Critical Asset & Portfolio Risk Analysis

State of Practice and Challenges

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Outline

- Risk Analysis & Management
- Critical Asset and Portfolio Risk Analysis
- Challenges
- Selected References

Terminology and Risk Fundamentals

Risk: The potential for loss or harm to systems due to the likelihood of an unwanted event and its adverse consequences.

- Potential means likelihood relating to vulnerability, consequences, and hazard rates
- Losses depend consequences and hazard rates
- Event(s) are defined by scenarios

Risk is an aggregate of (Hazard and scenarios, Consequences, Vulnerability, Threat rate)

Risk Assessment and Management

1. What could happen? (hazards)
2. How can it happen? (scenarios & vulnerabilities)
3. How likely is it to happen? (probabilities)
4. What are the consequences if it happens? (impacts)

Risk Assessment

5. What can be done to reduce the risks in a cost effective manner?
6. What effect will these actions have on subsequent risks and options?

Risk Management

CAPRA: **C**ritical **A**sset and **P**ortfolio (*including regional*) **R**isk **A**nalysis

CAPRA is a methodology and a process that can be used

- To quantitatively assess risks
- For a single asset, a portfolio of assets, or a region
- Due to natural hazards or human-caused hazards

CAPRA attributes

- **Analytic** – breaks risk down into its contributing components
- **Transparent –** all assumptions and analytical steps are clearly and explicitly identifies
- **Quantitative** – defines and quantifies these components using meaningful metrics/units (e.g., $)
- **Probabilistic** – uses probability theory to measure likelihood/chance

CAPRA attributes

- **Defensible** – all assumptions are supported by data and our credible expert judgment
- **Consistent** with existing practices of probabilistic risk analysis (PRA) used in many other fields and DHS practices including RAMCAP™
- **Adapted** to the unique nature of human-caused hazards such as dynamic and gaming

What decisions would CAPRA results inform?

At the **asset level**:

- Prioritizing hazards, critical elements and potential consequences
- Identifying potential actions to limit risks
- Computing benefit/cost ratios for these actions
- Providing information for assessing capabilities, readiness, and grant funding opportunities

What decisions would CAPRA results inform?

At the **asset-portfolio level**:

- Prioritizing (in tiers) assets, hazards and potential consequences
- Providing a framework to examine interdependence
- Identifying potential portfolio-level actions to limit risks
- Computing benefit/cost ratios for these actions
- Providing information for assessing capabilities, readiness, and grant funding opportunities

What decisions would CAPRA results inform?

At the **regional level**:

- Screening hazards based on their regional impacts
- For each hazard applicable to a region, providing
  - Losses by hazard intensity (accounting for physical vulnerabilities and existing mitigation measures)
  - Security vulnerabilities
  - Conditional risk profiles (without the hazard rates)
  - Regional risk profiles
- Developing HIRA reports

What decisions would CAPRA results inform?

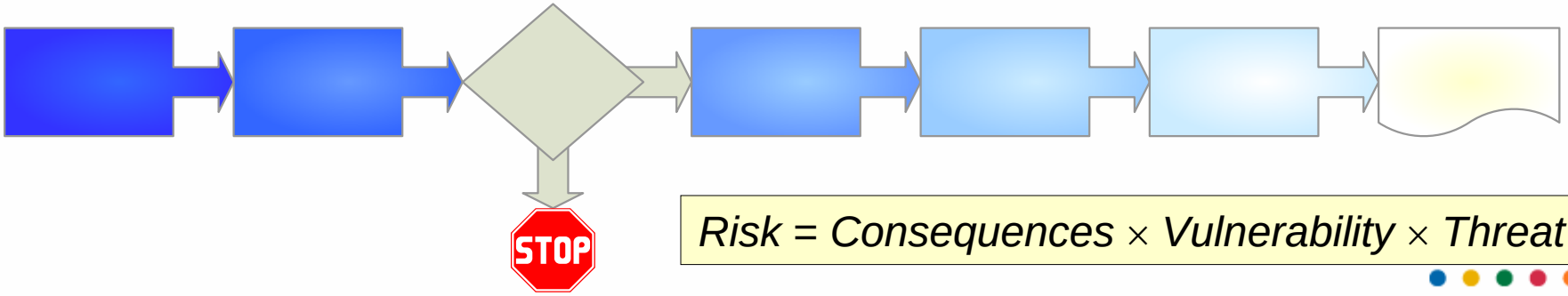
At the **regional level** (cont.):

