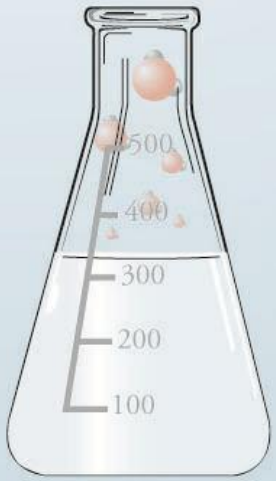
Chemistry and Terrorism



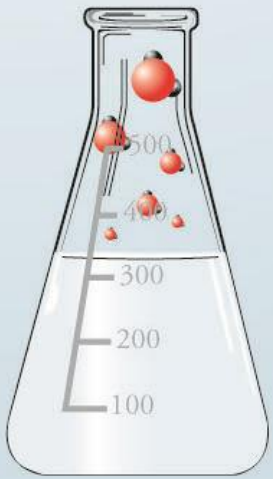
Scope of Accessible Chemicals for Terrorist Purposes

- ~627,000 toxic chemicals in PoisIndex™ (source for identifying, managing, and treating toxicological exposures. It includes ingredient and toxic substance information on commercial products, chemicals, drugs, toxic plants, and animals.
- ~600 new chemicals developed every year
  - Each one gets its own CAS # (Chemical Abstracts Service #)
- ~1.5 billion tons hazardous shipments annually

  (500,000 shipments/day)
- Academic, industrial laboratories

More on Accessible Chemicals: EPA Data

- ~850,000 U.S. businesses use, produce, or store Toxic Industrial Chemicals (TIC)
- 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.



“High Hazard” Toxic Industrial Chemicals (TICs)

NATO International Task Force 25 (ITF-25) studied potential use of TICs as weapons…high hazard TICs

- Sufficient toxicity by inhalation
- >30 tons produced
- LCT50 <100,000 mg/min/m^3, vapor pressure at 20 °C)

Tissue Irritants

- Ammonia
- Boron trichloride
- Fluorine
- Formaldehyde
- Hydrogen bromide
- Hydrogen chloride
- Phosgene
- Phosphorus trichloride
- Nitric acid
- Sulfur dioxide
- Sulfuric acid

Systemic Poisons

- Arsine
- Boron trifluoride
- Carbon disulfide
- Cyanide
- Diborane
- Ethylene oxide
- Hydrogen fluoride
- Hydrogen sulfide
- Tungsten hexafluoride

*HSEES Data on Chemical Incidents

- Over 24,000 U.S. hazmat incidents over 5 years
- 80% of incidents involve fixed facilities:
  - Chemical manufacture (agricultural)
  - Petroleum-refining
  - Electric light or power
  - Milling (pulp/paper)
- 20% of incidents are transportation-related
- 10% of incidents involve hospitals/schools

*Homeland Security Exercise and Evaluation Program, (HSEEP) www.hseep.dhs.gov

HSEES Designations of Chemical Threats

- Most Hazardous
  - Chlorine (Cl_2)
  - Ammonia (NH_3)
  - Nitrogen fertilizers
  - Hydrochloric acid (HCl)
- Others
  - Petroleum products
  - Pesticides
  - Corrosives
  - Metals
  - Volatile organics

Ranking Strategy for Small-scale Chemical Terrorist Attack

Need to consider:

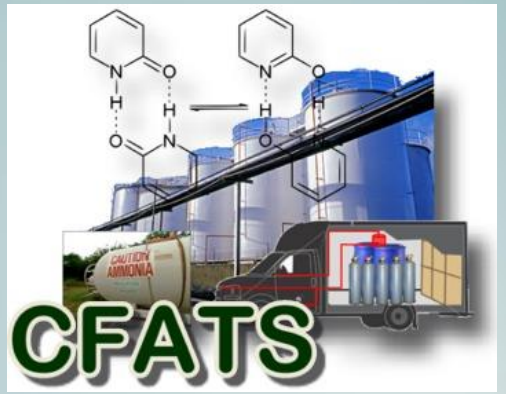
1. Ease of acquisition
2. Public health impact
3. Resistance to medical treatment
4. Ease of dissemination

