Introductory Remarks

Fire PRA: A Brief History and Some Workshop Challenges

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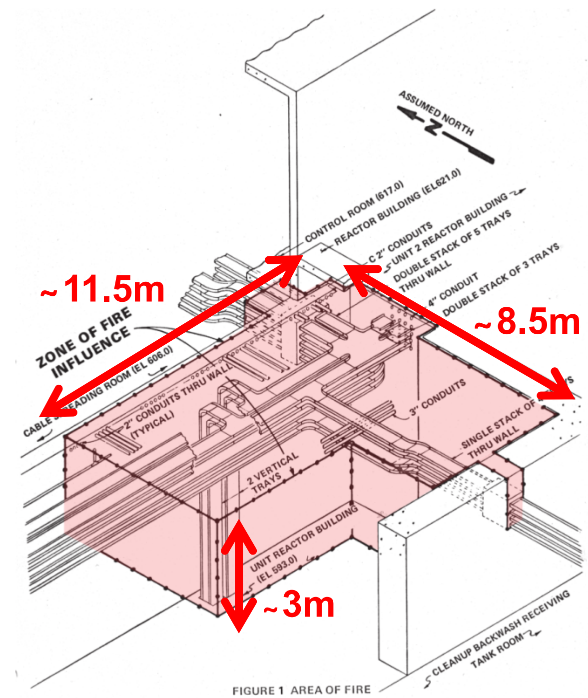
Some “Near Misses”

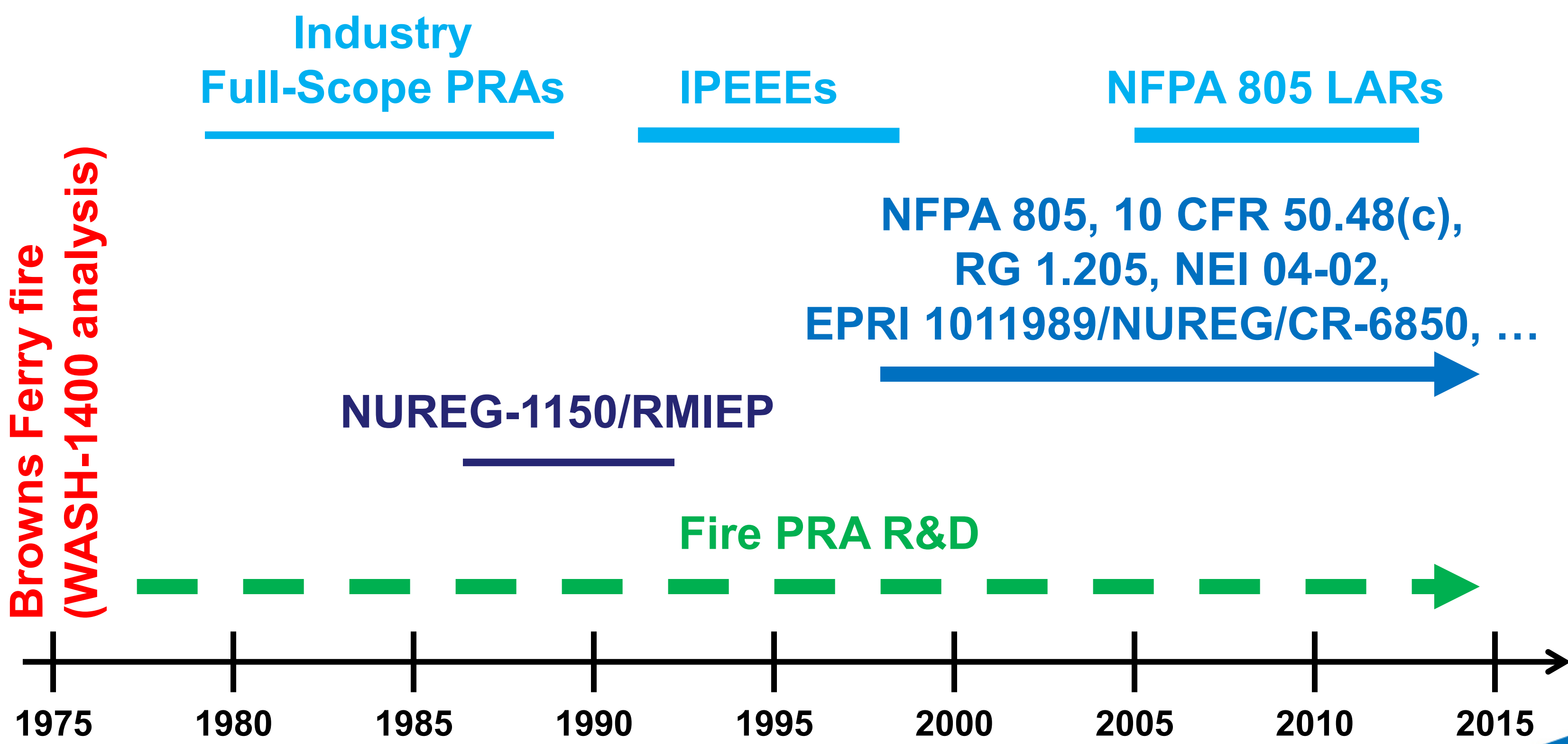
Event	Summary Description*
Browns Ferry (BWR, 1975)	Multi-unit cable fire; multiple systems lost, spurious component and system operations; makeup from CRD pump
Greifswald (VVER, 1975)	Electrical cable fire ; SBO, loss of all normal core cooling for 5 hours, loss of coolant through valve; recovered through low pressure pumps and cross-tie with Unit 2
Beloyarsk (LWGR, 1978)	Turbine lube oil fire , collapsed turbine building roof, propagated into control building , 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 EDG to high pressure pump
Chernobyl (RBMK, 1991)	Turbine failure and fire, turbine building roof collapsed; loss of generators, LOFW (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)

