

**Fire protection
at nuclear installations**

Topic of Interest:

Combinations of Fires with other Hazards

Presented by: Marina Röwekamp (GRS)
Christian Northe (BASE)
Eugenia Morgado (CSN)

Hazard combinations

consequential

correlated

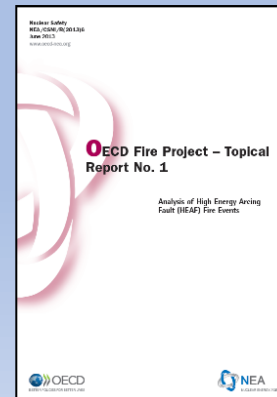
coincidental

**Combinations of hazards
(including combinations
of fires and other hazards)
need to be considered in the
design, operation and safety
assessments of nuclear installations**

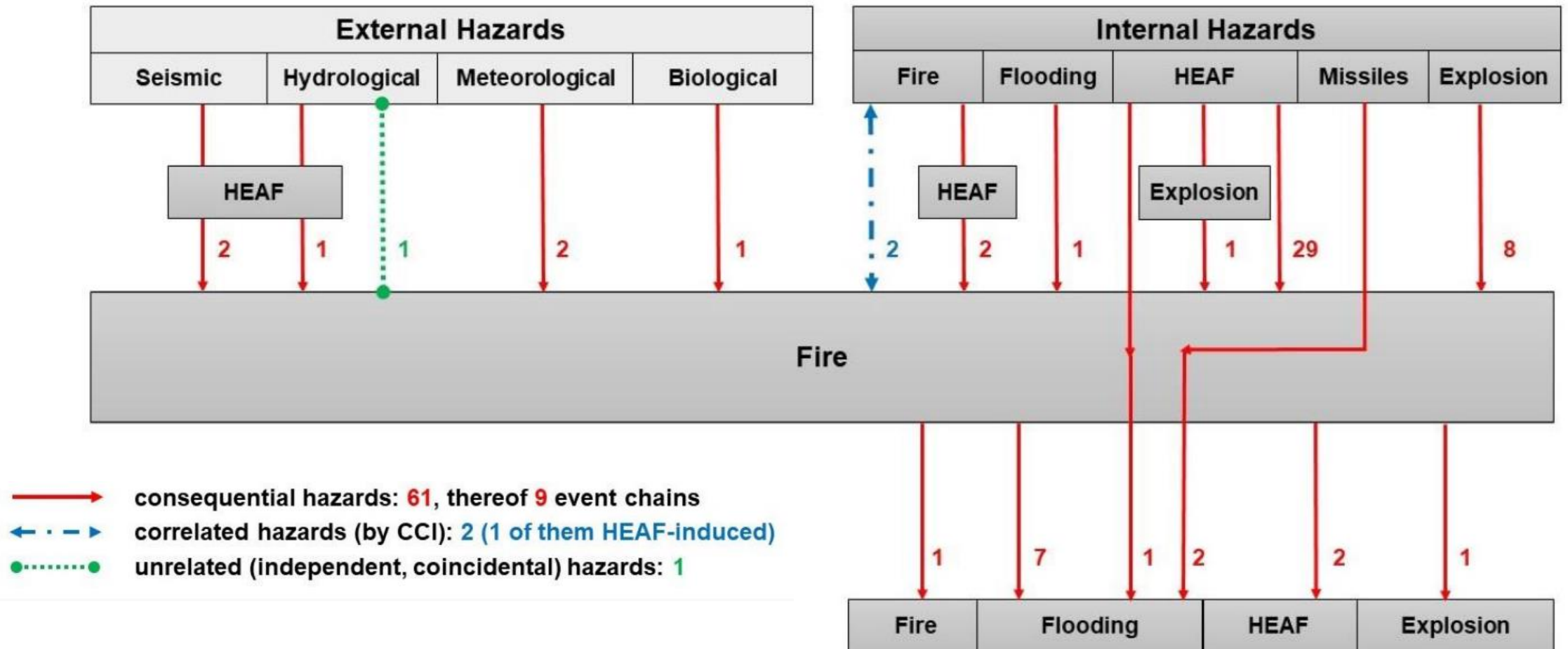


OPEX has demonstrated
significance of combined
fire hazards

- IAEA IRS
- OECD/NEA FIRE Database
incl. Topical Report No. 3



Combinations of Fires and Other Hazards



Aspects to be discussed



1. Combinations of hazards to be addressed in the safety analyses and criteria for their identification



2. Design, qualification and performance of fire protection features against combined hazards

Expected outcome of discussion

- Overview/benchmarking of approaches regarding event combinations of fires and other hazards to be considered in the different installations
- Better insights from national approaches to share experience and identify potential good practices and/or challenges