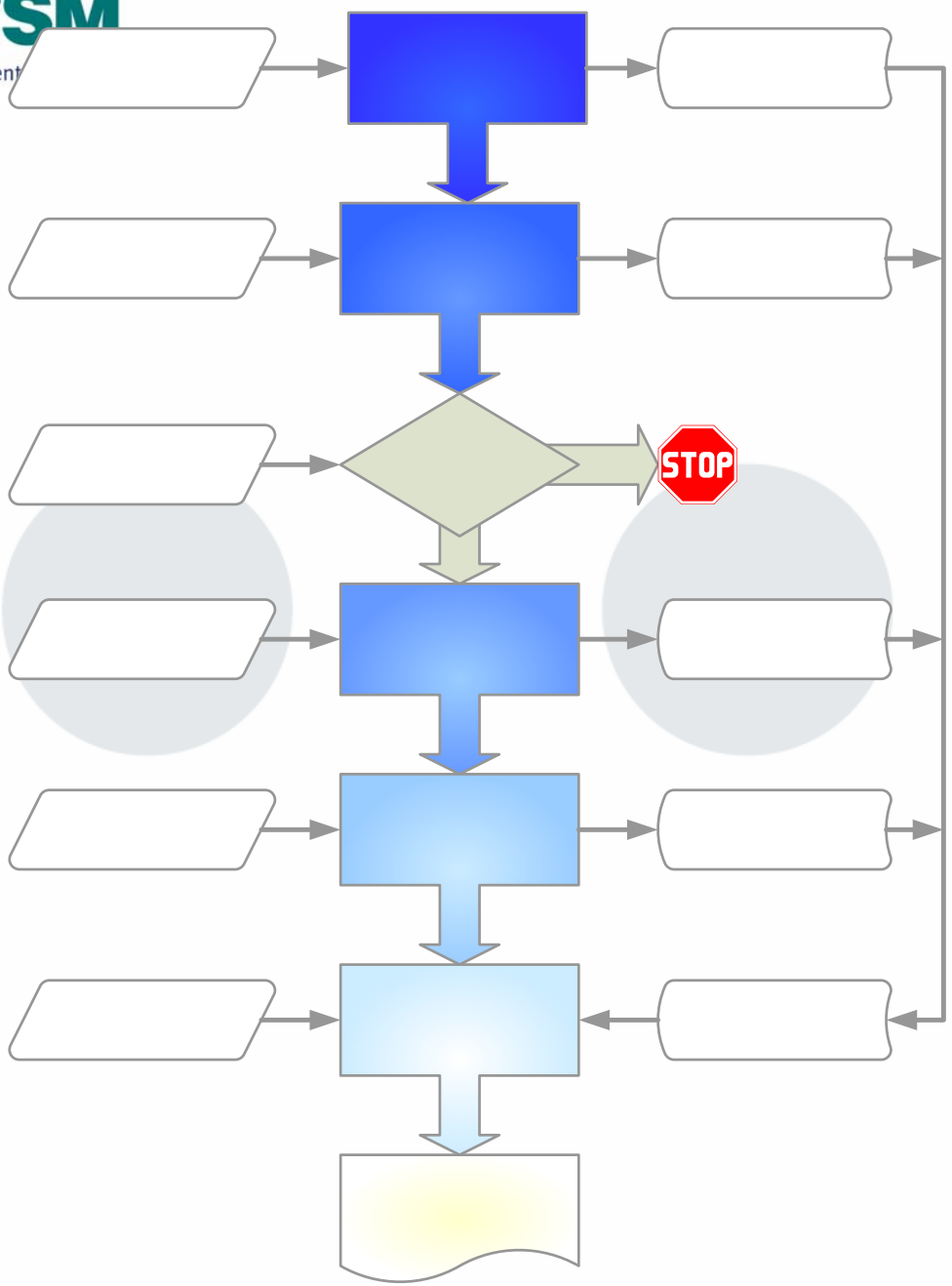
- Prioritizing (in tiers) hazards and potential consequences
- Providing a framework to examine interdependence
- Identifying potential region-level actions
- Computing benefit/cost ratios for these actions
- Providing information for assessing capabilities, readiness, and grant funding opportunities

