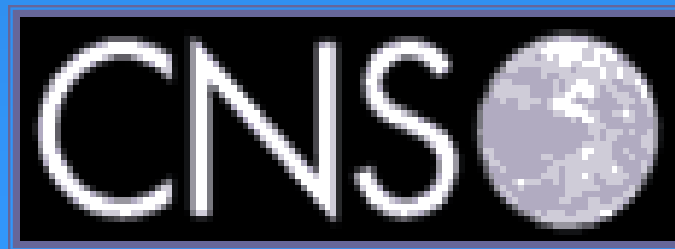


Contemplating Chemical & Biological Threats

Amy E. Smithson, PhD
Senior Fellow



Status at the State Level



Treaty	# of Member States	Critical Non-member States	Challenges
CWC	190	Egypt, Israel, North Korea	<ul style="list-style-type: none">• Chemical disarmament in Syria• Slow destruction programs of US, Russia• Need to update inspection approach to keep pace with technical/industry changes
BWC	170	Egypt, Israel, Syria 26 total	<ul style="list-style-type: none">• No inspection regime• Scientific revolution underway

Appeal to Terrorists

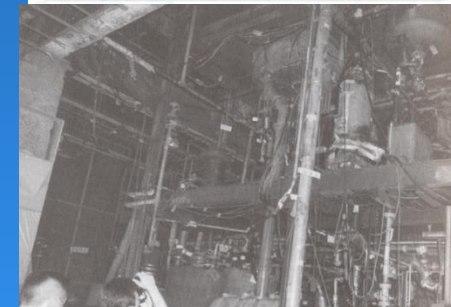
- **Accessibility:**
 - “Cookbooks” and patent literature
 - *Encyclopedia of Jihad*
 - Materials
 - Production equipment
 - Dispersal systems
- **Small-scale production = sufficient**
- **Easiest: RDDs, chemical sabotage**
- **Mass casualty and/or mass terror:**
 - Quick impact
 - Washington, DC: 1,000 kg of sarin, line source dispersal on a calm, cool night
 - 3,000 TO 8,000 DEAD (OTA, 1993)



Aum Shinrikyo's

Unconventional Weapons Programs

- Chemical:
 - 1985-1995: \$30 million
 - 100 involved
 - Agents synthesized:
 - VX • Soman • Mustard
 - Tabun • Sarin • Hydrogen cyanide
 - Production goals:
 - 70 tons in 40 days
 - 2 major attacks
- Biological program = total failure



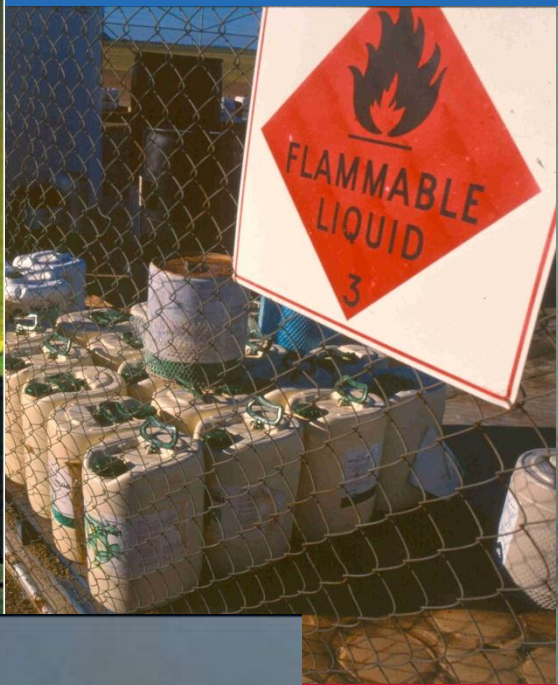
Terrorist Events Worldwide: 1997-2006

Total events:	23,135
Bombs:	12,806
Armed attacks:	5,798
Assassinations:	1,689
Kidnappings:	1,393
Arson:	786
Hostage-taking:	58
Hijacking:	32
Other/unknown:	524
Biological:	19
Chemical:	27
Food/water supply:	6
Radiological:	0