Source: Congressional Research Service, May 2004

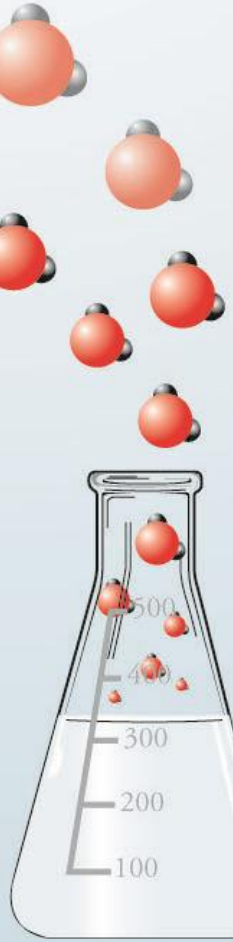
2007 Chemical Facility Anti-Terrorism Standards (CFATS)

First regulatory program that focuses on security at high-risk chemical facilities. Authorized DHS to:

- Require chemical facilities that possess one or more chemicals listed in CFATS Appendix A (384 compounds) in quantities above “Screening Threshold Quantities” to do risk assessment & determine if facility must comply with CFATS regulations
- Require high-risk chemical facilities to complete Security Vulnerability Assessments (SVAs)
- Require high-risk chemical facilities to develop Site Security Plans established by DHS
- DHS then ranks facility into one of four tiers, facility then must develop its individual site security plans according to their tier



Summary of Special Problems in Chemical Industry



- Facilities where toxic chemicals are produced and/or stored, including chlorine, various cyanide compounds, various arsenic compounds, pesticides, various ammonia compounds, petroleum products, etc.
- Land and sea transportation vehicles and containers that may be carrying any of the above
- Top industrial chemical threat agents in U.S. – hydrogen fluoride, anhydrous ammonia, and chlorine

Preventing & Addressing Chemical Terrorism

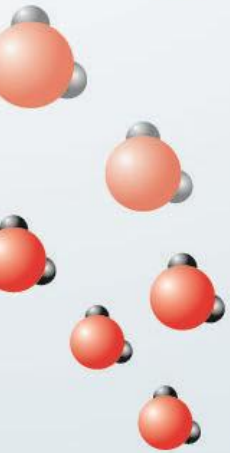
Addressing threats likely to require:

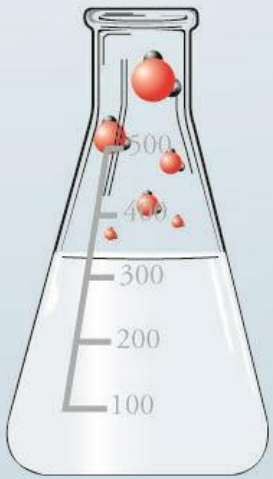
- Improving technical intelligence capabilities
- Bolstering existing social systems, especially public health and poison centers
- Establishing new research priorities
- Adopting new educational approaches: training of first responders, public health, hospitals, etc.

How Would United States Respond to Chemical Terrorist Event?

1. Local authority activates Incident Command System (local is Incident Commander); IC activates mutual aid
2. IC requests State assistance
3. State deploys National Guard Civilian Support Team and, if necessary, requests assistance from federal agencies
4. FBI immediately in charge
5. EPA provides On-scene Coordinator and contractors
6. National Labs, e.g., Lawrence Livermore Lab, participate

