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Risk Metrics for Chemical Facility Security

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Risk Metrics for the Chemical Facility Anti-Terrorism Standards (CFATS) Regulatory Program

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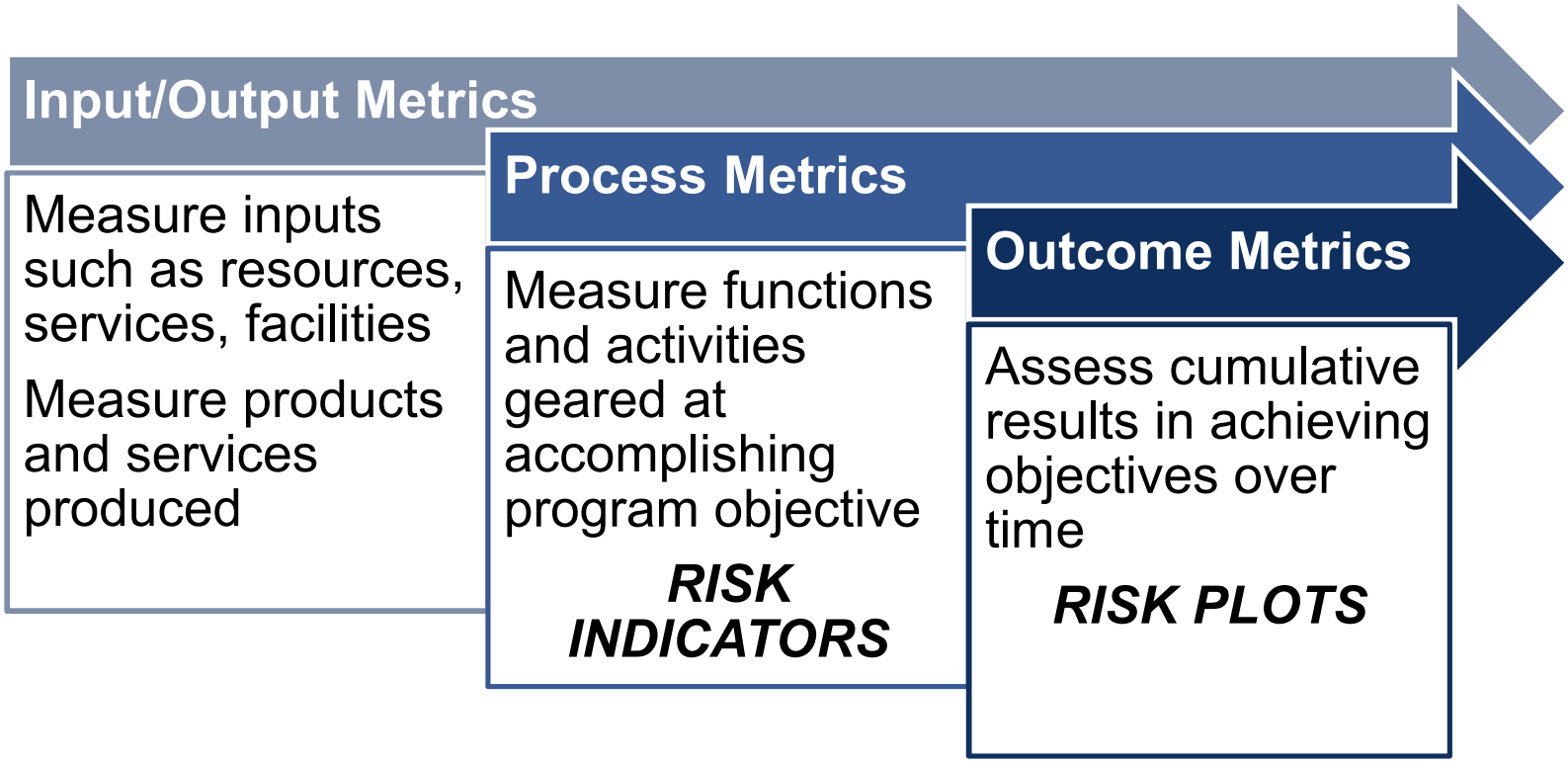
- CFATS is a set of security regulations imposed on high-risk chemical facilities by the U.S. Department of Homeland Security (DHS). CFATS requires covered chemical facilities to
  - Prepare Security Vulnerability Assessments
  - Develop and implement Site Security Plans (SSPs) that include security measures satisfying 18 Risk-Based Performance Standards (RBPSs) identified by CFATS