CAPRA Overview

Five phases:

1. Scenario identification
2. Consequence and criticality assessment
3. Security vulnerability assessment
4. Threat likelihood assessment
5. Benefit-cost analysis





Facility

Maximur
Physica
Mitigati

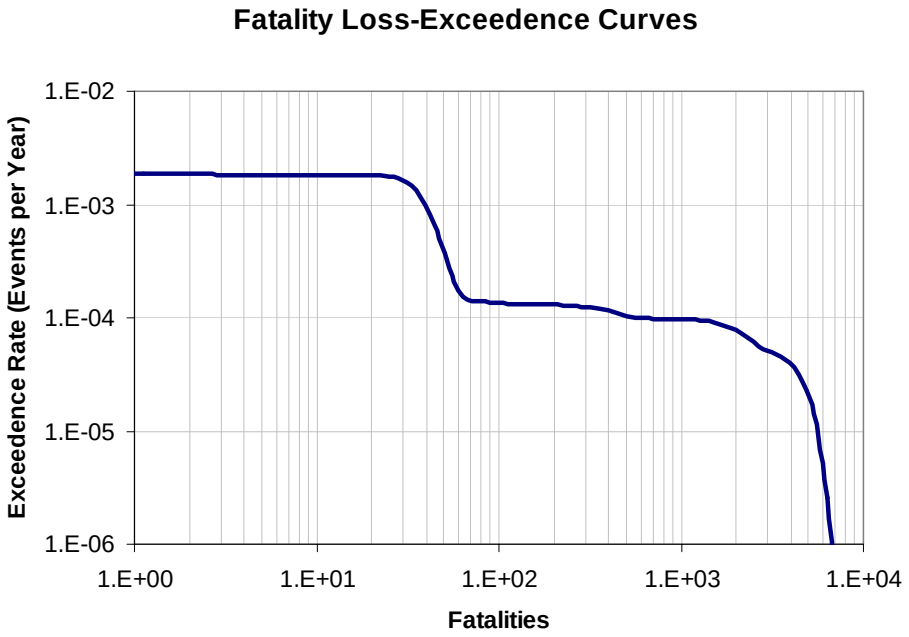
Benefit-Cost Analysis

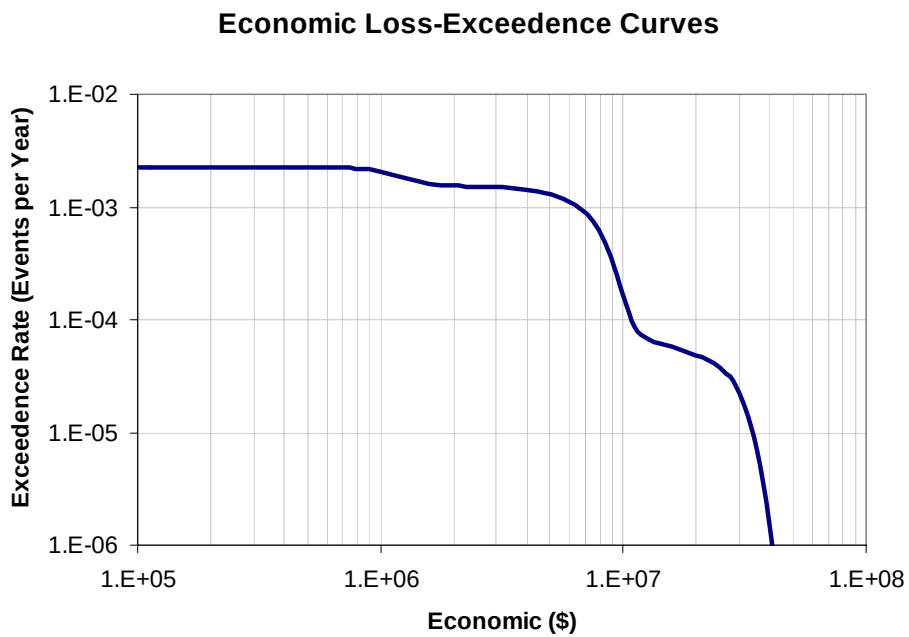
$$\text{Benefit} = (\text{Risk Before}) - (\text{Risk After})$$

