WEAPONS OF
MASS DESTRUCTION
PERFORMANCE - DEFENSIVE

“OPERATIONS”
ACKNOWLEDGEMENTS

This course and participant’s manual were developed and produced for the training of Operations level responders. Many individuals shared in the overall process in supportive, technical, and creative methods. This manual and course could not have been developed without the dedication of those involved in it’s production. It was the commitment to excellence that made this manual and course possible.

All artwork that has been used in the making of this educational product has been given source credit where credit could be found. All applicable works of art, photos and illustrations protected under copyright provisions are used in regard to “fair use” as stipulated in the 1961 Report of the Register of Copyrights on the General Revision of the U.S. Copyright Law. It is the purpose of this course to provide an educational resource for all persons needing to be trained to the Operations level and such related materials to give insight during the educational process.

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This manual is an integral part of the Ohio First Responder training pyramid. By itself, it does not constitute complete and comprehensive training. The training must be accompanied by instruction from a certified state of Ohio instructor recognized to teach this material.

The information outlined in this manual reflect the standard of knowledge and accepted practices in the State of Ohio as well as the United States at the time this manual was published. It is the reader’s responsibility to stay informed of changes in the procedures outlined in this manual.

Any and all questions related to the material printed herein should be sent to:

Ohio HazMat / WMD Operations Training
Ohio Fire Academy
8895 E. Main Street
Reynoldsburg, OH 43068
Disclaimer

This course covers the required competencies of The Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.120(q)(6)(ii) and US EPA 40 CFR part 311 for training the first responder to the Operations Level. This Course also addresses the Nation Fire Protection Association’s (NFPA 472 chapter 5 ) Standard for Hazardous Materials Operations Level Responders Specific elements of 29 CFR 1910.120(q)(6)(ii) A through F need to be addressed by the certifying employer before the employee can meet the requirements for first responder Operations Level.
Module 2 Description and Objectives

Scope of Module 2

This module is a comprehensive resource for response to WMD incidents. The completion of this module and each of its units' student performance objectives will meet or exceed the Office of Domestic Preparedness Performance – Defense (Operations) level objectives. It is the purpose of this module to teach students to respond defensively within the capabilities of their occupational domain.

Learning Objective

At the completion of this module the student will have met all of the student performance objectives established by the Office of Domestic Preparedness as it relates to response to WMD at the Performance – Defense (Operations) level. The students will demonstrate a working knowledge of recognition, identification, isolation and response to defensively handle a WMD threat at the operations level.

Student Performance Objectives

- Complete each of the student performance objectives in each unit.
- Satisfactorily complete the program of instruction as outlined in the matrix.
- Satisfactorily complete the scenario at the conclusion of this module.
- Satisfactorily complete the skill sheet test at end of this module.

Resource List

- Student manual (Module 2)

Scenario

At the end of this module there is a scenario for course completion. The instructor will determine if the scenario will be a table top or actual performance scenario based on the availability of resources to complete the scenario. All of the needed resources are listed at the beginning of the scenario unit.
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Background

The Office of Domestic Preparedness (ODP) is a federal agency under the direction of the Department of Homeland Security. Part of their responsibility is to establish federal guidelines and national standards for the levels of responders at terrorism incidents.

In the Ohio HazMat and WMD Awareness course, we were taught the ODP awareness level competencies for terrorism incidents. For Operation Level Responders these standards are known as Performance Level Guidelines. Performance Level Guidelines are broken into five separate professions, Law Enforcement, Fire Service, Emergency Medical Services, Hazardous Materials, and Public Works. Each profession is subdivided into two separate competencies, Performance - Defensive for Operations level responders and Performance Level B for technician level responders.

The following text will provide basic knowledge and understanding of these guidelines. All professions have some baseline competencies that are shared with each group. Each profession has certain competencies that are specific only to it.

The HAZMAT Awareness and WMD Awareness courses were integrated together in the first of this homeland security training series offered by the State of Ohio Security Task Force.

You must have successfully completed that course in order to proceed to the HAZMAT Operations (Performance - Defensive) training offered in this module.

The following matrix shows the Performance - Defensive objectives as published by the Office of Domestic Preparedness (ODP)
## Program of Instruction (POI)/Syllabus

<table>
<thead>
<tr>
<th>ODP</th>
<th>ODP Guidelines for Student Performance Objectives</th>
<th>Responders</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Student must have completed adequate and proper training at the awareness level for events involving hazardous materials, and for WMD and other specialized training.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>[PW]</td>
<td>Performance level training - General line operations personnel and supervisors. Have successfully completed additional training beyond awareness level to be able to provide skilled support services in the event of a WMD attack targeting a public works facility.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW]</td>
<td>Performance level training - Planners, engineers, and lab technicians. Have successfully completed additional training to effectively respond to a WMD incident either within a public works facility or within the community.</td>
<td>PW</td>
</tr>
<tr>
<td>I(a)</td>
<td>Complete training in (or have equivalent training and experience) and understand the guidelines at the awareness level for responders.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>I(b)</td>
<td>Understand the terminology (including any glossary of WMD terms).</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>[PW]</td>
<td>Recognize the characteristics and threats posed by a WMD agent.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW]</td>
<td>Recognize the characteristics and threats posed by a potential WMD agent. Follow organization procedures, including decontamination protocols, for responding to a potential WMD.</td>
<td>PW</td>
</tr>
<tr>
<td>I(c)</td>
<td>Be aware of any potential targets for possible attack by persons using WMD agents or materials. Know preplans to be used in his/her department’s emergency response plan for these locations.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>I(d)</td>
<td>Know how to collect and forward intelligence regarding potential terrorist/criminal actions involving possible WMD agents or materials. Be able to coordinate the gathering of such intelligence from a variety of sources and organizations that may be on the scene. Forward this information to the law enforcement manager or designee and the incident commander at the scene</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>I(e)</td>
<td>Demonstrate skill and knowledge in preparing hazard and risk analysis of potential WMD targets in the local community.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>[PW]</td>
<td>Participate in and contribute to the WMD vulnerability assessment for the public works organization.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW] I(c)</td>
<td>Be able to conduct a vulnerability assessment of public works operations.</td>
<td>PW</td>
</tr>
<tr>
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<td>--------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>I(e)(1)</td>
<td>Know how to access the potential for direct threats, as well as collateral damage effects.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>I(e)(2)</td>
<td>Be familiar with preplans for emergency response to these sites.</td>
<td>EMS</td>
</tr>
<tr>
<td>[PW] I(c)</td>
<td>Be familiar with the WMD incident response plan. Understand his/her role in that plan.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW] II(e)</td>
<td>Understand the role of public works in the WMD incident response plan.</td>
<td>PW</td>
</tr>
<tr>
<td>I(f)</td>
<td>Participate in joint training exercise or drill with other emergency response organizations that are expected to participate in responding to a potential WMD event in the local area.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>[PW] I(a)</td>
<td>Recognize the characteristics and threats posed by a WMD agent.</td>
<td>PW</td>
</tr>
<tr>
<td>I(g)</td>
<td>Recognize the special aspects of responding to a hazardous material or potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>I(g)(1)</td>
<td>Recognize special aspects of Hazmat &amp; WMD compared with more routine fire emergencies. Understand the special circumstances and properties of HAZMAT and WMD events compared with more routine fire emergencies.</td>
<td>FS</td>
</tr>
<tr>
<td>I(g)(2)</td>
<td>Recognize special aspects of HAZMAT &amp; WMD by being alert to signs and symptoms that may be exhibited by victims. (Know and follow emergency medical protocols for treating these victims.)</td>
<td>EMS</td>
</tr>
<tr>
<td>[PW] I(b)</td>
<td>Understand the potential impact and consequences of use of various WMD agents on public works facilities.</td>
<td>PW</td>
</tr>
<tr>
<td>II</td>
<td>Know the Incident Command System and be able to follow Unified Command System procedures for the integration and implementation of each system. Know how the systems integrate and support the incident. Be familiar with the overall operation of the two command systems and be able to assist in implementation of the Unified Command System if needed.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(a)</td>
<td>Know how to implement initial site management procedures following the department’s incident command system and emergency response plan. Such procedures include establishing communications with the dispatcher or command center, setting up the control zones for the scene, and locating the command post.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>[PW]</td>
<td>Understand his/her role as a member of a WMD response team either as a skilled support person or specialist.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW] II(d)</td>
<td>Understand his/her role in the public works facility’s continuity of services contingency plan.</td>
<td>PW</td>
</tr>
<tr>
<td>[PW] II(f)</td>
<td>Understand his/her role and responsibilities as a member of the incidence response team.</td>
<td>PW</td>
</tr>
<tr>
<td>II(a)(1)</td>
<td>Know how to forward any intelligence that has been collected on scene.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(a)(2)</td>
<td>Establish triage areas, coordinating with law enforcement and other agencies, transportation of victims needing additional medical treatment, establishing the EMS manager at the command post.</td>
<td>EMS</td>
</tr>
<tr>
<td>II(b)</td>
<td>Be able to implement the Incident Command System component of the department’s emergency response plan for potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(c)</td>
<td>Be aware of the assets available from the department and from other local law enforcement agencies that could provide assistance on a potential WMD event scene. Know what procedures to follow to get these resources to the scene as needed.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>II(d)</td>
<td>Be familiar with the assets that could be made available from other local emergency response organizations. Understand and follow department’s procedures for accessing these organizations for help with a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(d)(1)</td>
<td>Be aware of medical assets available from the department and from other emergency response agencies that could provide assistance on a potential WMD event scene. Know what procedures to follow to get these resources to the scene as needed.</td>
<td>EMS</td>
</tr>
<tr>
<td>II(e)</td>
<td>Understand the purpose and function of the Unified Command System. Know department procedures for assisting in implementation of the Unified Command System on the scene of a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(f)</td>
<td>Be able to assist in a critique of the actions taken during the complete response to a WMD event. Assist in documenting lessons learned from the critique as they pertain to response activities.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(g)</td>
<td>Understand the importance of and know how termination documentation for a WMD event is to be conducted related to activities on the scene.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(h)</td>
<td>Know and follow departmental guidelines in dealing with the local media during a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>II(i)</td>
<td>Know how to develop an Incident Action Plan in coordination with the on-scene incident commander. Ensure that the Incident Action Plan is consistent with the department’s emergency response plan.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(j)</td>
<td>Be familiar with emergency medical assets that could be made available from other local emergency response organizations. Understand and follow the department’s procedures for accessing these organizations for help with a potential WMD event.</td>
<td>EMS</td>
</tr>
<tr>
<td>-------</td>
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</tr>
<tr>
<td>III</td>
<td>Know and follow self-protection measures and rescue and evacuation procedures for WMD events.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(a)</td>
<td>Know how and when to use appropriate personal protective equipment (PPE) issued by the department to work in the warm zone on the scene of a potential WMD event. Fully understand the limitations of the PPE. Follow departmental policy for use, inspection, and maintenance of PPE.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(b)</td>
<td>Understand the hazards and risks associated with wearing chemical protective clothing and other protective clothing at a potential WMD event. Understand and follow the rehabilitation steps to help responders reduce the level of heat stress. Know what other precautions to take to protect responders on the scene.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>III(c)</td>
<td>Know how to determine the appropriate PPE for protecting responders who will be entering the warm zone on the scene of a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(c)(1)</td>
<td>Appropriate PPE likely will include gear to protect the responder against any infectious agents, such as blood borne pathogens that victims may have.</td>
<td>EMS</td>
</tr>
<tr>
<td>III(d)</td>
<td>Know the protective measures that will be needed to protect victims and others on the scene of a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(e)</td>
<td>Know the department’s and the on-scene incident commander’s plan for evacuation of persons from the hazard area of a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(e)(1)</td>
<td>Know the department’s and the on-scene incident commander’s plan for evacuation casualties.</td>
<td>EMS</td>
</tr>
<tr>
<td>III(f)</td>
<td>Be able to assist in rescuing and in moving victims of a potential WMD event to a safe area for triage and treatment by emergency medical responders.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>III(f)(1)</td>
<td>Be able to triage and treat injured.</td>
<td>EMS</td>
</tr>
<tr>
<td>III(g)</td>
<td>Understand the role of the Performance Level A responder, as well as the role of other levels of response in the department’s emergency response plan.</td>
<td>LE, FS</td>
</tr>
<tr>
<td>III(h)</td>
<td>Know how to implement appropriate decontamination procedures for victims, responders, mass casualties, and equipment. Understand the importance of proper decontamination of equipment that will be reused.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>III(i)</td>
<td>Know and follow departmental procedures and practices for handling and securing unknown suspicious packages.</td>
<td>LE, FS</td>
</tr>
<tr>
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<td>--------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>III(i)(1)</td>
<td>Know how to request assistance from law enforcement in handling suspicious packages.</td>
<td>EMS</td>
</tr>
<tr>
<td>[PW] II(a)</td>
<td>Be able to identify and avoid WMD devices and follow appropriate procedures when such a device is suspected.</td>
<td>PW</td>
</tr>
<tr>
<td>IV</td>
<td>Know and follow procedures for working at the scene of a potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>IV(a)</td>
<td>Know how to conduct a criminal investigation, protect and collect possible crime scene evidence, and follow department procedures for chain of custody, documentation, and security measures to store crime scene evidence whether or not it is contaminated.</td>
<td>LE</td>
</tr>
<tr>
<td>[PW] I(g)</td>
<td>Be able to recognize, safely handle, and properly secure potential WMD agents as crime scene evidence.</td>
<td>PW</td>
</tr>
<tr>
<td>IV(a)(1)</td>
<td>Understand the importance of procedures in how to conduct a criminal investigation, such as a suspected arson incident, and in protecting possible crime scene evidence.</td>
<td>FS</td>
</tr>
<tr>
<td>IV(a)(2)</td>
<td>Understand the importance of procedures used by law enforcement in conducting a criminal investigation and in protecting possible crime scene evidence without endangering others.</td>
<td>EMS</td>
</tr>
<tr>
<td>IV(b)</td>
<td>Implement the department’s emergency response plan scene security measures and procedures. These procedures include providing security for the command post and controlling or monitoring those entering and leaving the scene of a potential WMD event.</td>
<td>LE</td>
</tr>
<tr>
<td>IV(b)(1)</td>
<td>Implement and coordinate with law enforcement the department’s emergency response plan scene security measures and procedures. These procedures include providing security for the command post and controlling or monitoring those entering and leaving the scene of a potential WMD event.</td>
<td>FS</td>
</tr>
<tr>
<td>IV(b)(2)</td>
<td>Implement and coordinate with law enforcement the department’s emergency response plan scene security measures and procedures. These procedures include providing security for the command post and controlling or monitoring those entering and leaving the scene of a potential WMD event. Follow the traffic control plan implemented by the on-scene incident commander.</td>
<td>EMS</td>
</tr>
<tr>
<td>IV(c)</td>
<td>Know how to implement appropriate on-the-scene</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>[PW] l(d)</td>
<td>Understand the importance of proper decontamination in a WMD incident. Be able to implement public works facility decontamination procedures.</td>
<td>PW</td>
</tr>
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</tr>
<tr>
<td>IV(d)</td>
<td>Know how to implement basic life support procedures for protection and treatment of victims, responders and others at the scene.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>IV(e)</td>
<td>Know how to implement procedures and measures for minimizing the spread of contamination of hazardous agents or materials to other locations and persons.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>IV(f)</td>
<td>Be trained in how to recognize a potential terrorist incident. Be able to help identify the potential agents or materials that may be present at a WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>IV(g)</td>
<td>Fully understand the role and jurisdiction of Federal agencies in a potential WMD event. Be able to coordinate and assist in the overall criminal investigation of the potential WMD event.</td>
<td>LE, FS, EMS</td>
</tr>
<tr>
<td>IV(g)(1)</td>
<td>Be aware of criminal laws, as well as privacy and security issues related to WMD events.</td>
<td>LE</td>
</tr>
</tbody>
</table>

Matrix Legend: LE = Law Enforcement, FS = Fire Service, EMS = Emergency Medical Service, PW = Public Works

As outlined in the above Office of Domestic Preparedness matrix there are specific duties to be performed by certain responder domains. These specific duties are highlighted in this module by the use of the following pictures.

Pictorial Legend:

- These are points of interest for all response domains.
- Law enforcement specific reference.
- Firefighter specific reference.
- Emergency Medical Services specific reference.
- Public Works specific reference.
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Module 2
Unit 1
Scope of Module 2, Unit 1

This unit of module 2 is a review unit for the items learned in the awareness level training as well as build knowledge on the initial response effort.

Learning Objective

Each student will Demonstrate a working knowledge of the awareness training materials as related to use of weapons of mass destruction.

Student Performance Objectives

- Describe potential locations of terrorist acts and identify possible targets.
- Describe how recognition is one of the most important aspects of a response to an incident.
- Describe why WMD incidents require a safer response as compared to routine fire responses.
- Describe what EMS personnel should be watchful for at the incident.
- Describe the types of clues for threat recognition.
- Describe on scene warning signs of WMD use.
- Describe what responders should be watchful for as secondary hazards during a response.
- Describe your role and how to implement a disaster plan and the advantages of such a plan.
- Describe who will and how to collect intelligence at the scene of a WMD incident.
- Describe the four types of plans for response.

Resource List

- Student manual
Module 2  
Unit 1  
Training at the Awareness Level Review

The Standard
ODP – I(a) Law, Fire, EMS

“Students must have completed adequate and proper training at the awareness level for events involving hazardous materials, and for WMD and other specialized training.”

Introduction and Review

When responders are arriving at the scene of an emergency it is imperative that the recognition phase start immediately upon approach and arrival. If the responders observe any of the clues to lead to a belief of a more sinister incident the responders should take immediate protective actions for themselves and those bystanders around the scene.

At the conclusion of this unit you will have a review of the basic principals of recognition and identification with further emphasis on chemical, biological, radiological, and nuclear recognition and identification.

Potential Targets
ODP – I(c) Law, Fire, EMS, Public Works

Whether you are in a densely populated metropolis or a quiet rural setting, there are potential targets for terrorism. The targets may differ but the intent is the same no matter where you are.
Who are the Targets?

ODP – l(c) Law, Fire, EMS

The targets can be anything and anyone. Responders need to recognize those potential events, locations and high impact areas that yield a high probability of attack. The target may be small and tactically aimed such as one person or place, or the attack may be broad and more strategic in nature, aimed at a large group of people or places. Another possibility is that the target is YOU! There is a great deal of media attention when the target is the first responder to an incident. Be very observant and learn to make rapid recognition.

Recognition

Recognition is the single most important thing you can do as a responder to a potential WMD event.

If you recognize the event as a possible WMD event then you will be more effective in saving lives and not endangering your own life. Use the elements of recognition learned in the awareness training as well as the everyday attention to detail for identification of suspect events.

Recognition of Special Response to WMD

ODP – l(g) Law, Fire, EMS, Public Works

Since recognition is the single most important thing you can do, the next logical step after recognition is to formulate a special response to that suspect event. In all occupations there are different ways we approach and handle situations.

An example might be a motor vehicle accident. The special response to the motor vehicle accident would be to protect the scene with the trucks and to approach from a safe direction so as to be able to further process
any recognizable dangers upon approach. This would differ from a response to a life threatening medical emergency.

While the life threatening medical emergency may be a result of a hazardous situation (gunman) and responders should be vigilantly looking for anything that would give recognition of any threats to the response effort.

**CAUTION**

Take the time needed to ensure the safety of you and other responders.

**Special aspects of WMD compared to routine fire emergencies**

**ODP – I(g)(1) Fire**

Most would agree that a routine fire emergency is non-existent in the world because of so many different variables on each run. With that in mind, we will take a house fire run and look at how this would give the baseline for response to a WMD event.

When we get the call we equip ourselves for the run we are going on. Fire Responders will use firefighter protective clothing as their personal protective equipment as well as Self Contained Breathing Apparatus (SCBA) as an increased airway protection. While enroute to the scene of the fire run information is continually relayed from the communications center to the response commander. That commander takes all of the communicated information and starts to devise a plan for when they arrive at the scene. Upon arrival of the Fire Responders the commander will report to the communications center whether there are **RECOGNIZABLE** signs of fire on the structure. The commander may radio “no signs of fire, will be investigating.” This tells the communications center the intensity of the run and whether other resources will be needed.

If we change the run now to a potential WMD event, the response effort will change to meet the special needs for a safe response to the event. An example would be a report of an explosion at the Friday night football game. The Fire Responders would initially put on their firefighter protective clothing and ready their SCBA’s in a response to a fire explosion. While enroute the commander receives information from first responders that the explosion was by the bleachers and there is no damage to any structures. At this point the commanding officer of the Fire Response effort should be suspecting a dissemination device and preparing his specialized response efforts accordingly. The firefighter protective clothing may be changed to
chemical protective clothing and no personnel without respiratory protection may be permitted to enter the area of the scene until the investigatory team can dispel the suspicion of a dissemination device. At the same time the additional support services will need to be summoned and readied.

It is essential to remember to protect yourself and ready your mind for a “wide eyed” attention to detail approach to recognize threats or causal factors. Keep the response effort adaptable and ready for change as a result of the intelligence gathered while responding.

Special aspects of HAZMAT & WMD by signs and symptoms
ODP – I(g)(2) EMS

It is very important for the Emergency Medical Services to be able to recognize signs and symptoms of exposures to WMD materials.

In the about example of the device that exploded with no damage to any structure. The fire investigation may yield no recognition of a WMD device. The EMS personnel may however see a large influx of ill people that were in the proximity of the dispersion. This information should be immediately relayed to the incident commander and corrective actions start to be implemented.

EMS personnel should know common signs and symptoms of likely WMD materials. A close review of Units 5, 6, 7, of this module would give the EMS responder a huge insight for recognizing signs and symptoms.

In addition to recognizing the signs and symptoms and starting the appropriate treatment for the ailment the victim is suffering.

EMS PERSONNEL MUST FOLLOW EMERGENCY MEDICAL PROTOCOLS OF THEIR DEPARTMENT FOR TREATING THESE VICTIMS.

Clues for Recognition
ODP – IV(f) Law, Fire, EMS, PW

There are some typical indicators responders should be aware of when making an assessment of whether the response could be a potential WMD related event.

**Occupancy/Location.**
The location and type of occupancy can be a magnet for terrorist incidents. An example would be that of a church or historical landmark. These are examples of a location or occupancy that terrorists would find interesting because of the
impact on the general population for which they are trying to coerce their beliefs onto.

- Symbolic and historical targets
- Public buildings or assembly areas
- Controversial businesses
- Infrastructure systems

**Type of Event.**
The type of event will also draw interest from criminal elements and/or terrorists from local and abroad. If the location is not that productive of an impact on the general population nor the government then the event that occurs there might not be of enough magnitude to produce the desired effect.

**Timing of Event.**
The timing of an event may be of importance to a group of people wishing to demonstrate their beliefs on that anniversary date and time. The timing of an event should be regarded as important as the occupancy/location and type of event.

- Historical significant days
- Day of the week
- Time of day

**On Scene Warning Signs.**

ODP – PW I(a)
ODP – PW II(b)
ODP – PW I(a)

When responding to a scene of any type you will want to watch for anything that leads you to a suspected cause of the incident. Some warning signs that lend to the recognition of a CBRNE release may include:

- Unexplained patterns of mass illnesses or deaths
- Unusual orders or tastes
- Unexplained skin, eye, or airway irritation
- Unexplained vapor clouds, mists, and plumes
- Unusual chemical containers, spray devices, or lab equipment
- Items or containers that appear out of place at unusual incidents
- Fires of unusual behavior
- Anything that appears to be “not normal"
Identification

When a responder recognizes an incident as a potential hazard caused by accident or on purpose they must try to identify the hazard. It should be noted that a problem well defined is half solved. This means that gaining more knowledge about the hazard you are facing will allow Responders to formulate a plan for response.

Whenever you are identifying the hazard, you must always assume that you have made an error and always verify your identification method with several resources available. The purpose for this is to make certain that you have correctly identified the incident for further response. If an incorrect identification is made, the response effort may be jeopardized.

Secondary Devices

CAUTION

Always be alert to the possibility that the hazard has been set on purpose. Responders should always be vigilant of secondary devices.

Secondary Devices are those devices set secondary to the primary cause of the incident. These secondary devices are set adjacent to the incident response aimed at response efforts, evacuation or staging areas. Every Responder should be cognizant of secondary devices. Any secondary devices found during a response must be considered part of the total hazardous incident and handled appropriately during the response effort.

Terms Review

ODP – I(b) Law, Fire, EMS

In order to build upon your knowledge we must first review the critical information that was required under ODP awareness level guidelines. You should be familiar with the following terms and information:

WMD Terminology
CBRNE
Dirty bomb
Terrorism
TRACEM-P

Department pre-plans
Emergency response plans
Your role and position

Hazard and risk analysis
Training exercises
Participation

Basic signs and symptoms of victims
Biological
Radiological
Chemical
Blood
Blister
Choking
Nerve
Irritant

Initial treatment and first-aid
Emergency decon

If you are unfamiliar with any of these terms or aspects of a terrorism incident then you should review the “Ohio HazMat and WMD Awareness for the First Responder” book.

Planning for Response

The best recourse for any disaster or event is to have a plan. Through the formulation of plans, response organizations can better understand their role in the event of an emergency.

Since emergencies will occur, preplanning is necessary to prevent possible disaster. An urgent need for rapid decisions, shortage of time, and lack of resources and trained personnel can lead to chaos during an emergency. Time and circumstances in an emergency mean that normal channels of authority and communication cannot be relied upon to function routinely. The stress of the situation can lead to poor judgment resulting in severe losses.

The thought process of developing the plans is called preplanning. Preplans are then
combined into an overall plan called Emergency Response Plan.

The Emergency Response Plan deals primarily with how an organization will respond to an external emergency by:

- Delivering services which contribute to resolving the emergency situation.
- Providing for the needs of those affected by it.
- Facilitating the return to normality.

Development of the plan begins with a vulnerability assessment. This result of the study will show:

- How likely a situation is to occur;
- What means are available to stop or prevent the situation; and,
- What is necessary for a given situation?

From this analysis, appropriate emergency procedures can be established.

**Types of plans**

There are a myriad of different plans. Some of the most common plans are:

**Generic Plans** deal with the general response of an organization to a wide range of possible emergencies, in line with the principles of Integrated Emergency Management. A generic plan is the most basic type, and every organization should have one in order to ensure that it is able to make a swift and effective response to those emergencies which are unpredictable in their timing, location and origin. Generic plans usually cover activation, alerting, management and co-ordination aspects of the response to emergencies. They should also outline the type of response (rescue, providing equipment, etc.) which the organization could make to emergencies and the resources which would be available to do so. In preparing such plans, account should be taken both of the need to be flexible in responding to unexpected events and of any statutory duties or agreed response obligations which the organization already has.