  → DHS determines whether a facility is in compliance using an SSP review process followed by an inspection visit

- ***Key project question:*** How can DHS assess and communicate the impact of the CFATS program on security risk for the Nation's highest risk chemical facilities?

The project approach involved the development of both ***Process Metrics*** and ***Outcome Metrics***



- ***Risk Indicators*** were developed in Phase 1 of the project, and ***Risk Plots*** were developed in Phase 2

Key challenges in measuring CFATS program impact

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1. CFATS addresses a vast and diverse set of facilities – challenge to developing a meaningful metric of facility risk reduction
2. A number of stakeholders engaged in the program including investors and owners in private industry, government entities, and community members – a communication challenge
3. Methodology and metrics must be agile to accommodate the changing risk landscape of the chemical sector – a more fundamental challenge

Risk is a function of Threat, Vulnerability, and Consequences

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- Risk is defined by
  - What can happen? → Attack **scenarios**
  - How likely is it? → **Threat (T)** of attack, **Vulnerability (V)** given an attack
  - What are the potential consequences? → **Consequences (C)**, in terms of lives, $, etc.
- General attack **Scenarios** are outlined by CFATS
- Facilities have taken action to reduce
  - **vulnerability** by strengthening security and
  - **consequences** by reducing inventories of hazardous chemicals
- **Threat** should be underweighted when making long-term decisions regarding facility security, because it
  - Embodies (unknowable) adversary decision making process and values
  - Can change rapidly with adversary knowledge/capabilities, or world events
  - Is highly uncertain now, with uncertainty increasing into the future