$$\text{B/C Ratio} = \frac{\text{Benefit}}{\text{Cost}}$$

Case Study:
Explosive Attack Against Sport Center

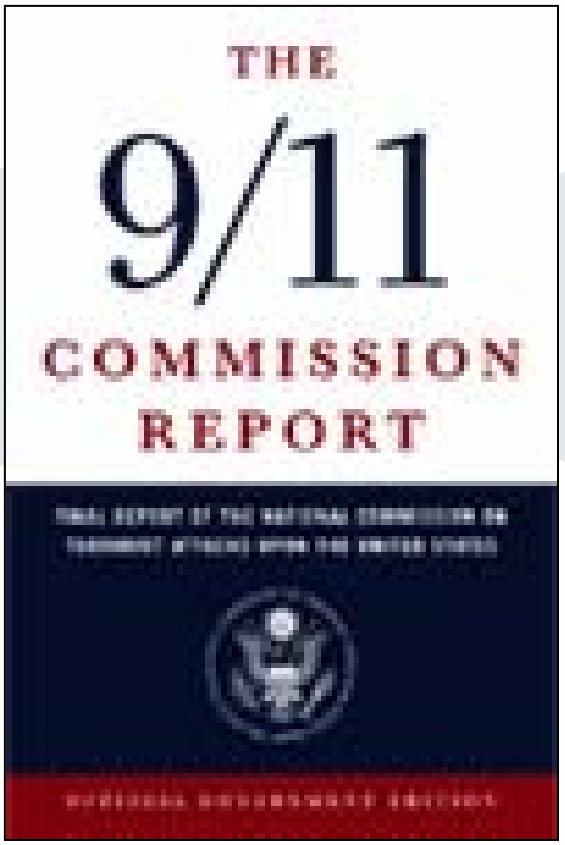
- Risk Assessment
  - Considering all security threat scenarios



