



Chemical Agents of Opportunity for Terrorism: TICs & TIMs

Toxic Warfare: Looking Beyond Conventional Chemical Weapons

Training Support Package

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Chemical Agents of Opportunity for Terrorism: TICs & TIMs

### Course Overview

- Why “Agents of Opportunity?”
- Neurotoxicology
- Gases
- Cyanide and Fumigants
- Food/Water/Medications
- Delayed Onset Toxins
- Psychological Aspects



Chemical Agents of Opportunity for Terrorism: The Medical and Psychological Consequences of TICs (Toxic Industrial Chemicals) and TIMs (Toxic Industrial Materials)

Module One – Toxic Warfare: Looking Beyond Conventional Chemical Weapons 2

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Chemical Agents of Opportunity for Terrorism: TICs & TIMs

### Learning Objectives

- Define TICs and TIMs
- Describe the goals of toxic terrorism
- Discuss prioritization and community response to chemicals of concern
- Introduce the concept of using clinical findings to identify a terrorist chemical agent and event
- Review historical examples of toxic terrorism

Module One – Toxic Warfare: Looking Beyond Conventional Chemical Weapons 3

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### Audience Response

Which of the following best describes the type of work you do?

1. Clinical Medicine or Nursing
2. First Responder
3. Law Enforcement
4. Military
5. Public Health
6. Other

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### Audience Response

Which of the following best describes who you work for?

1. Federal Government (incl. Military)
2. State Government
3. Local Government (incl. Police, Fire, EMS)
4. Educational (University, High School,...)
5. Hospital or Medical Facility
6. Corporation
7. Consulting Firm
8. Other

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### Official “Battlefield” Chemical Warfare Agents

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|---|--|
| <ul style="list-style-type: none"><li>• Purpose Designed Warfare Agents</li></ul> <ul style="list-style-type: none"><li>– Nerve (eg. Sarin, VX)</li><li>– Blister (eg. Mustard)</li><li>– 1° focus of chemical defense programs in past</li></ul> | <ul style="list-style-type: none"><li>• Dual Use Industrial Chemicals</li></ul> <ul style="list-style-type: none"><li>– Blood (eg. CN)</li><li>– Choking (eg. Phosgene)</li><li>– Less emphasis on industrial chemicals as a military threat</li></ul> |
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## TICs and TIMs

- TIC = Toxic Industrial Chemical
- TIM = Toxic Industrial Material
  
- Chemical substance that in sufficient available quantity produces a toxic effect through inhalation, ingestion, or other route of absorption

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## Audience Response

Which of the following would best be characterized as a toxic industrial compound?

1. Ammonia
2. Anthrax
3. Sarin
4. Mustard Gas
5. Water

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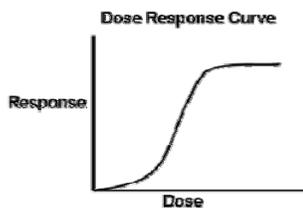
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## Importance of DOSE

"All substances are poisons: there is none which is not a poison. The right dose differentiates a poison and a remedy."  
Paracelsus (1493-1541)



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### Sources of TICs and TIMs (1)



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### Sources of TICs and TIMs (2)



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### Chemical Terrorism

- Definition – the use of chemicals to harm or alter the behavior of an adversary
- Utilizes existing stored chemicals – exploiting weapons of opportunity
- Who's at risk
  - Civilians in U.S.
    - Wide availability of toxic materials throughout U.S.
    - Proximity of industrial operations to large urban centers
  - Military abroad

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## Goals of Toxic Terrorism

- Health Effects
  - Incapacitating vs killing
- Damage / contamination of infrastructure
- Psychological effects resulting from actual or threatened use of toxic substances - terrorizing
  - Asymmetrical
  - Create uncertainty, fear, and panic
  - Uncertainties provide tactical and/or psychological advantages

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## Audience Response

- The goal of toxic terrorism is best accomplished by which of the following scenarios or releases?
1. Immediately lethal agent release in restaurant
  2. Disruption of a transportation corridor
  3. Creating fear leading to incapacity
  4. Occult insertion of a carcinogen
  5. Targeting a single factory component

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## Scenarios

- Large-scale outdoor release of toxic gas or fumes, and/or an explosion, from an attack on a mobile or fixed tank or vessel
- Targeted release of a toxic gas into a confined space (e.g. a subway, theater, or building) or against specific individuals or groups
- Acute or delayed poisoning by contamination of food, water, or a highly trafficked venue

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## Why Use Industrial Chemicals?