The CFATS Program is an example of Consequence-Based Vulnerability Management

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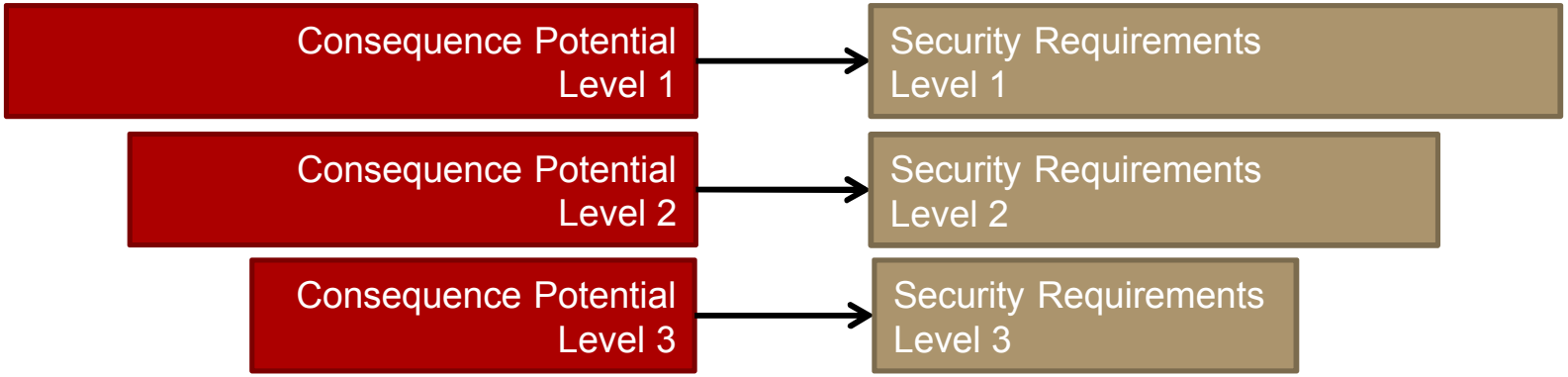
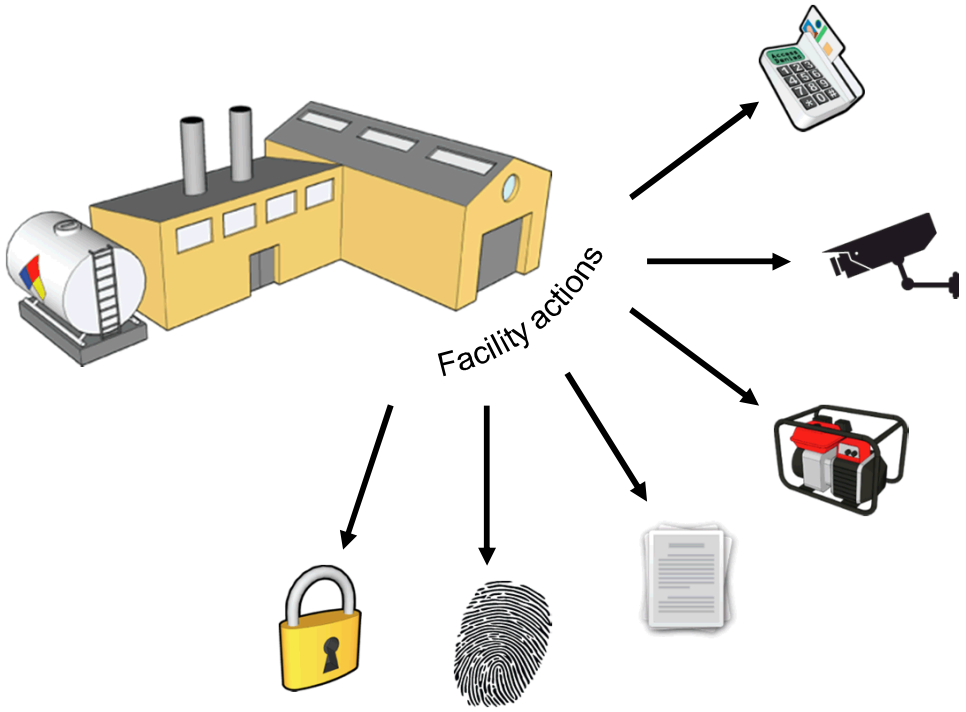
- Consequence-based vulnerability management (CBVM) methodology:
  1. Categorization of operations or materials by consequence potential
  2. Graded approach to security standards: higher consequence potentials require more stringent security



- NRC, DOE, and DoD utilize a similar conceptual framework to assess and manage risk at high security risk facilities
- A 2010 National Academies' security study for DOE indicated that qualitative security risk management is appropriate

CFATS has caused facility owners to take actions to reduce risk

- Facility actions mitigate vulnerabilities and/or consequences
- ***Risk Mitigation Indicators*** are quantitative measures of such actions based on existing CFATS data



