CARVER + Shock
Vulnerability Assessment Tool

Protecting the Middle East Food Supply
from Intentional Contamination
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CARVER – Overview

- Breaks a food system into its smallest pieces (nodes) in the farm to table continuum

- Identifies "critical nodes" that are the most likely targets for terrorist attack, by applying the analysis to each node

- Leads to the identification of countermeasures to reduce the risk at those nodes

CARVER METHOD

- **Identify foods for evaluation - based on screening methods**
- **Assemble evaluation team; potential expertise, depending on food or agriculture system being evaluated, might include:**
  - **Food Technologist**
  - **Microbiologist**
  - **Food Microbiologist**
  - **Food Chemist**
  - **Epidemiologist**
  - **Threat Intelligence Expert**
  - **Tampering/Counterfeiting Expert**
  - **Veterinarian**

  - **Economist**
  - **Risk Assessor**
  - **Toxicologist**
  - **Medical Doctor**
  - **Entomologist**
  - **Botanist**
  - **Plant pathologist**

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CARVER METHOD

- **Develop flow diagram for each product —"Farm to Table"**
    - **Farm**
    - **Bulk transportation**
    - **Processing**
    - **Finished product transportation**
    - **Warehousing**
    - **Retail/food service**
- **Develop terrorist profile based on threat intelligence and use throughout analysis**

Terrorist Profile

- **Who** is the threat (person/organization)?
- What are their **capabilities**?
- What is their **intent** (goals)?
- What is their prior **history** (past terrorist activities)?

Terrorist Profile - Example 1

- **A** **motivated terrorist organization can:**

    1. **Acquire/recruit the scientific training, technical know-how, fiscal support, and high level planning to produce or procure a wide array of specified agents**

    2. **Gain unauthorized access to a secure facility, and influence members of the facility staff.**

    3. **Recruit participants who may be unaware of their contribution**

    4. **Operate in a compartmented environment, with individual cells receiving instructions from organization planners**

Terrorist Profile - Example 1
(continued)

5. Use asymmetric attacks, including simultaneous attacks against multiple targets

6. Add contaminants directly to the food or to an ingredient

7. Recruit insiders

8. Have little concern for being killed during conduct of operation

9. Have as goals: attract attention to group's cause; degrade way-of-life (especially value placed on human life and fiscal strength)

Terrorist Profile - Example 2

- **A loosely ordered terrorist organization may:**
  1. Be sympathetic to and motivated by the central goals of one or more highly motivated organizations.
  2. Gain training and technical information from the Internet, large training camps, etc.
  3. Have little ability to assess the effectiveness of the tactics from a scientific or technical perspective.
  4. Be technically capable of producing or procuring a limited number of specified agents, often in limited dilution, quantity and purity.

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Terrorist Profile - Example 2

6. Use contamination techniques that are likely to lack sophistication and technical ability

7. Add contaminants directly to the food or to an ingredient

8. Have little concern for being killed during conduct of operation

9. Have as goals to: attract attention to group's cause; degrade way-of-life (especially value place on human life and fiscal strength)

CARVER + Shock

- **Considers seven factors that affect the desirability of a target:**
  - **Criticality** – **Public health and economic impacts to achieve the attacker's intent**
  - **Accessibility** – **Physical access to the target**
  - **Recuperability** – **Ability of the system to recover from the attack**
  - **Vulnerability** – **Ease of accomplishing the attack**
  - **Effect** – **Amount of direct loss from an attack**
  - **Recognizability** – **Ease of identifying a target**
  - **Shock** – **Psychological effects of an attack**

CARVER

- **Criticality: A target is critical when introduction of threat agents into food/system at this location would have significant health or economic impact.**

  – **One must ask: Does it achieve the goals of the terrorist profile?**

Criticality Scale

CRITERIA	SCALE
Loss of over **10,000 lives** OR loss of **more than $100 billion**	9 – 10
Loss of **1,000 – 10,000 lives** OR loss of **$10 billion - $100 billion**	7 – 8
Loss of **100 – 1000 lives** OR loss of **$1 - $10 billion**	5 – 6
Loss of **less than 100 lives OR** loss of **less than $1 billion**	3 – 4
No loss of life OR loss of **less than $100 million**	1 – 2

C**A**RVER

- **Accessibility**: A target is accessible when an attacker can reach the target to conduct the attack and egress the target undetected. Accessibility is the openness of the target to the threat. This measure is independent of the probability of successful introduction of threat agents.