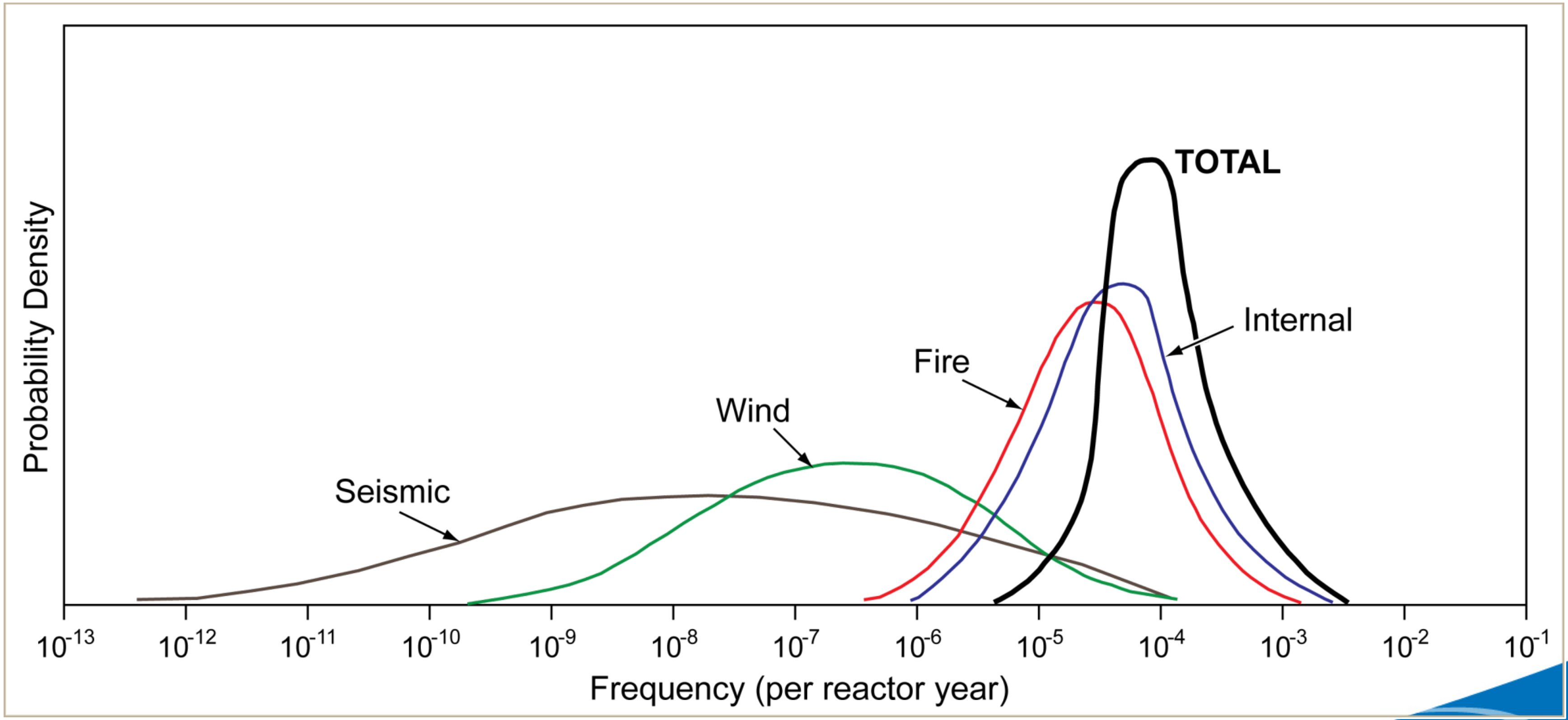


Adapted from NUREG-0050 (1976)

Fire PRA in the U.S.



