Module 14: Upgrades Analysis

Learning Objectives

- **Discuss the importance of, and a process for, upgrade selection**
- **Discuss examples of effective system enhancements**

Steps For Identifying Effective Upgrades

- Identify system weaknesses for the spectrum of threats
- Identify technical and procedural upgrades that address individual weaknesses
- Logically group the alternative upgrades into packages for meaningful analysis of their benefits
- Estimate costs and operational impacts of these upgrades packages; rank them

Identify System Strengths / Weaknesses

- Don't focus only on "worst case" results.
- Examine optimal (highest risk) strategies or scenarios and ones that are similar
  - Identify adversary actions that are not effectively detected in many of the scenarios
  - Perform defense-in-depth analysis to help identify critical components
    - A critical component is one whose failure would dramatically decrease performance
- When one security flaw is fixed the insider can switch to a different strategy

Example Evaluation Results

Location/measure	Weaknesses
Target location Chip vault-shelf	Many insiders with access to material
Process Area Emergency exit	Insider can actuate fire or criticality alarm Evacuation requires rapid departure Actuate alarm, remove material, throw over fence
Protected Area Vehicle portal	Shield in vehicle Piggyback Disguise as sample or waste
Process area MC&A system	Difficult to determine which operation is causing an inventory difference (ID) and large uncertainty on difference

Identify Safeguards Upgrades

Location/measure	Weaknesses	Potential upgrades
Target location Chip vault -shelf	Insider access	Enhanced 2 person rule - Add cages
MAA Emergency exit	Evacuation control	CCTV Emergency Inventory Better criticality alarm NM detector
PA Vehicle portal	Shield in vehicle Piggyback Disguise as sample	Vehicle search Cart and carrier search Verify transfer
Process area MC&A system	Cause of ID and large uncertainty	Restructure MBAs to better localize IDs

Upgrades And Varying Benefits

- Some vulnerabilities are easy to fix in a timely manner
- Combinations of hardware and procedural upgrades are often needed
- Procedural upgrades are often less costly and easier to implement than changes in facility or hardware
- An upgrade to address a given vulnerability may introduce a new one
- An upgrade may cause insider to switch to another strategy that is almost as effective

Packaging Upgrades – Benefits Analysis

- **Organize by theft stage:**
  - **SNM Acquisition**
  - **MAA Removal**
  - **PA Removal**
  - **MC&A system (protracted)**
- **Organize by ease of implementation:**
  - **Quick Fix (cheap)**
  - **Moderately Expensive**
  - **Most Expensive**

Identifying Upgrade Packages

- Identify candidate upgrade packages
- Repeat vulnerability assessment with upgrades in place, get new estimates of system effectiveness and risk
- If upgrades achieve acceptable risk, conduct cost-benefit analysis
- If upgrades do not achieve acceptable risk, identify additional upgrades and repeat

Estimating Upgrades Packages – Cost Effectiveness

Onetime costs	Design Equipment Installation
Recurring costs	Operation Maintenance Repair Replacement
Non-monetary costs	Production impact Health and safety Employee morale Aesthetics

Effectiveness-cost ratio = (Increase in Pd)/Cost

Questions From Audience