  – Includes the ability to gather intelligence, conduct reconnaissance, conduct the attack, and leave the target undetected.

  – One must ask: What are the barriers to an attack?

Accessibility Scale

CRITERIA	SCALE
Easily Accessible (e.g., target is outside building and no perimeter fence). Limited physical or human barriers or observation. Attacker has relatively unlimited access to the target. Attack can be carried out using medium or large volumes of contaminant without undue concern of detection. Multiple sources of information concerning the facility and the target are easily available.	9 – 10
Accessible (e.g., target is inside building, but in unsecured part of facility). Human observation and physical barriers limited. Attacker has access to the target for an hour or less. Attack can be carried out with moderate to large volumes of contaminant, but requires the use of stealth. Only limited specific information is available on the facility and the target	7 – 8
Partially Accessible (e.g. inside building, but in a relatively unsecured, but busy, part of facility). Under constant possible human observation. Some physical barriers may be present. Contaminant must be disguised, and time limitations are significant. Only general, non-specific information is available on the facility and the target. .	5 – 6
Hardly Accessible (e.g., inside building in a secured part of facility). Human observation and physical barriers with an established means of detection. Access generally restricted to operators or authorized persons. Contaminant must be disguised and time limitations are extreme. Limited general information available on the facility and the target	3 – 4
Not Accessible Physical barriers, alarms, and human observation. Defined means of intervention in place. Attacker can access target for less than 5 minutes with all equipment carried in pockets. No useful publicly available information concerning the target.	1 – 2

CA**R**VER

- **Recuperability:** Measured in the time it will take for the specific system to recover productivity.

Recuperability Scale

CRITERIA	SCALE
> 1 year	9 – 10
6 months to 1 year	7 – 8
3-6 months	5 – 6
1-3 months	3 – 4
< 1 month	1 – 2

CAR**V**ER

- **Vulnerability:** A measure of the ease with which threat agents can be introduced in quantities sufficient to achieve the attacker's purpose once the target has been reached.

- Vulnerability is determined both by:
  - characteristics of the target (e.g., ease of introducing agents, ability to uniformly mix agents into target) and
  - characteristics of the surrounding environment (ability to work unobserved, time available for introduction of agents).

- It is also important to consider what interventions are already in place that might thwart an attack.

Vulnerability Scale

CRITERIA	SCALE
Target characteristics allow for easy introduction of sufficient agents to achieve aim	9 – 10
Target characteristics almost always allow for introduction of sufficient agents to achieve aim	7 – 8
Target characteristics allow 30 to 60% probability that sufficient agents can be added to achieve aim	5 – 6
Target characteristics allow moderate probability (10 to 30 %) that sufficient agents can be added to achieve aim	3 – 4
Target characteristics allow low probability (less than 10%) sufficient agents can be added to achieve aim	1 – 2

CARV**E**R

- **Effect:** of system productivity damaged by an attack at a single facility. Thus, effect is inversely related to the total number of facilities producing the same product . The percentage of infrastructure (daily production) damaged by the attack.

Effect Scale

CRITERIA	SCALE
Greater than 50% of the system's production impacted	9 – 10
25-50% of the system's production impacted	7 – 8
10-25% of the system's production impacted	5 – 6
1-10% of the system's production impacted	3 – 4
Less than 1% of system's production impacted	1 – 2

CARVER

- **Recognizability: The degree to which it can be identified by an attacker without confusion with other targets or components .**
  - Factors that influence recognizability:
    - Size of the target
    - Complexity of the target
    - Existence of distinguishing characteristics

Recognizability Scale

CRITERIA	SCALE
The target is clearly recognizable and requires little or no training for recognition	9 – 10
The target is easily recognizable and requires only a small amount of training for recognition	7 – 8
The target is difficult to recognize or might be confused with other targets or target components and requires some training for recognition	5 – 6
The target is difficult to recognize. It is easily confused with other targets or components and requires extensive training for recognition	3 – 4
The target cannot be recognized under any conditions, except by experts.	1 – 2

Shock

- Combined measure of the health, psychological, and collateral national economic impacts of a successful attack on the target system.