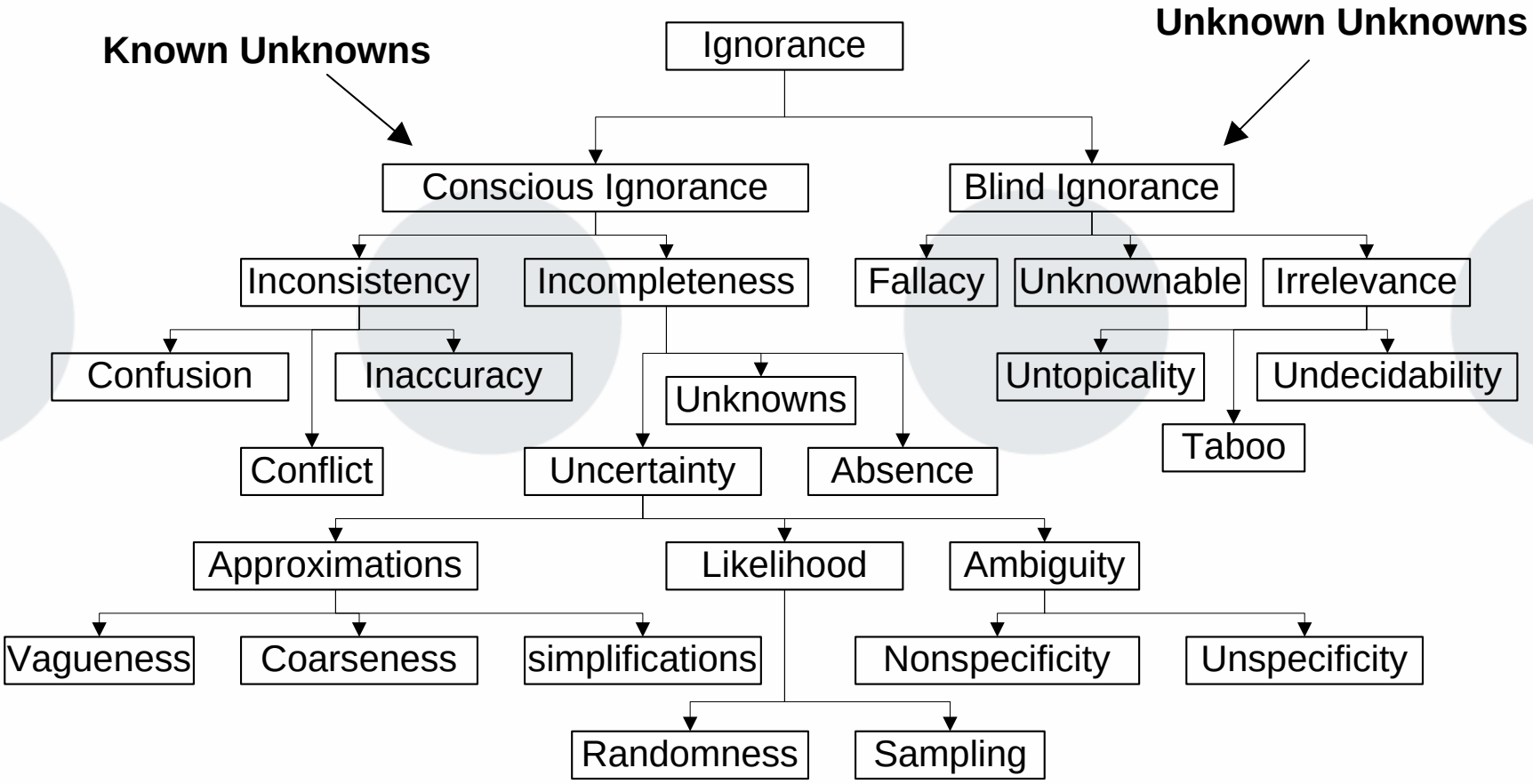


Challenges: Scenario Identification

- "We believe the 9/11 attacks revealed four kinds of failures: in imagination, policy, capabilities, and management"
  Page 339
- Open World Assumption, "Unknown Unknowns"



