



Towards to Methodical Framework for Vulnerability Analysis of Interconnected Infrastructures

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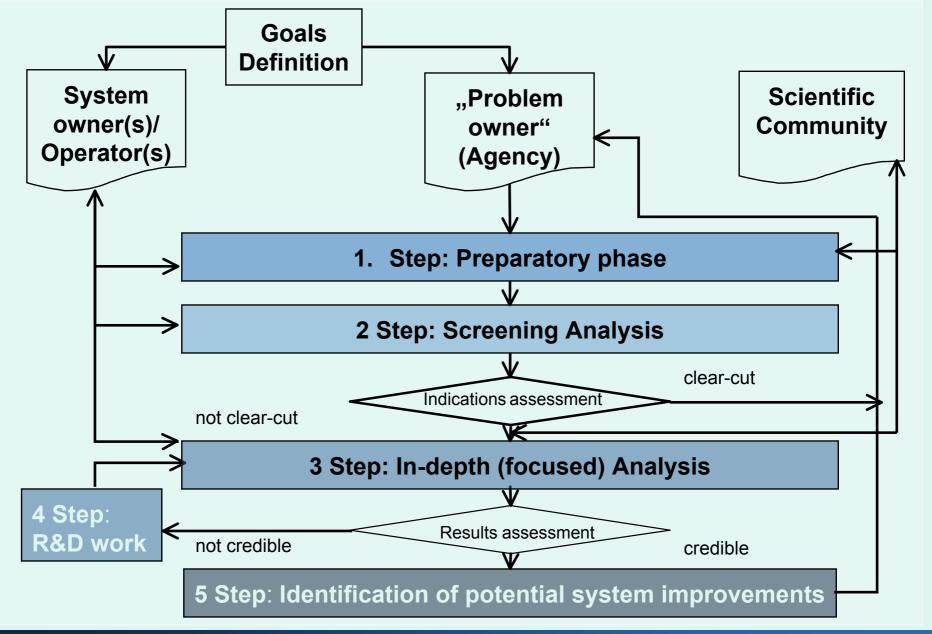