A picture of fire risk



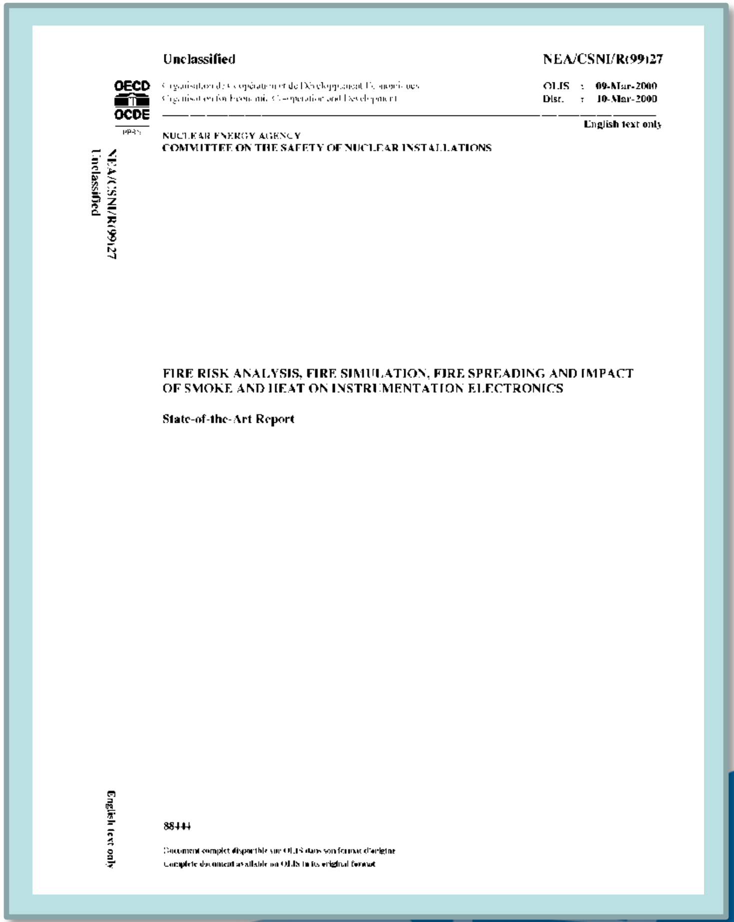
Past and ongoing OECD/NEA efforts

- Workshops
  - Helsinki (29 June – 1 July 1999)
  - Puerto Vallarta (23-26 May 2005)
- State-of-the-Art Report

  "Fire Risk Analysis, Fire Simulation, Fire Spreading and Impact of Smoke and Heat on Instrumentation Electronics," NEA/CSNI/R(99)27, 1999.
- Technical Opinion Paper

  "Fire probabilistic safety assessment for nuclear power plants," CSNI Technical Opinion Paper No. 1, Nuclear Energy Agency, Paris, France, 2002.
- PSA Survey

  "Use and Development of Probabilistic Safety Assessment: An Overview of the Situation at the End of 2010," NEA/CSNI/R(2012)11, 2012.
- OECD/NEA Projects
  - Operational experience (FIRE)
  - Experiments (PRISME, PRISME2, HEAF)


Unclassified NEA/CSNI/R(99)27

OECD OCDE

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 09-Mar-2000
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NUCLEAR ENERGY AGENCY
COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

NEA/CSNI/R(99)27
Unclassified

FIRE RISK ANALYSIS, FIRE SIMULATION, FIRE SPREADING AND IMPACT OF SMOKE AND HEAT ON INSTRUMENTATION ELECTRONICS

State-of-the-Art Report

English text only

88444

Document complet disponible sur OLIS dans son format d'origine
Complete document available on OLIS in its original format

Workshop Objectives (Condensed)

- Support assessment of current state of fire PRA
  - As a tool to address all plant operational states
  - As a tool to address the lessons learned from the post-Fukushima investigations and stress tests
  - Realism of results
- Share methods and good practices and experiences
- Identify new potential topics for further WGRISK activities
  - Potential update of the State-of-the-Art Report (SOAR)
  - Methods development
  - Collection and analysis of operational experience

WGRISK Vision

Mission

Provide a forum for information exchange that advances the understanding and utilisation of probabilistic safety assessment (PSA), thereby supporting the CSNI as it assists member countries in ensuring the safety of existing and future nuclear installations.

