

A Holistic Approach to Fire Risk Assessment: How to Combine Bow-Ties of Standard Fire Scenarios to Develop a Creative Yet Robust, Barrier Based, Fire Safety Strategy

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Nowadays performance based approach to fire safety can be considered a specific discipline in fire engineering activities. Performance based approach verifies the fire safety strategy considering specific fire scenarios and the produced negative effects (for occupants, environment and assets or business continuity) in a determined fire dynamics. Fire scenarios should become the basis of the assessment for the evaluation of the fire strategy: given predefined thresholds performance has to be verified being consistent with the fire risk associated with the scenario. Due to the amount of time needed to perform a quantitative assessment of the outcomes of credible and relevant scenarios it is fundamental to start from a precise fire risk assessment. Performance based approaches to fire engineering showed that risk based decisions and fire scenarios are a fundamental element of the fire safety strategy assurance but fire risk assessment has always been a challenging issue. In particular in the latest years, due to the computational possibilities granted by the advances in the information technology sector, performance based approaches have been replaced by the simulation of some scenarios among those considered to be relevant but without any risk assessment or case-based reasoning. This led in the most luck situations in a good reporting, difficult to be updated and without any resilience during time, while it led in the worst situations to three-dimensional cartoons without any real link with the fire and/or with the fire strategy in place. Fire safety strategy should be based on the evaluation of the performance against specific fire scenarios to be identified. Scenarios can be identified using specific standards (e.g. NFPA n. 101) combined with the use of a specific assessment based on the fire safety fundamentals, as those presented in the Fire Safety Concept Tree in NFPA® n. 550, referred to as “FSCT”. Given the paradigm of the “FSCT” for each fire compartment it is possible to judge the completeness of a fire safety strategy and the possibility to face specific identified scenarios in each aspect for the various outcomes (occupant’s safety, environment and business continuity or assets integrity). Robust fire strategies are not those implemented by severe and complex studies but are those that really represent the reality and are able to be maintained during time across all the possible modifications. Furthermore the performance should be able to be monitored during time (audited) in order to guarantee a proper level of residual fire risk (acceptable) or to mitigate an increase of risk with alternative measures (technical and organizational). This is an invaluable advantage when you have to identify alternative strategies or new or existing buildings. Alternative solutions can be evaluated taking into account the risk reduction operated by different strategies and by different elements composing the fire strategies themselves and also costs with a modern ALARP approach. Different strategies are based on safety critical elements (SCE) and barriers. So, at the end, from the initial performance based approach, the focus should be put to the fire safety barriers management during time. Complete approach has been supported by an informative system composed by several modules each one dedicated to a specific element of the risk life cycle.