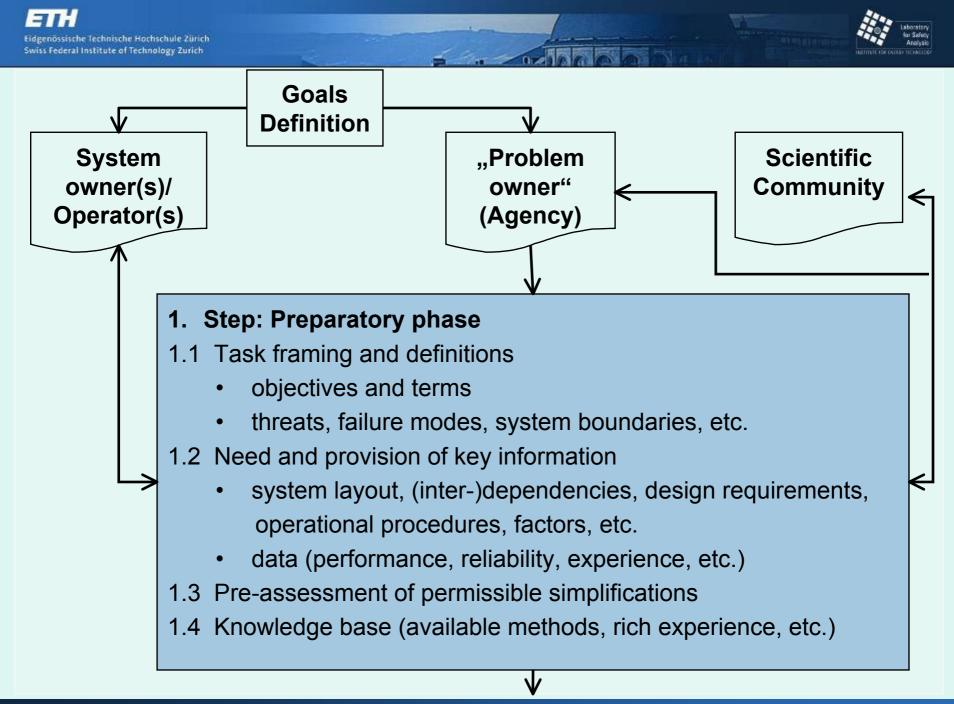
Motivation

- Requirements: Vulnerability analysis of interconnected infrastructures calls for 'system-of-systems thinking', suitable techniques and problem-oriented approach.
- Available: Many models for analyzing individual critical infrastructures
- Missing: Comprehensive framework for modeling and simulation of interdependencies