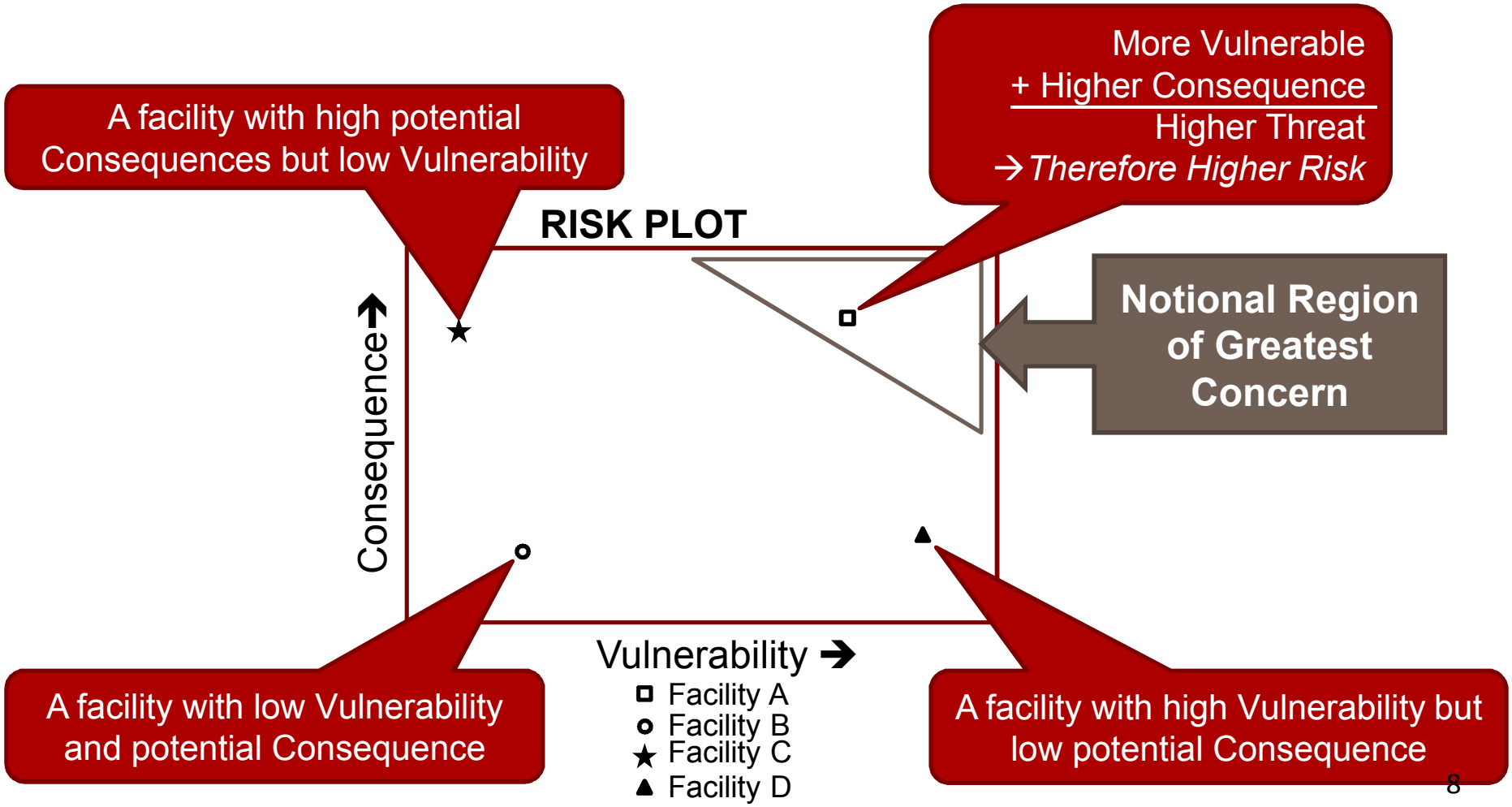
Risk Mitigation Indicators:

- Represent risk mitigation (V and/or C)
- Simplify communication of risk mitigation
- Are measurable, based on readily available data
- Directly measure actions taken under CFATS

Indicators represent concrete actions to reduce risk, but do not convey information regarding the magnitude of risk reduction