Hierarchy of Ignorance



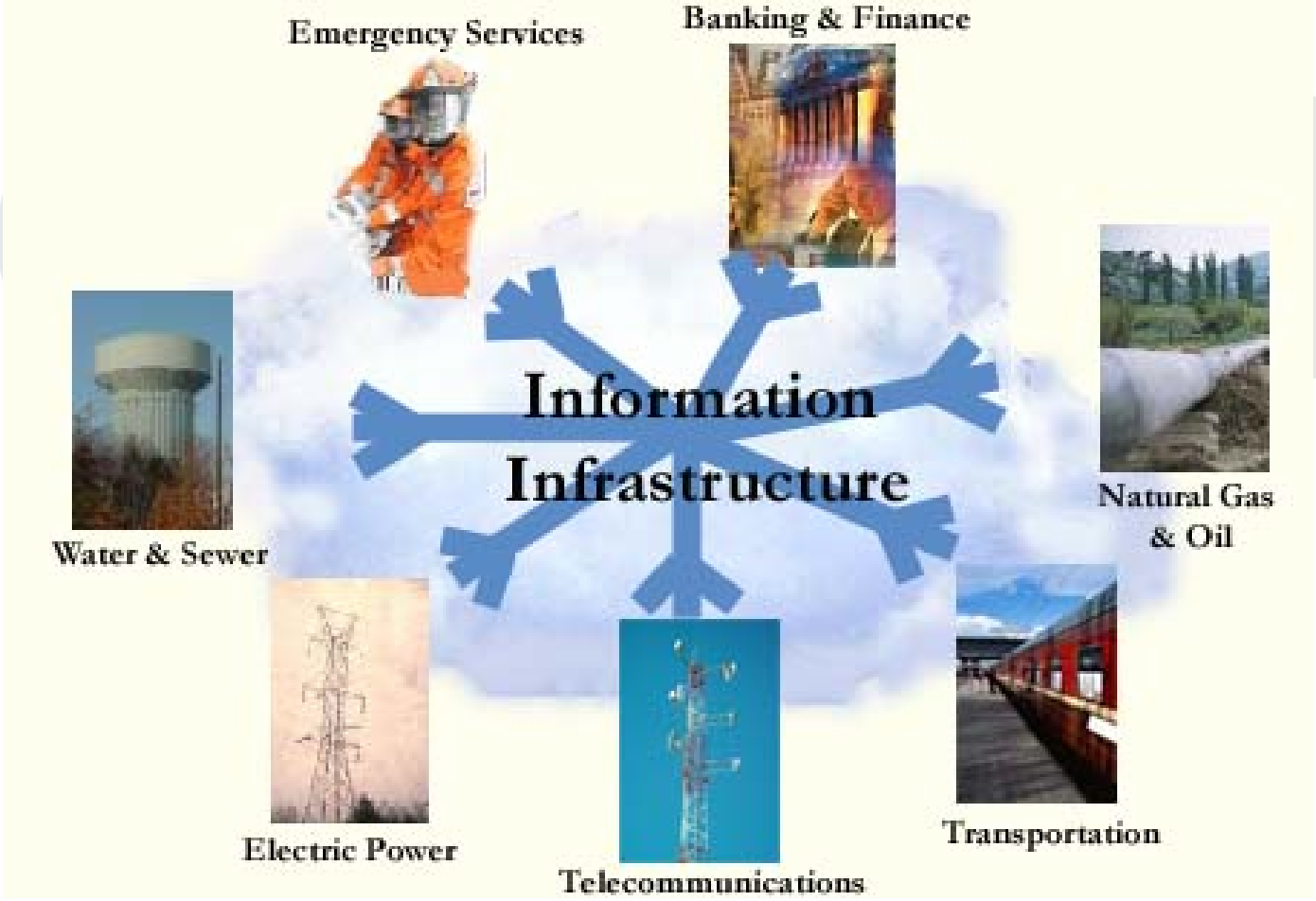
Consequence and Criticality Assessment

- **Valuation**

"O.K., who can put a price on love? Jim?"