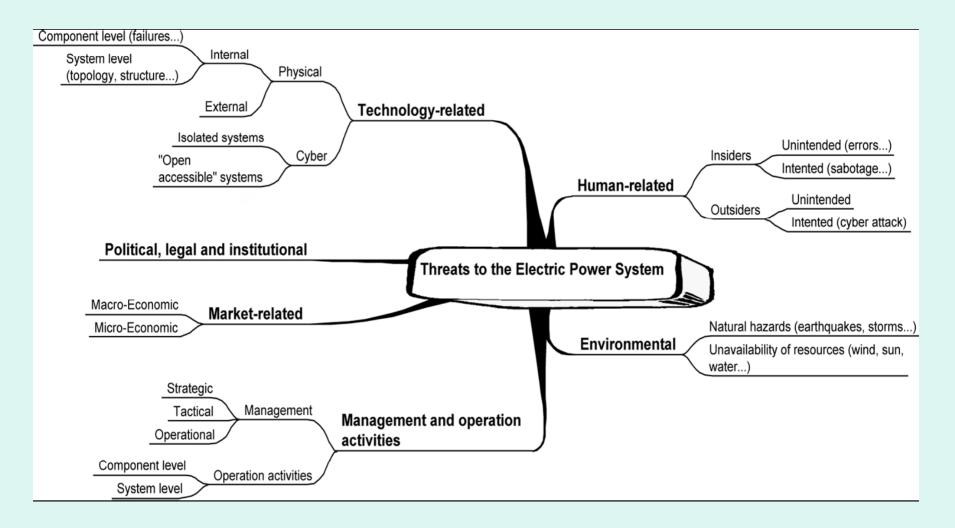


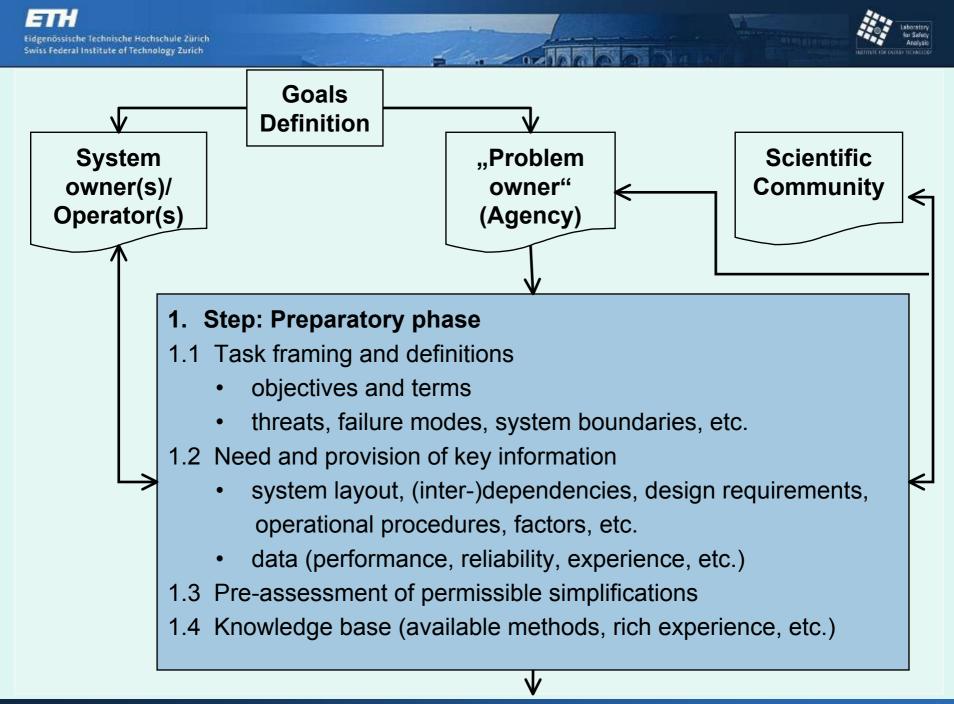


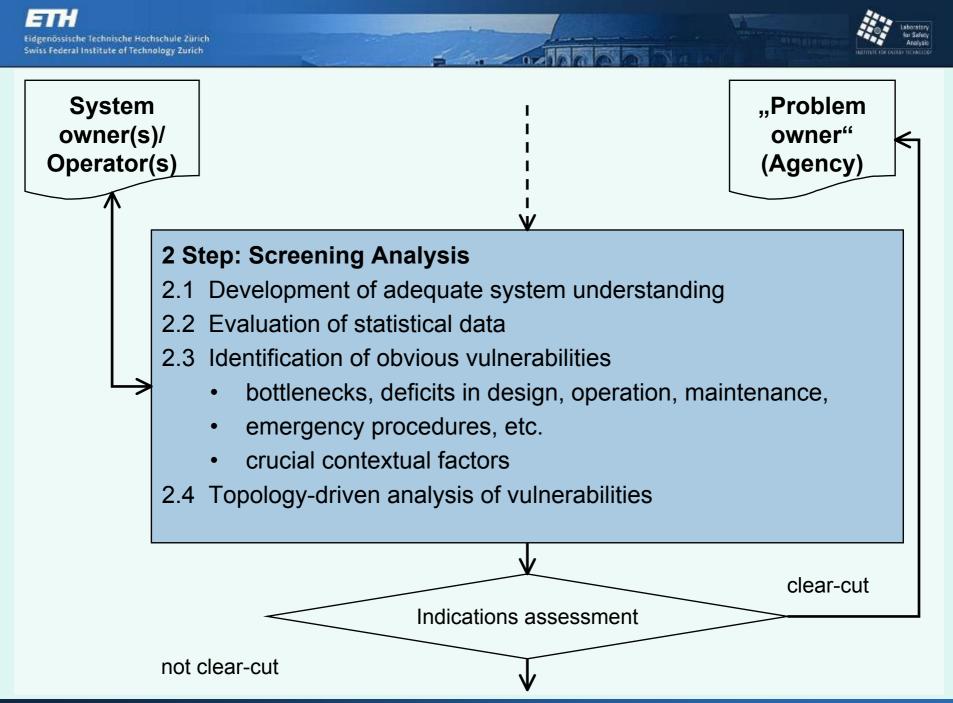




Threats to Electric Power Supply Infrastructure

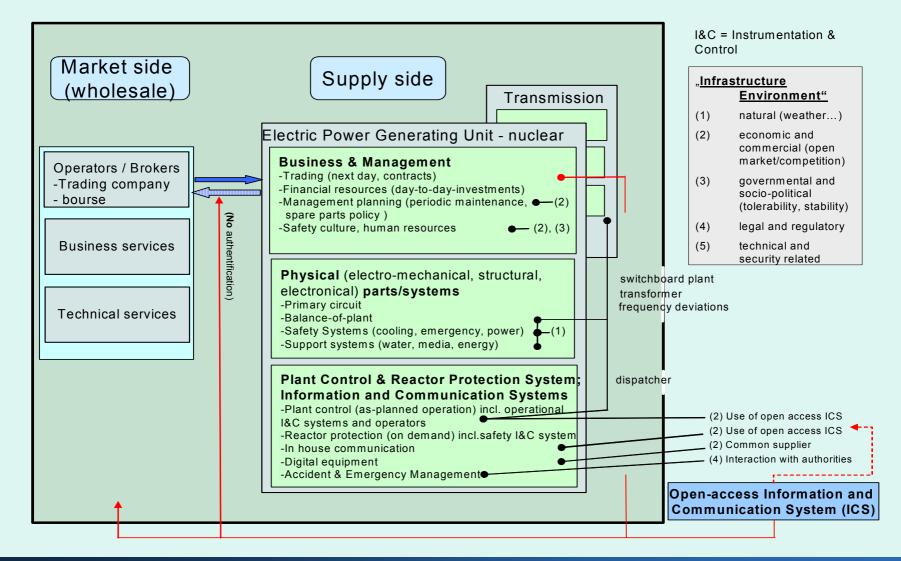