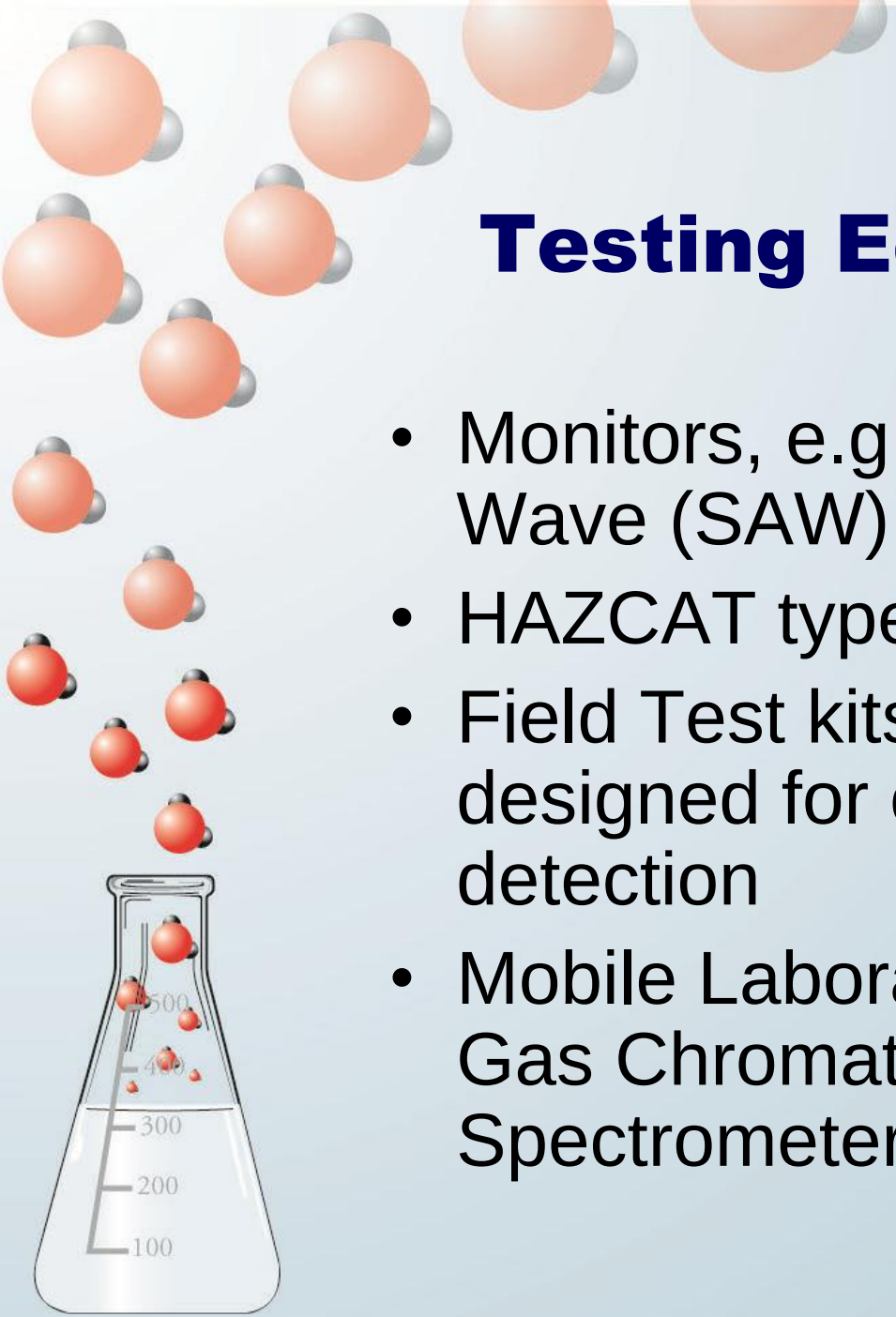
Testing Resources for Chemical Terrorist Event





- On-site Hazardous Categorization (HAZCAT) kits from initial responders
- Mobile Lab from the National Guard Civilian Support Team (CST)
- Contract commercial labs
- Government labs