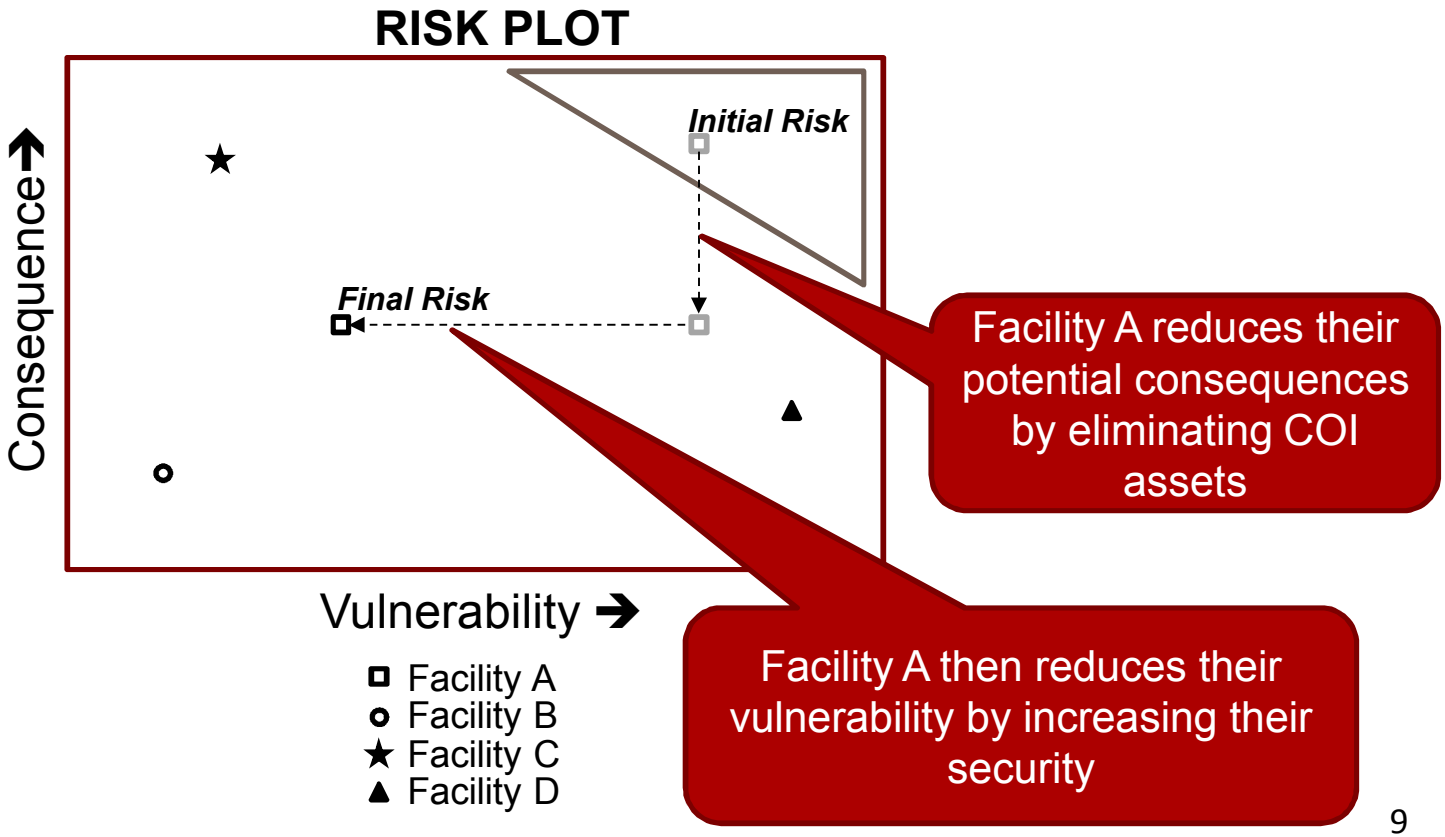
Chemical sector security risk is visualized using Risk Plots

- **Risk Plots enable assessment and communication of risk without the need to calculate a scalar value of risk**



Risk plots can be used to track changes in facility risk over time

- **As a facility makes changes that impact its *C* or *V*, its position on the plot can shift.**