**Site-specific plans** deal with known locations, which assessments have shown to pose specific risks. These plans can be a lot more specific than generic ones because the location and nature of likely emergencies can be predicted with some degree of certainty. Examples of site-specific plans would be airport plans or on-and off-site plans required for certain industrial premises by the Control of Major Accident Hazards. However, remember that these sites can be affected by emergencies unconnected with the hazardous activities carried out at them (e.g. an airport could be affected by flooding), so generic plans are required for them as well as specific ones.

**Risk-specific plans** deal with activities or events which are potentially or inherently hazardous, wherever they occur. Plans can address the specific
response required to the hazard, but should be flexible enough to deal with a variety of locations. For example, the transport of hazardous substances can result in a chemical emergency arising from a traffic accident, and there are specific responses, which should be made to ensure the safety of the public and emergency services. Likewise, public events pose specific risks associated with large crowds.

**Function-specific plans** deal with particular aspects of the response to an emergency – communication, control centre, Rest Centre, etc. - and should be flexible enough to be implemented in a variety of circumstances. For example, plans for setting up and running victim relief stations that could be activated in a whole range of circumstances, ranging from chemical incidents to bomb explosions. Detailed, function-specific plans for setting up individual facilities such as a victim relief station or a Communications Center are sometimes called “Standard Operating Procedures” or abbreviated as SOP’s.

Most generic plans will need to be supported by detailed plans which are site-, risk- or function-specific. These may be included as annexes to the generic plan or may be held separately, but cross-referenced with the generic plan.

Some plans may cross more than one category. For example, flood response plans are largely risk-specific in that they should be capable of being implemented wherever flooding takes place. However, some areas are known to be particularly prone to flooding, and it may be useful to prepare site-specific flood response plans for these areas.

**Public Works WMD response plan and your role in that plan**

**ODP – PW I(c) & II(e)**

With Public Works being an identified vulnerability and a known target for terrorist organizations, they should have in place an emergency response plan to deal with these threats. The plan should be both a site specific plan as well as a general plan. The end result of this plan should identify the role of the Public Works employees in the event there is an emergency that may affect Public Works directly or indirectly.

**Collection of Intelligence**

**ODP – I(d) Law, Fire, EMS**

In today’s fight against terrorism, it is essential that all responders collect and forward to investigators information in a timely manner. Never mind your personal view of whether the information may or may not be valid, let the investigator determine that. In many cases, terrorist organizations scatter the information so if that information is intercepted there is very little operational security lost.
Responders should keep their attention focused during all responses. There are usually covert as well as overt indicators of foul play and those observations will be very useful to the investigators following up on the investigation of the incident.

**Vulnerability assessment**

Although emergencies by definition are sudden events, their occurrence can be predicted with some degree of certainty. The first step is to find which hazards pose a threat to any specific enterprise.

When a list of hazards is made, records of past incidents and occupational experience are not the only sources of valuable information. Since major emergencies are rare events, knowledge of both technological (chemical or physical) and natural hazards can be broadened by consulting with specialists in the area of fire, insurance, engineering, and government assessors.

**Vulnerability assessment of Public Works**

ODP – PW I(f)  
ODP – PW III(c)

Public Works personnel should get involved with the vulnerability assessment of both the Public Works organization and the operations. By pulling in more resources for querying vulnerabilities will lend to more rapid identification of those weaknesses and thereby expediting the corrective actions.

**Assessment of direct threats and collateral damage**

ODP – l(e)(1) Law

Law enforcement needs to perform an assessment of potential targets that would most likely be subject to a direct threat. Once the primary direct threat locales have been identified there must be proactive planning to handle an incident should it ever arise. After the direct threat targets have been examined and identified there must be an assessment of locations or items in near proximity to the direct threat target. These areas adjacent to the direct threat target are those that will most likely sustain damage if an attack is launched on the target and are referred to as collateral damage.

Example of direct threat and collateral damage would be the Oklahoma City bombing. The direct threat was the Alfred P. Murrah building. The other buildings and people adjacent to the building were considered collateral damage from the direct threat target.
The assessment of collateral damage areas around an identified direct threat potential is very necessary for response efforts and ultimately planning for an attack on the target. In the case of the Oklahoma City bombing, the pre-school was an item of collateral damage.

**ODP – I(e)(2) Law**

It is very important for Responders to familiarize themselves with the emergency operations plan for a direct threat target in their area. After a familiarization of the direct threat target Responders should familiarize themselves with the emergency operations plans of the surrounding collateral damage sites. This familiarization will also lend to any discrepancies between direct threat target and collateral damage locations. If there is a plan that will interfere with the operations of another plan in the same local area, it is necessary to bring those two entities together to resolve this before the plans are used in a real life event.

**Potential impact and consequences of use of various WMD agents on public works facilities.**

**ODP – PW I(b)**

Public Works employees, whether they are administrative or laborers, must be aware of the potential impact and consequences of the use of a WMD agent on their facility. It has been very well documented that terrorist organizations have thought about attacking our city water supply and disrupting public utilities.

It is not possible to go over every thing that Public Works employees should be watchful for because they should be as vigilantly looking for indications of terrorist activities the same as every other public service agency, as well as the public at large.

Later in this module (units 5, 6, 7 and 8) there is a plethora of information on all forms of WMD. Read over all the information and educate yourself on the consequences of a WMD use as well as using those units to refer to in times of need.

**Joint training exercises**

**ODP – I(f) Law, Fire, EMS, Public Works**

The only way to put the emergency operating plans of multiple agencies and private industry in place is to either have an actual event or to have a joint exercise. With all things considered, the latter of the two would be the best opportunity to see what works and what does not.

Everyone is encouraged to take part in a joint training exercise. It is encouraged that leaders set up joint training between law enforcement, fire, EMS, private industry and
public works. This enables responders to practice, build confidence and add muscle memory to the response effort if it ever happens.
1) Potential targets can be in urban or rural areas.
   a. True
   b. False

2) What is the single most important thing you can do during a response to an incident?
   a. Put up signs
   b. Recognition of the event as a WMD
   c. Stop people from looking at the event
   d. Identify the chemical equation for the material used

3) Response to an incident that you suspect a WMD incident should be:
   a. Quick in and quick out
   b. Hold your breath and save as many as you can
   c. Proceed cautiously with safety from all responders
   d. Not to go to the incident because you can’t do anything anyways

4) Response, especially Fire responses, should keep information flowing to and from the scene during a response.
   a. True
   b. False

5) EMS personnel should be watchful for:
   a. What agency has the most equipped squad
   b. Common signs and symptoms of WMD agents
   c. How many pair of nitrile gloves they have on the squad
   d. What person took their name when they arrived

6) Which one of the following does not fit recognition clues for an incident where WMD has possibly been used?
   a. Occupancy
   b. Type of event
   c. Timing of event
   d. What tools are needed for extrication
7) Which of the following is an on scene warning sign of WMD?
   a. Unexplained pattern of mass illness
   b. Unusual odors
   c. Unexplained vapor clouds
   d. Unexplained chemical containers
   e. All of the above are warning signs

8) Responders should be VERY cognizant for which of the following at a WMD suspected event?
   a. Lost kids
   b. Keeping sight of the truck they rode in on
   c. Secondary devices
   d. What time they started their shift

9) The best resource for any disaster or catastrophic event is to:
   a. Radio all your ideas to command post
   b. To ask that one guy on your department to recite all of the federal regulations for response to WMD
   c. Have a plan and implement that plan upon arrival
   d. Make a list to discuss in the debrief

10) It is only the role of law enforcement to collect and forward intelligence?
    a. True
    b. False
Module 2
Unit 2
Scope of Module 2, Unit 2

This unit will go into further detail about incident command and unified command structure. It will build on the basic concept of incident command that was learned in the awareness level as well as serve as an example for how incident command is implemented.

Learning Objective

Describe the Incident Command System and the Unified Command System procedures for the integration and implementation of each system. Describe how the systems integrate and support the incident. Be familiar with the overall operation of the two command systems and be able to assist in implementation of the Unified Command System if needed.

Student Performance Objectives

- Describe the Componets of ICS and responsibilities of each componet.
- Describe command staff positions in ICS.
- Describe what the National Incident Management System is.
- Explain the importance of initial site management procedures.
- Describe how skilled personnel may be used in an incident.
- Describe how and where to establish triage areas.
- Explain the importance of demobilization and termination.
- Describe the basic assets available from other agencies.

Resource List

- Student Manual (Module 2)
Module 2
Unit 2
Incident Command

The Standard
ODP – II

Know the Incident Command System and be able to follow Unified Command System procedures for the integration and implementation of each system. Know how the systems integrate and support the incident. Be familiar with the overall operation of the two command systems and be able to assist in implementation of the Unified Command System, if needed.

The Incident Command System

At the Awareness Level, you are expected to establish Incident Command after you had recognized, identified, and protected the area around a potential HazMat/WMD event. This command would remain in effect until someone with more responsibility and authority could relieve you. In the Awareness level training, you were given a brief overview of incident command to help you perform this task.

At the Operations Level you must become much more knowledgeable about ICS and the National Incident Management System or (NIMS). You must be capable of working within the system and performing the tactical objectives that accomplish the strategic goals, which have been established in the incident’s Plan-of-action.

You must be familiar with Incident Control Zones, Communications; Chain of Command; Forwarding information (intelligence); Establishment of triage areas; Asset locations and abilities, and how to request them; “Unified Command” procedures; the importance of Critiquing; Debriefing, and after action reports; how to release Information; and how to develop a Plan-of-action.

By completing the on-line courses established by the Department of Homeland Security (DHS) and found at www.fema.gov, you can become knowledgeable in the performance of Incident Command. Those unfamiliar with ICS must spend the appropriate amount of time to be able to function under this system.

Functions of ICS

Incident Command
The command function is directed by the Incident Commander, who is the person in charge at the incident, and who must be fully qualified to manage the response. Major responsibilities for the Incident Commander include:

- Performing command activities, such as establishing the Incident Command Post (ICP).
- Protect life and property.
- Controlling personnel and equipment resources.
- Maintaining responder accountability as well as task accomplishment.
- Maintain effective liaison with outside agencies.
- Determine operational objectives.
- Develop and implement the Incident Action Plan (IAP).
- Develop organizational structure.
- Maintain manageable span of control.
- Authorizing release of information to the media.
- Keeping track of costs.

**Operations**

The *Operations Section* is responsible for carrying out the response activities described in the IAP. The Operations Section Chief coordinates Operations Section activities and has primary responsibility for receiving and implementing the IAP. The Operations Section Chief reports to the required resources and organizational structure within the Operations Section. The Operations Section Chief's main responsibilities are to:

- Direct and coordinate all operations, ensuring the safety of Operation Section personnel.
- Assist the Incident Commander in developing response goals and objectives for the incident.
- Implement the IAP.
- Request (or release) resources through the Incident Commander.
- Keep the Incident Commander informed of situation and resource status within operations.

**Logistics**

The *Logistics Section* is responsible for providing facilities, services and materials, including personnel to operate the requested equipment for the incident. This section takes on great significance in long-term or extended operations. It is important to note that Logistics Section functions are geared to support the incident responders. For example, the Medical Unit in the Logistics Section provides care for the incident responders not civilian victims.

**Public Information**

The *Information Officer* handles all the media inquiries and coordinates the release of information to the media with the Public Affairs Officer at the Emergency Operations Center (EOC).
Planning

In smaller events, the Incident commander is responsible for planning, but when the incident is of larger scale, the Incident Commander establishes the Planning Section. The planning Section’s function includes the collection, evaluation, dissemination, and use of information about the development of the incident and status of resources. This section’s responsibility can also include creation of the Incident Action Plan (IAP), which defines the response activities and resource utilization for a specified time period.

Finance

The Finance / Administration Section is critical for tracking incident costs and reimbursement accounting. Unless costs and financial operations are carefully recorded and justified, reimbursement of costs is difficult, if not impossible.

The Finance / Administration Section is especially important when the incident is of a magnitude that may result in a Presidential Declaration.

ICS Organization

By looking at the diagram of the Incident Command System you can see that it is made up of Command Staff and General Staff. At small incidents, both the Command Staff and General Staff positions may be filled by one individual, the Incident Commander. As an incident expands, however, the Incident Commander may need to assign the Command Staff positions of Information Officer, Safety Officer, and Liaison Officer, as shown in the following figure.
The Incident Commander may assign Section Chiefs for the Planning, Operations, Logistics, and the Finance/Administration sections.

**Expanding ICS**
ICS is capable of handling both small and large scale incidents. In other words, ICS is expandable from very small, routine operations into a larger organization that is capable of responding to very large incidents that cover many square miles or involve multiple communities or States. Although many incidents will never require the activation of any of the four sections, others will require some or all of the sections to be established.

The scenario presented throughout this section will illustrate how ICS structure can be expanded.

Every incident is somewhat unique and will expand differently.

**Scenario:** The Centerville police have received a complaint of a group of about 10 teenagers and young adults gathering at a house on Locust Street. The caller stated that the group is disrupting traffic and shouting obscenities at pedestrians. The house is a multifamily dwelling in a neighborhood of single-family homes and townhomes. The police department has dispatched two patrol cars to the scene to follow up on the complaint.

In this section the police department has dispatched two patrol cars, or *single resources*, to the scene of the complaint. When the police officers arrive at the scene,
the senior officer will assume the role of the Incident Commander. At this point in the scenario, the ICS organization would assume the structure shown in the next figure.

**Single Resources** – An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor that can be used at an incident.

As this incident unfolds, however, the ICS structure will change as described in the next segment of the scenario.

**Scenario Update:** As the police reviewed, or sized up the situation, they saw what appeared to be drug activity at the scene. They observed 12 persons outside the structure but were unsure how many additional persons may have been inside. They determined that they would require the following additional resources before taking additional action:

♦ 1 drug K-9 unit.
♦ 6 police officers to keep traffic and pedestrians from the area (perimeter control).
♦ 6 additional officers to assist with questioning and, if necessary, arrests.
The size up of the incident indicates a need for additional resources at the scene. The addition of these resources is still within a reasonable span of control. The ICS organization does expand, and a possible expanded structure is shown in the next figure.

As you can see from the graphic, the Incident Commander has determined that it is not necessary to activate an Operations Section or assign an Operations Section Chief at this time. But the incident is continuing to escalate.

**Organization terminology**

At each level in the ICS organization, individuals with primary responsibility positions (also known as overhead personnel) have distinctive titles, as shown below:

<table>
<thead>
<tr>
<th>Primary Position</th>
<th>Title</th>
<th>Support Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Commander</td>
<td>Incident Commander</td>
<td>Deputy</td>
</tr>
<tr>
<td>Command Staff</td>
<td>Officer</td>
<td>Assistant</td>
</tr>
<tr>
<td>Section</td>
<td>Chief</td>
<td>Deputy</td>
</tr>
<tr>
<td>Branch</td>
<td>Director</td>
<td>Deputy</td>
</tr>
<tr>
<td>Division/Group</td>
<td>Supervisor</td>
<td>N/A</td>
</tr>
<tr>
<td>Strike Team/Task Force</td>
<td>Leader</td>
<td>N/A</td>
</tr>
<tr>
<td>Unit</td>
<td>Leader</td>
<td>Manager</td>
</tr>
<tr>
<td>Single Resource</td>
<td>Use Unit Designation</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Incident Command Definitions

**Division** – The organizational level having responsibility for operations within a defined geographic area. The Division level is the organizational level between Single Resources, Task Forces or Strike Teams and the Branch level.

**Branch** – An organizational level having functional or geographic responsibility for major parts of incident operations. The incident Commander may establish *geographic branches* to resolve span-of-control issues – or may establish *functional branches* to manage specific functions (e.g., law enforcement, fire, EMS, etc.) A Branch is managed by a *Branch Director*.

**Group** – The organizational level having responsibility for a specified *functional* assignment at an incident (e.g., perimeter control, evacuation, fire suppression, etc.) A group is managed by a *Group Supervisor*.

**Section** – The organizational level with responsibility for major functional area of the incident. The Section is located organizationally between Branches and the Incident Commander.

**Size up** – Problem identification and an assessment of the possible consequences. Initially, size up is the responsibility of the first officer to arrive at the scene. Size up continues throughout the response to update continuously the answers to the following questions:

- What is the nature of the incident?
- What hazards are present?
- How large is the affected area?
- How can the area be isolated?
- What location would make a good staging area?
- What entrance and exit routes and safe routes would be good for the flow of the rescue personnel and equipment?

Continuous size up helps the Incident Commander identify contingencies, (things that *could* happen), identify resource needs, and determine how to deploy resources.

**Strike Team** – A group of resources of the same size and type (e.g., three drug K9 teams, five patrol units, etc.). A strike Team is managed by a *Strike Team Leader*.

**Task Force** – A combination of single resources assembled for a particular operational need, with common communications and a leader.
After reading the scenario update you can see that there is a continuous scene size up being conducted.

Based on the new situation size up, the Incident Commander has identified additional resource requirements. These additional resources will require creation of the Operations Section to maintain an affective span of control. The expanded ICS structure is shown in the following figure.

**Scenario Update:** The requested resources have arrived at the incident site. After establishing a perimeter, 10 police officers moved in to detain and question the suspects. Upon seeing the officers, the suspects scattered and began running away from the scene, and the officers pursued them on foot.

The K-9 Strike Team entered the structure and discovered not only drugs, drug paraphernalia, and drug-making equipment—but they also discovered a cache of automatic weapons and ammunition, high explosives, chemicals for making bombs, and several bombs that already were assembled. Given the situation, the K-9 team immediately exited the structure and reported their findings to the Investigation Group Supervisor.

The Investigation Group Supervisor reported the status to the Incident Commander. Based on the information contained in the Incident Status Summary (ICS Form 209), the Incident Commander requested the following additional resources:

- 6 patrol cars to assist with perimeter control.
- 6 patrol cars to assist with evacuations in the areas adjacent to the structure.
- 2 bomb squads.
- 1 hazardous materials unit.
- 1 fire battalion for possible fire suppression activities.
- 2 ambulances (assigned to Staging Area).

As a contingency, the Incident Commander also requested support from the Public Works Department and utility companies to turn off all utilities to the structure.
As shown in the graphic on this page, the Incident Commander has established two new positions within the Command Staff:
- Safety Officer
- Information Officer

The Incident Commander also has expanded the General Staff with the assignment of an Operations Section Chief.

To maintain effective span of control within the Operations Section, the Operations Section Chief also has established several positions, including a Fire Branch Director, and Public Works Branch Director. The Law Enforcement Branch has been expanded further to accommodate the additional resources required for perimeter control, evacuation, and explosive removal and disposal. The Operations Section Chief has also established a Public Works Branch to accommodate resources dispatched from the utility companies.
Scenario Update: When all requested resources had arrived and the utilities had been turned off, the bomb disposal unit entered the structure to remove and dispose of the bombs. In the process of removing the bombs, one exploded, causing a partial structure collapse, which trapped the bomb disposal team, and ignited a fire in the structure and two adjacent structures.

Fortunately the Incident Commander established an area for EMS to set up triage, treatment, and transportation (Casualty Collection Point).

With the extent of the bomb disposal injuries unknown at the time, fire suppression units began working to extinguish the fire and the EMS Units prepared to move in. As the heat from the fire grew more intense, the other bombs began exploding, raining flaming debris on other parts of the structure and on other adjacent structures.

To address the deteriorating situation, the Incident Commander quickly completed another sizeup and determined that additional resources would be required, including:

- Additional fire suppression units.
- Additional EMS units.
- Planning and logistics support.
The Command Staff is now expanded fully with the addition of a Liaison Officer. Although the Incident Commander has not determined the need for a Finance/Administration Section, he has expanded the General Staff to include Planning and Logistics Sections. Within the Planning Section, additional resources will include:

- A *Situation Unit*, which will continue the size up and analysis functions for the incident.
- A *Resources Unit*, which will analyze the incident status in the context of determining what resources are necessary and how they should be deployed. This unit is responsible for establishing all incident check-in activities.
- A *Documentation Unit*, which will document the incident as it progresses and prepare after-action reports.

Within the Logistics Section, a Service Branch has been established to accommodate the Communications Unit and Medical Unit (triage and treatment of responders). A Support Branch also has been established to accommodate a Facilities Unit, which will be responsible for setting up and maintaining the staging area.
After reading this scenario update you can see the ICS structure is set up to accommodate additional expansion, if and when it becomes necessary. But what happens when the incident is under control and begins to unwind?

As ICS is capable of continuously growing it also can continuously contract until it concludes completely.

With the incident under control, the Incident Commander has determined that some units are no longer needed and can be demobilized. To ensure that all personnel are debriefed and equipment is released to its controlling agencies, a Demobilization Unit is established under the Planning Section. After the personnel in the scenario update is released the ICS organization looks like the diagram shown on the next page.

**Scenario Update:** Firefighters at the scene were able to control the fires within the first hour. As a result of the explosion, two members of the Bomb Disposal Unit were killed. Several firefighters were injured by debris from the blast, and several others were overcome by smoke or suffered minor injuries.

As the responders gained control of the situation, several events occurred:

- To assist with demobilization, the Planning Section Chief established a Demobilization Unit.
- The perpetrators were arrested and transported to jail.
- Unexploded ordnance and equipment were removed from the structure and transported from the scene.
- Drugs and drug-making paraphernalia were removed and transported from the scene.
- When it was safe to reenter the area, the Perimeter Control and Evacuation Groups were demobilized.
- As personnel and equipment were released, the Staging Area was demobilized.
- As casualties were transported to local hospitals, the Support Branch and Facilities Unit were demobilized.
Gradual Demobilization of personnel and equipment will continue, with perhaps an occasional addition of additional operational resources such as Crime Scene Investigation Divisions, until the incident is reduced to its most simple form—Incident Commander only (who may be several persons removed from the original Incident Commander) and critical personnel remain on the scene.
Initial Site Management procedures

ODP – II(a)

As was said in the Awareness training, “THE FIRST 15 MINUTES OF AN INCIDENT WILL SET THE PACE FOR THE REST OF THE INCIDENT.” This means that if the incident is not set up properly from the onset, it will continuously try to catch up with itself and may never be truly a smooth operating incident.

Of the more important things to do when you arrive at the scene of an incident the first thing that should be done is to establish communications with dispatcher or command center. This will ensure that all responding units are able to communicate with each other as well as keep a central location informed as to the progress of the response effort.

After the Responder has recognized the need to control this incident he or she should set up control zones for the scene. This will control the perimeter so that the threat is contained. This works from surrounding a criminal for apprehension or controlling a hazardous chemical release.

All occupational domains will experience confusion from responding units unless those responding units know unmistakably where the command post is located. With law enforcement it will most likely be the first officer on the scene, but if you are the 10th officer at the scene how will you know who was first? For fire it is typically the fire engine on the scene, but after 5 engines how will you know where to go for command? Locating the command post will be an issue unless you take precautions to eliminate this problem.

All equipment trucks and patrol cars should be equipped with a simple and easily recognizable flag that says “Command Post”. This will help all the responding units when they arrive at the scene. Also remember where your command post is placed. Make sure it is placed in a safe area with respect to the incident being addressed. A final method for helping response units find the command post is to tell the communication center to relay the location and description of the command post to those responding units.

Basic Documentation & Forms

As with everything else in life, documentation is necessary for future reflection on the incident. The old adage that, “If it isn’t written down, it didn’t happen” can be applied to
the handling of an incident by ICS organization. This is especially important if responders need health care as a result of their response. We need to recreate the incident so treatments can be readied for those ailing responders.

The importance of PROPER DOCUMENTATION cannot be over emphasized.

The following pages have some examples of documentation forms for use.
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ICS 201 (12/93)  
NFES 1325

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<td>NFES 1325</td>
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51
7. CURRENT ORGANIZATION

INCIDENT COMMANDER

PLANNING

OPERATIONS

LOGISTICS

Finance Admin.

DIV./GROUP ____

DIV./GROUP ____

DIV./GROUP ____

AIR

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ICS 201 (12/93)
NEFS 1325

PAGE 4
Public Works role as a WMD response as skilled support person or specialist.

ODP – PW I(e)

Public Works personnel should be aware that they may be called upon amidst an incident to render special skills they possess that will help the overall response to the situation. An example might be a potential release of a biohazard in a high-rise building. Public Works from the electric company may be asked to provide a person who possesses the skills necessary to turn the power off to the building to eliminate the further spread of the potential threat.

The difference between a skilled person and a specialist are as follows.

**Skilled person** is any person that has a special ability needed by the response effort to the incident. This may include backhoe operators, electricians, heating ventilation air conditioning persons and anyone else that has a specific ability.

**Specialist** is any person that has formal training in a specific field of study that will lend large quantities of information to the Incident Commander during the response. An example might be a chemical engineer for the water department, building engineer for the city, township or county.

Public Works facilities continuity of services contingency plan.

ODP – PW II(d)

Public Works should have an understanding of their facilities capabilities and how their services fit into the overall plan for an emergency. This may be additional to what we have already discussed as a skilled or specialist helping at the scene.

Public Works role and responsibility as incident response team.

ODP – PW II(f)

Public Works may find themselves involved with a larger scale response. This larger response may have been planned out prior to the event and therefore attached Public Works employees to incident response teams. The incident response team which utilizes all the fields of law, fire, EMS and public works will find they are capable of handling any incident. The role of the Public Works personnel are to bring specific knowledge and information about the domain for which they work. Power Linemen will be necessary in the event there is a need to supply a special lead of power or shunt power from locations to avert a larger disaster.
Know how to forward intelligence that has been gathered at the scene

ODP – II(a)(1) Law, Fire, EMS, PW

In order to know how to forward intelligence that has been gathered at the scene you must first be able to recognize the information as possible intelligence. Once recognition of information is made that may yield intelligence the supervisor of that Responder should be immediately notified. The supervisor will then verify the information and relay that to the command post. The command post may forward the intelligence to the joint operations center where all of the entities that provide response efforts have a liaison. The intelligence should travel very fast and should not be impaired by any section of the chain of command because it may lead to more information that is important.

Establish Triage areas

ODP – II(a)(2) EMS

As with any emergency involving victims, whether those victims are citizens or Responders, there needs to be a triage area set up for processing the injured.

The location where a triage area should be set up will need to be coordinated with law enforcement. This coordination is necessary so both EMS and law enforcement can perform their jobs respective of each other. The victims may have important information about what they have experienced and law enforcement should be a part of that debriefing process. Another reason for efforts working in concert is so that the triage area does not interfere with any of the investigation into the incident.

Other items of concern when establishing the triage area is the transportation of the victims who need further medical treatment. Law enforcement and EMS should work closely together on this issue as well. This may have little to do with the investigation of the incident but will need highly accurate information for navigating from the scene to the medical facility. EMS should inform the traffic controlling law enforcement via the command post for best route of travel and for reporting any information that law enforcement may use for better traffic direction for expedited routes.