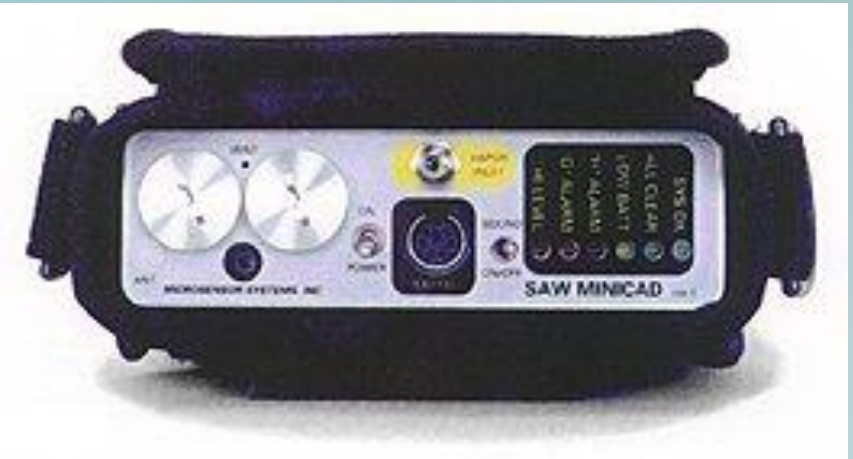
Testing Equipment



- Monitors, e.g., Surface Acoustic Wave (SAW) detectors
- HAZCAT type kits for field screening
- Field Test kits, e.g., M-256, designed for chemical agent detection
- Mobile Laboratories equipped with Gas Chromatography-Mass Spectrometer (GC-MS) system

Surface Acoustic Wave Detector

- Identifies vapors and gases by the acoustic (sound) waves generated on impact with a chip
- Currently in use for detection of nerve and chemical blister agents



Reference: www.esgsafety.com/ sawminicad.htm

HazCat Pro® KT7003 Kit

$6,998.00,
plus shipping & handling

This system is used to screen and detect chemical and biological weapons agents, common explosives, industrial chemicals, narcotics, and nuclear material before samples are taken to a reference laboratory. Kit includes swabs for sample specimen collection for direct PCR analysis and FBI evidence retention. System comes complete with all hardware, all reagents, waste collection bags, and manuals with material safety data information, all of which is packaged in hard shell case with wheels and handle.

M-256 Detection Kit

- Each kit consists of 12 disposable sampler-detectors plus one booklet of M8 paper
- Uses reagent ampoules for blister agents, blood agents, nerve agents, plus a Lewisite detecting pad

Source: sbccom.apgea.army.mil

Turnaround Times for Exposure Data

- HAZCAT results 1-4 hours after initial response
- Field equipment and mobile lab: minutes to a few hours after deployment
- Fixed laboratories: hours to a few days for more difficult tests
- Development of better/faster methods needed!

Case Study: Aum Shinrikyo and the Sarin Attacks of 1994-95

Aum Shinrikyo

- Apocalyptic millenarian cult based in Japan
- Sought to catalyze apocalypse through terrorist attacks in major cities
- Thought Japan and United States would engage in nuclear apocalyptic war in 2003
- 1995: ~50,000 members worldwide, large representation in Japan, Russia

Aum = Sanskrit; lots of meanings, including peace, God, creation, death

Shinrikyo = Japanese; teaching supreme truth

Shoko Asahara
(Chizuo Matsumoto),
Spiritual leader

Aum Shinrikyo's Nerve Agent Program

1993 - Recruitment of Scientists…

- Masami Tsuchiya - M.S. chemist with interest in making 'interesting' chemicals, LSD, methamphetamine, mescaline, etc.
- Tsuchiya scopes out CW agents for mass production and settles on Sarin: low cost, easy to produce, raw materials readily available,
- Finish 3-story nerve agent production building in June 1993, "Satian (Truth)-7"

Satian 7 Sarin Production Building
~$10 million
Production facilities hidden behind maze of corridors, 2-story distillation column behind shrine to Shiva

Matsumoto, 26 June 1994

Motivation

- Revenge for impending land dispute court case being decided against sect

Target

- Judges expected to rule against sect in the case
- Attacked judge's homes (dormitory building)

Agent and Delivery

- Sarin, ~ 20 kg
- Released as aerosol from back of truck

Casualties

- ~253 – medical attention
- 7 – dead

Aum Shinrikyo's 1st Large-Scale Attack. Matsumoto

- 20 June 1994: Asahara orders assassination of judges expected to rule against sect in a land dispute case.
  - Good opportunity to test effectiveness of produced Sarin!
  - Waited out rainy weather (would reduce Sarin effectiveness)
- 26 June 1994: Dry, hot evening, terrorists in place at target
  - Makeshift Sarin vaporizer system in back of refrigerator truck:
    - Steel tank holding Sarin, electric heater powered by 30 car batteries, fan to blow vaporized Sarin towards dormitory
  - 10pm- injected Sarin antidote, donned makeshift gas masks, powered up
- Plume reaches target, then wind changes
  - Sarin also reaches neighboring dormitory
  - Attackers flee
- Police and Fire arrive at scene
  - 5 residents at 2 sites already dead
  - 2 more victims die at hospital