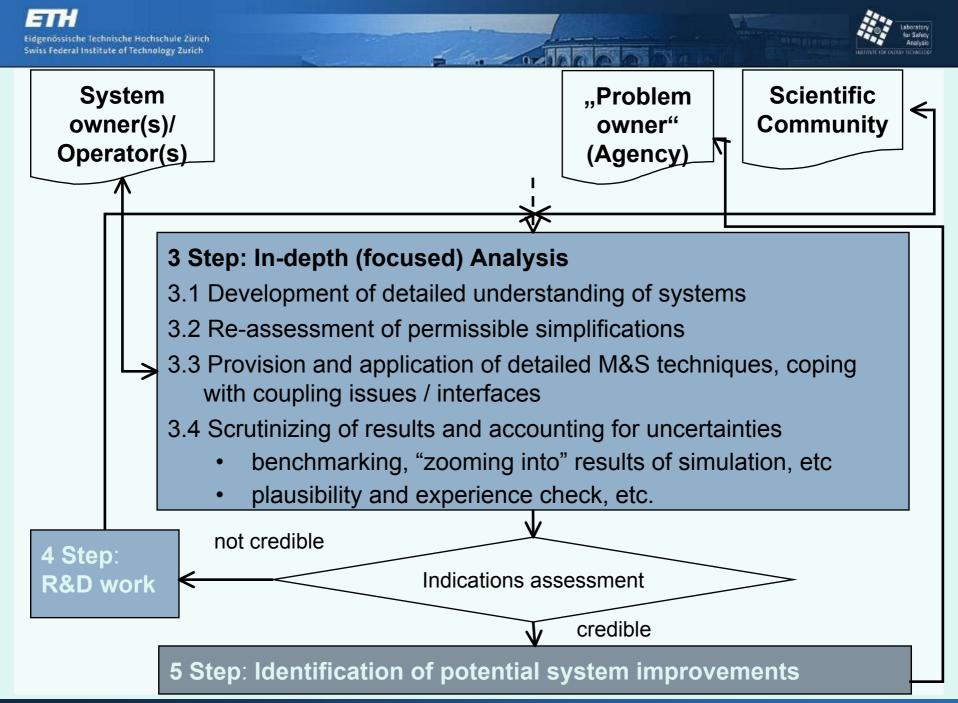






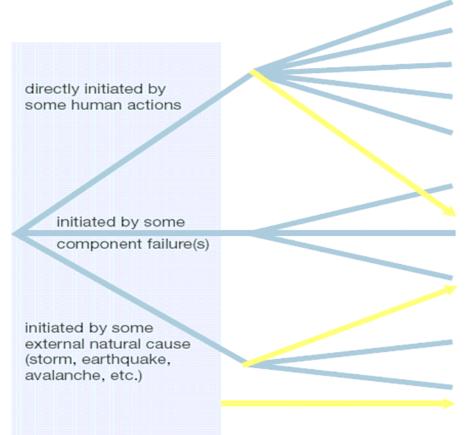
Electric Power Supply Infrastructure and its environment, detailed for a nuclear power generating unit interacting with ICS