With the establishment of the triage area and the close operations of law enforcement, EMS and Fire, there needs to be a liaison in the command post who can act in the capacity of an EMS manager. This would give finite instructions to the EMS personnel that are operating around the scene as well as give an experienced person the ability to verbally direct any other responder via radio to handle medical emergencies outside of the capabilities of the operating EMS personnel. The availability of an experienced leader in the command post to make a triage assessment dictating a prudent use of EMS service at the scene of an incident.
Implement ICS component of department’s emergency response plan for potential WMD

ODP – II(b) Law, Fire, EMS, PW

All occupational domains should be able to implement incident command system component while following the emergency response plan of that Responder’s occupation.

Assets

Assets from other agencies

ODP – II(c) Law, Fire

Be aware of assets from other agencies that could provide assistance on potential WMD event scene. Know the procedures to follow to get the needed assets. Responders should be aware that there are different types of equipment and resources needed depending on the situation. Responders should also be able to recognize the need for those different types of resources and have an idea of how to request them.

An example of law enforcement making this deductive reasoning might be a hostage barricade situation. The first responding units recognize the situation and know this needs a negotiator as well as tactical resources to mitigate the threat. The initial Responder calls the dispatch and asks for the hostage negotiations team and the special response team. The dispatch then makes the appropriate calls to those resources whether they are within that responsible agencies control or another agency.

An example of assets from other agencies in the case of fire response might be fire during a power outage in a major metropolitan area. This example is the fundamental job of the fire service, to fight fire. In this case, the metropolitan fire department is not prepared for the water shortage because of the power outage. The responding fire department will call other fire apparatus from other locations around the city to try to deliver enough water to the scene. The incident commander must realizes the need for a
more reliable source of water and calls dispatch for mutual aid with the surrounding rural fire departments to relay water to their fire suppression efforts. Knowing what to request, from where and how is essential to being prepared on the event of an emergency.

**ODP II(d)(1) EMS**

**ODP II(j) EMS**

EMS assets are going to be tasked at the onset of most WMD events because of the potential for high injury and casualty rate. In most areas mutual aid is not something new. It has been around for years to set up agreements in advance of an incident to combine efforts and resources of agencies to handle incidents. In the event of a WMD incident there will be many needs from EMS providers in the triage area, responder recovery area, transportation, and routine calls for service. This will quickly overwhelm the ability of the EMS systems in a particular area and therefore Responders must know where they can get additional resources. In addition to obtaining additional resources for an incident, EMS providers must recognize the onset of possible biological warfare agent use for implementation of medical intervention with the surrounding community.

An example of *EMS assets* being utilized is an explosion in an office building that created no damage to the building. The worker filled building was quickly filled with a seemingly inert gas from the first floor to the top. The victims were self-evacuating from the building as well as assisted evacuation by fire service. The symptoms of the exposure were mild respiratory irritation and nothing else. After the evacuation was completed, the fire service and law enforcement agencies continued the investigation to find that there had been a threat of a release of small pox previous to this attack. The potential of this incident could warrant the need to start a vaccination program in and around the release area. The implementation of the vaccination program will need several items, serum for administration and resources to administer the inoculations.

**Other emergency response organizations**

**ODP – II(d) Law, Fire, EMS, PW**

There are several other organizations that can and will help in any type of emergency or incident. Responders should be aware of those other assets in their area so they can make use of them in time of need.

**Unified Command**

**ODP – II(e) Law, Fire, EMS, PW**

In ICS, Unified Command is a unified team effort which allows all agencies with responsibility for the incident, either geographical or functional, to manage an incident by establishing a common set of incident objectives and
strategies. This is accomplished without losing or abdicating agency authority, responsibility or accountability.

**Department procedure for assisting and implementation of the Unified Command System.**

Departments and agencies should make available to their response units the policy and procedure for assisting other agencies where the unified command structure has been implemented. This policy should give them instruction on how to report for the incident and what resources would be permissible to send upon request from the originating agency.

**Debriefing / Termination**

Debriefing and termination is the process by which the incident is concluded. During the debriefing all of the responders, that were a part of the response to the incident, rap the events of the response. This recap will provide insight as to how things were done and explore how things could have been done. It is in the debriefing and termination that we learn what worked and what did not. The response personnel can inquire about any concerns they have about the response effort.

**Post action critiques and lessons learned**

**ODP – II(f) Law, Fire, EMS, PW**

Responders of all occupations should be able to assist in critiques of the actions taken during the complete response to a WMD event and assist in documenting those lessons learned.

**Termination documentation**

**ODP – II(g) Law, Fire, EMS, PW**

All responders must understand the importance of and know how termination documentation for a WMD event is to be conducted related to activities on the scene.

By having this knowledge responders have a much better understanding of what will need to be documented for proper termination of the incident.
Public Information

ODP II(h) Law, Fire, EMS, PW

Know and follow department guidelines in dealing with the local media during a potential WMD event.

Action Plans

The incident commander is responsible for overseeing the development and implementation of an Incident Action Plan (IAP). For simple incidents, the IAP may be prepared by the Incident Commander and may not be written. In more complex incidents, the IAP will be a written document that is developed by the Planning Section under the direction of the Incident Commander.

IAP’s are always based on incident needs and the ICS organization. They must be flexible and must be reevaluated constantly.

IAP’s are developed for specified time periods. These time periods, called operational periods, are determined by the needs of the incident. In rapidly escalating or very complex incidents, the operational periods should be shorter to allow for rapid response to changing events. In smaller, less complex incidents, the operational periods should be shorter to allow for rapid response to changing events. In smaller, less complex incidents, the operational periods should be longer but usually do not exceed 12 hours.

Coordination of IAP

ODP II(i) Law, Fire, EMS, PW

Incident action plans should be made in coordination with the on scene Incident Commander and should be consistent with the responder’s department emergency response plan.
1) In ICS, the section responsible for carrying out the response activities described in the Incident Action Plan (IAP) is called the:
   a. Logistics Section
   b. Operations Section
   c. Planning Section
   d. Finance/Administration Section

2) In ICS, the section responsible for providing facilities, services and materials to support the incident responders, particularly at long-term or extended incidents is called the:
   a. Logistics Section
   b. Operations Section
   c. Planning Section
   d. Finance/Administration Section

3) In ICS, the section responsible for the collection, evaluation, dissemination and use of information about the development of the incident and the status of resources is called the:
   a. Logistics Section
   b. Operations Section
   c. Planning Section
   d. Finance/Administration Section

4) In ICS, the section responsible for tracking incident costs and reimbursement accounting is called the:
   a. Logistics Section
   b. Operations Section
   c. Planning Section
   d. Finance/Administration Section

5) Which of the following is NOT part of the ICS Command Staff?
   a. Information Officer
   b. Safety Officer
   c. Liaison Officer
   d. Planning Officer
6) An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor, that can be used at an incident, is known as a:
   a. Strike Team
   b. Group
   c. Single Resource
   d. Task Force

7) The acronym “NIMS” stands for:
   a. National Information Management System
   b. Normal Implementation of Management Strategies
   c. National Incident Management System

8) The type of command structure which allows all agencies with responsibility, either geographical or functional, to manage an incident by establishing a common set of incident objectives and strategies is called:
   a. Management by Objectives (MBO)
   b. Unified Command (UC)
   c. Common Command (CC)
   d. Interagency Command (IAC)

9) The ICS organizational level having functional or geographic responsibility for major parts of incident operations, which is supervised by a Director:
   a. Group
   b. Branch
   c. Task Force
   d. Section

10) All four of the General Staff positions should be established and staffed at every incident.
    a. True
    b. False
Module 2
Unit 3
**Scope of Module 2, Unit 3**

As in Module 1 of this training series, responders learned basic Hazard and Risk Assessment techniques. During this unit you will learn to make Hazard and risk assessment decisions at WMD incidents.

**Learning Objective**

Describe how to follow self-protection measures and rescue and evacuation procedures for WMD events.

**Student Performance Objectives**

- Describe the different levels of personal protective equipment ensembles.
- Describe how the personal protective equipment varies from different occupational domains.
- Describe the different kinds of respiratory protection.
- Describe when to don the personal protective equipment.
- Describe how to select the proper personal protective equipment for warm zone operations.
- Describe the basic heat hazards to responders during personal protective equipment applications.
- Describe how to implement triage and victim protective actions.
- Describe the role of the Performance – Defensive (Operations) level responders.
- Describe the difference between shelter in place and evacuation.
- Describe basic life support procedures for first aid to victims.

**Resource List**

- Student Manual (Module 1 & Module 2)
Module 2  
Unit 3  
Self Protection Measures, Rescue, & Evacuation Procedures

The Standard  
ODP – III Law, Fire, EMS, PW

Know and follow self-protection measures and rescue and evacuation procedures for WMD events.

Introduction  
In HazMat operations, you learned basic Hazard and Risk Assessment techniques. These techniques are based upon your understanding of the incident, the chemical released and your level of personal protective equipment. The ODP standards require an Operations level responder to be able to make Hazard and risk assessment decisions at WMD incidents. They further require them to be able to implement appropriate rescue tactics.

PPE  
ODP – III(a) Law, Fire, EMS, PW
Personal protective equipment varies with job functions. Firefighters have full structural firefighting clothing with self-contained breathing apparatus (SCBA), Law enforcement may or may not have protective suits with air-purifying respirators (APR), EMS units may be equipped with nothing, one, or possibly both of the above ensembles.

PPE must be worn by operational level responders in all areas where there is a chance that contamination exists.

Consultation should be made with Hazardous Materials Technicians and/or Specialists about the protection level that each ensemble will provide.

There should be site safety plans established determining which level of PPE will be required for each area or zone in which operational level responders are operating. Factors such as permeation, degradation and penetration must be considered. Heat related stress must also be of concern to the responder.
Structural Firefighter Protective Clothing (SFPC) with an SCBA will provide good protection for a limited amount of time against chemical and biological agents. However, because of the ability of an agent to eventually contact the skin, these ensembles cannot be worn for long periods. This ensemble should be worn for rescue purposes initially. This ensemble is useful later in the event if HazMat technicians can verify its ability to protect.

For radiation incidents, this ensemble will protect from Alpha and Beta particles but offers no protection from Gamma and Neutron energy. Once again it is sufficient for quick in and out rescue use but will need to be evaluated for later uses on the scene.

Level B ensembles (Chemical protective suits and SCBAs) will provide good protection against chemical and biological agents. Permeation data must be consulted to determine how long each suit type will withstand breakthrough from the agent involved. These ensembles will provide the same type of protection against radiation as SFPC, protecting against Alpha and Beta but not Gamma and Neutron.

Level C ensembles (chemical protective suits and APR’s, Ohio first responder’s PPE Kits) provide good protection from biological agents and a few chemical agents but will not provide any protection against some chemical agents. Hazardous Materials Technicians and/or Specialists must be consulted before wearing this type of ensemble for anything other the escape purposes. This level provides the same protection against Alpha and Beta particles as first two and still no protection from Gamma and Neutron.

**Hazards and risks of wearing chemical protective clothing**

ODP – III(b) Law, Fire, EMS, PW

As was discussed in the awareness training and in Module 1 of Operations training, there are numerous risks when wearing chemical protective clothing. One such risk is the over exposure to heat.
Signs and Symptoms of Heat Stress

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<tr>
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<td>Usually</td>
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Rehabilitation steps to help responders reduce the level of heat stress.

**ODP – III(b) Law, Fire, EMS, PW**

Responders that become heat stress victims should immediately be treated for heat injury.

The important thing to remember is that if an intervention is not introduced immediately the victim stands a chance of having internal organ damage as a result of the heat.

When the body becomes overheated, a condition of heat stress exists. Early symptoms a victim may exhibit are feeling hot, uncomfortable, and listless - are mild and usually pose no threat unless they persist. However, because the serious signs of heat stress listed below are usually preceded by the milder ones, it is important that you get medical attention if you experience any of the following: Dizziness; Rapid heartbeat; Diarrhea; Nausea; Cramps; Throbbing headache; Dry skin (no sweating); Chest pain; Great weakness; Mental changes; Breathing problems; and Vomiting.

Heat stress can lead to a number of other problems, including heat exhaustion, heat stroke, heat cramps, fainting, or heat rash. It is important to be able to recognize each one and know what to do when it happens.

**Heat exhaustion**

Although not the most serious health problem, heat exhaustion is the most common heat-related ailment at an incident. Heat exhaustion happens when a worker sweats a lot and does not drink enough fluids or take in enough salt or both. The simple way to describe the worker is wet, white and weak.
Signs and symptoms

- Sweaty
- Weak or tired, possibly giddy
- Nausea
- Normal or slightly higher body temperature
- Pale, clammy skin (sometimes flushed)

What to do

- Rest in a cool place
- Drink an electrolyte solution, such as Gatorade or another sports drink. **Avoid caffeinated beverages such as colas, iced tea or coffee.**
- In severe cases involving vomiting or fainting, call EMS service.

Heat stroke

Heat stroke is the most serious health problem for people working in the heat, but is not very common. It is caused by the failure of the body to regulate its core temperature. Sweating stops and the body can not get rid of excess heat. Victims will die unless they receive proper treatment promptly.

Signs and symptoms

- Mental confusion, delirium, fainting, or seizures
- Body temperature of 106°F or higher
- Hot, dry skin, usually red or bluish color

What to do:

- Call Public Safety at 9-1-1 immediately and request an ambulance
- Move victim to a cool area
- Soak the victim with cool water
- Fan the victim vigorously to increase cooling
Heat cramps

Heat cramps are painful muscle spasms. They occur when a worker drinks a lot of water, but does not replace salts lost from sweating. Tired muscles – those used for performing the work – are usually the most likely to have the cramps.

**Signs and symptoms:**

- Cramping or spasms of muscles
- May occur during or after the work

**What to do**

- Drink an electrolyte solution (sports drink) such as Gatorade
- If the cramps are severe or not relieved by drinking a sports drink, seek medical attention.

Fainting (Heat Syncope)

Fainting usually happens to someone who is not used to working in the hot environment and simply stands around. Moving around, rather than standing still, will usually reduce the likelihood of fainting.

**Signs and symptoms**

- Brief loss of consciousness
- Sweaty skin, normal body temperature
- No signs of heat stroke or heat exhaustion

**What to do:**

- Lie down in a cool place
- Seek medical attention if not recovered after brief period of lying down

Heat rash

Heat rash, also called prickly heat, may occur in hot and humid environments where sweat cannot evaporate easily. When the rash covers a large area
or if it becomes infected, it may become very uncomfortable. Heat rash may be prevented by resting in a cool place and allowing the skin to dry.

**Signs and symptoms**

- rash characterized by small pink or red bumps
- irritation or prickly sensation
- itching

**What to do**

- keep skin clean and dry to prevent infection
- wear loose cotton clothing
- cool baths and air conditioning are very helpful
- some over-the-counter lotions may help ease pain and itching

**Proper Selection of PPE for responders in the warm zone.**

**ODP – III(c) Law, Fire, EMS, PW**

The general rule for personal protective equipment for the responders working in the warm zone of the incident is either the same level of protection as the hot zone personnel or no more than one level of protection below that which was used in the hot zone.

This is only a general rule. There may be other circumstances that warrant a different procedure in which the Incident Command Staff will make that determination.

**Protection against blood borne pathogens.**

**ODP – III(c)(1) EMS**

As in every other emergency response situation, specifically EMS, one of the main personal protective factors is “**BODY SUBSTANCE ISOLATION**” (BSI). Care should be taken to not only protect yourself but to protect other victims.

In the event there is a mass casualty incident there will be a proclivity for responders to protect themselves with BSI. This is good protection for the responders and is a definite for their safety but leaves little protection for the responder that makes contact with multiple victims with the same BSI protective equipment (gloves) on.

**Responders should try to keep a supply of fresh BSI protective equipment with them during an incident and change them after each physical contact with a victim.**
**Rescue**

The main priority of the First Responder Operations level responder is protection of lives. This starts with a need to protect your life first, fellow responders second, the unaffected population third, and the victims last. The higher your level of PPE the better your chances of not succumbing to whatever has been released.

On terrorism events rescue can only be attempted after making an evaluation of the scene. If victims are alive and only physically injured, attempts to remove them from the area will probably be successful. The more the victim is showing signs and symptoms of exposure to a CBRN (simple explosives are not included) agent the higher the level of PPE necessary for entry into the area to rescue that victim. If the rescuer becomes aware that most victims in an area are dead or fatally symptomatic, rescue attempts should be aborted and efforts directed at those whose chances of survival are greater.

Rescue attempts should be quick in-and-out operations spending no more than about 15 to 30 minutes to remove viable victims. Once out of the area the rescuer also becomes a victim in need of decontamination, transport and evaluation by medical personnel.

**Victims and casualties**

**Triage, Treatment and Transportation**

Once victims have been removed and decontaminated, they must be triaged, treated and transported away from the scene. This becomes the job of trained Emergency Medical Technicians (EMTs).

EMT’s at all levels must be capable of making decisions concerning the priority of a patient’s care. These decisions must be based on training and the additional knowledge of the CBRNE agents that are involved.

No victim should be triaged until they have been grossly decontaminated, this will limit the amount of PPE that the EMT must wear while performing the triage task. However, EMT’s must be concerned with exposure to the involved agent. Based on the type of injury and/or illnesses that they are being confronted with they should wear the appropriate PPE. Level C PPE should be very effective in the triage area for decontaminated chemical, biological and/or radiological victims. Simple blood borne pathogen protection will be sufficient if a simple explosive device has been used.
Protective measures for victims at the scene of a potential WMD event.

ODP – III(d) Law, Fire, EMS, PW

After an event has occurred where it is suspected that a WMD has been released, responders should act to deal with the threat the victims have been subjected to, according to the emergency response plan.

The main protective factor that can be offered is to sweep the affected area for secondary devices aimed at person being evacuated and response efforts.

The local emergency response plan should address the sweep for secondary devices as well as law enforcement response to secure the perimeter.

Department or Incident Commander plan for evacuation of persons from the hazard area.

ODP – III(e) Law, Fire, EMS, PW
ODP – III(e)(1) EMS

The Emergency Response Plan along should lay the fundamental groundwork for the response effort and how it will be carried out for the particular situation presented. The Incident Commander will then make an Incident Action Plan (IAP) that will attack the operational functions of the scene. As was said earlier this may or may not be written down for reference. The Incident Commander will make decisions in the IAP that should be the most logical and safe course of action for the incident event at hand.

A great majority of this IAP will be the evacuation of persons from the hazard area. An Emergency Response Plan can not devise a plan for every possible scenario and thus relies on the judgment and decision making of the Incident Commander for the specialized evacuation of the persons from the area. This will require weighing the risk vs. benefit for operations that will evacuate the hazard area victims while protecting the responders and prevent further harm to the victims.

It is the responsibility of the responder to know the IAP for the incident they are responding.

As an first responder you may be the one who has to set the initial Immediate Action Plan. Be prepared to set the plan in motion which will prepare the scene for more advanced rescue personnel.
The span of control should be kept to the 3-5 persons so those at the bottom of the chain of command are well informed about the Incident Action Plan the Incident Commander wishes to carry out.

**Moving victims to a safe area for triage and treatment by EMS responders.**

**ODP – III(f) Law, Fire**

Law enforcement and fire responders that have been properly equipped and trained to use PPE and are tasked with the evacuation and moving of victims should be aware of the IAP the Incident Commander has devised. As part of the response effort the Incident Command should have in place a triage area where all the victims and casualties should be taken. There may even be more than one triage area depending on the size of the emergency.

Responders who move casualties from the scene of the hazard should try to inform the command where the casualty was moved. This is important when the investigation into this incident starts.

**Casualties caused by the actions of persons for the purpose of causing harm, whether the harm was direct or collateral, is considered a crime under assault and murder statues. Subsequent investigations will need all the information they can obtain for the ensuing prosecution.**

**Be able to triage and treat injured.**

**ODP – III(f)(1) Law, Fire, EMS, PW**

While the primary responsibility of the triage aspect to the response effort falls on the shoulders of the EMS response effort, the other response efforts need to be able to perform triage within the hazard area.

This effort to have all the response personnel perform triage will help the EMS personnel by not flooding them with victims that have obvious signs of death, thereby, taking valuable time from those EMS personnel when they could be tending to another victim. This also helps when the triage area is divided into different sections where the law enforcement, fire and public works personnel can take the affected victims for which they have triaged them.

An example is a person has an arm cut off and has bled profusely but has applied a tourniquet to the wound, thereby controlling the bleeding. A rescuer finds this person and takes them to the section that deals with an immediate threat to life with high chance of survival. On the other hand, a rescuer comes across a person that has
OBVIOUS signs of death and takes that victim to the section that will triage obvious death to make certain they have been correctly triaged.

**Role of the Operations (Performance - Defense) Responder**

**ODP – III(g) Law, Fire, EMS, PW**

The Operations (Performance - Defense) Responders are individuals who respond to releases or potential releases of hazardous substances as part of the initial response for the purpose of protecting nearby persons, property and the environment from the effects of the release. Operations Level responders are trained to respond in a defensive fashion only, without actually trying to stop or control the release. The primary function is to contain the release from a safe distance, keep it from spreading and protect exposures. Operations Level personnel shall have sufficient training to demonstrate to following competencies:

- Knowledge of hazard and risk assessment techniques.
- Knowledge of how to select and use the proper personal protective equipment (PPE) available.
- An understanding of basic hazardous material terminology.
- Knowledge of how to perform basic control/containment, and or confinement techniques within the capabilities of the PPE and resources available.
- Basic decontamination techniques and procedures.
- An understanding of the standard operating procedures, and termination procedures, within the local emergency response plan.

**Decontamination**

**ODP – III(h) Law, Fire, EMS, PW**  
**ODP – IV(c) Law, Fire, EMS, PW**  
**ODP – I(d) PW**

As already emphasized at the awareness level, water is the key to survival. Contaminated victims must be washed with water as-soon-as-possible. Emergency decon should be started and mass casualty decon areas should be established by command.

Operations level responders may be tasked with staffing the decon areas. If asked to perform this role by Hazardous Materials Technicians they will be told what level of PPE is required.
Equipment that is contaminated on the scene must also be fully decontaminated before reuse. This may require additional expertise and decontamination areas to be set up and staffed.

Evacuation

**Self evacuation** – This is the ability of persons to be able to evacuate themselves without the aid of others.

**Assisted evacuation** – This is the inability of affected persons to evacuate themselves without assistance from others.

Shelter in place

Test findings revealed that for an accidental toxic gas release that occurs over several minutes to half an hour, even a very leaky building contains a sufficient reservoir of fresh air to provide effective sheltering-in-place. However, for longer-duration releases of one to three-hours, the average indoor concentration may reach 80% or more of the outdoor average during a steady continuous release. For releases that have a long duration of an hour or more, the choice between shelter or evacuation is difficult to make. Typical air exchange rates in a house are about 0.5 air changes per hour (ACH). For a three-hour release, this exchange rate causes the air in the house to be replaced 1.5 times during the event. After this air exchange, the indoor concentration is about 80% of the average outdoor value. Obviously, the more energy efficient or tight the building is, the slower the air exchange rate will be.

For more information see, “Effectiveness of Indoor Sheltering During Long Duration Toxic Gas Releases” by D. J. Wilson, Department of Mechanical Engineering, University of Alberta, Edmonton, Alberta, T6G 2G8.
Evacuation vs. Shelter in place

Still the biggest challenge to the responder will be evacuation and/or sheltering in place. Each community must preplan how they will accomplish such a large task. The NAERG provides baseline information on evacuation distances and suggestions on sheltering in place. However, local SOPs must be established and followed.

Unknown Packages

ODP – III(i) Law, Fire
ODP – III(i)(1) EMS, PW
ODP – PW II(a) PW

Refer to Unit 8 as it goes into great detail about suspicious devices as well as the typical indicators of a WMD suspicious device (leaking, powder etc.)

Responders should know their departmental procedure and practices for handling and securing unknown suspicious packages. When a Responder sees what they determine a suspicious package, it should be approached as a suspicious package.

If you have come to the revelation that the package is suspicious then there must be something about it that makes it suspicious. TREAT IT THAT WAY AND LIVE !!!

EMS, Fire, Law Enforcement and Public Works need to know that if a suspicious package is identified the appropriate personnel must be called upon to deal with that package. In some cases local fire agencies have a hazardous device mitigation unit and in other cases it is the responsibility of law enforcement. Know who you should call. Refer to Unit 8 for additional information and specifics about suspicious devices.

Basic Life Support (First Aid)

ODP – IV(d) Law, Fire, EMS, PW

It is recommended that every responder keep refreshed on their basic life support and first aid.
Keep in mind that the main cause for death in emergency incidents where mass casualties are found is hemorrhaging (bleeding). **Remember the ABC’s**

**Airway**

**Breathing**

**Circulation**
Hazmat/WMD First Responder Operations
Self Protection Measures, Rescue, & Evacuation
Module 2 – Unit 3 – Review Quiz

1) You should know self protection measures and rescue and evacuation procedures for WMD events.
   a. True
   b. False

2) PPE (Personal Protective Equipment) varies with job functions.
   a. True
   b. False

3) PPE must be worn by operational personnel where there is a chance of contamination.
   a. True
   b. False

4) SCBA stands for:
   a. Self condescending basic awareness
   b. Self contained breathing access
   c. Self contained breathing apparatus
   d. Self certification before acceleration

5) Is level B a good PPE selection for chemical and biological agents?
   a. Yes
   b. No

6) If a person wearing PPE is pale with moist skin, sweating profusely with a normal temperature and pulse is weak and rapid with subdued behavior but awake, they most likely suffer from:
   a. Heat exhaustion
   b. Allergies
   c. Heat Cramps
   d. Heat stroke
7) Heat stroke is not really a serious health threat.
   a. True
   b. False

8) Warm zone operational workers should select PPE:
   a. After the incident commander succumbs to the poison
   b. That is the same level or not more than one level below the hot zone personnel
   c. Based on color and how they look in it
   d. That is one size too small to save PPE materials

9) The primary personal protective factor for EMS is:
   a. Gas mask and winter gloves
   b. Body substance isolation (BSI)
   c. Seat covers for the ambulance
   d. Plastic lining for the back of the squad

10) Triage should be done prior to decon.
    a. True
    b. False
Module 2
Unit 4
Scope of Module 2, Unit 4

Performance – Defensive (Operations) level personnel must be able to work around a potential WMD incident by making further assumptions and decisions based on hazard and risk assessment while protecting the scene. This unit will discuss the elements of a crime so that all responders are aware of the potential for all items of an incident to be considered evidence and their role in the collection of that evidence.

Learning Objective

At the conclusion of this unit responders will Describe how to follow procedures for working at the scene of a potential WMD event by maintaining the crime scene and being careful not to destroy potential evidence for collection.

Student Performance Objectives

- Define the term defensive recon.
- Describe the elements of scene control.
- Explain the importance of command post security.
- Describe the elements of a crime.
- Describe how to recognize a crime scene.
- Describe the elements for a WMD crime scene.
- Explain who will coordinate a criminal investigation.
- Describe how Performance – Defensive (Operations) level personnel facilitate evidence collection.
- Describe your occupational role as a Performance – Defensive (Operations) level responder at the scene.
- Describe the need for the National Response Plan (NRP) and how your occupational domain fits in the NRP.