- Provide **timely, high-quality work products** addressing, to the extent practical, the broad range of risk assessment and management needs identified by CSNI and the working group members;
- Be **forward looking** in the identification of risk assessment and management issues that may need to be addressed by CSNI and the working group;
- Be sufficiently **flexible** to respond to emerging risk assessment and management issues;
- Be appropriately **coordinated** with the risk assessment and management programs of member countries and other international organizations;
- Serve as an **internationally recognized, authoritative source** on risk-related matters and as an important resource for risk-related knowledge management activities; and
- Continuously strive for **self-improvement**

Challenges to participants

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Recognizing high stakes and high visibility,

- Participate actively – make sure workshop proceedings reflect participants' points of view
- Have open discussions
  - Challenge (as appropriate) conventional wisdoms
  - Introduce new evidence and/or interpretations
  - Recognize differing points of view
- Help WGRISK separate "signal" from "noise"
  - Status: Where are we now?
  - Path forward: What should we do?
  - Audience includes senior decision makers

A blast from the past…

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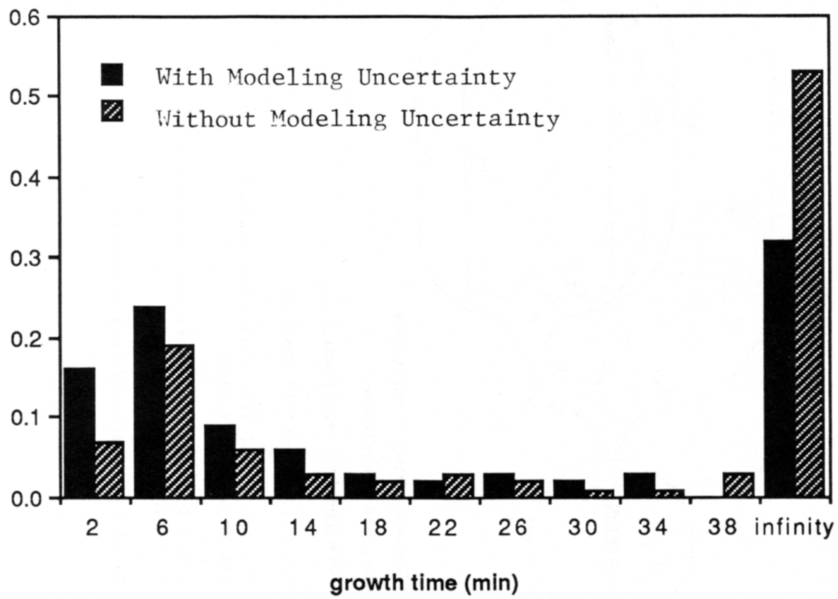
ACRS (2005)

"…while the uncertainties in fire ignition frequencies and post-fire human reliability will be quantified, many of the other uncertainties are to be relegated to a quality review rather than elucidated and made visible by estimation or analysis…"

"…although a reasonable attempt has been made to require the identification of the key sources of uncertainty, efforts should continue to develop new approaches to further identify, quantify, and document the remaining uncertainties."



EPRI Workshop on Fire Protection in Nuclear Power Plants,
EPRI NP-6476, August 1989.

What's in a number?

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Issue ID	Issue Title	Issue ID	Issue Title
I1	Adequacy of fire events database	P1	Circuit interactions
I2	Scenario frequencies	P2	Availability of safe shutdown equipment
I3	Effect of plant operations, including compensa[illegible]asures	[illegible]	[illegible]cenario cognitive impact
I4	Likelihood of severe fires	[illegible]	[illegible]f fire induced environment on operators
E1	Source fire modeling	[illegible]	R[illegible]e brigade in plant response
E2	Compartment fire modeling	[illegible]1	M[illegible]rol room fires
E3	Multi-compartment fire modeling	R2	T[illegible]uilding fires
E4	Smoke generation and transport mod[illegible]	R3	[illegible]nent fires
H1	Circuit failure mode and likelihood	R4	[illegible]c/fire interactions
H2	Thermal fragilities	R5	[illegible]ple unit interactions
H3	Smoke fragilities	R[illegible]	[illegible]n-power and degraded conditions
H4	Suppressant-related fragilities	[illegible]	Decommissioning and decontamination
B1	Adequacy of data for active and[illegible]	[illegible]	Fire-induced non-reactor radiological releases
B2	Barrier performance analysis tools	[illegible]	[illegible]le gas lines
B3	Barrier qualification	[illegible]	[illegible]dynamics
B4	Penetration seals	[illegible]	[illegible] analysis methods
S1	Adequacy of detection time data	R12	Uncertainty analysis
S2	Fire protection system reliability/availability	O1	Learning from experience
S3	Suppression effectiveness (automatic, manual)	O2	Learning from others
S4	Effect of compensatory measures on suppression	O3	Comparison of methodologies
S5	Scenario-specific detection and suppression analysis	O4	Standardization of methods