Simplified illustration of events that can result in degradation of infrastructures and of a few interactions



operator error

unforeseen consequence of operator action

caused accident (e.g. rail car spills into water reservoir)

action by disgruntled employee or citizen (e.g. cyber attacks)

terrorist action

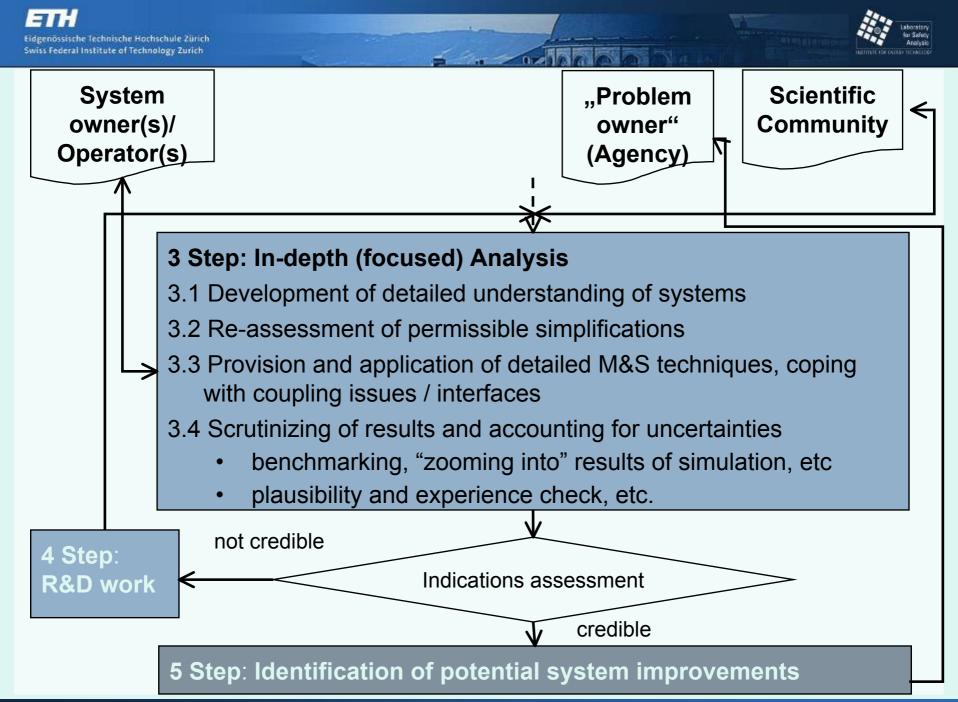
single or multi-point component failure sufficient to cause service failure or degradation

single or multi-point component failure sufficient to cause service failure or degradation when combined with a human action

single or multi-point component failure sufficient to cause service failure or degradation when combined with a natural event

single or multi-point component disruption sufficient to cause service failure or degradation

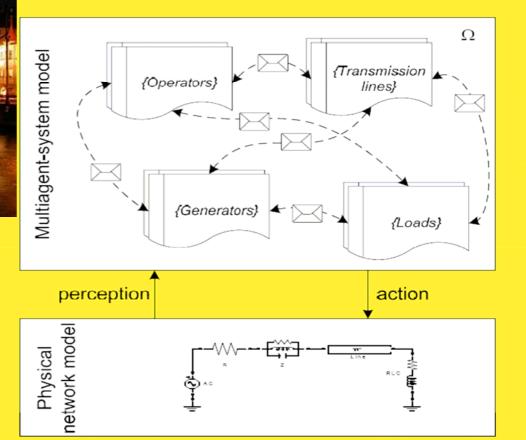
failure or degradation in some other infrastructure propagates with impact sufficient to cause service failure or degradation





Two-layer-approach to model the Electric Power Supply Infrastructure







Conclusions and outlook

- Framework for the analysis of CI proposed
- Steps described and illustrated by examples
- Its applicability and usefulness confirmed
- It needs to be further developed, e.g.
 by external reviews and by envisaged case studies



Definitions:

- Vulnerability degree of loss and damage depending on internal characteristics of the element at risk or/and a population's capacity to cope with a disaster, absorb, and recover as a measure of their capacity for adaption/capacity of resilience.
- *Risk* refers in general terms to the possibility (frequency) of loss, damage or injury and their extent (impact indicators).