Resource List

- Student Manual (Module 1 & Module 2)
Module 2
Unit 4
Working at the Scene

Standard
ODP – IV Law, Fire, EMS, PW

Know and follow procedures for working at the scene of a potential WMD event.

Introduction
In HazMat operations (Module 1), you learned techniques for working within a hazardous environment. These techniques are based upon your understanding of the incident, the chemical released and your level of personal protective equipment. The ODP standards require an Operations level responder to be able to make further assumptions and decisions based on the Hazard and risk assessment decisions at that WMD incident while protecting the scene and collection of evidence.

Defensive Recon
Operations personnel should not be entering a hazardous environment outside of a duty to save lives based entirely on risk vs. benefit for the totality of circumstances. In order for operations (performance - defense) responders to effectively make identification, a defensive recon should be made of the incident.

Defensive recon is to obtain information on site layout, device condition, physical hazards, access, and other related conditions from beyond the inner perimeter. This information can normally be obtained through threat assessments, interviews, physical observations, etc., a safe distance from the incident site.
Responders need to remember that they are the defense against further harm to bystanders and the environment. It is very important for responders to set up a control zone around the incident to contain it. By doing this you are protecting people from entering the hazard and controlling the chaos of those trying to get out of the hazard. This control of the hazard will lead to the eventual mitigation of the hazard. Here are some of the basics to scene control.

**Perimeter**

It will be the primary responsibility of law enforcement to protect the entrance and exit of the scene. Once the perimeter is set up and effective it should not be compromised throughout the response effort. The Incident Command Staff should ensure that the perimeter controls are set to control access by means of a credentialing system.

**Minimizing spread of contamination to other locations**

With the perimeter in place the only way to exit the scene is through the proper decontamination corridor and thereby reduces the possibility of spreading the contamination. The control entrance to the hazard area controls those persons allowed to expose themselves and keep innocent bystanders or aggressive actions out of the hazard area.

Law enforcement need to be aware of the need to evaluate the means they have available for controlling the scene. If a person who is traumatized by the incident may not respond to commands and may continue to self-evacuate in a manner that would not control the spread of the hazard.
DOES THAT MEAN YOU CAN USE DEADLY FORCE TO STOP THE THREAT?

Department policies need to direct law enforcement in their response to resistance as to what they can do to stop the uncontrolled behavior. A physical confrontation may not be the best course of action because it puts the officer at risk of being exposed to the victim if the victim tears the PPE the officer is wearing.

Security for the command post

History has shown that threats target the response efforts of an incident. This accomplishes further damage by their action because it stops the responders from mitigating the incident the offender has created. With this in mind, always carefully select the location of the command post using assets such as explosive detection canines and explosive ordnance disposal technicians to clear the area.

Law enforcement should be the primary in the implementation of the emergency response plan for security. This effort should be focused on the perimeter like we said earlier and also should detail the secure routed for transportation by the EMS personnel making transports to and from the scene. This security plan will most likely be formulated much like the Incident Action Plan. The Emergency Response Plan will outline the generalizations for the response effort but it will be up to the Law Enforcement Liaison Group Leader to form the security plan for the overall operation around the incident.

This will include the secure paths of travel for EMS. They will follow planned traffic routes for the emergency that have been laid out in the Emergency Response Plan. The Law Enforcement Group Leader will ensure those routes are maintained as secure and open routes of travel.

Eric Rudolf purposefully placed secondary explosive devices in locations where he knew the responders would set up the command post.
Crime scene Investigations and Evidence Collection

What is crime?
Crime is an act or the commission of an act that is forbidden or the omission of a duty that is commanded by a public law and that makes the offender liable to punishment by that law (MERRIAM-WEBSTER ONLINE).

Crimes are usually made up of four elements. Those four elements are actus reus, mens rea, concurrence, and causation. Even though these elements vary from case to case, they are essential for a prosecutor to obtain a conviction.

The laws that punish criminals will highlight those elements that must be proven in order to obtain a conviction of the offense. If there is a failure to prove any of the required elements, the suspect will be released from the charges.

Elements of crime
The four elements of a crime and a description of each are:

- **Actus reus** - Guilty act. (Latin)
- **Mens rea** - Mental state (Latin)
- **Concurrence** - Agreement in opinion.
- **Causation** - “Process of causing,” the act of causing something to happen.

It is the job of the investigator to obtain all the evidence from the scene to use against the suspect. It is then the job of the prosecutor to prove in court the previously mentioned elements for a conviction.

Felony vs. Misdemeanor
A **felony** is, in many jurisdictions of the US, any offence carrying a potential penalty of more than one year in prison. In contrast, **misdemeanors** are in general, crimes with a maximum punishment of less than one-year imprisonment. Those people who are convicted of misdemeanors are often punished with probation, community service or part-time imprisonment, served on the weekends. In many jurisdictions, misdemeanor convicts who are incarcerated serve their time in a local jail, whereas those convicted of a felony who are sentenced to more than one year serve their time in a prison.

What is a crime scene?
A crime scene is a location where an actual crime has taken place or where there is a reasonable suspicion that a crime has taken place. Law enforcement use crime scenes to collect evidence that was or would be used in the commission of a crime. The purpose of the crime scene is to set up a secure area for the purpose of collecting
evidence and building a case against the suspect. The goal of the collection of evidence is to show beyond any doubt that the suspect committed the crime resulting in successful prosecution.

A crime scene can be as small as a compartment or as large or larger than a parking lot. The investigators will change the size of the crime scene in search of evidence.

**Definition of a WMD crime scene.**

A crime scene involving a WMD incorporates all the traits of the traditional crime scene with some additional components. A WMD crime scene will most likely follow an example of the FBI's threat spectrum, which includes one or more of the following:

- Chemical
- Biological
- Radiological
- Nuclear
- Explosive

Incidents that involve one of the above listed CBRNE agents may turn out to be a WMD event. The scene will be considered a crime scene and processed as such by qualified individuals. These crime scenes may be as simple as a white powder on a suspicious piece of mail to a suicide bomber strapped with explosives pushing his way into a football game. It is important to remember that the crime scene can be any size. The only thing that dictates the size of the crime scene is the device’s capability or reach from the point of detonation.

**Important aspects of a WMD crime scene**

**ODP – IV(g)(1) Law, Fire, EMS, PW**

Life safety of the responders and those they are there to help.

ONLY THOSE EMERGENCY RESPONDERS THAT HAVE BEEN PROPERLY TRAINED AND EQUIPPED SHOULD ENTER THE INCIDENT SCENE AND ONLY WHEN AUTHORIZED BY LAW ENFORCEMENT.

Remember that each WMD crime scene is going to be different. There may be other devices set to harm the responders or there may be other hazards that were forecast by the offender aimed at responders.
When responding to a WMD crime scene it may be difficult to determine the perimeter. It is very important to get the perimeter set up to avoid further scene disturbance.

A WMD crime scene may be as complex as mass casualties or extraordinary damage to structures down to little damage and no visible signs of illnesses or injury at the scene.

Initial actions taken at the scene by the emergency responders are very important for preservation and proper collection of the evidence at the scene. This has to be protected even before the scene has been determined a crime scene. An example would be a footprint that is left on the perimeter of where a WMD has been released. Care should be taken by ALL RESPONDERS to protect everything around the incident for collection as possible evidence.

Once the crime scene has been established, law enforcement should control access to and from the scene.

There will be many obstacles for the emergency responders that are responding to a WMD crime scene. The most important thing to remember is to protect yourself and the scene and be flexible to adapt to the crime scene environment.

CONTROL THE RELEASE OF INFORMATION AS IT MAY HAMPER THE INVESTIGATION

Criminal Investigation

ODP – IV(a) Law

While not all responders will be crime scene investigators, there is a responsibility by all responders to protect the scene and to watch for very important pieces of the incident that they know will be of value to an investigative team.

Suspected arson incident

ODP – IV(a)(1) Fire

Fire agencies will have in place policy and procedure on how to handle a possible arson scene. These policies will need to be understood by responders from the fire service so they can preserve the evidence as well as mitigate the threat of the fire.
Crime scene evidence procedures, preservation and criminal investigation without endangering others.

**ODP – IV(a)(2) Law**

When the incident command determines the appropriateness of initiating the criminal investigation, law enforcement should do so with high regard to evidence procedures and investigation without endangering others at the scene.

**Evidence Collection**

**ODP – PW I(g) PW**

**ODP – IV(a) Law**

Evidence collection should be tasked to those persons with the training and equipment to perform it properly. Law enforcement investigators would be the premier choice for collection however the Incident Commander needs to either verify the competency of or train the investigator as a skilled person before allowing them to enter the hazard.

Those persons that will be tasked with the collection of evidence must be trained to secure potential WMD agents as evidence. It will be the responsibility of the Incident Commander to verify the ability of the WMD evidence collector.

Once the evidence has been collected the collector must follow the departmental procedure for chain of custody of evidence. That chain of custody is usually a document that travels with the evidence showing whom, when and why the evidence came from and to whom, what and why the evidence went to. Without the chain of custody for evidence a defendant can claim evidence was tampered with when it was in an unknown possession thereby making the evidence inadmissible in court.

After the evidence has been collected for the case it must be appropriately stored for prosecution. Most evidence lockers are not capable of holding a WMD agent because of improper ventilation if the container were to be compromised. It would be the best course of action for the appropriate testing facility to verify the suspect agent involved and to store it according to national evidence storage standards in a facility that could safely store the hazard.

**Roles of Responders**

The responsibility at a HAZMAT, WMD, or criminal incident will differ accordingly to the occupational domain for which you belong. Fire, EMS and Law
Enforcement must understand what those responsibilities are and how they are expected to perform them.

**Emergency Medical Services**

EMS personnel should be watchful for and be able to identify the signs and symptoms of possible WMD agents. EMS personnel should collect and document any information victims tell them during treatment or triage. If the information is related to criminal actions and not medically related, EMS personnel should go immediately to the law enforcement with the discovered information. This information may be vital to the totality of the incident and should not be held.

EMS personnel should be aware of types of injuries sustained by the victims, being careful not to destroy any evidence that the victim may have on their clothing. This may lead to a different standard of removal than the EMS provider is used to. EMS personnel shall document all the belongings of the persons being treated and triaged. This documentation is necessary as the whole area is a crime scene. If an EMS provider needs to disturb the scene to provide care for a victim then the EMS provider shall document what they disturbed and how they disturbed it. EMS personnel will have to keep an accurate record of where victims came from and how they were triaged and what medical facility they were transported. This all comes into play when they are trying to put the pieces of the puzzle back together by basing the effective harm to victims compared to the location of the dispersal or detonation. Likewise, if the care of a victim is transferred to another person there must be a documented exchange of care much the same way a chain of custody would be performed for evidence. In all reality the victims are, in and of themselves evidence.

**Fire Services**

Fire service personnel will extinguish fires, perform technical rescues, and perform initial cause and origin investigation. The information that is collected on these early stage investigations must be well documented and relayed to law enforcement. Fire service personnel should recognize and preserve possible evidence for law enforcement to collect and process. Since fire service personnel may be called upon for technical rescues or to assist with victim triage, they must document the locations of those victims and where they were taken. A lot of this can be conducted via radio to the command post for that particular operation. Fire service personnel are also tasked with being watchful for signs of WMD use when they are performing these operations. Proper documentation of who was on the scene and their responsibilities are essential if we need to figure out a certain piece of the puzzle later in court or reconstruction.
Hazardous Materials (HAZMAT) Teams

The HAZMAT teams shall be tasked with the identification and classification of materials or agents and identify the toxicology of the materials or agents. The HAZMAT teams will be responsible for the stopping of leaks and controlling spills or releases as necessary. It is essential for the HAZMAT teams who enter the hot zone to perform reconnaissance or to mitigate the threat to take photos, draw sketches and document anything and everything they had to do to perform their tasks. This may include the taking of samples for testing and accurate identification. All of the acquired information, photos, sketches and documentation will ultimately be turned over to law enforcement for inclusion into the total investigation. It is imperative that the HAZMAT teams be able to recognize and preserve possible evidence at the scene of the HAZMAT or WMD incident. Law enforcement may coordinate the collection of the evidence by use of the HAZMAT team. If there is a need for collection of a suspect items as evidence then it should go through proper decontamination and this decontamination process should be documented.

Telecommunications / Dispatch

Dispatchers and operators are usually the first emergency personnel to receive information about an incident. These emergency personnel are the first investigators who have a direct line to the victims and witnesses that call in reporting what they heard, saw, smelled and felt. The safety of the emergency responder lies within the investigatory ability of the dispatchers and operators so the responders do not approach from the wrong area or so they don’t stumble into a situation they can’t handle (shooting, bombing, etc.). The dispatchers and operators must get the information correct the first time through because the victims are relying on swift response from the time the call is made to when the first responders gets to the scene. Dispatchers and Operators must also give all the information that they have received to the emergency responders enroute to the incident so those units can be well informed for deductive strategies. The dispatchers and operators must remember that all radio communications can be used in court during prosecution or defense.

Law Enforcement

Law enforcement personnel are the primary agencies responsible for the criminal investigation of a WMD crime scene. This may include the use of intelligence from various agencies at the scene. It is the responsibility of law enforcement to set up the crime scene and secure it from disturbances. Law enforcement personnel are responsible for collecting and processing evidence located at the scene and their respective chain
of custody. Law enforcement will also perform security operations for all other emergency response efforts to maintain a secure scene.

Ohio Environmental Protection Agency

The State of Ohio Emergency Operations Plan assigns Ohio EPA responsibilities in the event of a Hazmat/WMD incident. The Plan states that Ohio EPA will employ emergency response capabilities during the incident to provide technical assistance pertaining to the environmental impacts. Ohio EPA On-Scene Coordinators (OCS) will potentially be first responders at a WMD incident. The OSC will promptly establish their role within the Incident Command System (ICS). One main role of Ohio EPA will be to act as a liaison with U.S. EPA first response teams, other Ohio EPA affected program areas and Ohio EPA’s Evidence Response Team (ERT).

The Ohio EPA’s ERT has the ability to respond to potential WMD events anywhere in the State of Ohio. The team is trained and equipped up to Level A entry into the hot zones and is comprised of eleven (11) members. The primary role of the ERT will be to assist lead response agencies in the processing of a WMD crime scene to secure evidence and assess environmental impacts as a result of the incident. The ERT is a State technical support resource and will not assume lead agency or incident command responsibilities during a WMD incident.

SUMMARY OF ERT SERVICES AND EXPERTISE

- Assist in assessing environmental impacts as a result of the WMD incident
- Assist in conducting hazard evaluations to determine exposure risks and select proper levels of protection
- Communicate to Incident Command environmental impact information to provide Incident Commander aid in decision making process involving mitigation activities to prevent contamination of surrounding areas
- Assist in securing the scene to preserve evidence
- Assist lead response agencies with the identification, collection and preservation of criminal evidence including samples, if appropriate
- If response agencies resources are tied up at other locations, assist local Incident Commander to stabilize situation until resources arrive
• Act as a Liaison with USEPA responders to assist in decontamination issues and environmental sampling/monitoring to assess exposure hazards

**Emergency Management Agency**

Emergency Management Agency is the central point of coordination within the state for response and recovery to disasters. The primary focus of the agency when not in a response or recovery mode is to ensure that the state, and the 11 million citizens residing in it, are prepared to respond to an emergency or disaster and to lead mitigation efforts against the effects of future disasters.

The Emergency Management Agency shall coordinate all activities of all agencies for emergency management within the state, shall maintain liaison with similar agencies of other states and of the federal government, shall cooperate with those agencies subject to the approval of the governor, and shall develop a statewide emergency operations plan that shall meet any applicable federal requirements for such plans.

**State Homeland Security Department**

Protecting Ohioans from potential acts of terrorism is central to Public Safety’s mission. Homeland Security was established as a new division within Public Safety in September 2003 to strengthen Ohio’s commitment to addressing the new threats and challenges of terrorism in wake of the September 11, 2001 attacks. The Homeland Security Division also oversees the licensing and regulation of private investigators and security guards.

**Ohio Department of Health**

Ohio Department of Health (ODH) works jointly with agencies to prevent disease, injury and premature death, support healthy lifestyles, and assure the quality of health care services.

ODH also work to ensure that Ohio children are healthy and safe. For instance, ODH supports statewide immunization efforts, local well child and family services, Women, Infant and Children (WIC) supplemental nutritional services, and dental sealant programs.

While preventing the spread of disease is the cornerstone of public health, research and planning are the building blocks for Ohio’s healthy future. ODH utilizes new technology and scientific and medical discoveries to meet the ever growing, ever changing health needs of our communities.
ODH also teams with public safety and the public health and medical partners to ensure that Ohio is prepared and protected from bioterrorism as well as other disasters.

**Primary Federal Agency Responsibilities**

**ODP – IV(g) Law, Fire, EMS, PW**

**Department of Justice (DOJ)/Federal Bureau of Investigation (FBI)**

The Attorney General is responsible for ensuring the development and implementation of policies directed at preventing terrorist attacks domestically, and will undertake the criminal prosecution of these acts of terrorism that violate U.S. law. DOJ has charged the FBI with execution of its LFA responsibilities for the management of a Federal response to terrorist threats or incidents that take place within U.S. territory or those occurring in international waters that do not involve the flag vessel of a foreign country. As the lead agency for crisis management, the FBI will implement a Federal crisis management response. As LFA, the FBI will designate a Federal on-scene commander to ensure appropriate coordination of the overall United States Government response with Federal, State and local authorities until the Attorney General transfers the overall LFA role to FEMA. The FBI, with appropriate approval, will form and coordinate the deployment of a Domestic Emergency Support Team (DEST) with other agencies, when appropriate, and seek appropriate Federal support based on the nature of the situation.

**Federal Emergency Management Agency (FEMA)**

As the lead agency for consequence management, FEMA will manage and coordinate any Federal consequence management response in support of State and local governments in accordance with its statutory authorities. Additionally, FEMA will designate appropriate liaison and advisory personnel for the FBI’s Strategic Information and Operations Center (SIOC) and deployment with the DEST, the Joint Operations Center (JOC), and the Joint Information Center (JIC).

**Department of Defense (DOD)**

DOD serves as a support agency to the FBI for crisis management functions, including technical operations, and a support agency to FEMA for consequence management. In accordance with DOD Directives 3025.15 and 2000.12 and the Chairman Joint Chiefs of Staff CONPLAN 0300-97, and upon approval by the Secretary of Defense, DOD will provide assistance to the LFA and/or the CONPLAN primary agencies, as appropriate, during all aspects of a terrorist incident, including both crisis and consequence management. DOD assistance includes threat assessment; DEST participation and transportation; technical advice; operational support; tactical support; support for civil disturbances; custody, transportation and disposal of a WMD device; and other capabilities.
including mitigation of the consequences of a release. DOD has many unique capabilities for dealing with a WMD and combating terrorism, such as the US Army Medical Research Institute for Infectious Diseases, Technical Escort Unit, and US Marine Corps Chemical Biological Incident Response Force. These and other DOD assets may be used in responding to a terrorist incident if requested by the LFA and approved by the Secretary of Defense.

**Department of Energy (DOE)**

DOE serves as a support agency to the FBI for technical operations and a support agency to FEMA for consequence management. DOE provides scientific-technical personnel and equipment in support of the LFA during all aspects of a nuclear/radiological WMD terrorist incident. DOE assistance can support both crisis and consequence management activities with capabilities such as threat assessment, NEST deployment, LFA advisory requirements, technical advice, forecasted modeling predictions, and operational support to include direct support of tactical operations. Deployable DOE scientific technical assistance and support includes capabilities such as search operations; access operations; diagnostic and device assessment; radiological assessment and monitoring; identification of material; development of Federal protective action recommendations; provision of information on the radiological response; render safe operations; hazards assessment; containment, relocation and storage of special nuclear material evidence; post-incident clean-up; and on-site management and radiological assessment to the public, the White House, and members of Congress and foreign governments. All DOE support to a Federal response will be coordinated through a Senior Energy Official.

**Environmental Protection Agency (EPA)**

EPA serves as a support agency to the FBI for technical operations and a support agency to FEMA for consequence management. EPA provides technical personnel and supporting equipment to the LFA during all aspects of a WMD terrorist incident. EPA assistance may include threat assessment, DEST and regional emergency response team deployment, LFA advisory requirements, technical advice and operational support for chemical, biological, and radiological releases. EPA assistance and advice includes threat assessment; consultation; agent identification; hazard detection and reduction; environmental monitoring; sample and forensic evidence collection/analysis; identification of contaminants; feasibility assessment and clean-up; and, on-site safety, protection, prevention, decontamination, and restoration activities. EPA and the United States Coast Guard (USCG) share responsibilities for response to oil discharges into navigable waters and releases of hazardous substances, pollutants, and contaminants into the environment under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). EPA provides the predesignated Federal On-Scene Coordinator for inland areas and the USCG for coastal areas.
to coordinate containment, removal, and disposal efforts and resources during an oil, hazardous substance, or WMD incident.

**Department of Health and Human Services (HHS)**

HHS serves as a support agency to the FBI for technical operations and a support agency to FEMA for consequence management. HHS provides technical personnel and supporting equipment to the LFA during all aspects of a terrorist incident. HHS can also provide regulatory follow-up when an incident involves a product regulated by the Food and Drug Administration. HHS assistance supports threat assessment, DEST deployment, epidemiological investigation, LFA advisory requirements, and technical advice. Technical assistance to the FBI may include identification of agents, sample collection and analysis, on-site safety and protection activities, and medical management planning. Operational support to FEMA may include mass immunization, mass prophylaxis, mass fatality management, pharmaceutical support operations (National Pharmaceutical Stockpile), contingency medical records, patient tracking, and patient evacuation and definitive medical care provided through the National Disaster Medical System.

**National Response Plan**

The following pages have been excerpted from the National Response Plan for the purpose of showing how local, state and federal agencies will work together at the scene of any incident or disaster.
III. Roles and Responsibilities

This section discusses the roles and responsibilities of Federal, State, local, tribal, private-sector, and nongovernmental organizations and citizens involved in support of domestic incident management.

State, Local, and Tribal Governments

Police, fire, public health and medical, emergency management, public works, environmental response, and other personnel are often the first to arrive and the last to leave an incident site. In some instances, a Federal agency in the local area may act as a first responder, and the local assets of Federal agencies may be used to advise or assist State or local officials in accordance with agency authorities and procedures. Mutual aid agreements provide mechanisms to mobilize and employ resources from neighboring jurisdictions to support the incident command.

When State resources and capabilities are overwhelmed, Governors may request Federal assistance under a Presidential disaster or emergency declaration. Summarized below are the responsibilities of the Governor, Local Chief Executive Officer, and Tribal Chief Executive Officer.

Governor

As a State’s chief executive, the Governor is responsible for the public safety and welfare of the people of that State or territory. The Governor:

- Is responsible for coordinating State resources to address the full spectrum of actions to prevent, prepare for, respond to, and recover from incidents in an all-hazards context to include terrorism, natural disasters, accidents, and other contingencies;
- Under certain emergency conditions, typically has police powers to make, amend, and rescind orders and regulations;
- Provides leadership and plays a key role in communicating to the public and in helping people, businesses, and organizations cope with the consequences of any type of declared emergency within State jurisdiction;
- Encourages participation in mutual aid and implements authorities for the State to enter into mutual aid agreements with other States, tribes, and territories to facilitate resource-sharing;
- Is the Commander-in-Chief of State military forces (National Guard when in State Active Duty or Title 32 Status and the authorized State militias); and

- Requests Federal assistance when it becomes clear that State or tribal capabilities will be insufficient or have been exceeded or exhausted.

Local Chief Executive Officer

A mayor or city or county manager, as a jurisdiction’s chief executive, is responsible for the public safety and welfare of the people of that jurisdiction. The Local Chief Executive Officer:

- Is responsible for coordinating local resources to address the full spectrum of actions to prevent, prepare for, respond to, and recover from incidents involving all hazards including terrorism, natural disasters, accidents, and other contingencies;
- Dependent upon State and local law, has extraordinary powers to suspend local laws and ordinances, such as to establish a curfew, direct evacuations, and, in coordination with the local health authority, to order a quarantine;
- Provides leadership and plays a key role in communicating to the public, and in helping people, businesses, and organizations cope with the consequences of any type of domestic incident within the jurisdiction;
- Negotiates and enters into mutual aid agreements with other jurisdictions to facilitate resource-sharing; and
- Requests State and, if necessary, Federal assistance through the Governor of the State when the jurisdiction’s capabilities have been exceeded or exhausted.

Tribal Chief Executive Officer

The Tribal Chief Executive Officer is responsible for the public safety and welfare of the people of that tribe. The Tribal Chief Executive Officer, as authorized by tribal government:

- Is responsible for coordinating tribal resources to address the full spectrum of actions to prevent, prepare for, respond to, and recover from incidents involving all hazards including terrorism, natural disasters, accidents, and other contingencies;
- Has extraordinary powers to suspend tribal laws and ordinances, such as to establish a curfew, direct evacuations, and order a quarantine;
Provides leadership and plays a key role in communicating to the tribal nation, and in helping people, businesses, and organizations cope with the consequences of any type of domestic incident within the jurisdiction;

- Negotiates and enters into mutual aid agreements with other tribes/jurisdictions to facilitate resource-sharing;

- Can request State and Federal assistance through the Governor of the State when the tribe’s capabilities have been exceeded or exhausted; and

- Can elect to deal directly with the Federal Government. (Although a State Governor must request a Presidential disaster declaration on behalf of a tribe under the Stafford Act, Federal agencies can work directly with the tribe within existing authorities and resources.)

Federal Government

Department of Homeland Security

The Homeland Security Act of 2002 established DHS to prevent terrorist attacks within the United States; reduce the vulnerability of the United States to terrorism, natural disasters, and other emergencies; and minimize the damage and assist in the recovery from terrorist attacks, natural disasters, and other emergencies. The Act also designates DHS as a focal point regarding natural and manmade crises and emergency planning.

Secretary of Homeland Security

Pursuant to HSPPD-5, the Secretary of Homeland Security is responsible for coordinating federal operations within the United States to prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. HSPPD-5 further designates the Secretary of Homeland Security as the “principal Federal official” for domestic incident management.

In this role, the Secretary is also responsible for coordinating federal resources utilized in response to or recovery from terrorist attacks, major disasters, or other emergencies if and when any of the following four conditions applies:

1. a Federal department or agency acting under its own authority has requested DHS assistance;
2. the resources of State and local authorities are overwhelmed and Federal assistance has been requested;
3. more than one Federal department or agency has become substantially involved in responding to the incident; or
4. the Secretary has been directed to assume incident management responsibilities by the President.