Source:
RAND/MIPT
Terrorism
Incident Database

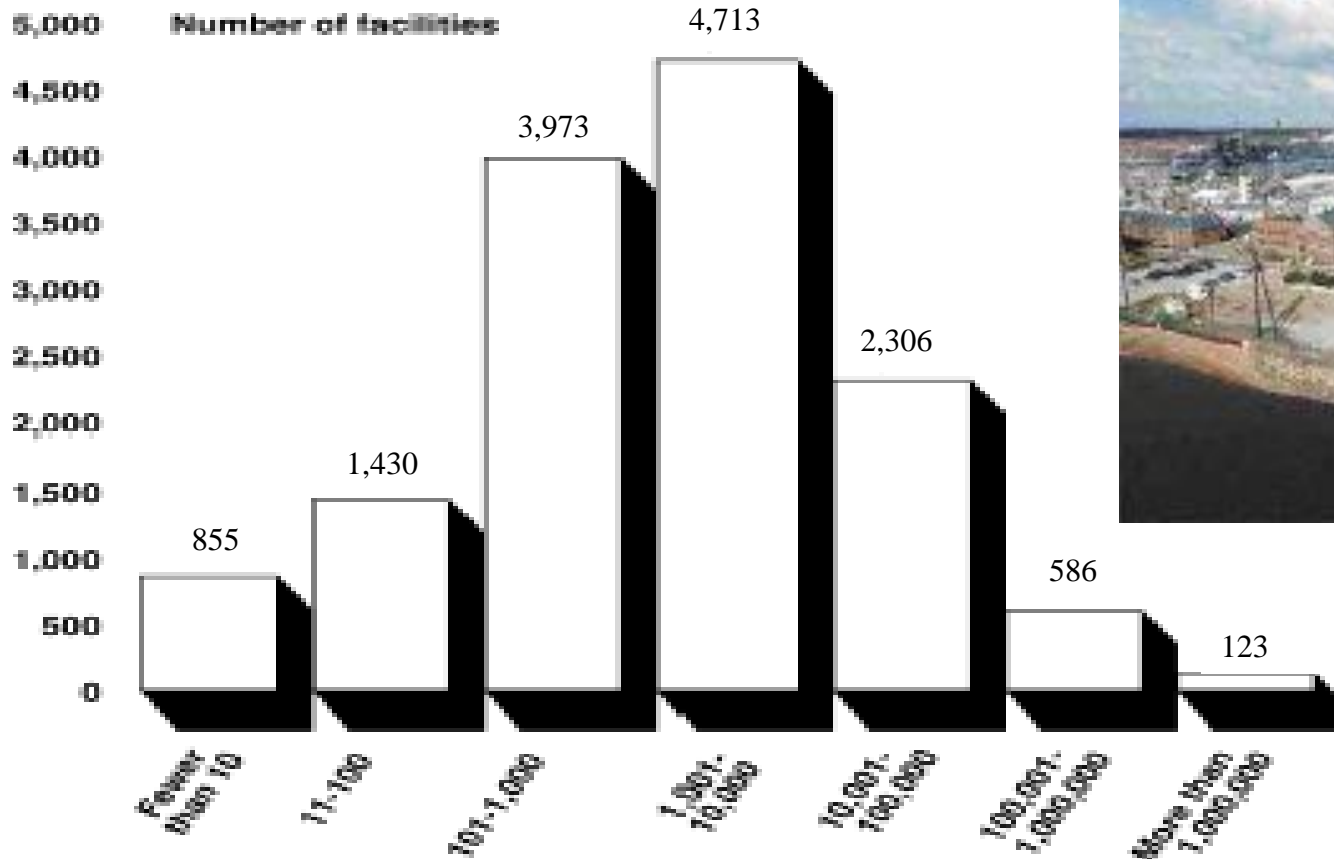


Poisonous Shortcuts



Industrial Sabotage Consequences

Figure 1: Number of Facilities with Worst-Case Accidental Release Scenarios by Residential Population Potentially Threatened

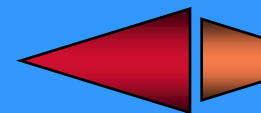


Source: EPA.

Notes: EPA, Chemical Accident Risks in U.S. Industry – A Preliminary Analysis of Accident Risk Data from U.S. Hazardous Chemical Facilities, Washington, D.C.: September 25, 2000.

Next Generation Nerve Agents

- Soviet *novichok* R&D began in 1970s
- *Novichok* #5:
 - 5-8 times as effective as VX
 - Approved as weapon by Red Army
 - Tons produced
- *Novichok* #7:
 - 10 times as effective as soman
 - 10s of tons produced
- Concept behind *novichoks*: bury the program in agrochemical industry
- Czech scientists have published similar agents