Tokyo Subway, 20 March 1995

Motivation

- Distract against imminent police raid of sect compound

Target

- 5 cars of 3 subway lines toward city center
- Busy lines, transfer station near police HQ, Ministry of Foreign Affairs, other gov't agencies

Agent and Delivery

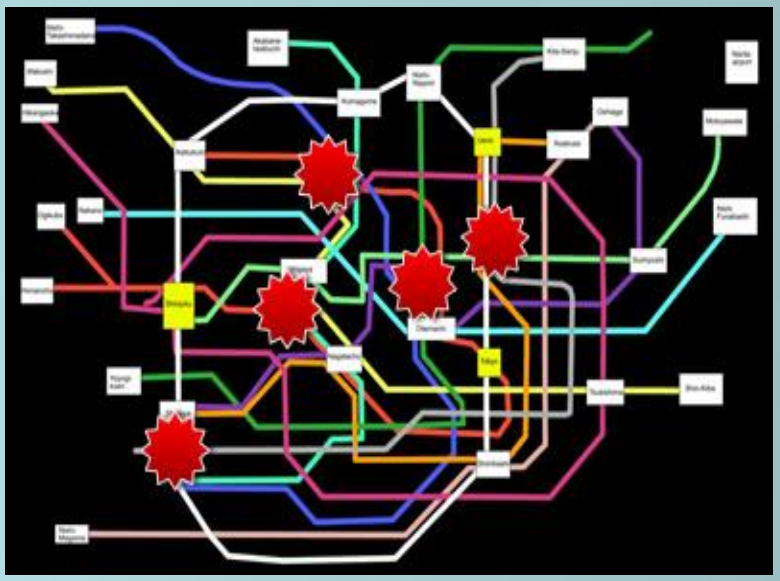
- Sarin, ~ 4.5 kg (159 ounces)
- Relased as liquid (punctured plastic bags)\

Casualties

- Over 5,500 – medical attention
- 12 – dead

20 March 1995 Tokyo Subway Sarin Attack

"…In the peaceful night of Matsumoto City,
people can be killed,
Even with our own hands,
everywhere there are dead bodies.
There! Inhale Sarin, Sarin,
Prepare Sarin! Prepare Sarin!
Immediately poison gas weapons will fill the place.
Spray! Spray! Sarin, the brave Sarin.



20 March 1995 Tokyo Subway Sarin Attack

Mid-1994, Attempts to mass produce Sarin.

- Asahara wanted enough for mass-casualty attacks in Tokyo, U.S.-cities
  - Goal: get 70 tons in 40 days
- Large-scale synthesis of Sarin intermediate, DMMP problems
  - Corrosive reagents, poor welding
  - Workers tried to seal with duct-tape and plastic, suffered spasms, vision loss
- July 9, 1994, DMMP tank overflows into surrounding environment
  - Community outraged - insists police investigate
  - Police hesitate since Aum a litigious religious group
- Dec 1994, convert DMMP to 60 L of DF (immediate Sarin precursor)
  - Leaks in production line remain; effort halted by Tsuchiya
- Early 1995, fearing a raid, Asahara orders all Sarin precursors destroyed
  - One scientist squirrels away ~ 1.5 kg DF for a rainy day

20 March 1995 Tokyo Subway Sarin Attack

That squirreled away DF unfortunately used later.

- Early 1995, Aum assassinations become more brazen.
  - March - sect members abduct and murder man (sister fled cult)
- Tokyo police finally must move in on sect.
  - Order 300 gas masks from Self-Defense Forces
  - Two Japanese army members of Aum tip off sect leaders.
- 18 Mar 1995, Asahara holds crisis meeting with top aids
  - How to divert police raid?
  - Someone suggests Sarin in the subway
  - Asahara approves: “that would cause panic”
- Chemists have only two days to produce Sarin for Monday morning commute
  - Use hidden DF precursor
  - No time to purify (distill), Sarin very impure (~60% impurities)
  - Asahara says better than nothing, gives blessing…
- Attack teams fill/seal plastic bags and prepare for attack.
- No time to purify…only about 30% ‘pure’ Sarin