A pilot study demonstrated the construction of risk plots from facility data

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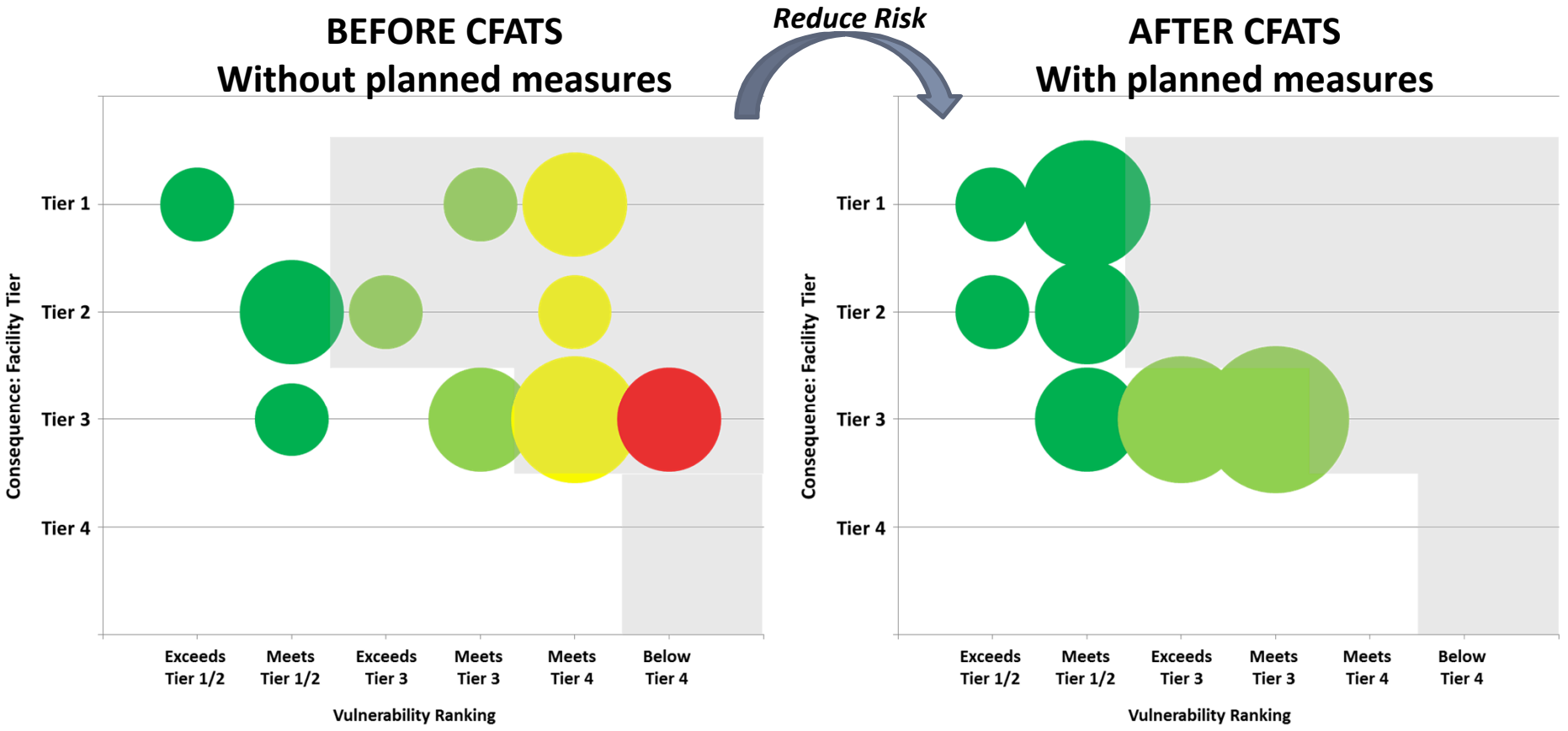

Circle size = # of facilities
Gray area = unacceptable security

Summary and conclusions

- Methods and tools are under development to assess and communicate the impact of the CFATS regulatory program on chemical sector risk
  - CFATS focuses on facility V and C, and appropriately underweights T

- Process metrics were developed in Phase 1: **Risk indicators**
  - Quantitative measures indicating progress in improving facility security (V↓) and reducing inventories of hazardous chemicals (C↓)

- Outcome metrics were developed in Phase 2: **Risk Plots**
  - Risk plots convey C and V information that is lost in the calculation of a scalar value of risk
  - Risk plots enable identification of high-risk facilities, and can be used to show risk reduction over time
  - A pilot study demonstrated the construction of risk plots from actual CFATS facility data

