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External Hazards PSA – Some Personal Perspectives*

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*The views expressed in this presentation are not necessarily those of the U.S. Nuclear Regulatory Commission

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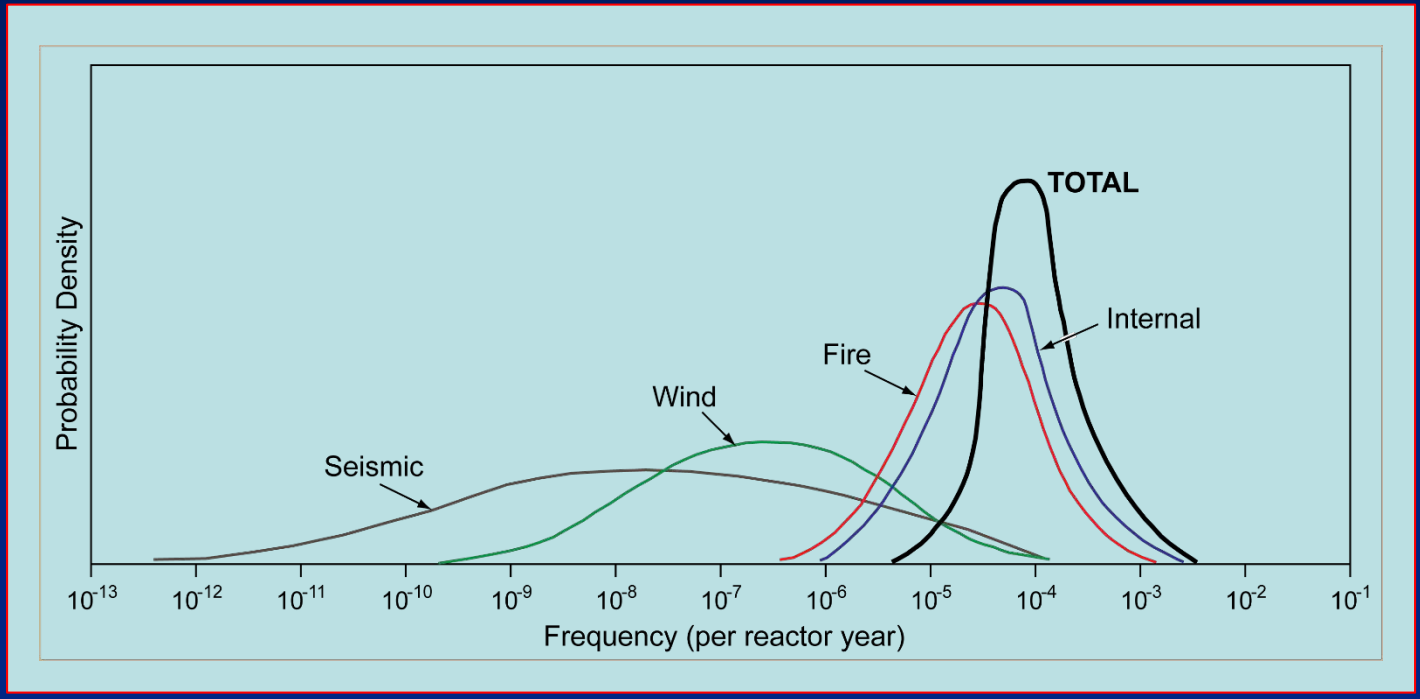
(1) Early PSAs showed the importance of external hazards => Fukushima should not have been such a shock.



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(2) Post-Fukushima investigations, inspections, analyses, discussions, etc. are informing follow-on activities.

- R&D issues
- PSA Standards
- Risk-informed decisionmaking
  - ✓ Aggregation
  - ✓ Credit for portable equipment

Example Challenges

- Multiple, correlated hazards
- Multiple mechanisms
- Scale of analysis
  - ✓ Regional sources
  - ✓ Multiple units and sites
- Human effects
- Data (hazard and site)

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(3) Improved knowledge management can aid imagination, searches for failure scenarios.

- Information, e.g.,
  - ✓ Events
  - ✓ Analyses
- Mechanisms, e.g.,
  - ✓ Workshops
  - ✓ Information Technology
- **Commitment**

E. De Fraguier, "Lessons learned from 1999 Blayais flood: overview of EDF flood risk management plan," U.S. NRC Regulatory Information Conference, March 11, 2010.

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Additional Slides

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Knowledge Management – Blayais

- 12/27/1999 – Storm during high tide in Gironde River estuary
- Overtopping of protective dyke
- Loss of
  - Offsite power (Units 2 and 4) – wind
  - Essential service water (Unit 1, Train A), low head safety injection and containment spray pumps (Units 1 and 2), site access – flooding
  - Site accessibility
- Papers in 2005 IAEA workshop following Indian Ocean tsunami
- Presentation at 2010 USNRC Regulatory Information Conference
- Little notice in PSA community

E. De Fraguier, "Lessons learned from 1999 Blayais flood: overview of EDF flood risk management plan," U.S. NRC Regulatory Information Conference, March 11, 2010.

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Some Fire-Induced "Near Misses"

Event	Summary Description*
Browns Ferry (BWR, 1975)	Multi-unit cable fire; multiple systems lost, spurious component and system operations; makeup from CRD pump
Greifswald (VVER, 1975)	Electrical cable fire; station blackout (SBO), loss of all normal core cooling for 5 hours, loss of coolant through valve; recovered through low pressure pumps and cross-tie with Unit 2
Beloyarsk (LWGR, 1978)	Turbine lube oil fire , collapsed turbine building roof, propagated into control building, main control room (MCR) damage, secondary fires; extinguished in 22 hours; damage to multiple safety systems and instrumentation.
Armenia (VVER, 1982)	Electrical cable fire (multiple locations), smoke spread to Unit 1 MCR, secondary explosions and fire; SBO (hose streams), loss of instrumentation and reactor control; temporary cable from emergency diesel generator to high pressure pump
Chernobyl (RBMK, 1991)	Turbine failure and fire, turbine building roof collapsed; loss of generators, loss of feedwater (direct and indirect causes); makeup from seal water supply
Narora (PHWR, 1993)	Turbine failure, explosion and fire, smoke forced abandonment of shared MCR; SBO, loss of instrumentation; shutdown cooling pump energized 17 hours later

*See NUREG/CR-6738 (2001), IAEA-TECDOC-1421 (2004)