Department of Justice

In accordance with HSPPD-5 and other relevant statutes and directives, the Attorney General has lead responsibility for criminal investigations of terrorist acts or terrorist threats by individuals or groups inside the United States, or directed at U.S. citizens or institutions abroad, where such acts are within the Federal criminal jurisdiction of the United States, as well as for related intelligence-collection activities within the United States, subject to applicable laws, Executive orders, directives, and procedures.

Attorney General

Generally acting through the Federal Bureau of Investigation (FBI), the Attorney General, in cooperation with other Federal departments and agencies engaged in activities to protect national security, coordinates the activities of the other members of the law enforcement community to detect, prevent, preempt, and disrupt terrorist attacks against the United States. This includes actions to prevent, preempt, and disrupt specific terrorist threats or actual incidents that are based upon specific intelligence or law enforcement information. Nothing in this plan derogates the Attorney General’s status or responsibilities.

Following a terrorist threat or an actual incident that falls within the criminal jurisdiction of the United States, the full capabilities of the United States will be dedicated to assisting the Attorney General to identify the perpetrators and bring them to justice, consistent
with U.S. law and with authorities of other Federal departments and agencies to protect national security.

**Department of Defense (DOD)**

DOD has significant resources that may be available to support the Federal response to an Incident of National Significance.

**Secretary of Defense**

The Secretary of Defense authorizes Defense Support of Civil Authorities (DSCA) for domestic incidents as directed by the President or when consistent with military readiness operations and appropriate under the circumstances and the law. The Secretary of Defense retains command of military forces under DSCA, as with all other situations and operations.

Concepts of "command" and "unity of command" have distinct legal and cultural meanings for military forces and operations. For military forces, command runs from the President to the Secretary of Defense to the Commander of the combatant command to the commander of the forces. The "Unified Command" concept utilized by civil authorities is distinct from the military chain of command.

Nothing in this plan impairs or otherwise affects the authority of the Secretary of Defense over the DOD, including the chain of command for military forces from the President as Commander in Chief, to the Secretary of Defense, to the commander of military forces, or military command and control procedures. The Secretary of Defense shall provide defense support of civil authorities for domestic incidents as directed by the President or when consistent with military readiness and appropriate under the circumstances and the law. The Secretary of Defense shall retain command of military forces providing civil support.

**Department of State**

DOS has international coordination responsibilities.

**Secretary of State**

The Secretary of State is responsible for coordinating international prevention, preparedness, response, and recovery activities relating to domestic incidents, and for the protection of U.S. citizens and U.S. interests overseas.

**Other Federal Agencies**

During an Incident of National Significance, other Federal departments or agencies may play primary, coordinating, and/or support roles based on their authorities and resources and the nature of the incident. In situations where a Federal agency has jurisdictional authority and responsibility for directing or managing a major aspect of the response, that agency is part of the national leadership for the incident and participates as a Senior Federal Official (SFO) or Senior Federal Law Enforcement Official (SFLEO) in the Joint Field Office (JFO) Coordination Group at the field level, and as part of the Interagency Incident Management Group (IIMG) and/or Homeland Security Policy Coordination Committees (PCC). (See section IV, page 22.)

Some Federal agencies with jurisdictional authority and responsibility may also participate in the Unified Command at the Incident Command Post (ICP). Federal departments and agencies participate in the ESF structure as coordinators, primary agencies, and/or support agencies and/or as required to support incident management activities.

**Emergency Support Function**

A grouping of government and certain private-sector capabilities into an organizational structure to provide support, resources, and services.

HSPD-5 directs the heads of all Federal departments and agencies, in the context of domestic incident management, to "provide their full and prompt cooperation, resources, and support, as appropriate and consistent with their own responsibilities for protecting our national security, to the Secretary of Homeland Security, the Attorney General, the Secretary of Defense, and the Secretary of State."

Several Federal agencies have independent authorities to declare disasters or emergencies. These authorities may be exercised concurrently with or become part of a major disaster or emergency declared under the Stafford Act. Some examples of agencies exercising independent authorities include the following scenarios:

- The Secretary of Agriculture may declare a disaster in certain situations in which a county sustained production loss of 30 percent or greater in a single major enterprise, authorizing emergency loans for physical damages and crop loss.
- The Administrator of the Small Business Administration may make a disaster declaration based on physical damage to buildings, machinery, equipment, inventory, homes, and other property as well as economic injury.
- The Secretary of Commerce may make a declaration of a commercial fisheries failure or fishery resources disaster.
- The Secretary of Health and Human Services may declare a public health emergency.
- The U.S. Army Corps of Engineers (USACE) Chief of Engineers may issue a disaster declaration in response to flooding and coastal storms. USACE is authorized to undertake emergency operations and activities.
- A Federal On-Scene Coordinator (OSC), designated by the Environmental Protection Agency (EPA), DHS/US Coast Guard (DHS/USCG), DOD, or the Department of Energy (DOE) under the NRP, has the authority to direct response efforts at the scene of a discharge or release of oil, hazardous substance, pollutants, or contaminants, depending on the substance and the location and source of release.
- The ESF, Support, and Incident Annexes provide further discussion of the domestic incident management roles and responsibilities of other Federal departments and agencies.

### Emergency Support Functions

The NRP applies a functional approach that groups the capabilities of Federal departments and agencies and the American Red Cross into ESFs to provide the planning, support, resources, program implementation, and emergency services that are most likely to be needed during Incidents of National Significance. The Federal response to actual or potential Incidents of National Significance is typically provided through the full or partial activation of the ESF structure as necessary. The ESFs serve as the coordination mechanism to provide assistance to State, local, and tribal governments or to Federal departments and agencies conducting missions of primary Federal responsibility. ESFs may be selectively activated for both Stafford Act and non-Stafford Act incidents where Federal departments or agencies request DHS assistance or under other circumstances as defined in HSPD-5. The ESFs provide staffing for the National Response Coordination Center (NRCC), Regional Response Coordination Center (RRCC), JFO, and ICP as required by the situation at hand.

Each ESF is composed of primary and support agencies. The NRP identifies primary agencies on the basis of authorities, resources, and capabilities. Support agencies are assigned based on resources and capabilities in a given functional area. The resources provided by the ESFs reflect the resource-typing categories identified in the NIMS. The scope of each ESF is summarized in Figure 2 on the following page. ESFs are expected to support one another in carrying out their respective roles and responsibilities. Additional discussion on roles and responsibilities of ESF coordinators, primary agencies, and support agencies can be found in the introduction to the ESF Annexes.

Note that not all Incidents of National Significance result in the activation of ESFs. It is possible that an Incident of National Significance can be adequately addressed by DHS and other Federal agencies through activation of certain NRP elements (e.g., Principal Federal Official (PFO), IIMG) without the activation of ESFs. Similarly, operational security considerations may dictate that activation of NRP elements be kept to a minimum, particularly in the context of certain terrorism prevention activities.

### Nongovernmental and Volunteer Organizations

NGOs collaborate with first responders, governments at all levels, and other agencies and organizations providing relief services to sustain life, reduce physical and emotional distress, and promote recovery of disaster victims when assistance is not available from other sources. For example, the American Red Cross is an NGO that provides relief at the local level and also coordinates the Mass Care element of ESF #6. Community-based organizations (CBOs) receive government funding to provide essential public health services.

The National Voluntary Organizations Active in Disaster (NVOAD) is a consortium of more than 30 recognized national organizations of volunteers active in disaster relief. Such entities provide significant capabilities to incident management and response efforts at all levels. For example, the wildlife rescue and rehabilitation activities conducted during a pollution emergency are often carried out by private, nonprofit organizations working with natural resource trustee agencies.
## FIGURE 2. Emergency Support Functions

<table>
<thead>
<tr>
<th>ESF</th>
<th>Scope</th>
</tr>
</thead>
</table>
| **ESF #1 - Transportation** | - Federal and civil transportation support  
- Transportation safety  
- Restoration/recovery of transportation infrastructure  
- Movement restrictions  
- Damage and impact assessment |
| **ESF #2 - Communications** | - Coordination with telecommunications industry  
- Restoration/repair of telecommunications infrastructure  
- Protection, restoration, and sustainment of national cyber and information technology resources |
| **ESF #3 - Public Works and Engineering** | - Infrastructure protection and emergency repair  
- Infrastructure restoration  
- Engineering services, construction management  
- Critical infrastructure liaison |
| **ESF #4 - Firefighting** | - Firefighting activities on Federal lands  
- Resource support to rural and urban firefighting operations |
| **ESF #5 - Emergency Management** | - Coordination of incident management efforts  
- Issuance of mission assignments  
- Resource and human capital  
- Incident action planning  
- Financial management |
| **ESF #6 - Mass Care, Housing, and Human Services** | - Mass care  
- Disaster housing  
- Human services |
| **ESF #7 - Resource Support** | - Resource support (facility space, office equipment and supplies, contracting services, etc.) |
| **ESF #8 - Public Health and Medical Services** | - Public health  
- Medical  
- Mental health services  
- Mortuary services |
| **ESF #9 - Urban Search and Rescue** | - Life-saving assistance  
- Urban search and rescue |
| **ESF #10 - UII and Hazardous Materials Response** | - Oil and hazardous materials (chemical, biological, radiological, etc.) response  
- Environmental safety and short- and long-term cleanup |
| **ESF #11 - Agriculture and Natural Resources** | - Nutrition assistance  
- Animal and plant-disease/pest response  
- Food safety and security  
- Natural and cultural resources and historic properties protection and restoration |
| **ESF #12 - Energy** | - Energy infrastructure assessment, repair, and restoration  
- Energy industry utilities coordination  
- Energy forecast |
| **ESF #13 - Public Safety and Security** | - Facility and resource security  
- Security planning and technical and resource assistance  
- Public safety/security support  
- Support to access, traffic, and crowd control |
| **ESF #14 - Long-Term Community Recovery and Mitigation** | - Social and economic community impact assessment  
- Long-term community recovery assistance to States, local governments, and the private sector  
- Mitigation analysis and program implementation |
| **ESF #15 - External Affairs** | - Emergency public information and protective action guidance  
- Media and community relations  
- Congressional and international affairs  
- Tribal and insular affairs |
Private Sector

DHS and NRP primary and support agencies coordinate with the private sector to effectively share information, form courses of action, and incorporate available resources to prevent, prepare for, respond to, and recover from Incidents of National Significance. Further, the Secretary of Homeland Security utilizes a private-sector advisory group with broad representation to provide advice on incident management and emergency response issues impacting their stakeholders.

**Roles:** The roles, responsibilities, and participation of the private sector during Incidents of National Significance vary based on the nature of the organization and the type and impact of the incident. The roles of private-sector organizations are summarized below.

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacted Organization or Infrastructure</td>
<td>Private-sector organizations may be affected by direct or indirect consequences of the incident, including privately owned critical infrastructure, key resources, and those main private-sector organizations that are significant to local, regional, and national economic recovery from the incident. Examples of privately owned infrastructure include transportation, telecommunications, private utilities, financial institutions, and hospitals.</td>
</tr>
<tr>
<td>Response Resource</td>
<td>Private-sector organizations provide response resources (donated or compensated) during an incident—including specialized teams, equipment, and advanced technologies—through local public-private emergency plans, mutual aid agreements, or incident-specific requests from government and private-sector-geared initiatives.</td>
</tr>
<tr>
<td>Regulated and/or Responsible Party</td>
<td>Owners/operators of certain regulated facilities or hazardous operations may bear responsibilities under the law for preparing for and preventing incidents from occurring, and responding to an incident once it occurs. For example, Federal regulations require owners/operators of Nuclear Regulatory Commission (NRC)-regulated nuclear facilities and activities to maintain emergency (incident) preparedness plans, procedures, and facilities and to perform assessments, prompt notifications, and training for a response to an incident.</td>
</tr>
<tr>
<td>State/Local Emergency Organization Member</td>
<td>Private-sector organizations may serve as an active partner in local and State emergency preparedness and response organizations and activities.</td>
</tr>
</tbody>
</table>

**Responsibilities:** Private-sector organizations support the NRP (voluntarily or to comply with applicable laws and regulations) by sharing information with the government, identifying risks, performing vulnerability assessments, developing emergency response and business continuity plans, enhancing their overall readiness, implementing appropriate prevention and protection programs, and donating or otherwise providing goods and services through contractual arrangement or government purchases to assist in response to and recovery from an incident.

Certain organizations are required by existing law and regulation to bear the cost of planning and response to incidents, regardless of cause. In the case of an Incident of National Significance, these private-sector organizations are expected to mobilize and employ the resources necessary and available in accordance with their plans to address the consequences of incidents at their own facilities or incidents for which they are otherwise responsible.

**Response Resources:** Unless the response role is inherently governmental (e.g., law enforcement, etc.), private-sector organizations are encouraged to develop and maintain capabilities to respond to and manage a complete spectrum of incidents and emergencies. The Federal Government maintains ongoing interaction with the critical infrastructure and key resources industries to provide coordination for prevention, preparedness, response, and recovery activities. When practical, or when required under Federal law, private-
sector representatives should be included in planning and exercises. The government may, in some cases, direct private-sector response resources when they have contractual relationships, using government funds. Through the Defense Production Act of 1950, 64 Stat. 798 (1950), as amended, and the Homeland Security Act, DHS has the authority to redirect production and distribution of certain response and incident management resources.

Functional Coordination: The primary agency(ies) for each ESF maintains working relations with its associated private-sector counterparts through partnership committees or other means (e.g., ESF #2, Communications – telecommunications industry; ESF #10, Oil and Hazardous Materials Response – oil and hazardous materials industries; etc.).

Citizen Involvement

Strong partnerships with citizen groups and organizations provide support for incident management prevention, preparedness, response, recovery, and mitigation.

The U.S. Citizen Corps brings these groups together and focuses efforts of individuals through education, training, and volunteer service to help make communities safer, stronger, and better prepared to address the threats of terrorism, crime, public health issues, and disasters of all kinds.

Local Citizen Corps Councils implement Citizen Corps programs, which include Community Emergency Response Teams (CERTs), Medical Reserve Corps, Neighborhood Watch, Volunteers in Police Service, and the affiliate programs; provide opportunities for special skills and interests; develop targeted outreach for special-needs groups; and organize special projects and community events.

Citizen Corps Affiliate Programs expand the resources and materials available to States and local communities through partnerships with programs and organizations that offer resources for public education, outreach, and training; represent volunteers interested in helping to make their communities safer; or offer volunteer service opportunities to support first responders, disaster relief activities, and community safety efforts.

Other programs unaffiliated with Citizen Corps also provide organized citizen involvement opportunities in support of Federal response to major disasters and events of national significance. One example is the National Animal Health Emergency Response Corps (NAHERC), which helps protect public health by providing a ready reserve of private and State animal health technicians and veterinarians to combat threats to U.S. livestock and poultry in the event of a large outbreak of a foreign animal disease.
Hazmat/WMD First Responder Operations
Working the Scene
Module 2 – Unit 4 – Review Quiz

1) Operational personnel can make use of defense recon.
   a. True
   b. False

2) It is responsibility of all responders to maintain scene control and security.
   a. True
   b. False

3) What is the name of the outer edge of any incident?
   a. Outer edge
   b. Perimeter
   c. Shell
   d. Stopping point

4) EMS and Fire do not need to be familiar with crime and elements of offenses at the scene of a WMD event.
   a. True
   b. False

5) Anyone and everyone should collect evidence at a WMD crime scene.
   a. True
   b. False

6) Choose the most fragile piece of evidence that might be scene at a WMD crime scene.
   a. Gun
   b. Metal from a bomb
   c. Foot print
   d. Bodies
7) Dispatchers are essential in their role at a WMD scene for documentation and intelligence.
   a. True
   b. False

8) Who will be undertake the prosecution of acts of terrorism?
   a. FBI
   b. County Prosecutor
   c. Attorney General of the United States
   d. Department of Interior

9) Who will be the lead investigative agency at the scene of a WMD event involving radioactive materials.
   a. FBI
   b. Department of Energy
   c. Department of Agriculture
   d. Department of Immigration

10) The national response plan states that an Incident Commander can request Federal assets if the local response is overwhelmed.
    a. True
    b. False
Module 2
Unit 5
Scope of Module 2, Unit 5

Performance-Defensive (Operations) level personnel should have a working knowledge of potential weaponized chemical agents. This knowledge will help in the recognition and identification of WMD use at an incident.

Learning Objective

At the completion of this unit Operations level personnel will Describe the most common types of chemical agents used in a WMD attack and their associated signs and symptoms.

Student Performance Objectives

- Describe the two classifications of chemicals used in WMD.
- Describe the 5 types of chemical agents.
- Describe the basic action mechanism for blister agents.
- Describe the basic action mechanism for nerve agents.
- Describe the basic action mechanism for blood agents.
- Describe the basic action mechanism for choking agents.
- Describe the basic action mechanism for riot agents.
- Describe basic decontamination for chemical agents.
- Describe the process for chemical weapon manufacture.

Resource List

- Student Manual (Module 2)
Module 2
Unit 5
Chemical Agents

*Types of Chemicals for Use*
The two basic categories of chemicals that can be used as weapons are industrial chemicals and chemical agents.

**Industrial Chemicals.** Sometimes called Toxic Industrial Chemicals (TIC) they occur routinely each year, often with far-reaching consequences. Terrorists and saboteurs use chemicals commonly found in communities in industrialized nations to create improvised explosives, incendiaries, and chemical agents. The industrial chemicals are used in place of military chemical agents due to the difficulty and danger in manufacturing, obtaining, or dispersing the military agent. The common chemicals can be easily obtained and deliver a similar effect.

**Chemical Agents.** Chemical agents are classified into categories according to their effect on the body. Categories of chemical agents include neurotoxins (nerve agents), chemical asphyxiants (blood agents), pulmonary agents (choking agents), vesicants (blister agents), and antipersonnel agents (riot control agents). The agents are used to incapacitate and in some cases, to kill. There is considerable variability in properties of chemicals. Chemical agents can be weaponized by adding stabilizers to the agents to prevent degradation, adding thickeners to increase viscosity and persistency, and through developing effective means of dispersal. Temperature, volatility, vapor pressure, vapor density, wind speed, physical properties of the compound, are factors that impact the effect a chemical could have on people and would have to be taken into account for use in a terrorist attack.
**Blood Agents**

Blood agents, including cyanogen agents, are agents that are absorbed into the body through the action of breathing. Once in the body and blood stream they cause lethal damage by acting on the enzyme called cytochrome-oxidase.

These agents act by binding the iron (Fe) component of the cytochrome-oxidase system, which controls the cellular respiration and exchange of oxygen. The treatment of this agent includes the administration of oxygen and nitrates.

**Standard military treatment includes administration of 10cc of 3% solution of sodium nitrite followed by sodium thiosulfate (50cc of 25% solution) by intravenous.**

Some other medical authorities recommend the use of Amyal Nitrate crushable ampoules followed by the nitrite listed above.

**Amyl nitrite (Isoamyl Nitrate) -- Ampoules can be crushed and inhaled by a spontaneously breathing patient or ventilated into an apneic patient using a bag valve mask device; temporary measure until IV access can be established.**

Others recommend using Vitamin B12, EDTA, and/or hyperbaric oxygen (High Compression oxygen chamber). Due to the fact that "field" conditions do not allow the use of such extensive equipment, or inconsistent treatment methods; the military method is recommended for the near future.

**Cyanides**

Cyanides can be delivered by artillery, rockets, bombs, or released from upwind canisters. The symptoms of cyanide poisoning include:

(AC- Hydrogen cyanide HCN)  
(CK- Cyanogen chloride CNCL)

**Hydrogen Cyanide (AC)**

Cyanogen halides do the same thing that hydrogen cyanide does except that they irritate the mucus membranes and eyes. They also cause burning sensations in the throat and lungs, overall the upper respiratory tract, of an exposed individual.
Cyanide is a rapidly acting, potentially deadly chemical that can exist in various forms. Cyanide can be a colorless gas, such as hydrogen cyanide (HCN) or cyanogen chloride (CNCl), or a crystal form such as sodium cyanide (NaCN) or potassium cyanide (KCN). Cyanide sometimes is described as having a bitter almond smell, but it does not always give off an odor, and not everyone can detect this odor. Cyanide is also known by the military designations AC (for hydrogen cyanide) and CK (for cyanogen chloride).

Hydrogen cyanide, under the name Zyklon B, was used as a genocidal agent by the Germans in World War II. Reports have indicated that during the Iran-Iraq War in the 1980s, hydrogen cyanide gas may have been used along with other chemical agents against the inhabitants of the Kurdish city of Halabja in northern Iraq. Cyanide is released from natural substances in some foods and in certain plants such as cassava. Cyanide is contained in cigarette smoke and the combustion products of synthetic materials such as plastics. Combustion products are substances given off when things burn. In manufacturing, cyanide is used to make paper, textiles, and plastics. It is present in the chemicals used to develop photographs. Cyanide salts are used in metallurgy for electroplating, metal cleaning, and removing gold from its ore. Cyanide gas is used to exterminate pests and vermin in ships and buildings. If accidentally ingested (swallowed), chemicals found in acetonitrile-based products that are used to remove artificial nails can produce cyanide.

The symptoms for individuals exposed to cyanogen halides are the same as those who are exposed to hydrogen cyanide, but cyanogen halides also produce symptoms similar to some choking agents. The added symptoms that cyanogen halides produce are that they quickly irritate and paralyze the upper respiratory tract and cause dyspnea to be produced.

The extent of poisoning caused by cyanide depends on the amount of cyanide a person is exposed to, the route of exposure, and the length of time that a person is exposed. Breathing cyanide gas causes the most harm, but ingesting (swallowing) cyanide can be toxic as well. Cyanide gas is most dangerous in enclosed places where the gas will be trapped. Cyanide gas evaporates and disperses quickly in open spaces, making it less harmful outdoors. Cyanide gas is less dense than air, so it will rise. Cyanide prevents the cells of the body from using oxygen. When this happens, the cells die. Cyanide is more harmful to the
heart and brain than to other organs because the heart and brain use a lot of oxygen.

**Immediate signs and symptoms of exposure to cyanide**
People exposed to a small amount of cyanide by breathing it, absorbing it through their skin, or eating foods that contain it may have some or all of the following symptoms within minutes:

- Rapid breathing
- Restlessness
- Dizziness
- Weakness
- Headache
- Nausea and vomiting
- Rapid heart rate

Exposure to a large amount of cyanide by any route may cause these other health effects as well:

- Convulsions
- Low blood pressure
- Slow heart rate
- Loss of consciousness
- Lung injury
- Respiratory failure leading to death
- Showing these signs and symptoms does not necessarily mean that a person has been exposed to cyanide.

**Cyanogen Chloride (CK)**
Hydrogen sulfide causes paralysis of the cells aerobic metabolism. This in turn results in decreased cellular energy production, metabolic acidosis, cellular suffocation, and death. Exposure can occur through inhalation, ingestion or absorption. Hydrogen sulfide appears as a colorless gas, has a sweet taste, but smells like rotten eggs in larger concentrations.

Cyanogen halides do the same thing that hydrogen cyanide does except that they irritate the mucus membranes and eyes. They also cause burning sensations in the throat and lungs, overall the upper respiratory tract, of an exposed individual.

**Amyl nitrite (Isoamyl Nitrate)** -- Ampoules can be crushed into gauze and inhaled or broken into an Ambu bag and ventilated into the patient; only a temporary measure until IV access is obtained.
Immediate signs and symptoms of exposure to cyanogens chloride

- lacrimation (tearing)
- bronchorrhea
- rhinorrhea (running nose)
- anxiety and/or confusion
- vertigo
- nausea with or without vomiting
- vomiting with or without nausea
- headache
- bradypnea followed by apnea
- hyperpnea followed by apnea
- convulsions
- cyanosis (often absent; may be followed by a pink color in the skin)
- bradycardia
- cardiac arrest

Symptoms alone are not usually specific enough to allow definitive diagnosis. Onset is usually rapid. Effects on inhalation of lethal amounts may be observed within 15 seconds with death occurring in less than 10 minutes. Cyanogen chloride should be suspected in terrorist incidents involving prompt fatalities, especially when the characteristic symptoms of nerve agent intoxication are absent.

NIOSH EMERGENCY RESPONSE CARD

<table>
<thead>
<tr>
<th>BLOOD AGENT</th>
<th>CYANOGEN CHLORIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN #: 1589 (inhibited) (Guide 125)</td>
<td>Chlorine cyanide Chlorocyanide Chlorocyanogen CK</td>
</tr>
<tr>
<td>CAS #: 506-77-4</td>
<td>Chemical Formula: CICN</td>
</tr>
<tr>
<td>RTECS #: GT2275000</td>
<td>Molecular weight: 61.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TYPES OF HAZARD/EXPOSURE</th>
<th>ACUTE HAZARDS/CLINICAL SIGNS/SYMPTOMS</th>
<th>PREVENTION/PERSNAL PROTECTIVE EQUIPMENT</th>
<th>FIRST AID/FIRE FIGHTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE</td>
<td>Not combustible. Heating</td>
<td>N/A</td>
<td>In case of fire in the</td>
</tr>
</tbody>
</table>
Cyanogen Chloride has properties similar to riot control agents and it can cause irritation of the eyes, nose, and airways resulting in lacrimation (tearing), rhinorrhea (runny nose), and increased fluid production in the lungs.

**AVOID ALL CONTACT!**

### Synopsis:

- **Inhalation:**
  - Runny nose (rhinorrhea).
  - Sore throat.
  - Drowsiness.
  - Confusion.
  - Nausea.
  - Vomiting.
  - Cough.
  - Unconsciousness.
  - Edema with symptoms which may be delayed (See Notes.)

- **Ventilation, local exhaust, or breathing protection.**
- **Pressure demand, self-contained breathing apparatus (SCBA) (SCBA CBRN, if available) is recommended in response to non-routine emergency situations.**
- **CBRN, Full Facepiece APR (when available) is recommended in non-routine, emergency situation environments less than IDLH but above REL or PEL levels.**

- **Fresh air, rest. Half-upright position. Artificial respiration if indicated.**
- **Seek medical attention immediately.**

- **Skin:**
  - Cyanogen Chloride is readily absorbed through intact skin causing systemic effects without irritant effects on the skin.
  - On contact with liquid frostbite may occur. The liquid may be absorbed.
  - Redness. Pain.

  - **Cold-insulating gloves. Butyl rubber gloves. Teflon, Responder, or Tychem Protective clothing.**
  - **Frostbite: rinse with plenty of water, do NOT remove clothes.**
  - **Seek medical attention immediately.**

- **Eyes:**
  - On contact with liquid: frostbite.