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## Limitations with Purpose: Designed WMD

- Aum Shinrikyo – Matsumoto 1994, Tokyo 1995 (Sarin)
- Spent ~\$30 million on chemical weapons research
  - Employed many scientists
  - Killed only 19
  - Problems with
    - Production
    - Effective Delivery System



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## More Effective: Bhopal (1984)

- Methyl isocyanate
- > 2,500 deaths
- 60,000 injuries



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### Should We Worry?

- ~ 850,000 U.S. businesses use, produce, or store TICs
- EPA report – 123 chemical plants across US have enough toxic chemicals to kill/injure 1 million people in terrorist attack
- 750 other plants have enough chemicals to kill/injure at least 100,000 people in an attack
- U.S. army study - terrorist attack on chemical plant in densely populated area could result in 2.4 million fatalities or injuries

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High Volume Chemical Production and Use  
of Facilities with 100,000 Pounds or Greater Onsite  
Reporting Year 2000



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### Audience Response

Which characteristic is not common to most TICs and TIMs?

1. Widespread or ready availability
2. Generally available in large quantities
3. Very expensive
4. Variable and often inadequate security
5. Significant toxicity
6. Found in fixed and portable facilities

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## US Legislative Response to Major Chemical Accidents

- Emergency Planning and Community Right-to-Know Act (EPCRA) 1986
- Clean Air Act Amendments of 1990
  - Occupational Safety & Health Administration's (OSHA) Process Safety Management (PSM)
  - Environmental Protection Agency's (EPA) Risk Management Program (RMP) 1996

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## Emergency Planning & Community Right-to-Know Act (EPCRA)

- Required chemical facilities to provide
  - Information necessary for emergency planning to Local Emergency Planning Committees (LEPCs)
  - annual hazardous chemical inventories to State Emergency Response Commissions (SERCs), LEPCs and local fire departments.
- Required SERCs & LERCs to prepare emergency response plans for chemical accidents.
- Established Toxics Release Inventory (TRI), which requires facilities to annually report quantities of their emissions of toxic chemicals to TRI database.

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## EPA: Risk Management Program

- Aim: Prevent/minimize consequences of accidental chemical releases from fixed facilities.
- Facilities that manufacture, process, use, store, or otherwise handle any of 140\* listed substances at or above specified threshold quantities (range from 500–20,000 pounds) must submit a Risk Management Plan (RMP).
- The number of chemicals has been increased to 650

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## Risk Management Programs (61 CFR 31667, 06/20/96)

- Hazard vulnerability assessment
- Accident prevention program
- Emergency response program
- Specified facility information
- Make info available to: EPA, state & local governments, FD & public

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## Worst-Case Scenario: Likelihood of Occurrence?

- WCS are considered unlikely because:
  - assume a very large release occurring during worst-case atmospheric conditions
  - does not include active release mitigation such as water deluge systems and automatic shutoff valves
    - passive mitigation efforts included, such as containment dikes and building enclosures
- However, with terrorist attack, more than one process likely to be affected

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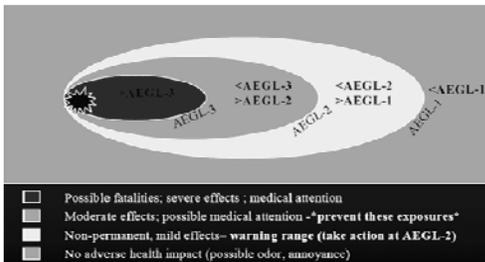
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## AEGL Plumes



Acute Exposure Guideline Levels (AEGL): [www.epa.gov/oppt/aegl/](http://www.epa.gov/oppt/aegl/)

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### Rail links transporting chemical tanker cars travel through or near major cities



Photo Credit: Jim Dougherty July 9, 2004

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### Railway Explosion

- Power cables touch rail cars loaded with ammonium nitrate fertilizer
- Buildings for several hundred meters were totally flattened
- 129 public buildings destroyed or damaged including hospital, food processing plant, and college.
- Rescue workers described utter devastation with damage extending for 4 km



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### Area Before Explosion



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### Area After Explosion



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### North Korean Railway Incident

- Death toll: 154, including 76 schoolchildren
  - A primary school had just ended when the explosion happened
  - Some children were on their way home, while others were trapped in the building
  - Most people were injured when they were trapped or thrown from buildings.