Brief Synopsis of Attack

- 8 am, 20 March 1995, cult members puncture plastic bags filled with Sarin on three subway lines headed to Tokyo center
- 10 min later, Tokyo Metropolitan Fire Dept. (TMFD) arrive on scene
- 8:45 am, first victims arrive at hospital (by ambulance, on foot)
- Last subway train stopped at 9:30 am.
- TMFD detectors sensed CH_3CN (acetonitrile, a common chemical solvent) in subway cars and stations
- Special Defense Agency (SDA) correctly ID Sarin two hours after the event.
- Hospital staff begin uniform victim treatment at 10:30 am
- Over 500 victims and initial “worried-well” inundated St. Luke’s Hospital
- ~5,500 injuries and 12 dead

What is the “Worried-Well”?

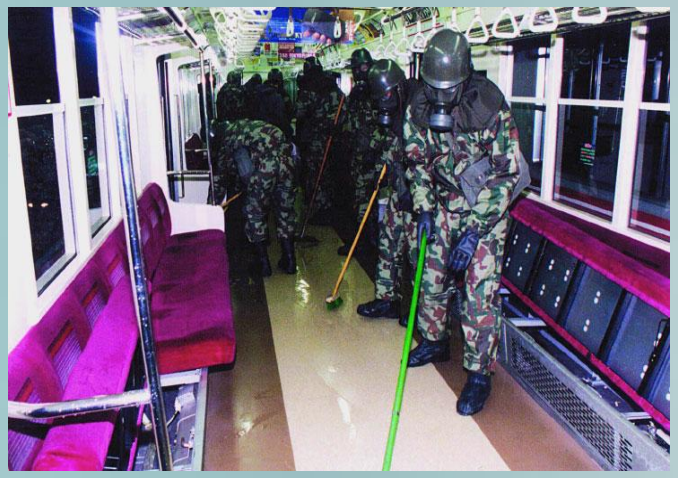
- Person(s) who experience/s psychosomatic injuries after a catastrophe that has not been PHYSICALLY injured/exposed but demand the same response resources (first responders, hospitals, etc.)
- Often result from lack of awareness/education over what caused event (innate ‘fear’ of chemicals, infectious agents, radioactive materials, etc.)
- Media typically exaggerate the crisis…24 hr news cycle
- Number of worried-well persons in the Tokyo subway Sarin event: thousands
- Can be a huge tax in resources (money, responders) during large scale emergency response efforts!


MASSACRE BY POISON GAS

Many die, 1,200 collapse in Tokyo Tube attack

Features of the Emergency Response to this Disaster

- Immediate responders (subway staff, victims, fellow passengers) had no personal protective equipment (PPE)
- Secondary responders at first, No PPE
- Media involvement
  - Key in alerting local civilians and experts
  - Expedited correct agent ID, getting extra antidote for victims



Identified Gaps in Emergency Response to this Disaster

- Preparedness
  - Notion that terrorist attack ‘can’t happen here’
  - Poor responder training for chemical/unnatural events
    - Proper use of PPE
  - No plans to deal with “worried well” phenomena
  - Poor access to chemical antidotes for large events
- Response
  - Lack of appropriate monitoring/sensor devices to determine nature of event/agent
  - Improper utilization of PPE
    - 10% secondary exposure, e.g. hospital staff

Readings

Readings-

- *Terrorism: Background on Chemical, Biological, and Toxin Weapons and Options for Lessening Their Impact*, Congressional Research Services, 2004. Available at: http://www.fas.org/irp/crs/RL31669.pdf (14 pgs)
- *Chemical Plant Security, Congressional Research Services*, 2006. available at: http://www.fas.org/sgp/crs/homesec/RL31530.pdf (46 pgs)

OPTIONAL READINGS:

- Jonathan Tucker, War of Nerves, 2006, “The Tokyo Subway”, Ch. 17.
- Amy E. Smithson, *Re-thinking the Lessons of Tokyo,* in *Ataxia: The Chemical And Biological Terrorism Threat And The US Response*, 2000, available at: http://www.stimson.org/images/uploads/research-pdfs/atxchapter3.pdf