Alcohol,
promoter

DF

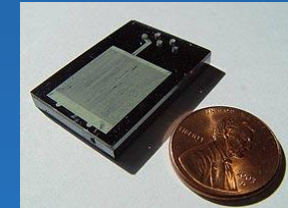
Concealing Production

- Make-shift or homemade equipment:
 - Stainless steel (dairy, kitchen supply)
 - Large chemical resistant plastic tanks, tubs, tubing
 - Safety hoods (\$200-\$300 supplies)
 - Scrubber (activated charcoal)
- Order from many chemical suppliers
- Steal supplies
- Order using non-standard chemical names
- Use non-standard production approaches
- Make classic agent variants
- Locate downwind from a stinky operation
- Isolated building with power (water optional)



Micro Process Technology

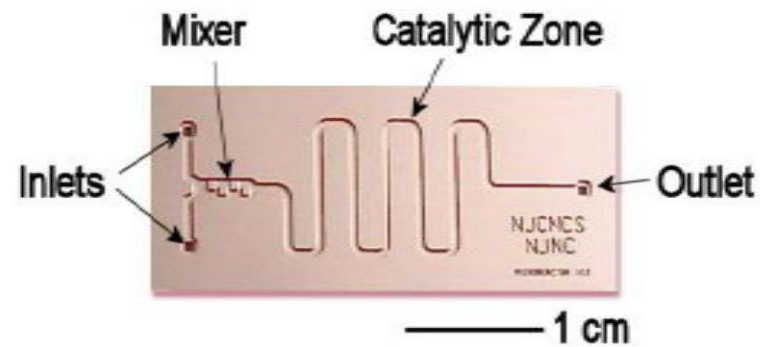
- High surface area to reactant ratio
- Stainless, ceramic, glass, hastelloy, silicon
- Devices = milli to micro channels
- Number up = multi-ton production
- Industrial problem-solvers:
 - Safer
 - Faster
 - Uniform product
 - More energy & cost efficient
 - Greener
 - Higher yields
 - Automated



HITACHI
Inspire the Next



DOW CORNING



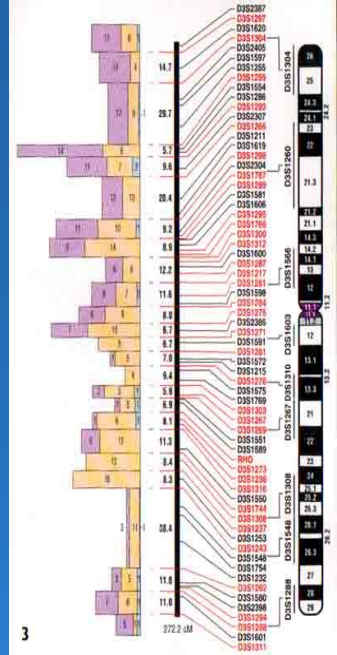
The Nonproliferation Challenge

- The toolkit vs. micro process technology
 - GEOINT
 - SIGINT
 - MASINT
 - OSINT
 - HUMINT
 - CWC inspects chemical types/quantities, not equipment
 - Australia Group does not specifically cover micros

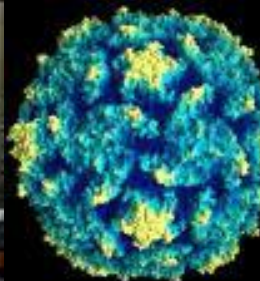
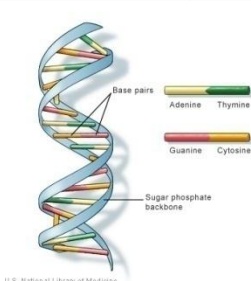


Snapshot of a Scientific Revolution

- Life sciences landmarks:
 - Discovery of the structure of DNA (1953)
 - Identification of the genetic code (1966)
 - Development of recombinant DNA technology (early 1970s)
 - Mapping the human genome (2000)
 - **Synthetic biology:**



Microorganism	# of Base Pairs	Date Synthesized
Polio virus	7,741	2003
1918 influenza virus	13,500	2005
<i>M. Genitalium</i> genome	1,080,000	2010
Smallpox virus	186,102	????



Globalization

- Diffusion:
 - Scientific journals on-line
 - De-skilling
 - Equipment manufactured widely
 - Outsourcing
- Government support => shortcut to:
 - Economic power
 - Better standard of living
- Future biotechnology powerhouses:
 - * Cuba
 - * China
 - * Brazil
 - * India
 - * Indonesia
 - * Russia
 - * Singapore
 - * Taiwan



The Dark Side of a Revolution



- Tremendous benefits to come from new knowledge:
 - Human neurological, immunological systems
- But, governance not keeping pace with advances
- Incapacitating agents:
 - Riot control (tear gas)
 - Psychochemicals
- Crossing chemical & biological agents
 - Fast acting + long lasting
- The ultimate weapons?

