls,” NEI 13-02)
(Draft Only)



NEI/Industry Presentation Filtering Strategies for Mark I and Mark II Containments Rulemaking



NRC

Background Slides

(July 11, 2013 Public Meeting)



MELCOR Calculation Matrix



Japan Lessons Learned

Consideration of Analysis Options

- RCIC operation
 - RCIC duration: 16 hr., 4 hr., 0 hr.
 - Flow rate: 600 gpm (or EPG/SAG specification, if any)
- RPV depressurization and vessel injection (?)
 - Reliability of vessel injection under SA condition
 - Injection source, capacity, and effectiveness
- Drywell spray
 - Spray actuation time: @RCIC stop, @ vessel breach, other (?)
 - Spray flow rate: 500 gpm, variation (if any)
- Containment venting
 - Vent sizing: variable between wetwell and drywell, same
 - Vent cycling criteria: (PCPL)/(PCPL-15), other (if any)?
 - Transition from WW to DW venting: SP high water level, other (?)
 - Early venting option: criteria (?)
- Duration of transients: 72 hours, other (?)

MELCOR Calculation Matrix

Case Description	Input Parameters	Case 1	Case 2	Case 3	Case 4	Case 5
Main Steam Line Creep	RCIC failure (hr.)	16	4	0	16	4
Rupture	Drywell spray actuation	@ RCIC failure	@ RCIC failure	@ vessel breach	@ vessel breach	@ vessel breach
	Drywell spray flow rate (gpm)	500	500	500	500	500
	Wetwell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)
	Drywell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)
	Run time (hr.)	72	72	72	72	72



MELCOR Calculation Matrix

Case Description	Input Parameters	Case 6	Case 7	Case 8
Main Steam	RCIC failure (hr.)	16	16	16
Line Creep	Drywell spray actuation	16	16	@ vessel breach
Rupture	Drywell spray flow rate (gpm)	500	500	500
	Wetwell vent cycling	(PCPL)/ (PCPL-15)	Early venting	Early venting
	Drywell vent cycling	No cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)
	Run time (hr.)	72	72	72



MELCOR Calculation Matrix

Case Description	Input Parameters	Case 9	Case 10	Case 11	Case 12	Case 13
Vessel Breach	RCIC failure (hr.)	16	4	16	16	16
	Drywell spray actuation	16	4	@ vessel breach	16	16
	Drywell spray flow rate (gpm)	500	500	500	500	500
	Wetwell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	Early venting (PCPL)/ (PCPL-15)
	Drywell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	none	(PCPL)/ (PCPL-15)
	Run time (hr.)	72	72	72	72	72



MELCOR Calculation Matrix

Case Description	Input Parameters	Case 14	Case 15	Case 16	Case 17
SRV failure	RCIC failure (hr.)	16	4	16	16
	Drywell spray actuation	16	4	@ vessel breach	16
	Drywell spray flow rate (gpm)	500	500	500	500
	Wetwell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	Early venting
	Drywell vent cycling	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)
	Run time (hr.)	72	72	72	72



MELCOR Calculation Matrix

Case Description	Input Parameters	Case 18	Case 19		
Containment overpressure failure (e.g., head flange leakage)	RCIC duration (hr)	16	4		
	Drywell spray actuation time (hr.)	16	4		
	Drywell spray flow rate (gpm)	500	500		
	Venting				
	Run time (hr.)	72	72		
	RCIC duration (hr)	16	4		



MELCOR Calculation Matrix

Case Description	Input Parameters	Case 20	Case 21	Case 22
Containment bypass (e.g., liner melt-through)	RCIC duration (hr)	16	4	16
	Drywell spray actuation time (hr.)	@ vessel breach	@ vessel breach	@ vessel breach
	Drywell spray flow rate (gpm)	500	500	500
	Wetwell venting	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	Early venting (PCPL)/ (PCPL-15)
	Drywell venting	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)	(PCPL)/ (PCPL-15)
	Run time (hr.)	72	72	72



Assumptions and Notes

- All cases start with ELAP; SACV capability assumed to be in place as are FLEX and other EPG/SAG features; FLEX for pre-core damage only
- MSL rupture simulating a LOCA - assumed break size 6" dia.
- RCIC quits at battery depletion; RCIC flow rate of 600 gpm assumed based on existing information
- Vessel breach timing is calculated
- Assumed value of 500 gpm subject to revision based on industry's EPG/SAG
- Assumed 16" wetwell vent line; vent cycling assumed with vent opening at PCPL and closing at (PCPL-15); subject to revision based on EPG/SAG
- Early venting and vent cycling strategy explored at lower pressure limits
- Assumed 12" drywell vent line; wetwell to drywell transition @ suppression pool high water level, if needed
- Vent cycling assumed with vent opening at PCPL and closing at (PCPL-15); subject to revision based on EPG/SAG
- Drywell vent once opened, assumed late in the transient, remains open
- Both stochastic failure and thermal seizure of SRVs to be considered
- Head flange leakage simulating Fukushima-type accident; venting in this case assumed not initiated in time or it is ineffective in preventing overpressure; equipment and human reliability issue
- Matrix shown is representative of Mark I calculations; identical or substantially similar effort is anticipated for Mark II.

Abbreviations

- ACRS – Advisory Committee on Reactor Safeguards
- CER – Cumulative Effects of Regulation
- DW – Drywell
- EPG – Emergency Procedure Guidelines
- GPM – gallons per minute
- PCPL – Primary Containment Pressure Limit
- RCIC – Reactor Core Isolation Cooling
- SA – Severe Accident
- SAG – Severe Accident Guidelines
- SP – Suppression Pool
- WW – Wetwell



Questions & Discussion

