Consideration of Fire and Other External Event Risk in 10 CFR 50.65(a)(4) Assessments

NEI Public Meeting on NUMARC 93-01

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Background

10 CFR 50.65(a)(4) states:

"*Before performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and preventative and corrective maintenance), the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The scope of the assessment may be limited to structures, systems, and components that a risk-informed evaluation process has shown to be significant to the public health and safety.*"

(Became effective 27 November, 2000)

Background (cont'd)

- **Industry Guidance on (a)(4) Implementation**
  - February 2000 Revision to Section 11 of NUMARC 93-01
    - Provided for quantitative risk assessment using at-power, Level I, internal-events PRA.
    - External events addressed, but implied those external to plant only.
    - Fire (treated in the IPE as an "external event") not explicitly addressed
- **NRC Response**
  - R.G. 1.182, May 2000
    - Endorsed the revised Section 11 of NUMARC 93-01
  - RIS-2001-009
    - Clarified staff position on maintenance affecting risk-significant hazard barriers (including fire barriers), 50.65(a)(4) risk assessment, and 50.59 evaluation.

Background (cont'd)

- **NRC Response (cont'd)**
  - Inspection Procedure IP71111.13 instructs inspectors to evaluate licensee risk assessment and management of potential fire and other external events (including flooding) when the event or condition exists or is expected to exist during the maintenance.
- **Recent Inspections**
  - Many licensee (a)(4) risk assessments have not considered the impact of fire and other external events, even qualitatively.

NRC Staff Concerns

- **Hidden Risk from fire and other external events during maintenance activities.**
  - Should warrant additional risk management.
- **Not assessing the impact of external events may lead to a potential increase in risk to the public.**
- **Potential compliance issue if external events are not considered.**

Staff Safety/Risk Evaluation

- **NRC Staff Preliminary Evaluation**
  - Fire risk chosen since it's the highest contributor among external events for most plants.
- **Other external events (e.g., flooding) must also be considered.**
- **All modes of plant operation need to be considered.**
- **NUREG-1742 – Report in IPEEE Results**
  - Majority of submittals reported fire-initiated CDF at same level, or an order of magnitude higher than internal event CDF.

SPAR-EE

- In 2006, NRC-RES developed SPAR models for a selected group of plants.
- Models represent the best estimates of plant response to fire, based on licensee's full-power IPEEE submittals and may lack detail on specific plant configurations.
- Useful as a screening tool for quantitative assessment of the concern.

Safety Assessment From SPAR-EE Models

Six representative plants selected

- **BWR**
  - 1 BWR/4 with Mark II Containment.
  - 2 BWR/4 with Mark I Containments.
- **PWR**
  - 1 W-2 loop with large dry containment.
  - 2 W-4 loop with large dry containments.

SPAR-EE Methodology

- **Simple Case For Each Plant Evaluated Within Existing 10 CFR 50.65 (a)(4) Program**
  - The single most risk-significant structure, system, or component (SSC) routinely removed from service for maintenance or testing chosen based on Fussel-Vesely importance ranking of the internal-events SPAR model.

SPAR-EE Methodology (cont'd)

Representative Plant	SSC Taken Out of Service
BWR # 1	RHR Pump B
BWR # 2	ESW-A
BWR # 3	HPCI
PWR # 1	EDG-1B
PWR # 2	EDG-1B
PWR # 3	ABFP-32