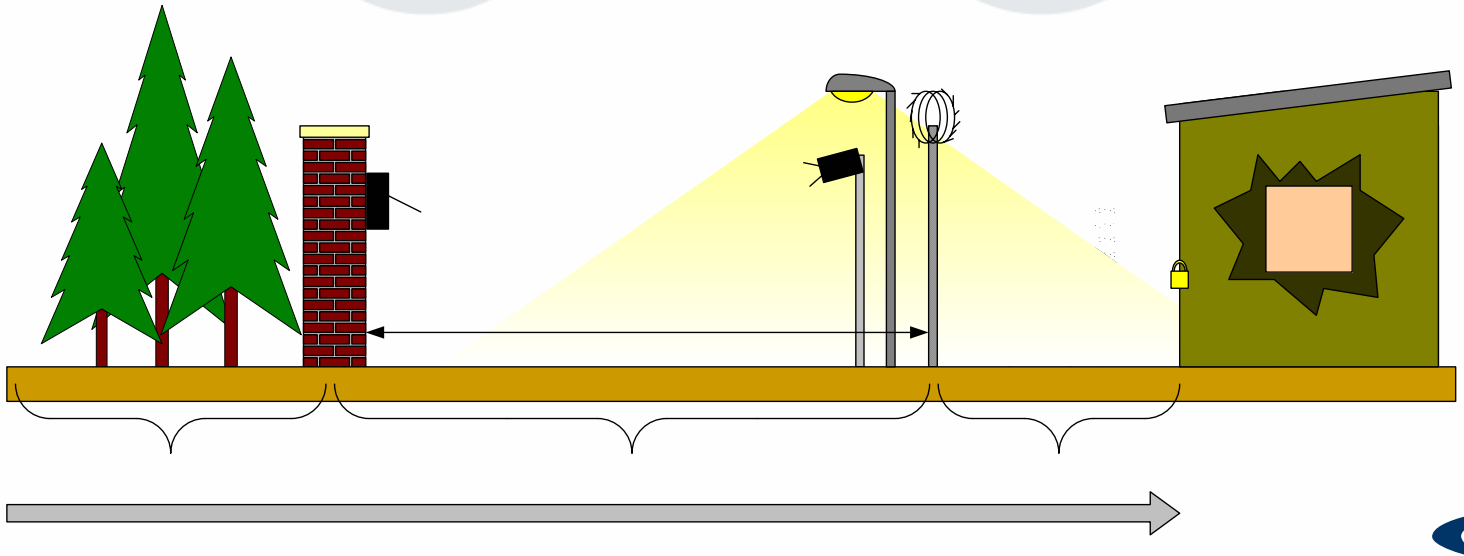
Consequence and Criticality Assessment

- **Interdependencies**



Security Vulnerability

- Information sharing
- Public access
- Adverse impact on education (publications, visa policy, image, etc.)



Threats and Their Likelihood

- Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, Transmittal Letter, March 31, 2005
- "We conclude that the Intelligence Community was dead wrong in almost all of its pre-war judgments about Iraq's weapons of mass destruction. … On a matter of this importance, we simply cannot afford failures of this magnitude."

Risks

- Shifting and changing threats
- Standards (methods and features/products)
  - Would they lead to added vulnerabilities?
- All hazards
- Owner liability