Acknowledgements

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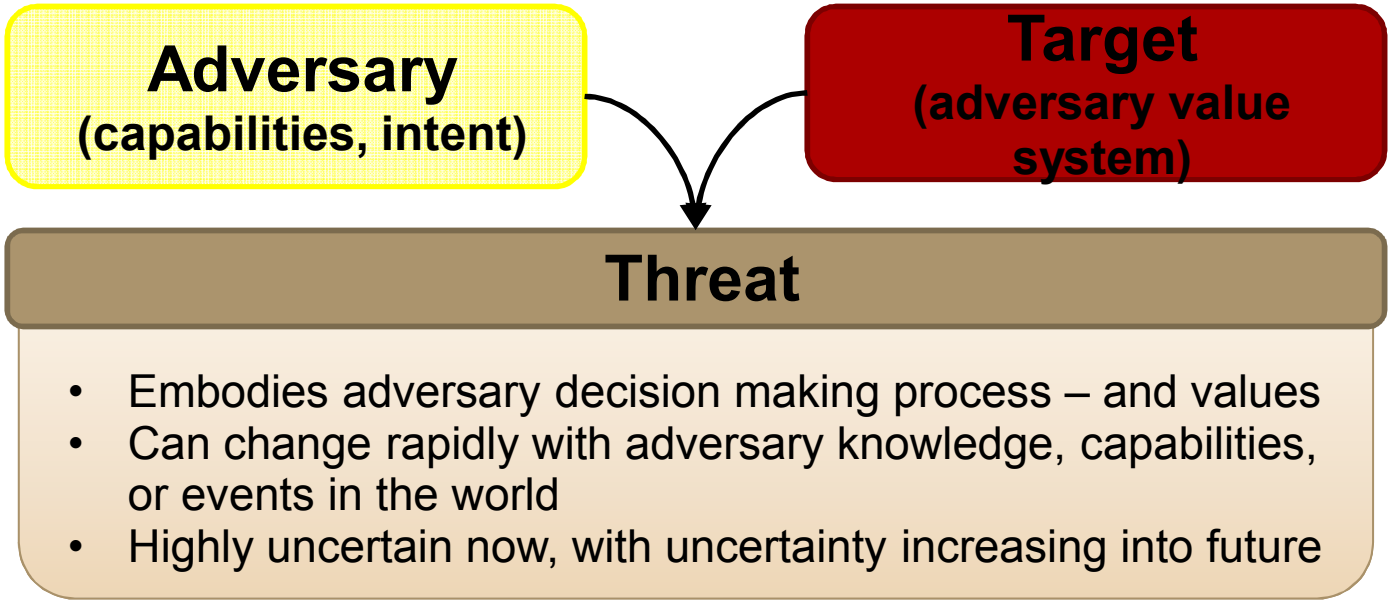
BACK-UP SLIDES

Threat in Strategic and Tactical Time

Considerations for Risk Management & Regulation



- CFATS methods can appropriately address Threat in both strategic and tactical timeframes

  Strategic time: Since threat can change quickly with motivation and intent, it should be underweighted when making long-term decisions regarding facility security

  Tactical time: Concrete knowledge of Threat can be used to guide rapid changes in security posture on a temporary basis

- Evolution of risk methods should ensure that sound Threat weighting principles continue to be used

Threat in Strategic and Tactical Time

Considerations for Risk Management & Regulation

Use of Threat	… in Strategic Time (Long Term)	… in Tactical Time (Short Term)
Decisions Supported	Long-term security measures, regulation (stability desired)	Tactical support for sites with imminent attack possibility
Speed of Evolution	Adversary evolves more quickly than defender	Defender quickly responds to adversary
Threat Insight	Threat is uncertain; uncertainty increases with time	Actions are a direct response to observed threat
Appropriate Risk Weight	T should be underweighted; limit the effect on computed risk & tiering	T should be fully weighted or even over weighted
Current ISCD Mechanism	Tiering, RBPS, risk calculation, inspection, etc.	RBPS 9 & 13 with Fusion Centers, JTTF local law enforcement & others