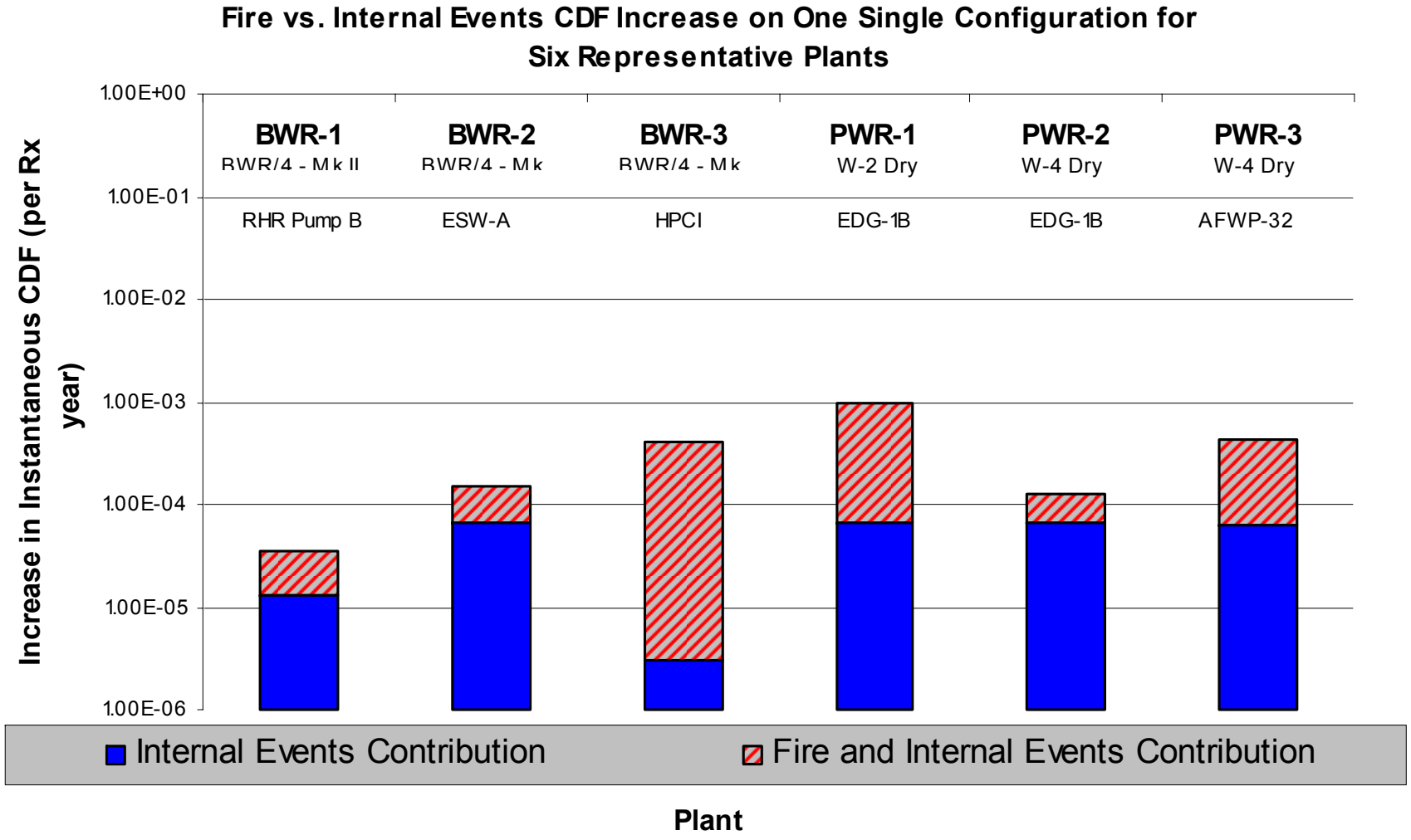
SPAR-EE Methodology (cont'd)

- **Quantification of base case and specific SSC outage performed for each plant model <u>with</u> and <u>without</u> inclusion of fire impact.**
  - Evaluation of configuration using criteria similar to that used by licensees use when assessing maintenance risk (typically by workweek)
  - Color-coded system (Similar to EPRI's ORAM-Sentinel)
  - Thresholds at internal-events instantaneous CDF multiples

Risk Band Color Codes Used

- Green – very low risk increase, normal work controls
- Yellow - low risk increase, some risk management actions (RMA) required
- Orange - moderate risk increase - avoid configuration in scheduling. Entry allowed under special conditions requiring station management approval and contingency briefing with shift.
- Red - avoid configuration. Entry not allowed except to prevent higher risk evolution. Requires higher management approval and extensive RMAs.

Results



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Risk Band Changes

	Plant					
	BWR-1	**BWR-2**	**BWR-3**	**PWR-1**	**PWR-2**	**PWR-3**
SSC ->	**RHR Pump B**	**ESW-A**	**HPCI**	**EDG-1B**	**EDG-1B**	**AFW Pump 32 (TDP)**
Color of Configuration - Internal Only	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Color of Configuration - Internal and Fire (evaluated against internal criteria)	Orange	Orange	**Red**	**Red**	Orange	Orange

Conclusions and Recommendations

- **Regulatory Issue Summary (RIS) has been prepared to clarify staff expectations and point out needed clarification in industry guidance.**
  - Will be sent to the Committee to Review Generic Requirements (CRGR) for review.
  - Public meeting/workshop to be scheduled.
- **Purely qualitative assessment or blended with quantitative acceptable**
- **New thresholds (requiring additional RMAs) for increased maintenance risk may need to be developed by licensees using quantitative method.**

Proposed Implementation and Impact

- **NEI has developed interim guidance – roll into latest revision of NUMARC 93-01.**
  - RG 1.160 to be revised to cover new revision and RG 1.182 cancelled.
- **Licensees will need to update 10CFR50.65 (a)(4) programs.**
- **New contingencies or restrictions need to be developed on current on-line maintenance programs.**