  - Shock is considered on a **national level**.
  - The psychological impact will be increased if there are a **large number of deaths** or the target has **historical, cultural, religious** or **other symbolic significance**.
  - Mass casualties are **not** required to achieve widespread economic loss or psychological damage.
  - Collateral economic damage includes such items as **decreased national economic activity, increased unemployment in collateral industries**, etc.
  - Psychological impact will be increased if victims are members of sensitive subpopulations such as children or the elderly.
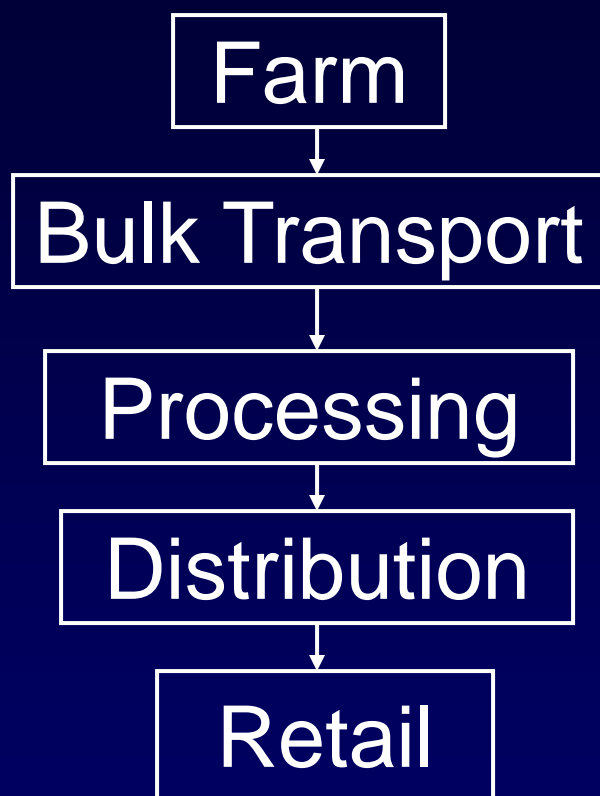
Shock

| Shock	Scale
Target has major historical, cultural, religious, or other symbolic importance. Loss of over 10,000 lives. Major impact on sensitive subpopulations, e.g., children or elderly. National economic impact more than $100 billion .	9-10
Target has high historical, cultural, religious, or other symbolic importance. Loss of between 1,000 and 10,000 lives. Significant impact on sensitive subpopulations, e.g., children or elderly. National economic impact between $10 and $100 billion .	7-8
Target has moderate historical, cultural, religious, or other symbolic importance. Loss of life between 100 and 1,000. Moderate impact on sensitive subpopulations, e.g., children or elderly. National economic impact between $1 and $10 billion .	5-6
Target has little historical, cultural, religious, or other symbolic importance. Loss of life less than 100. Small impact on sensitive subpopulations, e.g., children or elderly. National economic impact between $100 million and $1 billion .	3-4
Target has no historical, cultural, religious, or other symbolic importance. Loss of life less than 10. No impact on sensitive subpopulations, e.g., children or elderly. National economic impact less than $100 million .	1-2

Example – Food ABC

Farm

↓

Bulk Transport

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Processing

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Distribution

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Retail

Example – Food ABC

Target	C	A	R	V	E	R	Shock	Score	Rank
Processing Plant									
ABC receiving									
Vitamin receiving/storage									
Raw ABC silo									
Pasteurizer/Closed System									
Pasteurized ABC silo									
Fillers									
Cold storage									
Distribution									
Shipping									
Warehousing									
Retail									
Receiving									
Food Service									
Display									