  - **Face shield, or eye protection in combination with breathing protection.**
  - **First rinse with plenty of water for several minutes.**
  - **Seek medical attention immediately.**
### Ingestion:
- N/A

- Do not eat, drink, or smoke during work. Wash hands before eating.
- N/A

### OCCUPATIONAL EXPOSURE LIMITS (OELs):
- OSHA PEL: N/A
- NIOSH REL: C 0.3 ppm (0.6 mg/m³)
- ACGIH TLV: 0.3 ppm; as (ceiling value) (ACGIH 2002).
- NIOSH IDLH: N/A

### SAMPLING AND ANALYTICAL METHODS:
- NIOSH: N/A
- OSHA: N/A

### DECONTAMINATION
- Patients/victims: Wet contaminated clothing should be removed and the underlying skin washed with soap and water or water alone for 2-3 minutes.
- Equipment: N/A
- Environment: (See Spillage Disposal.)

### SPILLAGE DISPOSAL
- Storage: Fireproof if in building. Provision to contain effluent from fire extinguishing. Cool.

### PACKAGING & LABELLING
- UN # **1589** (inhibited) (Guide 125)
  - Marine Pollutant
  - Hazard Class: 2.3
  - Subsidiary Risks: 8
  - UN # 1589 (inhibited) Guide 125
  - NFPA 704 Signal:
    - Health - N/A
    - Flammability - N/A
    - Reactivity - N/A
    - Special - N/A

### IMPORTANT DATA

#### PHYSICAL STATE; APPEARANCE:
Colorless compressed liquefied gas, with pungent odor.

#### PHYSICAL DANGERS:
The gas is heavier than air.

#### CHEMICAL DANGERS:
The substance decomposes on heating producing toxic and corrosive fumes (hydrogen cyanide, hydrochloric acid, nitrogen oxides). Reacts slowly with water or water vapor to form hydrogen chloride.
**ROUTES OF EXPOSURE:**
The substance can be absorbed into the body by inhalation.

**INHALATION RISK:**
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

**EFFECTS OF SHORT-TERM EXPOSURE:**
The substance severely irritates the eyes with excessive tearing (lacrimation), the skin and the respiratory tract causing runny nose (rhinorrhea) and edema (fluid buildup in the lungs). Cyanides poison the vital organs of the body (for example the lungs and heart) including areas of the brain that regulates proper functioning of those organs. Exposure may result in convulsions, unconsciousness and in death. (See Notes.) Inhalation of the substance may cause lung edema (see Notes). The effects may be delayed. Rapid evaporation of the liquid may cause frostbite. Medical observation is indicated.

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
unknown

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>Melting Point: 21.2°F (-6°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boiling Point: 56.8°F (13.8°C)</td>
</tr>
<tr>
<td></td>
<td>Vapor Pressure (25°C): 1230 mm Hg</td>
</tr>
<tr>
<td></td>
<td>Density/Specific Gravity (20°C): 1.19</td>
</tr>
<tr>
<td></td>
<td>Volatility: N/A</td>
</tr>
<tr>
<td></td>
<td>Relative vapor density (air = 1): 2.16</td>
</tr>
<tr>
<td></td>
<td>Aqueous solubility(20°C): soluble</td>
</tr>
<tr>
<td></td>
<td>Flashpoint: N/A</td>
</tr>
<tr>
<td></td>
<td>Flammability: N/A</td>
</tr>
</tbody>
</table>

| ENVIRONMENTAL DATA | The substance is very toxic to aquatic organisms. |

<table>
<thead>
<tr>
<th>ACUTE EXPOSURE GUIDELINES (AEGLs)</th>
<th>10 min</th>
<th>30 min</th>
<th>1 hr</th>
<th>4 hr</th>
<th>8 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEGL 1 (discomfort, non-disabling)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>AEGL 2 (irreversible or other serious, long-lasting effects or impaired ability to escape)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>AEGL 3 (life-threatening effects or death)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**NOTES**
The occupational exposure limit value should not be exceeded during any part of the working exposure. The symptoms of lung edema (buildup of fluid in the lungs) often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation is therefore essential. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Do NOT spray water on leaking cylinder (to prevent corrosion of cylinder). Turn leaking cylinder with the leak pointing up to prevent escape of gas in liquid state.

| ADDITIONAL INFORMATION | Trade Names and Other Synonyms |
Arsine (SA)
The chemical name for arsine is arsenic trihydride or arsine. Arsine can have an odor similar to garlic and is highly volatile. Arsine is so volatile that it can even explode on contact with the air. Arsine differs from other blood agents in that in combination with the common blood agent effects on an individual it also cause additional damage to the kidneys and liver. Arsine can be found in combinations with lewisites to cause an immediate irritation affect. Skin damage due to the lewisite (a mustard agent) can also occur in compounds that contain arsines and lewisites.

Mannitol (Osmitrol, Resectisol) -- Increases osmotic pressure of glomerular filtrate, inducing an osmotic gradient that inhibits tubular resorption of water and electrolytes, resulting in increased urinary output.

Arsine is a colorless, nonirritating toxic gas with a mild garlic odor. The odor can be detected only at levels greater than those necessary to cause poisoning. Arsine is formed when arsenic comes in contact with an acid. Arsine is similar to a gas called stibine, which is formed when the metal antimony comes in contact with an acid. Stibine has health effects similar to those of arsine, but it is not as widely available, and it has a much more noticeable odor (like rotten eggs).

Arsine was investigated as a warfare agent during WWII, it was never used on the battlefield. Arsine is most commonly used in the semiconductor and metals refining industries.

Signs and symptoms of arsine exposure
At lower doses, people may not know they have been exposed to arsine, because it has no odor. At higher doses, a mild garlic odor has been reported. Stibine, on the other hand, has a strong odor, so people will probably be aware that they may have been exposed to something. People exposed to a low or
A moderate dose of arsine by inhalation may experience some or all of the following symptoms within 2 to 24 hours of exposure:

- Weakness
- Fatigue
- Headache
- Drowsiness
- Confusion
- Shortness of breath
- Rapid breathing
- Nausea, vomiting, and/or abdominal pain
- Red or dark urine
- Yellow skin and eyes (jaundice)
- Muscle cramps

Exposure to a large dose of arsine by any route may result in these additional health effects:

- Loss of consciousness
- Convulsions
- Paralysis
- Respiratory failure, possibly leading to death
- Showing these signs and symptoms does not necessarily mean that a person has been exposed to arsine

Long-term health effects of arsine exposure

- Severely exposed people are not likely to survive. If people survive the initial exposure, long-term effects may include
  - kidney damage
  - numbness and pain in the extremities
  - neuropsychological symptoms such as memory loss
  - confusion
  - irritability

**Protection**

There is no antidote for arsine exposure, the best thing to do is avoid it. First, get fresh air by leaving the area where the arsine was released. Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to arsine.
Blister Agents

Blister agents are also known as Vesicants. Vesicants, also referred to as Blister agents, were the most commonly used chemical warfare agents during World War I. The most likely routes of exposure are inhalation, dermal contact, and ocular contact. Vesicants are highly reactive chemicals that combine with proteins, DNA, and other cellular components to result in cellular changes immediately after exposure, i.e., blisters.

Depending on the vesicant, clinical effects may occur immediately (as with phosgene oxime or lewisite) or may be delayed for 2 to 24 hours (as with mustards). Following exposure, the most commonly encountered clinical effects include dermal (skin erythema and blistering), respiratory (pharyngitis, cough, dyspnea), ocular (conjunctivitis and burns), and gastrointestinal (nausea and vomiting).

The amount and route of exposure to the vesicant, the type of vesicant, and the premorbid condition of the person exposed will contribute to the time of onset and the severity of illness. For example, ingestion of a vesicant leads to gastrointestinal symptoms more prominent than those that would result from inhalation exposure to the same dose and type of vesicant.

There are three categories of blister agents.

**Mustards**
- Distilled mustard (HD)
- Mustard gas (H) (sulfur mustard)
- Mustard/lewisite (HL)
- Mustard/T
- Nitrogen mustard (HN-1, HN-2, HN-3)
- Sesqui mustard
- Sulfur mustard (H) (mustard gas)

**Lewisites/chloroarsine agents**
- Lewisite (L, L-1, L-2, L-3)
- Mustard/lewisite (HL)

**Phosgene oxime (CX)**
Impure Sulfur Mustard (H) / Distilled Sulfur Mustard (HD)

Sulfur mustard is also known as mustard gas or mustard agent, or by the military designations H. It is reported to smell like garlic, onions, or mustard and sometimes has no odor. This can be a vapor (the gaseous form of a liquid), an oily-textured liquid, or a solid. The physical properties of sulfur mustard can be clear to yellow or brown when it is in liquid or solid form depending on the other chemicals mixed with it.

Sulfur mustard is not found naturally in the environment and is a result of manmade production. The impure or undistilled version of sulfur mustard (H) is less persistent and less concentrated than distilled mustard and therefore more copious application is needed for a similar distilled mustard result.

Sulfur mustard (HD) is a thick liquid at ambient temperature, but becomes a solid at 58 °F. It is heavier than water as a liquid and heavier than air as a vapor. It does not occur naturally in the environment. It is often called mustard gas, but sulfur mustard is not likely to change into a gas immediately if it is released at ordinary temperatures. As a pure liquid, it is colorless and odorless, but when mixed with other chemicals, it looks brown and has a garlic-like smell.

It was reportedly used in the Iran-Iraq war in 1980-1988.

Exposure

If sulfur mustard is released into the air as a vapor, people can be exposed through skin contact, eye contact, or breathing. Sulfur mustard vapor can be carried long distances by wind. If sulfur mustard is released into water, people can be exposed by drinking the contaminated water or getting it on their skin. People can be exposed by coming in contact with liquid sulfur mustard. Sulfur mustard can last from 1 to 2 days in the environment under average weather conditions and from weeks to months under very cold conditions. Sulfur mustard breaks down slowly in the body, so repeated exposure may have a cumulative effect (that is, it can build up in the body).
Prehospital Care:

The top 2 priorities are protecting the caregiver and removing the offending agent from the casualty as quickly as possible. Then assess airway, breathing, and circulation (ABCs) as usual. All medical personnel who may come into contact with vesicant vapor or liquid should wear protective gear.

The activated charcoal in the chemical protective mask adequately adsorbs these agents. Protective boots, gloves, pants, and jacket (e.g., mission-oriented protective posture [MOPP] gear) protect the skin; however, organic arsenicals attack rubber and can cause it to break down with prolonged exposure. This is especially true of L.

Vesicant agents irreversibly bind to the skin within minutes. Remove the agent as quickly as possible.

Remove liquids via any means available. The military has specially developed charcoal-based kits (e.g., M258A1 kit, M291 kit). If specialized kits are not available, rags, leaves, sticks, or just about any other material can be used to blot off liquid agent.

Flushing the eyes or skin is another solution. Dilute hypochlorite (0.5% solution) can be used on the skin. Live steam or alkaline solutions (e.g., sodium hydroxide) can be used to decontaminate closed spaces.

Immediate signs and symptoms of sulfur mustard exposure

Exposure to sulfur mustard is usually not fatal. When sulfur mustard was used during World War I, it killed fewer than 5% of the people who were exposed and got medical care. People may not know right away that they have been exposed, because sulfur mustard often has no smell or has a smell that might not cause alarm. Typically, signs and symptoms do not occur immediately. Depending on the severity of the exposure, symptoms may not occur for 2 to 24 hours. Some people are more sensitive to sulfur mustard than are other people, and may have symptoms sooner. Sulfur mustard can have the following effects on specific parts of the body:

- Skin: redness and itching of the skin may occur 2 to 48 hours after exposure and change eventually to yellow blistering of the skin.
- Eyes: irritation, pain, swelling, and tearing may occur within 3 to 12 hours of a mild to moderate exposure. A severe exposure may cause symptoms within 1 to 2 hours and may include the symptoms of a mild or moderate
exposure plus light sensitivity, severe pain, or blindness (lasting up to 10 days).

- Respiratory tract: runny nose, sneezing, hoarseness, bloody nose, sinus pain, shortness of breath, and cough within 12 to 24 hours of a mild exposure and within 2 to 4 hours of a severe exposure.
- Digestive tract: abdominal pain, diarrhea, fever, nausea, and vomiting.

Showing these signs and symptoms does not necessarily mean that a person has been exposed to sulfur mustard.

Long-term health effects may be:

- Exposure to sulfur mustard liquid is more likely to produce second- and third-degree burns and later scarring than is exposure to sulfur mustard vapor. Extensive skin burning can be fatal.
- Extensive breathing in of the vapors can cause chronic respiratory disease, repeated respiratory infections, or death.
- Extensive eye exposure can cause permanent blindness.
- Exposure to sulfur mustard may increase a person’s risk for lung and respiratory cancer.

Protection

Because no antidote exists for sulfur mustard exposure, the best thing to do is avoid it. Immediately leave the area where the sulfur mustard was released. Try to find higher ground, because sulfur mustard is heavier than air and will settle in low-lying areas. If avoiding sulfur mustard exposure is not possible, rapidly remove the sulfur mustard from the body. Getting the sulfur mustard off as soon as possible after exposure is the only effective way to prevent or decrease tissue damage to the body. Quickly remove any clothing that has liquid sulfur mustard on it. If possible, seal the clothing in a plastic bag, and then seal that bag inside a second plastic bag. Immediately wash any exposed part of the body (eyes, skin, etc.) thoroughly with plain, clean water. Eyes need to be flushed with water for 5 to 10 minutes. Do NOT cover eyes with bandages, but do protect them with dark glasses or goggles. If someone has ingested sulfur mustard, do NOT induce vomiting. Give the person milk to drink. Seek medical

Filling 75-mm artillery shells with mustard agent at Edgewood Arsenal, Md. Facilities designed to fill shells with chemical agents were notoriously hazardous. Photograph: Chemical and Biological Defense Command Historical Research and Response Team, Aberdeen Proving Ground, Md.

Source: http://sc-ems.com
attention right away. Dial 911 and explain what has happened.

**Nitrogen Mustard (HN-1, HN-2, HN-3)** was produced in the 1920s and 1930s as potential chemical warfare weapons. They are vesicants (or blister agents) similar to the sulfur mustards. Nitrogen mustards come in different forms that can smell fishy, musty, soapy, or fruity. They can be in the form of an oily-textured liquid, a vapor (the gaseous form of a liquid), or a solid. Nitrogen mustards are liquids at normal room temperature (70°F). Nitrogen mustards can be clear, pale amber, or yellow colored when in liquid or solid form. The nitrogen mustards are also known by their military designations of HN-1, HN-2, and HN-3.

The nitrogen mustards were never used in warfare. Nitrogen mustards are not found naturally in the environment. HN-1 was originally designed to remove warts but was later identified as a potential chemical warfare agent. HN-2 was designed as a military agent but was later used in cancer treatment. Other treatment agents have now replaced it. HN-3 was designed solely as a military agent.

If nitrogen mustards are released into the air as a vapor, you could be exposed through skin contact, eye contact, or breathing. If nitrogen mustards are released into water, you could exposed by drinking the contaminated water or getting it on your skin. You could be exposed by coming in direct contact with liquid nitrogen mustards. Because it is heavier than air, nitrogen mustard vapor will settle in low-lying areas.

Adverse health effects caused by nitrogen mustards depend on the amount of nitrogen mustard to which people are exposed, the route of exposure, and the length of time that people are exposed. Nitrogen mustards are powerful irritants that damage the skin, eyes, and respiratory (breathing) tract. Nitrogen mustards can enter the cells of the body very quickly and cause damage to the immune system and bone marrow.

**Immediate signs and symptoms of nitrogen mustard exposure**

Typically, signs and symptoms of nitrogen mustard exposure do not occur immediately. Depending on the severity of the exposure, symptoms may not
occur for several hours. Nitrogen mustards can have the following effects on specific parts of the body:

- **Skin:** redness usually develops within several hours after exposure followed by blistering within 6 to 12 hours.
- **Eyes:** irritation, pain, swelling, and tearing may occur. High concentrations can cause burns and blindness.
- **Respiratory tract:** nose and sinus pain, cough, sore throat, and shortness of breath may occur within hours. Fluid in the lungs is uncommon.
- **Digestive tract:** abdominal pain, diarrhea, nausea, and vomiting.
- **Brain:** tremors, incoordination, and seizures are possible following a large exposure.

What the long-term health effects may be

- Exposure to nitrogen mustard liquid is more likely to produce second- and third-degree burns and later scarring than is exposure to nitrogen mustard vapor.
- Extensive breathing in of the vapors can cause chronic respiratory disease.
- Extensive eye exposure can cause long-lasting eye problems.
- Nitrogen mustards may cause bone marrow suppression beginning as early as 3 to 5 days after exposure. Bone marrow suppression can cause anemia, bleeding, and increased risk for infection. If severe, these effects could lead to death.
- Prolonged or repeated exposures to nitrogen mustards have caused cancer in animals. Some evidence exists that prolonged or repeated exposures to nitrogen mustards cause leukemia in humans.

**Protection**

Because no antidote exists for nitrogen mustard exposure, the best thing to do is avoid it. If the nitrogen mustard release was indoors, get out of the building. If the release was outdoors, move away from the area of the release, stay upwind if possible, and seek higher ground. Quickly moving to an area where fresh air is available is highly effective in reducing the possibility of death from exposure to nitrogen mustard. If you are near a release of nitrogen mustard, emergency coordinators may tell you to either evacuate the area or shelter in place inside a building to avoid being exposed to the chemical. If you think you may have been exposed, you should remove your clothing by cutting the clothing off and rapidly wash your entire body with soap and water, and get medical care as quickly as possible.

**Removing your clothing:**
• Quickly take off clothing that has nitrogen mustard on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head.
• If you are helping other people remove their clothing, try to avoid touching any contaminated areas, and remove the clothing as quickly as possible.

Washing yourself:
• As quickly as possible, wash any nitrogen mustard from your skin with large amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.
• If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and put them with the contaminated clothing. Do not put the contacts back in your eyes (even if they are not disposable contacts). If you wear eyeglasses, wash them with soap and water. You can put your eyeglasses back on after you wash them.

Disposing of your clothes:
• After you have washed yourself, place your clothing inside a plastic bag. Avoid touching contaminated areas of the clothing. If you can't avoid touching contaminated areas, or you aren't sure where the contaminated areas are, wear rubber gloves or put the clothing in the bag using tongs, tool handles, sticks, or similar objects. Anything that touches the contaminated clothing should also be placed in the bag. If you wear contacts, put them in the plastic bag, too.
• Seal the bag, and then seal that bag inside another plastic bag. Disposing of your clothing in this way will help protect you and other people from any chemicals that might be on your clothes.
• When the local or state health department or emergency personnel arrive, tell them what you did with your clothes. The health department or emergency personnel will arrange for further disposal.
• Do not handle the plastic bags yourself.

If nitrogen mustard has been ingested (swallowed), do not induce vomiting or give fluids to drink. Seek medical attention right away. Dial 911 and explain what has happened.

**Treatment**

No antidote exists for nitrogen mustard exposure. Treatment consists of removing the nitrogen mustard from the body as soon as possible and providing supportive medical care in a hospital setting.
Lewisite (L)

Lewisite is a type of chemical warfare agent. This kind of agent is called a vesicant or blistering agent, because it causes blistering of the skin and mucous membranes on contact. Lewisite is an oily, colorless liquid in its pure form and can appear amber to black in its impure form. It is reported to have an odor like geraniums. Lewisite contains arsenic, a poisonous element.

Lewisite was produced in 1918 to be used in World War I, but its production was too late for it to be used in the war. Lewisite has been used only as a chemical warfare agent. It has no medical or other practical use. Lewisite is not found naturally in the environment.

Adverse health effects caused by lewisite depend on the amount people are exposed to, the route of exposure, and the length of time that people are exposed. Lewisite is a powerful irritant and blistering agent that immediately damages the skin, eyes, and respiratory (breathing) tract. Because it contains arsenic, lewisite has some effects that are similar to arsenic poisoning, including stomach ailments and low blood pressure.

Immediate signs and symptoms of lewisite exposure

Most information on the health effects of lewisite is based on animal studies. Signs and symptoms occur immediately following a lewisite exposure. Lewisite can have the following effects on specific parts of the body:

- Skin: pain and irritation within seconds to minutes, redness within 15 to 30 minutes followed by blister formation within several hours. The blister begins as a small blister in the middle of the red areas and then expands to cover the entire reddened area of skin. The lesions (sores) from lewisite heal much faster than lesions caused by the other blistering agents, sulfur mustard and nitrogen mustards, and the discoloring of the skin that occurs later is much less noticeable.
- Eyes: irritation, pain, swelling, and tearing may occur on contact.
- Respiratory tract: runny nose, sneezing, hoarseness, bloody nose, sinus pain, shortness of breath, and cough.
- Digestive tract: diarrhea, nausea, and vomiting.
- Cardiovascular: Lewisite shock. or low blood pressure may occur.

Showing these signs and symptoms does not necessarily mean that a person has been exposed to lewisite.
Phosgene Oxime (CX)

Phosgene oxime is a manufactured chemical warfare agent. Phosgene oxime is a type of agent called an urticant or nettle agent. This is because on contact with the skin, it produces intense itching and a rash similar to hives. Phosgene oxime is also referred to as a corrosive agent because of the type of skin and tissue damage it causes. Phosgene oxime was first produced in 1929, but it has never been used on the battlefield. Specific information on this chemical is very limited. Phosgene oxime is colorless in its solid form and yellowish-brown when it is a liquid. Phosgene oxime has a disagreeable, irritating odor. Phosgene oxime is also known by its military designation, CX.

Although phosgene oxime has been produced only as a chemical warfare agent, it has never been used during wartime. Phosgene oxime is not found naturally in the environment. Phosgene oxime vapor is heavier than air, so it will settle in low-lying areas. Phosgene oxime does not last in the environment for very long. It breaks down in soil within 2 hours when temperatures are normal, and it breaks down in water within a few days.

The extent of poisoning that phosgene oxime causes depends on the amount of phosgene oxime to which a person is exposed, how the person is exposed, and the length of time of the exposure. Phosgene oxime produces instant and almost unbearable pain on exposed skin and exposed eyes. When inhaled, it causes immediate irritation to the respiratory (breathing) tract. Phosgene oxime can penetrate clothing and rubber faster than other chemical warfare agents.

Immediate signs and symptoms of phosgene oxime exposure

- Skin: pain occurring within a few seconds, and blanching (whitening) of the skin surrounded by red rings occurring on the exposed areas within 30 seconds. Within about 15 minutes, the skin develops hives. After 24 hours, the whitened areas of skin become brown and die, and then a scab is formed. Itching and pain may continue throughout the healing process.
- Eyes: severe pain and irritation, tearing, and possibly temporary blindness.
- Respiratory tract: immediate irritation to the upper respiratory tract, causing runny nose, hoarseness, and sinus pain. Absorbing phosgene oxime through the skin or inhaling it may result in fluid in the lungs (pulmonary edema) with symptoms of shortness of breath and cough.
- Digestive tract: no information exists on digestive tract effects in humans.
Management of phosgene toxicity is supportive. Oxygen, corticosteroids (inhaled, systemic), leukotriene inhibitors, IV fluids, and prophylactic antibiotics are recommended. The recommended steroid dose is much higher than the dose conventionally used in asthma. Prophylactic antibiotics and antifungals may be required because of the risk of super infection. Pressor agents may be required to treat hypotension, bradycardia, and renal failure.

Nerve Agents

Nerve agents are one of the most common and toxic war chemicals because they cause severe incapacitation and death. Nerve agents work by binding with the enzyme, acetylcholinesterase, which results in over stimulation of nerve pathways. Primarily, the parasympathetic nervous system is affected, but the central and somatic systems may be too. They are appealing weapons because they can enter the body through almost any route. In addition, often two less toxic chemicals can be safely transported and then mixed together at the delivery point to make a more toxic nerve chemical. People often use organophosphates for pest control, which are very similar to nerve agents. Nerve agents disable enzymes that are responsible for the transmission of nerve impulses. Most nerve agents display the same signs and symptoms and are clear, colorless, and odorless. If nerve agents were used in a terrorism attack, the route of exposure would most likely be through inhalation or direct skin contact.

Listing of Nerve Agents

- Tabun (GA)
- Sarin (GB)
- Soman (GD)
- VX
- Methyl Parathion
- Sevin
“G” Series Nerve Agent Medical Intervention

**Atropine** (Isopto, Atropair, Atropisol) -- Initial DOC for symptomatic victims of nerve agent exposure; acts via muscarinic receptors to reverse bronchoconstriction, bronchorrhea, abdominal pain, nausea, vomiting, and bradycardia; appears to be involved in stopping seizure activity. Because atropine does not act on nicotinic receptors, has no effect on muscle weakness or paralysis. The most important therapeutic endpoints are drying of respiratory secretions, reversal of bronchoconstriction, and reversal of bradycardia; pupillary response and tachycardia are not useful measures of adequate atropinization; >20 mg rarely is needed in first 24 h, unlike in organophosphate insecticide poisoning where up to 200 mg may be required; atropine almost never is required beyond 24 h postexposure.

**Pralidoxime chloride** (2-PAM Cl, Protopam) -- Reverses skeletal muscle weakness by reactivating AChE; acts by disrupting covalent bond between nerve agent and AChE before it becomes permanent. Bonds between different nerve agents and AChE have various aging periods. The half-time of the aging reaction for GD is approximately 2 min, for GB it is 5 h, and for GA it is 13 h. Accordingly, administer pralidoxime IV as early as possible (ideally concurrently with atropine). Excreted rapidly and almost completely unchanged by the kidneys.

Administration over 30-40 min minimizes adverse effects (e.g., hypertension, headache, blurred vision, epigastric pain, nausea, vomiting).

**Tabun (GA)**

Tabun is a man-made chemical warfare agent classified as a nerve agent. Nerve agents are the most toxic and rapidly acting of the known chemical warfare agents. They are similar to pesticides (insect killers) called organophosphates in terms of how they work and what kinds of harmful effects they cause. However, nerve agents are much more potent than organophosphate pesticides. Tabun was originally developed as a pesticide in Germany in 1936. Tabun is also known as GA. Tabun is a clear, colorless, tasteless liquid with a faint fruity odor. Tabun can become a vapor if heated.

The extent of poisoning caused by tabun depends on the amount of tabun to which a person was exposed, how the person was exposed, and the length of time of the exposure. Symptoms will appear within a few seconds after exposure to the vapor form of tabun, and within a few minutes to up to 18 hours after exposure to the liquid form. All the nerve agents cause their toxic effects by preventing the proper operation of the chemical that acts as the body’s off switch for glands and muscles. Without an off switch, the glands and muscles are constantly being stimulated. They may tire and no longer be able to sustain breathing function. Compared with other nerve agents, tabun is more volatile
than VX but less volatile than sarin. The higher a chemical's volatility, the more likely it will evaporate from a liquid into a vapor and disperse into the environment. People can be exposed to the vapor even if they do not come in contact with the liquid form. Because of its high volatility, tabun is an immediate but short-lived threat and does not last a long time in the environment. Because tabun is more volatile than VX, it will remain on exposed surfaces for a shorter period of time compared with VX. Because tabun is less volatile than sarin, it will remain on exposed surfaces for a longer period of time compared with sarin.

