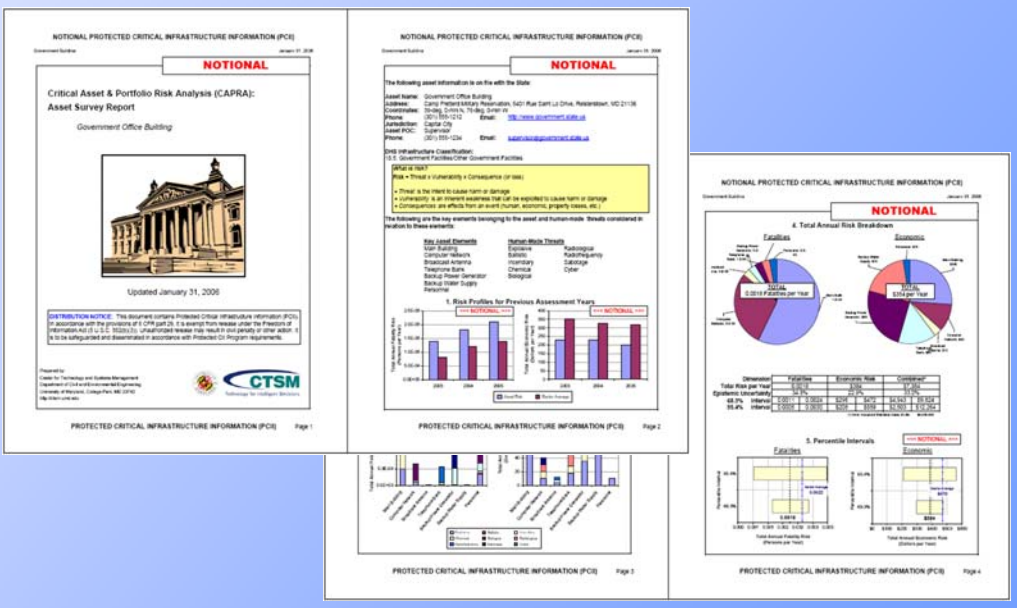
CAPRA

Critical Asset & Portfolio Risk Analysis

BACKGROUND AND OVERVIEW OF THE CAPRA PROJECT

The protection of critical infrastructure and key resources (CI/KR) for homeland security requires choosing among a large set of protective, response, and recovery actions for reducing risk to an acceptable level. The selection of investment alternatives for improving regional or asset security and increasing infrastructure resilience depends on several factors – their cost to implement, whether they meet risk reduction objectives, and their cost-effectiveness. To accomplish this task, the Department of Homeland Security (DHS) has identified risk methods as the primary underlying framework for system evaluations, operational assessments, technology assessments, resource and support analyses, and field operations analyses; according to the draft DHS National Infrastructure Protection Plan, benefit-cost analysis is the hallmark of critical infrastructure protection decision-making.

The *Critical Asset & Portfolio Risk Analysis* (CAPRA) project develops robust procedures for assessing and managing the risks to CI/KR exposed to a wide spectrum of current and emerging hazards and threats. The CAPRA methodology is designed to analyze, assess, and report risks for the purpose of identifying, screening, and ranking hazards or assets based on their relative risk exposure to all hazards. The CAPRA methodology provides a framework for evaluating the cost-effectiveness of proposed risk reduction and security investment alternatives considered for managing risks to a region or CI/KR. The results from a CAPRA assessment are communicated to all relevant stakeholders in the form of custom-tailored risk communication reports designed to meet the unique information needs and requirements of all persons charged with managing risk. Results are summarized by hazard type, asset type, location, and infrastruc-



TECHNICAL DETAILS

Based on sound principles of risk and uncertainty analysis, the CAPRA methodology provides a quantitative framework for assessing risk to a region and its assets due to natural and technological hazards and security threats. Defining risk as the combination of rates and consequences, CAPRA uses an annual rate of occurrence derived from past data (for natural hazards) or expert judgment of scenario attractiveness and annual attack rates (for security threats). For consequence, CAPRA quantifies the potential loss for each hazard and threat scenario in terms of several metrics including economic damages and loss of life. These metrics combined yield risk profiles in terms of dollars and lives lost; these intuitive metrics facilitate a rational and coherent evaluation of the net benefit associated with alternative risk reduction strategies.