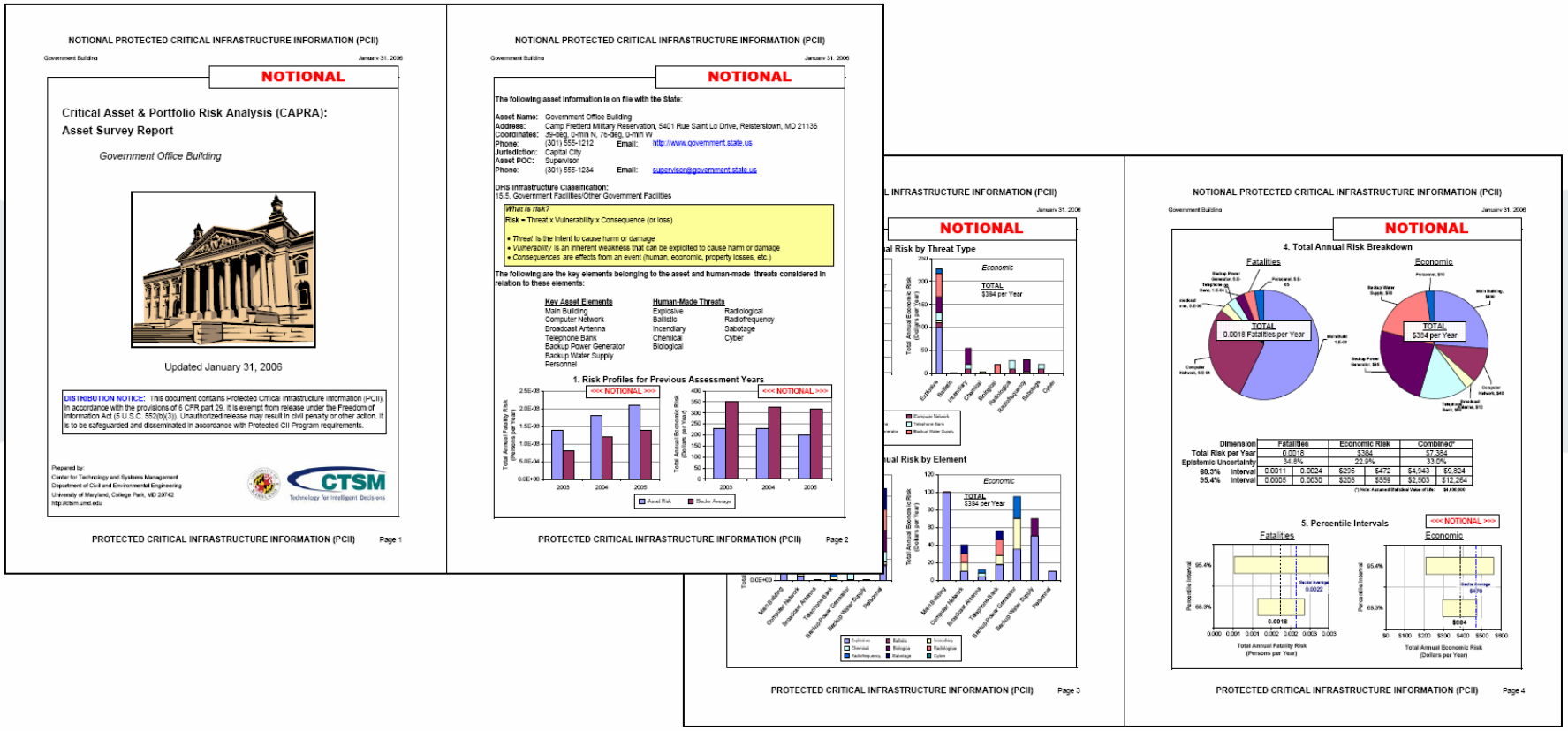
Types of Risk Analysis

- Strategic risk analysis
  - Uses a notional adversary (or postulated threat)
  - Seeks to minimize the risks associated with all that could happen
  - Leads to budgets/priorities for risk reduction
- Operational risk analysis
  - Is similar to the strategic type
  - Divides resources up among static and dynamic countermeasures and consequence mitigation strategies
- Tactical risk analysis
  - Focuses on effectively leveraging dynamic countermeasures in response to real-time risks

Implementations of CAPRA-like Methods

- Buy-in and active participation by all stakeholders
- Too many assets and threats
- Consistency
- Stratified sampling and predictions

Risk Communication



Information security and vulnerability

Publications

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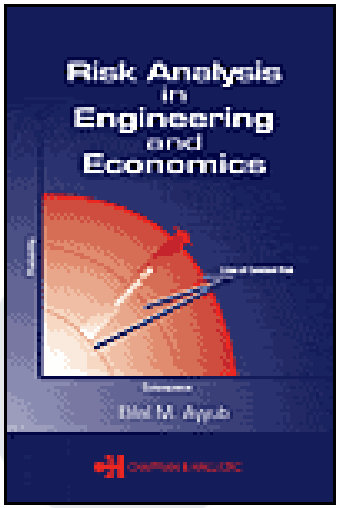

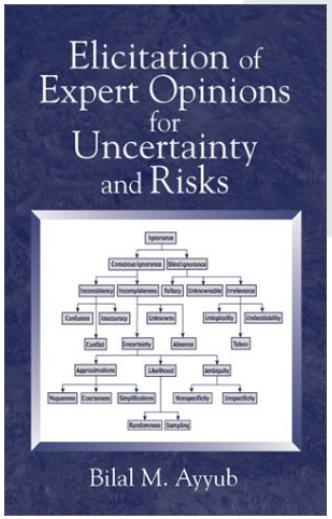

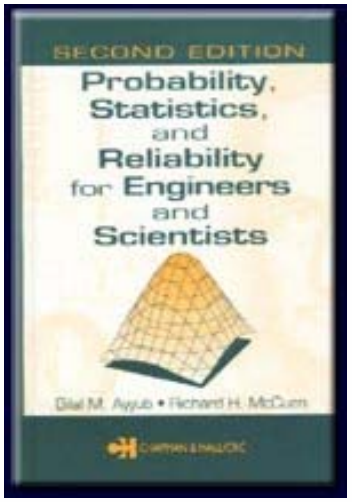

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