**Immediate signs and symptoms of tabun exposure**

Although tabun has a faint fruity odor, the odor may not be noticeable enough to give people sufficient warning about a toxic exposure. People exposed to a low or moderate dose of tabun by inhalation, ingestion (swallowing), or skin absorption may experience some or all of the following symptoms within seconds to hours of exposure:

- Runny nose
- Watery eyes
- Small, pinpoint pupils
- Eye pain
- Blurred vision
- Drooling and excessive sweating
- Cough
- Chest tightness
- Rapid breathing
- Diarrhea
- Increased urination
- Confusion
- Drowsiness
- Weakness
- Headache
- Nausea, vomiting, and/or abdominal pain
- Slow or fast heart rate
- Abnormally low or high blood pressure

Even a tiny drop of nerve agent on the skin can cause sweating and muscle twitching where the agent touched the skin.

Exposure to a large dose of tabun by any route may result in these additional health effects:

- Loss of consciousness
- Convulsions
- Paralysis
• Respiratory failure possibly leading to death

Sarin (GB)

Sarin is a human-made chemical warfare agent classified as a nerve agent. Nerve agents are the most toxic and rapidly acting of the known chemical warfare agents. They are similar to certain kinds of pesticides (insect killers) called organophosphates in terms of how they work and what kind of harmful effects they cause. However, nerve agents are much more potent than organophosphate pesticides. Sarin originally was developed in 1938 in Germany as a pesticide. Sarin is a clear, colorless, and tasteless liquid that has no odor in its pure form. However, sarin can evaporate into a vapor (gas) and spread into the environment. Sarin is also known as GB.

The extent of poisoning caused by sarin depends on the amount of sarin to which a person was exposed, how the person was exposed, and the length of time of the exposure. Symptoms will appear within a few seconds after exposure to the vapor form of sarin and within a few minutes up to 18 hours after exposure to the liquid form. All the nerve agents cause their toxic effects by preventing the proper operation of the chemical that acts as the body's off switch for glands and muscles. Without an off switch, the glands and muscles are constantly being stimulated. They may tire and no longer be able to sustain breathing function. Sarin is the most volatile of the nerve agents, which means that it can easily and quickly evaporate from a liquid into a vapor and spread into the environment. People can be exposed to the vapor even if they do not come in contact with the liquid form of sarin. Because it evaporates so quickly, sarin presents an immediate but short-lived threat.

People may not know that they were exposed because sarin has no odor.

Immediate signs and symptoms of sarin exposure

People exposed to a low or moderate dose of sarin by breathing contaminated air, eating contaminated food, drinking contaminated water, or touching contaminated surfaces may experience some or all of the following symptoms within seconds to hours of exposure:
• Runny nose
• Watery eyes
• Small, pinpoint pupils
• Eye pain
• Blurred vision
• Drooling and excessive sweating
• Cough
• Chest tightness
• Rapid breathing
• Diarrhea
• Increased urination
• Confusion
• Drowsiness
• Weakness
• Headache
• Nausea, vomiting, and/or abdominal pain
• Slow or fast heart rate
• Low or high blood pressure

Even a small drop of sarin on the skin can cause sweating and muscle twitching where sarin touched the skin. Exposure to large doses of sarin by any route may result in the following harmful health effects:

• Loss of consciousness
• Convulsions
• Paralysis
• Respiratory failure possibly leading to death

**Soman (GD)**

Soman is a human-made chemical warfare agent classified as a nerve agent. Nerve agents are the most toxic and rapidly acting of the known chemical warfare agents. They are similar to pesticides (insect killers) called organophosphates in terms of how they work and the kinds of harmful effects they cause. However, nerve agents are much more potent than organophosphate pesticides. Soman was originally developed as an A chemical warhead for the Honest John rocket. It was designed to break apart and disperse the spherical bomblets of nerve agent. Photograph: Chemical and Biological Defense Command Historical Research and Response Team, Aberdeen Proving Ground, Md.

Source: http://sc-ems.com
insecticide in Germany in 1944. It is possible that soman or other nerve agents were used in chemical warfare during the Iran-Iraq War in the 1980s. Soman is also known as GD.

Soman is a clear, colorless, tasteless liquid with a slight camphor odor (for example, Vicks Vapo-Rub®) or rotting fruit odor. It can become a vapor if heated. Soman is not found naturally in the environment.

The extent of poisoning caused by soman depends on the amount of soman to which a person was exposed, how the person was exposed, and the length of time of the exposure. Symptoms will appear within a few seconds after exposure to the vapor form of soman, and within a few minutes to up to 18 hours after exposure to the liquid form. All the nerve agents cause their toxic effects by preventing the proper operation of the chemical that acts as the body’s off switch for glands and muscles. Without an off switch, the glands and muscles are constantly being stimulated. They may tire and no longer be able to sustain breathing function. Compared with other nerve agents, soman is more volatile than VX but less volatile than sarin. The higher a chemical's volatility, the more likely it will evaporate from a liquid into a vapor and disperse into the environment. People can be exposed to the vapor even if they do not come in contact with the liquid form. Because of its high volatility, soman is an immediate but short-lived threat and does not last a long time in the environment. Because soman is more volatile than the nerve agent VX (the most potent nerve agent), it will remain on exposed surfaces for a shorter period of time compared with VX.

**Immediate signs and symptoms of soman exposure**

Although soman has a camphor or fruity odor, the odor may not be noticeable enough to give people sufficient warning against a toxic exposure. People exposed to a low or moderate dose of soman by inhalation, ingestion (swallowing), or skin absorption may experience some or all of the following symptoms within seconds to hours of exposure:

- Runny nose
- Watery eyes
- Small, pinpoint pupils
- Eye pain
- Blurred vision
- Drooling and excessive sweating
- Cough
- Chest tightness
- Rapid breathing
- Diarrhea
- Increased urination
- Confusion
- Drowsiness
• Weakness
• Headache
• Nausea, vomiting, and/or abdominal pain
• Slow or fast heart rate
• Abnormally low or high blood pressure

Even a tiny drop of nerve agent on the skin can cause sweating and muscle twitching where the agent touched the skin.

Exposure to a large dose of soman by any route may result in these additional health effects:

• Loss of consciousness
• Convulsions
• Paralysis
• Respiratory failure possibly leading to death

**VX**

VX is a human-made chemical warfare agent classified as a nerve agent. Nerve agents are the most toxic and rapidly acting of the known chemical warfare agents. They are similar to pesticides (insect killers) called organophosphates in terms of how they work and what kinds of harmful effects they cause. However, nerve agents are much more potent than organophosphate pesticides. VX was originally developed in the United Kingdom in the early 1950s. VX is odorless and tasteless. VX is an oily liquid that is amber in color and very slow to evaporate. It evaporates about as slowly as motor oil.

It is possible that VX or other nerve agents were used in chemical warfare during the Iran-Iraq War in the 1980s. VX is not found naturally in the environment. The extent of poisoning caused by VX depends on the amount of VX to which a person was exposed, how the person was exposed, and the length of time of the exposure. Symptoms will appear within a few seconds after exposure to the vapor form of VX, and within a few minutes to up to 18 hours after exposure to the liquid form. VX is the most potent of all nerve agents. Compared with the nerve agent sarin (also known as GB), VX is considered to be much more toxic by entry through the skin and somewhat more toxic by inhalation. It is possible that any visible VX liquid contact on the
skin, unless washed off immediately, would be lethal. All the nerve agents cause their toxic effects by preventing the proper operation of the chemical that acts as the body’s off switch for glands and muscles. Without an off switch, the glands and muscles are constantly being stimulated. They may tire and no longer be able to sustain breathing function. VX is the least volatile of the nerve agents, which means that it is the slowest to evaporate from a liquid into a vapor. Therefore, VX is very persistent in the environment. Under average weather conditions, VX can last for days on objects that it has come in contact with. Under very cold conditions, VX can last for months. It is because of this slow evaporation that VX can be a long-term threat as well as a short-term threat. Surfaces contaminated with VX should therefore be considered a long-term hazard.

Immediate signs and symptoms of VX exposure

People exposed to a low or moderate dose of VX by inhalation, ingestion (swallowing), or skin absorption may experience some or all of the following symptoms within seconds to hours of exposure:

- Runny nose
- Watery eyes
- Small, pinpoint pupils
- Eye pain
- Blurred vision
- Drooling and excessive sweating
- Cough
- Chest tightness
- Rapid breathing
- Diarrhea
- Increased urination
- Confusion
- Drowsiness
- Weakness
- Headache
- Nausea, vomiting, and/or abdominal pain
- Slow or fast heart rate
- Abnormally low or high blood pressure

Even a tiny drop of nerve agent on the skin can cause sweating and muscle twitching where the agent touched the skin.

Exposure to a large dose of VX by any route may result in these additional health effects:

- Loss of consciousness
• Convulsions
• Paralysis
• Respiratory failure possibly leading to death

**Code and Chemical Names for the V-Series Agents**

<table>
<thead>
<tr>
<th>Code Name</th>
<th>Chemical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>VX</td>
<td>O-Ethyl-S-[2(diisopropylamino)ethyl] methylphosphonothioate</td>
</tr>
<tr>
<td>VE</td>
<td>O-Ethyl-S-[2-(diethylamino)ethyl] ethylphosphonothioate</td>
</tr>
<tr>
<td>VG</td>
<td>O,O-Diethyl-S-[2-(diethylamino)ethyl] phosphorothioate</td>
</tr>
<tr>
<td>VM</td>
<td>O-Ethyl-S-[2-(diethylamino)ethyl] methylphosphonothioate</td>
</tr>
<tr>
<td>V-gas</td>
<td>Russian equivalent of VX</td>
</tr>
</tbody>
</table>

**Prehospital Care for “V” Series Agent Exposure**

All but the mildest exposures have some degree of respiratory compromise. For this reason, oxygen should be readily available. Most of these symptoms result from bronchorrhea and bronchoconstriction and improve after administration of antidotes. In the severely poisoned patient, respiratory muscle paralysis adds to the problem. Intubation and mechanical ventilation are required for these patients.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>2 mg q5-10min prn</td>
<td>IV/IM/ETT</td>
<td>Excessive muscarinic symptoms</td>
<td>Relative - IV route in hypoxia has been associated with ventricular fibrillation</td>
</tr>
<tr>
<td>2-PAM CI (pralidoxime chloride, Protopam)</td>
<td>15-25 mg/kg over 20 min; can be repeated after 1 h</td>
<td>IV/IM</td>
<td>Symptomatic nerve agent poisoning</td>
<td>Rapid infusion may result in hypertension</td>
</tr>
<tr>
<td>Diazepam (Valium)</td>
<td>2-5 mg IV or 10 mg IM</td>
<td>IV/IM</td>
<td>Active seizures; administer as prophylaxis if moderate or severe signs of poisoning are present</td>
<td>None</td>
</tr>
</tbody>
</table>
### Summary of Treatment Modalities According to Severity of Exposure*

<table>
<thead>
<tr>
<th>Severity/Route of Exposure</th>
<th>Atropine</th>
<th>2-PAM CI</th>
<th>Diazepam</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Decontamination and 18-h observation for liquid exposures</td>
</tr>
<tr>
<td>Mild</td>
<td>2 mg for severe rhinorrhea or dyspnea; may repeat prn</td>
<td>Administer if patient has nonimproving dyspnea or GI symptoms</td>
<td>No</td>
<td>Decontamination and 18-h observation for liquid exposures; oxygen</td>
</tr>
<tr>
<td>Moderate</td>
<td>6 mg; may require repeat doses</td>
<td>Administer with atropine</td>
<td>Administer even in absence of seizures</td>
<td>Decontamination, oxygen</td>
</tr>
<tr>
<td>Severe</td>
<td>Start with 6 mg; may need to repeat</td>
<td>Administer with atropine; should repeat once or twice</td>
<td>Administer even in absence of seizures</td>
<td>ABCs, decontamination</td>
</tr>
</tbody>
</table>

### Methyl Parathion

Methyl parathion is an insecticide that does not occur naturally in the environment. Pure methyl parathion exists as white crystals. Impure methyl parathion is a brownish liquid that smells like rotten eggs.

Methyl parathion is used to kill insects on farm crops, especially cotton. The EPA now restricts how methyl parathion can be used and applied; only trained people are allowed to spray it. Methyl parathion can no longer be used on food crops commonly consumed by children.

Methyl parathion enters the environment primarily through spraying on farm crops. It breaks down quickly to other chemical compounds by interacting with water, bacteria in the water, and sunlight. There is little threat that methyl parathion will move from soil to ground water because it sticks to the soil. Methyl parathion does not appear to accumulate in fish or plants.

![Source: www.ipmthailand.org](www.ipmthailand.org)
Most people are not exposed to methyl parathion in the air they breathe or on things they touch, unless they live next to areas being sprayed. Farm workers, chemical sprayers, and people who work in factories that make methyl parathion are most likely to be exposed. People who live near farms where methyl parathion is used or near landfills where methyl parathion has been dumped may be exposed. Individuals may also be exposed by going into fields too soon after spraying.

Methyl parathion interferes with the normal way that the nerves and brain function. Exposure to very high levels of methyl parathion for a short period in air or water may cause death, loss of consciousness, dizziness, confusion, headaches, difficult breathing, chest tightness, wheezing, vomiting, diarrhea, cramps, tremors, blurred vision, and sweating. Changes in mental state may last several months after exposure to high levels of methyl parathion has ended. If people are exposed to levels of methyl parathion below those that affect nerve function, few or no health problems seem to occur. A reduced ability to fight infections has also been seen in some animal studies; we do not know if this would also occur in humans.

Sevin

Sevin is used primarily as an insecticide. The generic name for this insecticide is 1-napthyl N-methylcarbamate and is commonly called carbaryl with the trade name of Sevin. It has been in production since 1958 when it was first manufactured for the agricultural industry. The chemical composition put it in the carbamates family with the other nerve agents Sarin, Soman, VX and Methyl Parathion.

Sevin is a crystalline solid that is white in color. It essentially has no odor and melts at 142 degrees C. The vapor pressure for sevin is <0.005 mm H9 at 26 C. The flashpoint of sevin is 380 degrees F.

Toxicological Characteristics for this pesticide nerve agent are as follows:

- Acute Oral LD50: 225 mg/kg, Toxicity Category II
- Acute Dermal LD50: > 2 g/kg, Toxicity Category III
- Primary Dermal Irritation: no irritation, Toxicity Category IV
- Primary Eye Irritation: Conjunctival irritation at 24 hours Cleared at 48 hours. Toxicity Category III
- Acute Inhalation LC50: data gap
Mechanism of pesticidal action: A contact insecticide which causes reversible carbamylation of the acetylcholinesterase enzyme of tissues, allowing accumulation of acetylcholine at cholinergic neuroeffector junctions (muscarinic effects), and at skeletal muscle myoneural junctions and autonomic ganglia. Poisoning also impairs the central nervous system function.

Metabolism and persistence in plants and animals: Carbaryl is rapidly excreted in animals, mainly in the urine. Residues in animals are carbaryl, 1-naphthol, and hydroxycarbaryl. The hydroxy metabolites are found mainly as glucuronide and sulfate conjugates. Carbaryl is slowly taken up into plants, after which it is metabolized. The disappearance of carbaryl residue from plant surfaces is attributed to mechanical attribution, volatilization and uptake into plant. Photochemical degradation does not appear to be a factor. 1-naphthol is the major metabolite.

**Pulmonary (Choking) Agents**

**Listing of Choking Agents**
- Ammonia
- Bromine (CA)
- Chlorine (CL)
- Hydrogen chloride
- Osmium Tetroxide
- Phosgene
- Diphosgene (DP)
- Phosgene (CG)
- Phosphine
- Phosphorus, elemental, white or yellow

**Phosgene (CG)**

Phosgene is a major industrial chemical used to make plastics and pesticides. At room temperature (70°F), phosgene is a poisonous gas. With cooling and pressure, phosgene gas can be converted into a liquid so that it can be shipped and stored. When liquid phosgene is released, it quickly turns into a gas that stays close to the ground and spreads rapidly. Phosgene gas may appear colorless or as a white to pale yellow cloud. At low concentrations, it has a pleasant odor of newly mown hay or green corn, but its odor may not be noticed by all people exposed. At high concentrations, the odor may be strong and unpleasant. Phosgene itself is nonflammable (not easily ignited and burned), but it can cause flammable substances around it to burn. Phosgene is also known by its military designation, CG.
Phosgene was used extensively during World War I as a choking (pulmonary) agent. Among the chemicals used in the war, phosgene was responsible for the large majority of deaths. Phosgene is not found naturally in the environment. Phosgene is used in industry to produce many other chemicals such as pesticides. Phosgene can be formed when certain compounds are exposed to heat, such as some types of plastics. Phosgene gas is heavier than air, so it would be more likely found in low-lying areas.

Risk for exposure depends on how close they are to the place where the phosgene was released. If phosgene gas is released into the air, people may be exposed through skin contact or eye contact. They may also be exposed by breathing air that contains phosgene. If phosgene liquid is released into water, people may be exposed by touching or drinking water that contains phosgene. If phosgene liquid comes into contact with food, people may be exposed by eating the contaminated food.

Poisoning caused by phosgene depends on the amount of phosgene to which a person is exposed, the route of exposure, and the length of time that a person is exposed. Phosgene gas and liquid are irritants that can damage the skin, eyes, nose, throat, and lungs.

Immediate signs and symptoms of phosgene exposure

- Coughing
- Burning sensation in the throat and eyes
- Watery eyes
- Blurred vision
- Difficulty breathing or shortness of breath
- Nausea and vomiting
- Skin contact can result in lesions similar to those from frostbite or burns
- Following exposure to high concentrations of phosgene, a person may develop fluid in the lungs (pulmonary edema) within 2 to 6 hours

Exposure to phosgene may cause delayed effects that may not be apparent for up to 48 hours after exposure, even if the person feels better or appears well following removal from exposure. Therefore, people who have been exposed to phosgene should be monitored for 48 hours afterward. Delayed effects that can appear for up to 48 hours include the following:

- Difficulty breathing
- Coughing up white to pink-tinged fluid (a sign of pulmonary edema)
- Low blood pressure
- Heart failure
What the long-term health effects are

Most people who recover after an exposure to phosgene make a complete recovery. However, chronic bronchitis and emphysema have been reported as a result of phosgene exposure.

Prevention

Leave the area where the phosgene was released and get to fresh air. Quickly moving to an area where fresh air is available is highly effective in reducing the possibility of death from exposure to phosgene.

- If the phosgene release was outdoors, move away from the area where the phosgene was released. Go to the highest ground possible, because phosgene is heavier than air and will sink to low-lying areas.

- If the phosgene release was indoors, get out of the building.

If you think you may have been exposed, remove your clothing, rapidly wash your entire body with soap and water, and get medical care as quickly as possible.

Removing and disposing of clothing:

- Quickly take off clothing that has liquid phosgene on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head. If possible, seal the clothing in a plastic bag. Then seal the first plastic bag in a second plastic bag. Removing and sealing the clothing in this way will help protect you and other people from any chemicals that might be on your clothes.

- If you placed your clothes in plastic bags, inform either the local or state health department or emergency personnel upon their arrival. Do not handle the plastic bags.

- If you are helping other people remove their clothing, try to avoid touching any contaminated areas, and remove the clothing as quickly as possible.

Washing the body:

- As quickly as possible, wash your entire body with large amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.

- If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and place them in the bags with the contaminated clothing. Do not put the contacts
back in your eyes. If you wear eyeglasses, wash them with soap and water. You can put the eyeglasses back on after you wash them.

* If you have ingested (swallowed) phosgene, do not induce vomiting or drink fluids. Seek medical attention right away. Dial 911 and explain what has happened.

Treatment for phosgene exposure consists of removing phosgene from the body as soon as possible and providing supportive medical care in a hospital setting. **No antidote exists for phosgene. Exposed people should be observed for up to 48 hours, because it may take that long for symptoms to develop or reoccur.**

**Diphosgene (DP)**

Diphosgene (DP, trichloromethylchloroformate) was a product of the chemical weapons race in World War I. It belongs to a class of chemicals termed lung-damaging agents or choking agents. These agents attack lung tissue directly, causing pulmonary edema. The mechanism of action is not well understood, but the chemical is believed to react directly upon the alveolar and capillary walls, resulting in pulmonary edema. The Germans staged the first major successful chemical attack of the war using chlorine. Chlorine then was replaced by phosgene, which caused greater casualties. Gas masks of the era were designed to filter out phosgene. DP was created by combining phosgene with chloroform, which destroyed the gas filters. Blistering and nerve agents largely have replaced the pulmonary agents chlorine, phosgene, and DP.

In the field, DP rapidly vaporizes and breaks down into phosgene and chloroform. It is a colorless gas under standard temperatures and pressures. Clinically, DP behaves in essentially the same manner as phosgene. The chloroform does not reach levels sufficient to cause toxicity, even of the liver, during tactical employment. DP is heavier than air and remains in low-lying areas for longer periods. Doses are cumulative, since DP is not detoxified in the body.

DP deployment almost surely indicates a purposeful, not an accidental, event. Industrial accidents have occurred with both chlorine and phosgene but not with DP, which is not a normal product of manufacturing processes. It also is relatively unstable and degrades easily into phosgene and chloroform. DP must be transported in glass (instead of metal) containers. No automatic detectors are available for use in the field.

Pathophysiology: Like phosgene, the principal feature of DP is delayed pulmonary edema. Although the mechanism is not entirely clear, edema may be caused by direct alveolar damage when DP breaks down into hydrochloric acid and carbon dioxide in the presence of water. DP also causes irritation of the
upper respiratory tract and rarely can cause airway obstruction. Respiratory effects occur at doses of 1-10 ppm. Doses greater than 25 ppm can be rapidly fatal. Toxicity varies with both the concentration of vapor and the length of exposure. Because of DP's low water solubility, patients often inhale significant amounts of vapor before symptoms appear.

**Albuterol 0.5% (Proventil, Ventolin)** -- Used to relieve bronchospasm after DP exposure. Beta-agonist for bronchospasm refractory to epinephrine. Relaxes bronchial smooth muscle by action on beta2-receptors with little effect on cardiac muscle contractility.

**Incapacitating Agents**

**BZ**

Background: The chemical warfare agent 3-quinuclidinyl benzilate (QNB, BZ) is an anticholinergic agent that affects both the peripheral and central nervous systems (CNS). It is one of the most potent anticholinergic psychomimetics known, with only small doses necessary to produce incapacitation. It is classified as a hallucinogenic chemical warfare agent. QNB usually is disseminated as an aerosol, and the primary route of absorption is through the respiratory system. Absorption also can occur through the skin or gastrointestinal tract. It is odorless. QNB's pharmacologic activity is similar to other anticholinergic drugs (e.g., atropine) but with a much longer duration of action.

Pathophysiology: QNB acts by competitively inhibiting muscarinic receptors. Muscarinic receptors primarily are associated with the parasympathetic nervous system, which innervates numerous organ systems, including the eye, heart, respiratory system, skin, gastrointestinal tract, and bladder. Sweat glands, innervated by the sympathetic nervous system, also are modulated by muscarinic receptors. The IC₅₀ (concentration in air of QNB necessary to incapacitate 50% of exposed and
unprotected individuals through inhalation during a set time) has been reported to be 100 mg·min/m³. Effects of QNB by any route of exposure are slow in onset and long in duration. The onset of action is approximately 1 hour, with peak effects occurring 8 hours postexposure. Symptoms gradually subside over 2-4 days. Most of the QNB that enters the body is excreted by the kidneys, making urine the choice for detection.

In the US: Use of QNB against the United States has never been reported. Currently, the US government is funding numerous programs to prepare the nation for potential chemical terrorist attacks against citizens and the military.

Internationally: Use of QNB has been suggested in a number of international conflicts. In January 1992, soldiers in Mozambique experienced an explosion above their troop formation. Subsequent symptoms resembled those expected from QNB. In July 1995, approximately 15,000 people attempted to walk from the enclave of Srebrenica to the free territory in Bosnia. Many experienced hallucinations during their march that were suspected to be secondary to QNB.

**Riot Control Agents**

**List of Riot Agents**

Riot control agents are not intended to cause significant injury or fatality.

- Chloracetephenone (CN)
- Bromobenzylcyanide (CA)
- and Dibenzoxapine (CR)

Riot control agents cause tearing, intense eye pain, and irritation of the skin. The effects are immediate, and do not necessitate treatment because the symptoms relieve themselves. These agents are irritants that have a short duration of action. Riot control agents render individuals incapable of effective concerted actions. If Riot control agents were used in a terrorism attack, the route of exposure would most likely be through inhalation or direct skin contact.

Other such irritants are:

- Chloracetephenone (CN)
- Bromobenzylcyanide (CA)
- Dibenzoxapine (CR)
- O-Chlorobenzalidene Malonitrile (CS)

After skin or vapor exposure, to the riot control agents, the effects are seen immediately and recede in 10 to 30 minutes. Fresh air expedites the process. CN is more toxic than others, but is still in use by police in some countries. Deployed, CN appears as a white smoke smells like apple blossom. The severest of these
symptoms is reached in a few minutes and then gradually decreases. After about 1 or 2 hours all symptoms disappear. CA is an older lachrymator, which is very toxic for use as riot control agent, and therefore is considered obsolete. CS is the most commonly used irritant for riot control purposes. CR is a newer riot control agent, which is minimally known.

Main Classification of riot control agents are as Irritants. Riot control agents (sometimes referred to as tear gas.) are chemical compounds that temporarily make people unable to function by causing irritation to the eyes, mouth, throat, lungs, and skin. Several different compounds are considered to be riot control agents. The most common compounds are known as chloroacetophenone (CN) and chlorobenzylidene malononitrile (CS). Other examples include chloropicrin (PS), which is also used as a fumigant (that is, a substance that uses fumes to disinfect an area); bromobenzylcyanide (CA); dibenzoaxazepine (CR); and combinations of various agents.

In general, only decontamination with water is necessary when a patient's skin has become grossly exposed. Bronchodilators, analgesics, and pulmonary support may be needed depending upon severity of injury.

Albuterol 0.5% (Proventil, Ventolin) -- Beta-agonist for bronchospasm refractory to epinephrine. Relaxes bronchial smooth muscle by action on beta 2-receptors with little effect on cardiac muscle contractility.

Bromobenzylcyanide (CA)

Bromobenzene cyanide (CA) were developed before World War I. Both largely have been replaced, as they were too lethal for their intended effects but not lethal enough to compete with the more effective blistering and nerve agents.

Chloroacetophenone (CN)

Early records reveal that German scientists discovered CN about 1870. This is a chemical compound that was first prepared for use in 1877 but was not subsequently used to any great extent. The French were the first to use it successfully in the late 1920s to break up civil disorders in their colonies. It was then adopted practically all over the world for use by law enforcement agencies around 1930. During World War II (1941-45) CN was further
developed and it was discovered that micro-pulverized CN (talc-sized particles) produced a longer lasting and greater irritation effect.