Food ABC

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┌─────────────────────┐
│        Farm         │
└─────────────────────┘
           ↓
┌─────────────────────┐
│  **Bulk Transport** │
└─────────────────────┘
           ↓
┌─────────────────────┐
│    **Processing**   │
└─────────────────────┘
           ↓
┌─────────────────────┐
│      Shipping       │
└─────────────────────┘
           ↓
┌─────────────────────┐
│    Warehousing      │
└─────────────────────┘
      ↙           ↘
┌──────────┐   ┌──────────────┐
│  Retail  │   │ Food Service │
└──────────┘   └──────────────┘
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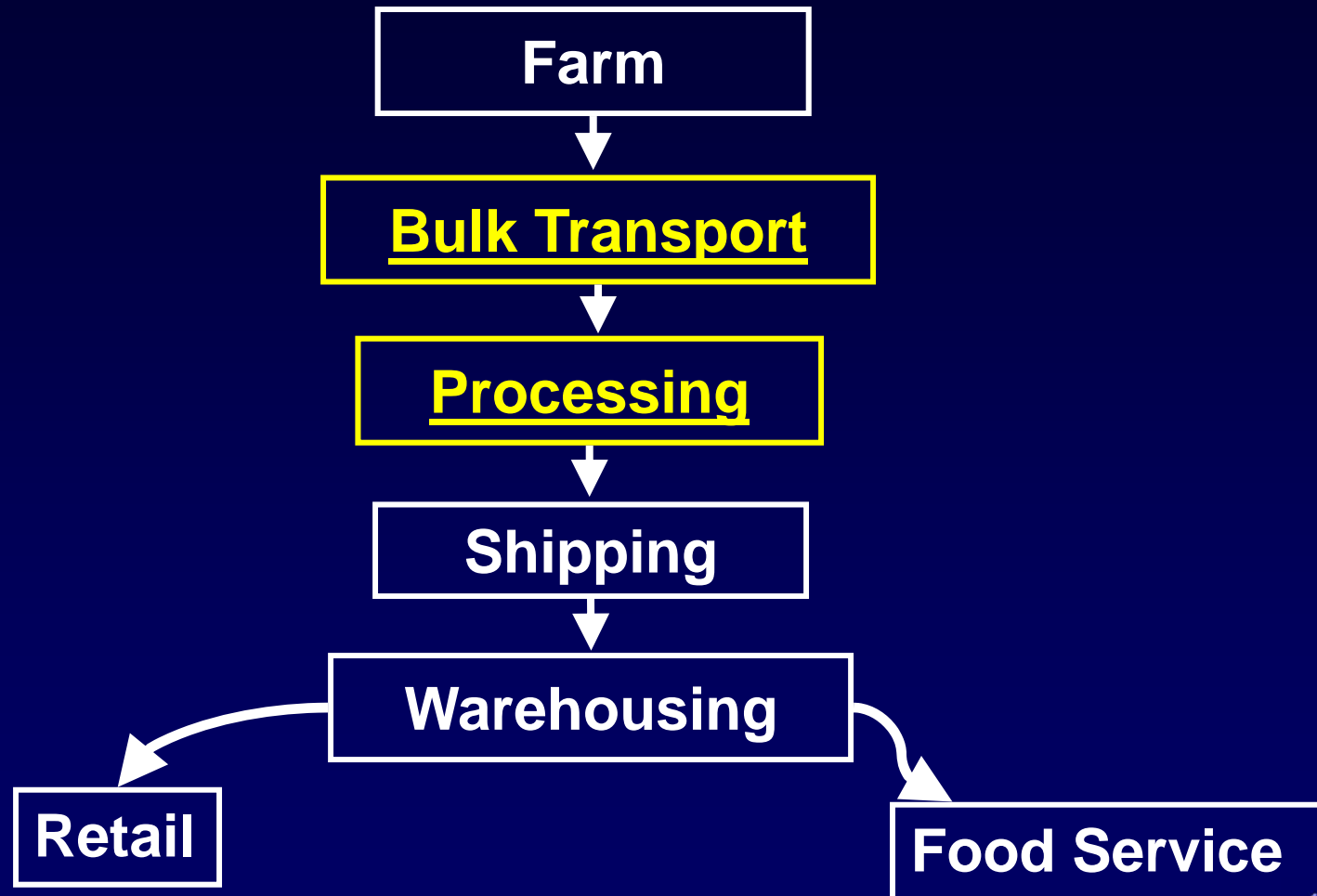
Underline signifies critical node

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