POINT OF CONTACT

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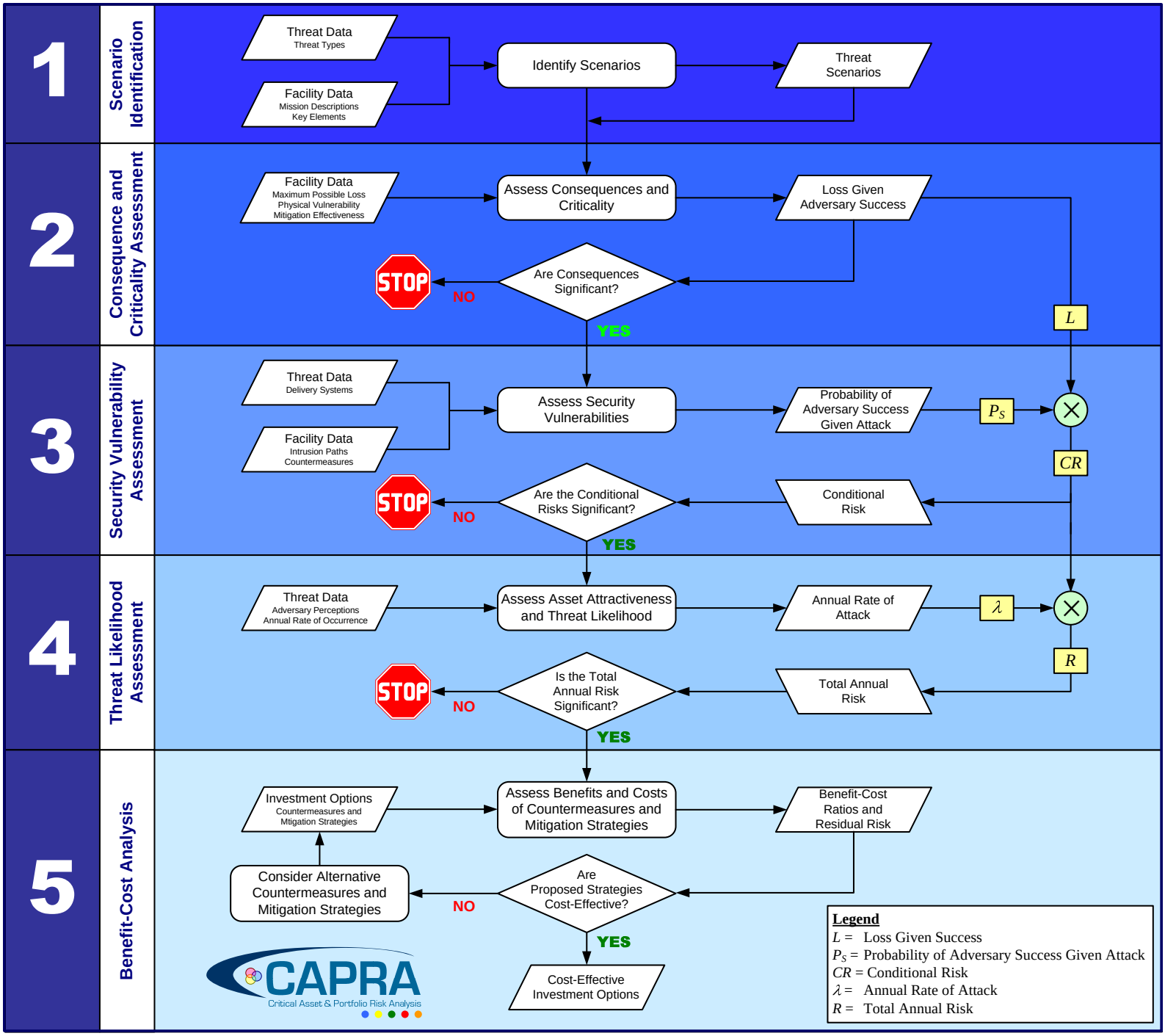

CAPRA METHODOLOGY

The CAPRA methodology is divided into five phases as follows:

Scenario Identification characterizes the mission of a region or an asset, and identifies hazard and threat scenarios that could cause a significant impact should they occur. The product of this phase is a complete set of hazard and threat scenarios that are relevant to the region or asset.

Consequence and Criticality Assessment assesses the loss potential for each scenario identified for a region or asset. The results of this phase provide estimates of potential loss for each hazard and threat scenario, which are used to screen scenarios and determine those that warrant further analysis.

Security Vulnerability Assessment assesses the effectiveness of measures to deny, detect, delay, respond to, and defeat an adversary determined to cause harm to a region or asset. The results from this phase provide estimates of the probability of adversary success for each threat scenario, which combined with loss yields an estimate of conditional risk.

Threat Likelihood Assessment assesses asset and scenario attractiveness from the adversary's point of view. The results from this phase provide estimates of the annual rate of occurrence for each threat scenario.

Based on the results from the previous four phases, the total risk for a hazard or threat scenario is calculated as:

$$Risk = Loss \times P(S) \times Rate$$

where *Loss* is potential loss associated with the scenario, $P(S)$ is the probability of adversary success (if applicable), and *Rate* is the annual rate of occurrence for the scenario. Risk can be presented as a point estimate or loss-exceedence curve.

Benefit-Cost Analysis assesses the cost-effectiveness of proposed countermeasures and consequence mitigation strategies. The results from this phase provide benefit-to-cost ratios for each proposed risk mitigation strategy, which are used to support resource allocation decisions.