Draft Slides for Rulemaking and ISG

July 11 Public Meeting

Performance Measures

- SRM directs evaluation of several performance measures
  - Decontamination factor
    - "Strategies that result in a DF greater than 1000 are considered viable."
  - QHO Margin (see 6/26/2013 presentation)
  - Equipment and procedure availability similar to those required to implement 10 CFR 50.54(hh)
    - Example: BWROG Tabletop performance goals
    - How does this relate to QHO Margin? Same result?
  - Others under consideration

Alternatives

- Severe accident capable dry well flood added to alternatives
  - FLEX for before core damage only, no role after core damage
- All alternatives assume severe accident capable dry well and wet well vents

Industry Plans

- Staff requests update of industry plans for:
  - Analyses to support evaluation of performance measures
  - Definition of severe accident conditions
  - Severe accident event tree/fault tree
  - Treatment of uncertainties
  - Alternatives
    - Cost of alternatives
  - Mark II

Industry Plans (Cont.)

- Will work continue on:
  - Filtering strategies water management
    - Achieve high decontamination (> 1000 DF) while not blocking wet well vent
    - BWROG Tabletop insights
  - Use of dry well spray for decontamination
  - New equipment
    - Automated cycling vent valve
    - Instrumentation to determine vessel breach and to support auto vent valve cycling after breach

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 Rupture	RCIC failure (hr.)	16	4	0	16	4
	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 Line Creep Rupture	RCIC failure (hr.)	16	16	16		
	Drywell spray actuation	16	16	@ vessel breach		
	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
	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		
	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.

ISG

July 11, 2013

Scope and Purpose

- Design and operation of vents (SACV) in beyond-design-basis core damage conditions
- Includes conditions created in a sequence of events leading to core damage
- Most extreme conditions of temperature, pressure (includes hydrogen, CCI), radiation determined by analysis of severe accidents that include reactor vessel breach, main steam line rupture, and SRV failure
- SACV primary mission is to protect the dry well head gasket from failure