NBC Hazards
Implications for respiratory protection

- Nuclear/ Radiological

- Biological

- Chemical
Presentation Goals

• Discuss potential terrorism hazards
• Implications for respiratory protection
• NOT discussion of:
  – Biological mechanisms of harm
  – Other PPE
Radiological Hazards

Radioactive particulate absorption vs. Ionizing radiation exposure
What Is Ionizing Radiation?

• radiation that can knock an electron out of an atom or molecule, forming an ion (an electrically charged particle)

• Radiation sources:
  – natural sources
  – manmade sources
Radiation Exposure Hazards

• External: Radiation from external sources
  – Respirators can **not** protect against this

• Internal: Radiation from sources taken into the body
  – Contaminated wounds
  – Ingested sources
  – Inhaled sources – *respiratory protection*
Radiation Penetration
From an External Source

Rules of thumb for shielding against various types of radiation

- Piece of paper
- Alpha
- Beta
- Gamma
- Neutron

5 cm. lead

Adapted from: Ionizing Radiation and Radioactivity, TRIUMF Safety Note No. 6.3.1; http://www.triumf.ca/safety/tsn/tsn_6_3/tsn_6_3.html
Ionizing Radiation in the Lungs
Respiratory Protection

The Department of Energy recommends full-face respiratory protection for entrance into a radiologically contaminated area. DOE/RW-0362 SR Office of Civilian Radiological Waste Management

The respiratory threat can be eliminated by employing High Efficiency Particulate Air (HEPA) or P100 filters. Domestic Preparedness Technician-HAZMAT Course
Military RN Respiratory Protection

Two-element canister

• (HEPA) filtration media
• ASC Whetlerite Carbon filtration media.
HEPA/P100 Filters for RN Particles

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<tr>
<th>Particle diameter, µm</th>
<th>Percent Filter Efficiency</th>
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<td>0.2 - 10</td>
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Uranium dust (0.2-10µm)
Biological Agent
Particulate Exposures
Biological Exposure Scenarios

- Response to a discovered device or source (real or hoax)
- Occult release resulting in disease outbreak – exposure comes from transporting patients
- Likelihood of each?
Portals of Entry

- Inhaled
- Mucous membrane (eye, nose, mouth)
- Break in skin (cut, wound, etc)
- Portals of entry differ by disease!
- Biological weapons primarily inhalation exposures
Biological Agents
(USAMRIID or CDC Lists)

- Anthrax
- Brucellosis
- Glanders
- Pneumonic Plague
- Tularemia
- Q Fever

- Smallpox
- Venezuelan Equine
  Encephalitis
- Viral Hemorrhagic Fevers
- T-2 Mycotoxins
- Botulism
- Ricin
- Staphylococcus Enterotoxin B
HEPA/P100 Filters for Biologicals

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<td>99.97</td>
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<td>1.0</td>
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- Anthrax (1-8um length, 1-1.5 um breadth)
- Brucellosis (0.5 x 1.5 um)
- Glanders (0.3 x 1-3 um)
- Smallpox (.13 - .3 um)
- Q fever (0.3x1.0 um)
- Viral Hemorrhagic Fevers (50-500 nm)
- Venezuelan Equinè Encephalitis (40-70 nm)
Biological Incident Responses

• A respirator will reduce but may not entirely prevent exposures
  – Depends on concentration, exposure time, fit
• Respirators are part of a response plan
• Other elements:
  – Infection control practice: barrier precautions, handwashing, disinfection
  – Immunization or post-exposure antibiotics for workers likely to be exposed
  – Work with your health department on planning
Identifying Chemical Warfare Agents and Toxic Industrial Chemicals

U.S. Domestic Concerns
Process

• Contact key agencies
• Obtain Hazard/Vulnerability Assessments
• Evaluate relevance of lists
• Develop “customized” criteria
• Apply criteria to original databases
• Overcome security sensitivities
• Release preliminary report
Contacted Agencies

- Department of Defense: DTRA, AFMIC, TSWG
- Department of Justice: NIJ, FBI, OJP
- Environmental Protection Agency
- Agency for Toxic Substances and Disease Registry
- Department of Energy
- General Accounting Office
- CDC: Bioterrorism Committee, National Centers for Environmental Health
NIOSH/SBCCOM EVALUATED the Following Assessments:

- Department of Defense reports of toxic industrial chemicals (TIC)
- National Institute of Justice/Federal Bureau of Investigation/Technical Support Working Group (NIJ/FBI/TSWG), Threat Assessment, Draft
- Agency For Toxic Substances and Disease Registry (ATSDR/CDC)
  - Industrial Chemicals as Weapons of Mass Destruction
  - Hazardous Substances Disaster Assessment and Assistance - 1999 CERCLA List of Priority Hazardous Substances
- Environmental Protection Agency (EPA)
DoD TIC LISTS of Toxic Industrial Chemicals

• OBJECTIVES: Determine which industrial chemicals are most likely to pose a hazard to military personnel

• CRITERIA:
  – Inhalation toxicity
  – Vapor pressure
  – Acute hazard effects
  – Large production quantity (# of Producers)
  – World-wide production by (# of Continents)
Draft NIJ/FBI/TSWG Report

• Focused on C/B agents that may be more likely to be used in domestic terrorism

• Aid to law enforcement in addressing needs for better NBC detection and Personal Protection Equipment (PPE)

• Selection criteria: Availability, history of use and toxicity
Threat Watch List:

- Based on Availability, History of Use, Ties to Terrorist Literature, Physical and Chemical Characteristics and Toxicity

- Represents those C/B materials that may be more likely to be used in domestic terrorism
ATSDR Lists

1. Industrial Chemicals as Weapons of Mass Destruction
2. Hazardous Substances Disaster Assessment and Assistance

- Emphasis on industrial chemicals as weapons
- Gathered information on past use as weapons
“Customized” Criteria for Selecting Toxic Industrial Chemicals (TIC)

- Inhalation toxicity
- Respiratory hazard
- Accessible
- Acute effect
- Used previously by terrorist
- Chemicals that are produced in or are imported into the United States
Chemical Warfare Agents (CWA) and Riot Control Compounds

- For Chemical Warfare Agents, we selected blister, choking, blood, and nerve agents
- For Riot Control Compounds, we selected vomiting and tear agents
Tentative Chemical List

- **126 TIC**
- **32 CWA and Riot Control Compounds**

- Segregate chemicals into families based on common factors
- From each family, determine representative test substances using a multi-criteria weighting method
Summary

• Focused on U.S. domestic terrorism
• NIOSH/SBCCCOM list now contains 158 chemicals: CWA, TIC and Riot Control Compounds
• Segregate into families based on a common factor
• From each family, determine representative test substances using a multi-criteria weighting method
NBC Hazards Conclusion

- Identified the NBC Hazards that we feel pertain to U.S. domestic terrorism
- Must identify new hazards by monitoring new threat assessments and by keeping in contact with law enforcement agencies
- Develop new respirator test standards as needed depending on the emerging threat