



# *ALL-HAZARDS RISK AND RESILIENCE*

Prioritizing Critical Infrastructures Using the  
RAMCAP Plus<sup>SM</sup> Approach



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## **PREFACE**

The events of 9/11, Hurricane Katrina, terrorist attacks and natural disasters abroad have heightened the nation's awareness of the risks to critical infrastructures in the United States. This awareness has stimulated the requirement that risks and risk-reduction options be assessed permitting the direct comparisons needed for rational decisions to allocate limited resources. A management process to meet this requirement would be characterized by the consistent application of common terminology, metrics and procedures that could be applied to the full variety of assets in diverse infrastructures. ASME Innovative Technologies Institute, LLC, has met this need by developing the Risk Analysis and Management for Critical Asset Protection (RAMCAP<sup>SM</sup>) process for hazards due to terrorism, naturally occurring events and interruptions of supply chains on which they are dependent to carry out their essential functions.

The purpose of this publication is to provide an understanding of the RAMCAP Plus<sup>SM</sup> process and its use to identify, prioritize and coordinate preparedness of the nation's critical infrastructure, including protection (avoiding hazardous events or their consequences) and resilience (rapid return to full function after those events that occur). The RAMCAP Plus process is a high-level approach that can be tailored to various sectors, thereby providing a mechanism for comparing risk and risk-management benefits at scales ranging from assets to whole sectors of the economy. Sector-Specific Guidance documents (SSGs), which apply the RAMCAP process for seven critical infrastructure sectors and subsectors, have already been developed.

The RAMCAP Plus process avoids unnecessary detail, precision and cost by focusing on the most critical assets at a facility and keeping the approach relatively simple and intuitive. There are numerous other risk methodologies in use by specific industries, but their results are generally not comparable with other industry sectors or, in some cases, with other facilities within the sector. Many are qualitative, producing relative results that can be compared only locally, if at all. Moreover, several of the available methods require the assistance of specialized consultants and/or considerable amounts of time, money and personnel resources, which discourages their use and makes them costly to use on a regular basis. The RAMCAP Plus process – through the cost-effective application of common and consistent terminology and metrics – provides a basis for using existing data and reporting results in a consistent, quantitative, directly comparable manner.

This publication reflects changing circumstances and incorporates lessons learned in developing the seven Sector-Specific Guidance documents (SSGs). It is composed of three major parts:

- A. Executive Summary – a brief description of the highpoints of RAMCAP
- B. The RAMCAP Plus Process in Overview – background, logic and structure
- C. Using the RAMCAP Plus Process – detailed instructions for organizing and carrying out the approach, with details on each of the seven steps.

ASME Innovative Technologies Institute, LLC  
November 2008

## **ACKNOWLEDGEMENTS**

The development of the RAMCAP Plus process, its application and evolution, are the result of the efforts of a great many people. From the earliest meetings between ASME volunteers and officials of the Federal government, through the many committee meetings, pilot studies, presentations and working group meetings, the RAMCAP Plus process has been crafted from the insight and experience of some of the leading scientists, engineers, academics, industry leaders, federal, state and local government officials working in the areas of risk and resilience management. Their numbers are too large to name them individually and the value of collaboration too great to single out any one name. It must be left to a generic thank you to all that have had a hand in the development of the RAMCAP Plus process.

ASME-ITI extends its gratitude to one and all.

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# Part A: Executive Summary

## 1. Origin and Description

RAMCAP Plus<sup>SM</sup> represents the most current stage of the continuing development of Risk Analysis and Management for Critical Asset Protection (RAMCAP<sup>SM 1</sup>). The development was initiated in response to the recommendation of a 2002 White House conference of more than one hundred senior executives from the private sector concerning the protection of the Nation's critical infrastructure. The executives' highest priority was an objective, consistent and efficient method for assessing and reducing infrastructure risks in terms directly comparable among the assets of a given sector and across sectors. The RAMCAP process allowed rational allocation of finite resources to protect the most important and vulnerable infrastructure assets. At the same time, the executives recognized that no universal process would fit the wide range of industries defined as critical infrastructures without some tailoring to fit the respective industries.

To achieve the necessary consistency and comparability while recognizing the differences among industries, the RAMCAP approach was conceived as having two levels: a high-level and general method, periodically updated in a publication such as this, and as a series of Sector-Specific Guidance (SSG) documents, expressly tailored to the technologies, issues and cultures of the respective sectors and subsectors. The SSGs – and adaptations of other tools – would be “RAMCAP-consistent” if they met explicit criteria derived from the then-current approach. This assured that the results of applying SSGs would be directly comparable, regardless of the industry to which they were applied.

The RAMCAP Plus process consists of seven steps (defined later in this publication) that are practical and robust rather than esoteric or overly theoretical. The goal is an efficient, straight-forward process that could be carried out by on-site professionals within a week or less, with a modicum of special training. This design requirement dictates many of the specific trade-offs within in the RAMCAP Plus process.

## 2. Progress and Evolution to Date

The philosophy of the RAMCAP process was adopted in the *National Infrastructure Protection Plan*. Three successive versions of the approach and SSGs for seven sectors and subsectors have been completed. The completed SSGs are: (1) nuclear power generation; (2) spent nuclear waste transportation and storage; (3) chemical manufacturing; (4) petroleum refining; (5) liquefied natural gas offloading terminals; (6) dams and navigational locks; and (7) water and wastewater systems.