1. Combinations of hazards to be addressed in the safety analyses and criteria for their identification

- Within or beyond the design basis
- Addressing all types of combinations according to IAEA SSG-64, SSG-3. etc.

Approaches reported in the NAR:

- Hazard combinations are considered for all types of installations in fire safety analyses and the implementation/upgrades of fire protection concepts
- Exceptionally, for NPP and RR, full scope PSA (all plant operational states, all internal events, all internal and external hazards) analysis of hazard combinations
 - Scope covers single and combined hazards screening and analysis of credible combinations identified and includes design basis events, but also design extension conditions
 - Systematic screening all types of credible combinations (types defined in SSG-64)
 - Application of qualitative (from IAEA) and, as far as necessary, quantitative criteria



1. Combinations of hazards to be addressed in the safety analyses and criteria for their identification (contd.)

- Within or beyond the design basis
- Addressing all types of combinations according to IAEA SSG-64, SSG-3. etc.

Approaches reported in the NAR:

- Hazard combinations are not systematically addressed in FSA, mainly considered in recent Fire PSA for NPPs (and for RRs as applicable), approaches however vary;
- Detailed FSA for hazard combinations are carried out only for extremely few non-reactor installations, due to the lower risk potential, in particular for WSF and SFSF
- For installations under decommissioning a need for FSA considering hazard combinations is often not seen; few countries still consider such combinations as far as applicable

What are the approaches (deterministic/probabilistic) in your country for your installations?



- **which combinations are considered?**
- **how are they identified and screened?**
- **what are the most penalizing scenarios?**



2. Design, qualification and performance of fire protection features against combined hazards

- Natural hazards and consequential or coincidental plant internal fire
- Human induced hazards and consequential plant internal fire
- Fires and consequential hazards
- Identification of relevant plant areas/rooms where such combinations identified as credible could inadmissibly impair safety
- Fire prevention means implemented to prevent inadmissible impacts of such credible combinations
- Active fire protection means implemented to cover impacts of such credible combinations and their qualification (e.g. seismic)
- Qualification of passive fire protection features to prevent inadmissible impacts of such credible combinations (e.g. against combinations of seismic and fire)

How are the identified credible scenarios implemented in the whole fire protection programme/concept/strategy with respect to:



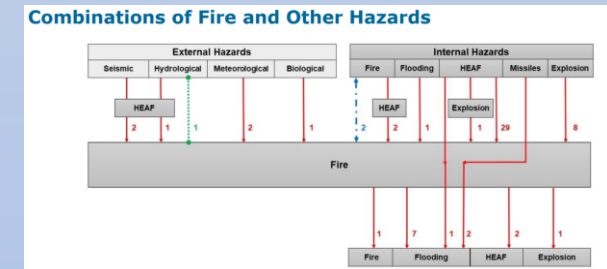
- **Design and qualification of SSCs**
- **Fire-fighting strategy and training?**

Combinations of Fires and Other Hazards



2. Design, qualification and performance of fire protection features against combined hazards (contd.)

- National and international experience
- From nuclear and non-nuclear installations



Approaches reported in the NAR (various countries):

- National nuclear experience is applied as far as available (e.g. reportable combined fire event) reported (mainly for reactors, but more severe events also from other installations) in many countries
- For several countries with installations of a lower risk potential only being present, combined hazards are not or inadequately addressed/considered
- Applicable operating experience on combined fire hazards from abroad is considered in most countries only for NPP (IRS, INES, OECD/NEA FIRE Database in some member countries), in few countries for higher risk RR
- Consideration of experience from non-nuclear installations was nearly not reported



How can the operating experience be better considered for risk reduction?

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Thank you for your participation and contributions!