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### School After Explosion



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### Prioritizing Chemicals of Concern: NATO ITF-25 Definition of TICs – 1996

- High Production Volume Chemicals (HPVs)
  - produced in quantities > 30 tons (60,000 pounds) in a single facility
- High Toxicity
  - LCt50 by inhalation < 100,000 mg/min/M3
- Appreciable vapor pressure at 20°C
  - Thus, airborne hazards only
- Hazard Index = {(toxicity)x(state)x(distribution)x(producers)}
  - maximum value of 625

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### NATO ITF-25: High Hazard TICs

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|--------------------------|-------------------------|
| • Tissue Irritants       | • Systemic Poisons      |
| – ammonia                | – arsine                |
| – boron trichloride      | – boron trifluoride     |
| – chlorine               | – carbon disulfide      |
| – fluorine               | – cyanide               |
| – formaldehyde           | – diborane              |
| – hydrogen bromide       | – ethylene oxide        |
| – hydrogen chloride      | – hydrogen fluoride     |
| – phosgene               | – hydrogen sulfide      |
| – phosphorus trichloride | – tungsten hexafluoride |
| – nitric acid            |                         |
| – sulfur dioxide         |                         |
| – sulfuric acid          |                         |

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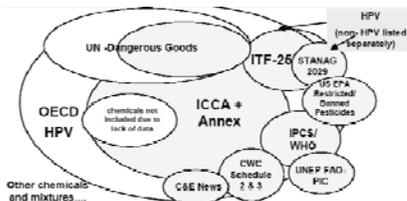
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### USACHPPM – 2002 Reevaluation

- Also evaluated - corrosiveness, reactivity, flammability, less volatile chemicals




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“Terrorists can make the 'unlikely' happen.”




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### Methods Used by Terrorists for Delivery of Chemical (N=126)

- Casual/direct contact 33 (30%)
- Aerosol/spray 21 (19%)
- Food/drink 13 (12%)
- Unknown 12 (11%)
- Product tampering 10 (9%)
- Explosive 6 (5%)
- Water supply 5 (4%)
- Jug/jar/canister 1 (1%)
- Mail/letter 4 (3%)
- Reaction device 3 (2%)
- Injection/projectile 1 (1%)

Monterey Institute Database, 2000

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### Terrorism Preparedness




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## Unusual Agents of Historic Importance



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## WORLD Ricin recipes found at London flat

Thursday, April 14, 2005 Posted: 4:08 AM EDT (0859 GMT)

**LONDON, England (AP) — Britain's case against nine North Africans accused of plotting to spread the deadly toxin ricin in the British capital resulted in only one conviction — an Algerian linked to al-Qaeda — with eight others either not brought to trial or acquitted, according to details released Wednesday.**



A police photo of ingredients found at the flat.

Britain had forbidden reporting on the case until two lengthy trials were complete, and a judge lifted the prohibition after a court found four of the accused, all Algerians, not guilty Friday and dropped charges against four — three Algerians and a British — on Wednesday.

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## Unusual Agents: Characteristic Toxidromes



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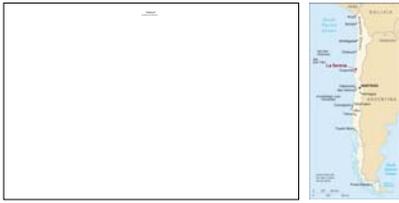
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## It Doesn't Even Have to Be Real: Fear and Economic Terror



Hoax - 1989 - Chilean grapes imported into  
the US alleged to contain Cyanide

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## Challenges of Chemical Agent Identification

- Symptoms similar to common disease (gastroenteritis)
- Immediate symptoms might be mild or nonexistent
- Staggered reports over long periods / different locations
- Mixed clinical presentations
- Health care providers may be less familiar with certain chemical induced presentations

MMWR 10/3/03

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## Clues to Chemical Exposure

- Unusual number seeking care for chemical-related illness
- Unexplained deaths among young, healthy people, plants, animals
- Clusters of illness with common source (e.g. water)
  - Surveillance methods including PCC, pharmacy sales
- Presence of a clinical pattern or toxidrome

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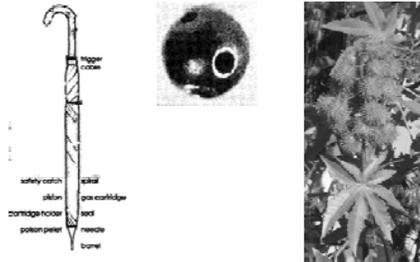
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## Ricin Poisoning



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## QUESTIONS?



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