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Through these developments, the original goal of reducing terrorism risks was augmented to include the enhancement of the organization's resilience and its ability to rapidly restore full functionality after an undesired event. The original suite of standard reference threats was limited to various types and intensities of terrorist attacks. Hurricanes Katrina and Rita and natural disasters outside the United States broadened the focus of RAMCAP from terrorist-only attacks to so-called "all hazards," which include hurricanes, tornadoes, earthquakes and floods. Increased understanding of vulnerabilities led to adding new threats to the standard suite: product contamination, interruptions in supply chains (dependencies) and the possibility of collateral damage from an attack on nearby facilities. The addition of the broader goal, these new hazards, new ways of estimating terrorist likelihood and the dual economic impact estimation (on asset owners and on the metropolitan area and other communities they serve) were among the changes that drove the development of the RAMCAP Plus process.

The RAMCAP Plus process is meant to continually evolve based on experience in adapting it to new sectors and changing needs of the Nation. At the time of this writing, ASME-ITI has undertaken a project to develop a risk-based approach to aging infrastructure and requirements for new infrastructures as dictated by the growth and evolution of the economy. The RAMCAP Plus approach may be extended to address these cases as well as natural hazards, terrorism, and dependency/proximity risks.

### **3. Benefits of Using the RAMCAP Plus Process**

Use of the RAMCAP Plus process generates benefits to the organization using it, the sector or industry that adopts it, the community served and the public policy toward infrastructure security and resilience.

For organizations using the RAMCAP Plus process, the direct comparability of consistently quantified risk and resilience levels, potential net benefit and benefit-cost ratios of means to enhance security and resilience can result in rational allocation of resources across sites, facilities assets and lines of business. The benefits of making decisions on this basis are more efficient management of capital and human resources and enhanced reliability in performance of its mission. The ability to define risk and resilience levels quantitatively at the community level enables the firm to partner with other firms and public agencies. Individual organizations will incur additional benefits if its sector adopts the RAMCAP Plus process, especially if adapted to be a voluntary consensus standard, as it becomes the vehicle for incentives, such as preferred supplier status, lower insurance costs, higher credit ratings and lower liability exposure.

A sector adopting the RAMCAP Plus process will be able to identify the components with the greatest need and potential for improvement through the concrete, quantitative RAMCAP Plus assessments. They will have concrete, repeatable descriptions of the current levels of risk and resilience, the potential benefits and benefit-cost ratios of their sector. Adoption also permits direct comparison of the sector's risk and resilience level to other sectors for higher level resource allocation and policy-making. If the sector decides to make its RAMCAP Plus-consistent methods or SSG into a consensus standard,

additional benefits can be incurred, such as an affirmative defense in liability cases, preferential treatment by insurers, financial rating services and customers, the ability to substitute self-regulation by standards for bureaucratic regulation, and direct participation in federal regulatory, procurement or other action involving security and resilience of the sector. This version of RAMCAP Plus has been written as the basis for an overarching ANSI-approved American National Standard, applicable to any infrastructure and many industries not usually seen as infrastructures. The overarching standard will be complemented by derivative, sector-specific voluntary consensus standards, developed by ASME in collaboration with individual sector standards developing organizations.

For the community and public policy, the facilities using the RAMCAP Plus process will be routinely asked to estimate the potential for lost economic activity by the metropolitan region it serves, allowing that to become a salient criterion in both private and public decisions. Use of the RAMCAP Plus process will allow cooperative decision-making by providing risk and resilience analysis on a comparable, consistent basis, which may also support rational trade-offs should the community, metropolitan region or public-private partnership determine to enhance the region's security and resilience. Further, if a RAMCAP Plus consensus standard exists, a community might designate the standard as the local code of expected practice.

And, finally, if state, multi-state regions or federal agencies seek to allocate resources rationally to maximize the security and resilience enhancement within a finite budget, widespread use of the RAMCAP Plus process could provide the required method of consistency and direct comparability needed to perform the assessment. The methods used to estimate economic losses to metropolitan regions can be extended to states, multi-state regions or the national economy – whatever scales are relevant to the decisions to be made.

In summary, use of the RAMCAP Plus process yields significant benefits to the asset owners who use it, the communities they serve and their role in local, regional and/or national economies.

#### **4. Further Information**

To learn more about the RAMCAP Plus process, please visit the ASME-ITI website ([www.asme-iti.com](http://www.asme-iti.com)) or contact ASME-ITI by phone (202-785-7499) or email ([ITIinfo@asme.org](mailto:ITIinfo@asme.org)).

To order the full RAMCAP Plus publication, *All-Hazards Risk and Resilience: Prioritizing Critical Infrastructures Using the RAMCAP Plus Approach*, call ASME (800- 843-2763; book order #802878) or order online [http://catalog.asme.org/books/PrintBook/ITIRAMC\\_AllHazards\\_Risk.cfm](http://catalog.asme.org/books/PrintBook/ITIRAMC_AllHazards_Risk.cfm).