In 1923, the United States Government financed the development of chemical agents at Edgewood Arsenal. A great deal of time and expense went into the research of non-lethal irritants that could be successfully used in law enforcement. CN was successfully developed in a form very similar to what we have today in canisters. CN is the active ingredient of Chemical Mace, an aerosol irritant acquired by many U.S. police agencies around 1965.

CN in its pure form is a white crystalline solid resembling ordinary granulated sugar or salt. Since it is made of solid particles, it must be carried through the air by an agent or expelled in a fine dust. CN has an odor similar to apple blossoms.

CN causes tearing and irritation of the eyes, and a burning sensation on the skin. The primary effects of CN on the eyes is lachrymation (tearing) and photophobia (sensitivity to light).

There are certain subjects on which CN will have little effect. CN has little or no effect on animals. Tests reveal that if a dog is tied up where he cannot move freely, he will make very little attempt to get away from CN when it is present or sprayed on him. Any individual who is under the influence of narcotics or alcohol to the extent that he has lost his sense of feeling will not be affected by CN.

Facts about CN:

- LC50: 10,000 mg min/m3
- ICt50: 20 mg min/m3
- Takes effect in 5 to 10 seconds
- No effect on animals
- Recovery within 10 minutes
- Side or after effects: Has caused documented second degree burn and acute "vesicular dermatitis"
- Has caused poisoning and documented incidents of death
- Decontamination: Soda Ash or Alcoholic Caustic Soda
- Shelf-life 3 years. Depends on humidity and packaging
- CN is a Co-carcinogen (cancer promoting)
Chlorobenzylidenemalononitrile (CS)

CS is the code name for orthochlorobenzylidene malononitrile. On account of its stronger irritant effects and its lower toxicity it has superseded CN. It is a white crystalline solid substance. Volubility is very poor in water, moderate in alcohol and good in acetone, chloroform, methylene dichloride, ethylacetate and benzene. CS is unstable in aqueous solution. If enough CS can be dissolved in water (e.g., by adding propylene glycol or other organic co-solvent) spraying fluids with an irritant action of short duration result. Although the smoke is non-persistent, CS may stick to rough surfaces (e.g., clothes) from which it is released only slowly. At least 1 hour of aeration is necessary to cleanse such materials from CS after exposure. CS is usually dispersed as an aerosol generated pyrotechnically, or by spraying a solution of CS in a suitable solvent.

Chloropicrin (PS)

PS was used in large quantities during World War I; it was stockpiled during World War II and is no longer authorized for military use. PS is more toxic than chlorine but less toxic than phosgene (CG). Overexposure Effects Chloropicrin is a powerful irritant whose vapors cause lung, skin, eye, nose and throat irritation, coughing and vomiting. As an eye irritant, it produces immediate burning, pain and tearing. In high concentration, PS damages the lungs, causing pulmonary edema. Exposure to liquid PS can cause severe burns on the skin that generally result in blisters and lesions. The lowest irritant concentration is 9 mg-min/m for 10 minutes, and the median lethal concentration is 2,000 mg-3 min/m .

Dibenzoxazepine (CR)

CR is similar in its effects to CS, but the minimum effective concentration is lower and the LCt50 is higher. Symptomatology and treatment are similar to those of CS.

It is a pale yellow crystalline solid which melts at 163° F (73° C) and is stable in organic solutions. It has limited volubility in water and is not hydrolyses in aqueous solutions. It has a pepper-like odor. The agent is currently used only in solution for dissemination in liquid dispensers. The solution in the dispensers contains 0.1% CR in 80 parts propylene glycol and 20 parts water. In organic
solutions, CR is an eye irritant at concentrations down to 0.0025% or even lower. CR differs from CS in being less toxic when inhaled but CR skin effects are more pronounced.

Riot control agents (irritants) are liquids or solids (for example, powder), riot control agents such as CN and CS could be released in the air as fine droplets or particles. If agents are released into the air, people could be exposed to them through skin contact, eye contact, or breathing.

The extent of poisoning caused by riot control agents depends on the amount of riot control agent to which a person was exposed, the location of exposure (indoors versus outdoors), how the person was exposed, and the length of time of the exposure. Riot control agents work by causing irritation to the area of contact (for example, eyes, skin, nose) within seconds of exposure. The effects of exposure to a riot control agent are usually short-lived (15–30 minutes) after the person has been removed from the source and decontaminated (cleaned off).

**Immediate signs and symptoms of exposure to a riot control agent**

People exposed to riot control agents may experience some or all of the following symptoms immediately after exposure:

- Eyes: excessive tearing, burning, blurred vision, redness
- Nose: runny nose, burning, swelling
- Mouth: burning, irritation, difficulty swallowing, drooling
- Lungs: chest tightness, coughing, choking sensation, noisy breathing (wheezing), shortness of breath
- Skin: burns, rash
- Other: nausea and vomiting

Long-lasting exposure or exposure to a large dose of riot control agent, especially in a closed setting, may cause severe effects such as the following:

- Blindness
- Glaucoma (a serious eye condition that can lead to blindness)
- Immediate death due to severe chemical burns to the throat and lungs
- Respiratory failure possibly resulting in death

**Long-term health effects of exposure to riot control agents**

Prolonged exposure, especially in an enclosed area, may lead to long-term effects such as eye problems including scarring, glaucoma, and cataracts, and may possibly cause breathing problems such as asthma. If symptoms go away soon after a person is removed from exposure to riot control agents, long-term health effects are unlikely to occur.
Protective Actions

Since inhalation is likely to be the primary route of exposure, leave the area where the riot control agents were released and get to fresh air. Quickly moving to an area where fresh air is available is highly effective in reducing exposure to riot control agents.

- If the riot control agents were released outdoors, move away from the area where the agents were released. Avoid dense, low-lying clouds of riot control agent vapor.

- Go to the highest ground possible, because riot control agents will form a dense vapor cloud that can travel close to the ground.

- If the release of riot control agents was indoors, get out of the building.

If you think you may have been exposed to riot control agent, you should remove your clothing, rapidly wash your entire body with soap and water, and get medical care as quickly as possible.

Removing your clothing:

- Quickly take off clothing that may have riot control agent on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head.

- If you are helping other people remove their clothing, try to avoid touching any contaminated areas, and remove the clothing as quickly as possible.

Washing yourself:

- As quickly as possible, wash any riot control agent from your skin with large amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.

- If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and put them with the contaminated clothing. Do not put the contacts back in your eyes (even if they are not disposable contacts). If you wear eyeglasses, wash them with soap and water. You can put your eyeglasses back on after you wash them. If you are wearing jewelry that you can wash with soap and water, you can wash it and put it back on. If it cannot be washed, it should be put with the contaminated clothing.
Disposing of your clothes:

- After you have washed yourself, place your clothing inside a plastic bag. Avoid touching contaminated areas of the clothing. If you can't avoid touching contaminated areas, or you aren't sure where the contaminated areas are, wear rubber gloves, turn the bag inside out and use it to pick up the clothes (inverting the bag over the clothes when you have all the clothes picked up), or put the clothes in the bag using tongs, tool handles, sticks, or similar objects. Anything that touches the contaminated clothing should also be placed in the bag. If you wear contacts, put them in the plastic bag, too.

- Seal the bag, and then seal that bag inside another plastic bag. Disposing of your clothing in this way will help protect you and other people from any chemicals that might be on your clothes.

- When the local or state health department or emergency personnel arrive, tell them what you did with your clothes. The health department or emergency personnel will arrange for further disposal. Do not handle the plastic bags yourself.

**Stockpiles of Chemicals in the United States**

![Map of Chemical Stockpiles in the United States](image)

- Chemical Weapons Stockpile
  - Umatilla Chemical Depot
    - VX and sarin nerve agents, Mustard blister agent
    - 3,717 tons (13%)
  - Newport Chemical Depot
    - VX nerve agent
    - 1,269 tons (4%)
  - Edgewood Chemical Agent Storage Yard
    - VX and sarin nerve agents, Mustard blister agent
    - 1,623 tons (6%)
  - Blue Grass
    - VX and sarin nerve agents, Mustard and lewisite blister agents
    - 523 tons (2%)
  - Pueblo Chemical Depot
    - Mustard blister agent
    - 2,611 tons (9%)
  - Pine Bluff Arsenal
    - VX and sarin nerve agents
    - 523 tons (13%)
  - Anniston Army Depot
    - VX and sarin nerve agents, Mustard blister agent
    - 2,254 tons (8%)

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Holly Deyo, 2001
## CHEMICAL WARFARE AGENTS CHART

### CHEMICAL TERRORISM AGENTS AND SYNDROMES: Watch for these signs and symptoms

<table>
<thead>
<tr>
<th>Agents</th>
<th>Signs</th>
<th>Symptoms</th>
<th>Onset</th>
<th>Clinical Diagnostic Tests</th>
<th>Exposure Route and Treatment</th>
<th>Differential diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve Agents:</td>
<td>Sarin (GB), Tabun (GA), Soman (GD), Cyclosarin (Sarin (GF)), VX, Novichok agents, other organophosphorus compounds, and pesticides</td>
<td></td>
<td></td>
<td></td>
<td>Inhalation and dermal absorption</td>
<td>Poisoning from organophosphates and carbamate pesticides may occur as a result of occupational exposure</td>
</tr>
<tr>
<td>Cyanides:</td>
<td>Hydrogen cyanide (HCN), cyanogen chloride</td>
<td>Moderate exposure: Metabolic acidosis, venous blood O2 level above normal, hypotension, &quot;pig&quot; skin color</td>
<td></td>
<td></td>
<td>Inhalation, ingestion and dermal absorption</td>
<td>Cyanide poisoning</td>
</tr>
<tr>
<td>Vesicants/Blister Agents</td>
<td>Sulfur mustard, lewisite, nitrogen mustard, mustard lewisite, phosgene-oarsine</td>
<td>Skin erythema and blistering, watery, scalded eyes, upper airways sloughing with pulmonary edema, metabolic failure, neutropenia and sepsis (esp. sulfur mustard, later in course)</td>
<td></td>
<td></td>
<td>Inhalation and dermal absorption</td>
<td>Similar CNS illness can result from: industrial/occupational exposure to HCN and derivatives; carbon monoxide (CO) exposure from incomplete combustion of natural gas or petroleum fuels (e.g., fumes in enclosed areas); hydrogen sulfide (H2S) exposure from sewers, animal waste, industrial sources; Poisoning from nerve agents</td>
</tr>
<tr>
<td>Pulmonary/</td>
<td>Phosgene, chlorine, dichlorine, chloropicrin, oxides of nitrogen, sulfur oxides,</td>
<td>Pulmonary edema with some mucosal irritation (greater water solubility of agent = greater mucosal irritation) leading to ARDS or non-cardiogenic pulmonary edema</td>
<td></td>
<td></td>
<td>Inhalation</td>
<td>Diffuse skin exposure with irritants, such as caustics, sodium hydrosulfate, ammonia, etc., may cause similar syndromes. Sodium hydrosulfate (NaSH) from trucking accidents</td>
</tr>
<tr>
<td>Ricin (castor bean oil extract)</td>
<td>Clusters of acute lung or GI injury; circulatory collapse and shock, tractocholecithis, pulmonary edema, necrotizing pneumonia</td>
<td>Shortness of breath, wheezing, laryngeal spasm, mucosal and dermal irritation and redness</td>
<td></td>
<td></td>
<td>mieszkańców</td>
<td>Mucosal irritation, airway reactions, and deep lung effects depend on the specific agent, especially water solubility</td>
</tr>
<tr>
<td>1-2 myotoxins:</td>
<td>Fusarium, Mycotoxins, Trichoderma, Verticillium, Stachybotrys</td>
<td>Dermal and mucosal irritation, blistering, necrosis, blurred vision, eye irritation, tearing</td>
<td></td>
<td></td>
<td>Inhalation and dermal contact</td>
<td>Tularemia, plague, and Q fever may cause similar syndromes, as may biological weapons and chemical weapon agents such as Staphylococcal enterotoxin B and phosgene</td>
</tr>
</tbody>
</table>

**REFERENCES:**
- Chemical Weapons Identification and Non-Detection
- Chemical Warfare Agents
- Biological Warfare: A Threat to Public Health
- Emergency Management of Chemical Casualties
- Chemical and Biological Threats: Military Strategies and Countermeasures
- Chemical Terrorism: A Threat to National Security
- Chemical Warfare and Terrorism: A Comprehensive Guide

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**NOTES:**
- Always consult with a qualified professional for accurate and up-to-date information.
- The information provided is for educational purposes only and should not be used as a substitute for professional medical advice.
- The list of symptoms, signs, and treatments is not exhaustive and may vary depending on the specific agent and exposure.

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### Characteristics and Effects of Chemical Agents

<table>
<thead>
<tr>
<th>Chemical Agent Name</th>
<th>Agent Type</th>
<th>Physical Properties</th>
<th>Physiological Effects</th>
<th>Relative Rate of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
<td>Choking</td>
<td>Pungent odor, greenish-yellow, heavier than air gas.</td>
<td>Corrosive to eyes, skin and respiratory tract. Burning sensation followed by coughing, headache, labored breathing and nausea. Pulmonary edema.</td>
<td>Immediate irritation in high concentrations. Symptoms of lung edema may take several hours to appear.</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>Blood</td>
<td>Almond odor, highly volatile gas.</td>
<td>If high concentration—violent convulsions after 20–30 seconds, breathing stops in one minute; cardiac failure occurs within a few minutes.</td>
<td>Very rapid; incapacitation within minutes and death within 15 minutes.</td>
</tr>
<tr>
<td>Lewisite</td>
<td>Blister</td>
<td>Colorless, oily liquid with little odor in its pure state. Amber to geranium-like odor with amber to dark-brown color in less pure form.</td>
<td>Stinging pain followed by blistering. It is also a systemic poison causing pulmonary edema, diarrhea, hypotension and restlessness.</td>
<td>Initial pain in 10–20 seconds; blistering within 12 hours.</td>
</tr>
<tr>
<td>Mustard</td>
<td>Blister</td>
<td>Possible garlic odor, medium volatility, oily liquid.</td>
<td>Blisters or irritation to skin, eyes and lungs.</td>
<td>Delayed onset (4–6 hours).</td>
</tr>
<tr>
<td>Phosgene</td>
<td>Choking</td>
<td>Fresh cut hay odor, heavy gas.</td>
<td>Coughing and choking, followed by chest tightness, nausea, tearing, vomiting and headaches. Death due to fluid accumulation in the lungs.</td>
<td>Immediate irritation in high concentrations, and delayed reaction (several hours) in low concentrations.</td>
</tr>
<tr>
<td>Sarin</td>
<td>Nerve</td>
<td>Colorless/odorless, volatile liquid.</td>
<td>Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions and eventually death.</td>
<td>Rapid (within minutes).</td>
</tr>
<tr>
<td>Tabun</td>
<td>Nerve</td>
<td>Clear, odorless, tasteless liquid with a slight fruity odor.</td>
<td>Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions and eventually death.</td>
<td>Rapid (within minutes).</td>
</tr>
<tr>
<td>VX</td>
<td>Nerve</td>
<td>Colorless/odorless, low volatility, oily liquid.</td>
<td>Difficulty breathing, miosis, blurred vision, headache and nausea leading to respiratory distress, convulsions and eventually death.</td>
<td>Relatively rapid (within 30 minutes).</td>
</tr>
</tbody>
</table>

*—Depending on the concentration.  
|—Contraction of the pupils.
Chemical Agent Decontamination

Nuerotoxins (Nerve agents). The use of a mask and protective equipment should be used while decontaminating nerve agents. Early decontamination is vital. Household bleach works best to deactivate nerve agents. Water can decontaminate nerve agents, but if the nerve agent has been mixed with thickening substances it works more slowly. The addition of alkaline soap can expedite the process. Once decontaminated, there is no further risk of contamination.

Asphyxiants (Blood agents). For asphyxiants a mild bleach solution is suggested for the decontamination of liquid or solid chemical exposure. Decontamination should not be necessary for cyanogen chloride or hydrogen cyanide.

Pulmonary Agents (Choking agents). Decontamination for choking agents is usually not necessary because they are gases and will disperse into the environment. If skin exposure is significant, wash with a mild soap and water. Clothing removal for patient transport, such as a closed ambulance, is recommended.

Vesicants (Blister agents). For blister agents, decontamination must occur immediately. The agent should be blotted off, not wiped off so the agent will not be spread furthering contamination. Mustards should not be decontaminated with water, except for the eyes, as it will spread the agent. Eyes and mucous membranes should be flushed with water, saline, or isotonic sodium bicarbonate. For phosgene oxide, alkalis are effective for chemical inactivation. Chlorination solution may also be used to inactivate mustard and lewisite, but is less effective for HN3, and is ineffective for phosgene oxime. For phosgene oxime, chemical inactivation by using alkalis, such as Fuller's earth, can be used.

Antipersonnel Agents (Riot control agents). Decontamination for riot control agents can be performed by removing clothing and washing exposed areas thoroughly with soap and water. Irrigation of the eyes is not necessary but may help with pain relief.
Treatment Chemical Agent Exposure

Neurotoxins (Nerve agents). Removal of the victim from the environment and decontamination should occur first. Support ventilation and providing an open airway are the first steps in treatment of nerve agent patients. High flow oxygen should be administered to avoid an abnormal cardiac rhythm. Atropine, preferably through IV administration and pralidoxime chloride may be given when advanced treatment is warranted. Valium may be considered for the treatment of seizures and muscle twitches. Diazepam, an anticonvulsant may also be provided.

Asphyxiants (Blood agents). Removal of the victim from the environment and decontamination should occur first. Treatment for asphyxiants is based primarily on providing rest, oxygen, and assisted ventilation and drugs that bind with cyanide. Inhaled Amyl nitrite, intravenous sodium nitrite, and intravenous sodium thiosulfate, may be used for the treatment of asphyxiants.

Pulmonary Agents (Choking agents). Removal of the victim from the environment and decontamination should occur first. The first step in treatment is to open the airway, if it is not already open. Second, treatment should focus on reducing the fluid in the alveoli. Providing oxygen to the alveoli is vital. Bronchodilators, such as alupent and albuterol, given in an updraft will provide some dilation of the airways. Further dilation of airways may be accomplished by brethine or epinephrine subcutaneously. For lower airway injury that results in pulmonary edema positive pressure ventilations using a positive end expiratory pressure (PEEP) valve may be indicated. Corticosteroids given intravenously may be particularly helpful for the treatment of phosgene.

Vesicants (Blister agents). The victim should be decontaminated first. Treatment for impure and distilled sulfur mustard can be provided through phenargen for vomiting, itching, and edema. Local dressings and antibiotics can be used for the affected skin areas. Analgesics, cycloplegics, and antibiotics can be used to treat the eyes. IV fluids may also be helpful for treatment as well as antibiotics for respiratory infections. Treatment for phosgene oxime consists of sodium bicarbonate dressings, systemic analgesics, and standard necrotic skin lesion treatment. British anti-lewisite (BAL), in oil IM for systemic chelation and in ointment form for the eyes and skin can be given to treat lewisite.

Antipersonnel Agents (Riot control agents). There is no treatment for these agents and they usually do not cause enough injury to need medical care, with symptoms naturally subsiding within 30 minutes of exposure. Medical care that can be provided is focused on pain relief of the
symptoms. Fresh air may help to expedite the disappearance of symptoms. For eye irritation, analgesic nose and eye drops may be used Module 2.

**Process of Chemical Weapon Manufacture**

The life cycle of the chemical agent is identified as obtaining precursors, making final product, testing the product and delivering the agent to the target. If a suspect has committed to the testing phase by having animals for testing it is **VERY LIKELY** the agent will be used against a target.

**Chemical Precursors**

Each of the chemical agents can be derived by the combination of precursor chemicals.

**Final Chemical Product**

The proper combination of precursor chemicals will yield the final chemical agent.

**Animal Testing**

After the final product has been made then a test will need to be completed to verify the quality of the chemical made.

**Use on People**

After the tests have been successfully completed it will most likely be delivered to the target recipient.
1) What are the two main types of chemicals can be used as WMD.
   a. Cosmetic, Garden
   b. Industrial, Botanical
   c. Superflorides, Subcutaneous
   d. Industrial Chemicals, Weaponized Chemical Agents

2) Blood agents are absorbed into the body commonly through the action of:
   a. Bleeding
   b. Injection
   c. Breathing
   d. Vectors

3) Onset of blood agents is immediate.
   a. True
   b. False

4) Blister agents are very persistent liquids.
   a. True
   b. False

5) Nerve agents attack the nerves by over stimulating the nerve pathways causing severe incapacitation and death.
   a. True
   b. False

6) Vesicants are a type of nerve agent.
   a. True
   b. False

7) VX is a very volatile chemical and will evaporate quickly.
   a. True
   b. False
8) Which of the following choking agents has the sign “CG”.

   a. Sarin
   b. Phosgene
   c. Diphosgene
   d. Chloroacetophenone

9) Decontamination for riot agent is:

   a. Breath the agent more so you get used to it
   b. Remove yourself from the agent and sit away from the wind
   c. Remove clothing, wash exposed area with soap and water
   d. Remove clothing and wash with ethylene glycol

10) What is the most common recognition factor to identify a suspect's potential to use a chemical agent?

   a. Precursor possession
   b. Farmer
   c. Chemical engineering degree
   d. Animal testing
Module 2
Unit 6
Scope of Module 2, Unit 6

In this unit Performance – Defensive (Operations) level personnel must be familiar with the different types of biological agents and the associated signs and symptoms that would be seen in persons exposed. It is the purpose of this unit to familiarize students with the different types of biological agents and serve as a reference for biological agent identification.

Learning Objective

At the end of this unit students will Describe the different types of biological agents and the basic signs and symptoms that will lead to the identification of biological agent used.

Student Performance Objectives

- Describe what vectors are and the three main types of vectors used for transmission.
- Describe the 6 biological agent classifications.
- Describe the basic difference between the 3 categories of biological agents.
- Describe why toxins are classified as biological agents.
- Describe the process of toxin weaponization.
- Describe the basic process of aerobic bacteria weaponization.
- Describe the basic process of anaerobic bacteria toxin weaponization.
- Describe the basic process of virus weaponization.
- Describe the most important identifying characteristic in the weaponization process of a WMD.
- Describe what agri-terror means.

Resource List

- Student Manual (Module 2)
Module 2
Unit 6
Biological

Introduction

Natural features of biological agents, which have some bearing on their likely use as a weapon and what makes them different from their chemical counterparts are their ability to multiply in the body over time and actually increase their effect. A glossary is included at the beginning of this unit to assist in understanding some of the terminology used. This unit will address the characteristics of a biological warfare (BW) agent; life cycle of a BW agent; BW agent classification, BW agent categorization by category and BW agent description.

Glossary:

Abattoir – a slaughterhouse
Abscess – a contained collection of pus anywhere in the body due to breakdown or dislocation of tissue
Acute – having a sudden onset, sharp rise and short course
Aerobic – requires oxygen for growth
Aerosolized – made into a mist
Anaerobic – capable of growth in an environment without oxygen
Anorexia – loss of appetite especially when prolonged
Antigen – various substances, including toxins, bacteria and the cells of transplanted organs, that when introduced into the body stimulates the production of antibodies
ARDS – adult respiratory distress syndrome; in essence a failure to efficiently exchange oxygen and carbon dioxide in the lungs
Arthralgia – severe pain in a joint
Arthropod – any of a phylum (Arthropoda) of invertebrate animals (as insects, arachnids and crustaceans) that have a segmented body and jointed appendages, a usually chitinous (a horny polysaccharide that forms part of the hard outer integument of insects, arachnids and crustaceans) exoskeleton molted at intervals and a dorsal anterior brain connected to a ventral chain of ganglia
Asexually – involving or reproducing by reproductive processes (as cell division, spore formation, fission or budding) that do not involve the union of individuals or germ cells

Assizes – the former periodical sessions of the superior courts in English counties for trial of civil and criminal cases

Asymptomatic – without or having no symptoms

Bubonic – an inflammatory swelling of a lymph gland especially in the groin

Chronic – marked by long duration or frequent recurrence

Conjunctivitis – inflammation of the mucous membrane that lines the inner surface of the eyelids and is continued over the forepart of the eyeball

Cutaneous – pertaining to the skin

Disseminated intravascular coagulation (DIC) – blood clotting occurs throughout the body in the beginning and depletes the clotting factors; then hemorrhaging occurs leading eventually to death

Encephalitis – inflammation of the brain

Endemic – a disease that occurs continuously in a population and usually has low mortality

Endotoxic – a toxin of internal origin; specifically: a poisonous substance present in bacteria (as the causative agent of typhoid fever) but separable from the cell body only on its disintegration

Enterotoxins – toxin produced in or originating in the intestinal contents. An exotoxin produced by certain species of bacteria that cause intestinal changes present in food poisoning

Epidemic – appearance of an infectious disease or condition that strikes many people at the same time in the same geographical area

Equinophilous – literally, horse loving

Exotoxin – a toxin produced by a microorganism and secreted into its surrounding environment

Extracellular – situated or occurring outside a cell or the cells of the body

Fulminant – occurring suddenly, rapidly and with great severity or intensity

Gastrointestinal – pertaining to the stomach and intestines

Gram Stain – a method for the differential staining of bacteria by treatment with a watery solution of iodine and the iodide of potassium after staining with a triphenylmethane dye (as crystal violet)

Hemorrhage – bleeding

Hosts – a living animal or plant affording subsistence or lodgment to a parasite

Hypotensive (Hyper) – low blood pressure (high)
**Immunocompetent** – the capacity for a normal immune response

**Immunocompromised** – having the immune system impaired or weakened (as by drugs or illness)

**Inflammation** – a tissue’s response to injury; may be discolored, swollen or painful; as a suffix: itis

**Ingestion** – the act of eating or drinking

**Inhalation** – act of drawing in breath, vapor or gas into the lungs

**Inoculation** – the introduction of an antigen into the body, usually by injection

**Insidious** – lacking symptoms so that the individual is unaware of its onset

**Intubation** – insert a tube into a hollow organ or body passage

**IV** (Intravenous) – the act of giving fluids through a needle into a vein

**Latent** – present and capable of becoming though not now visible, obvious, or active

**Localized** – restricted to a limited part or area

**Leukocytes** – any of the blood cells that are colorless, lack hemoglobin, contain a nucleus and include the lymphocytes, monocytes, neutrophils, eosinophils and basophils -- also called white blood corpuscle and used as a defense against invading organisms

**Macrophages** – phagocytic tissue cell of the reticuloendothelial system that may be fixed or freely motile, is derived from a monocyte and functions in the protection of the body against infection and noxious substances

**Maculopapular** – an eruption consisting of both macules (a spot) and papules (a small circumscribed, superficial, solid elevation of the skin) sometimes erroneously used to designate a papule that is only slightly elevated

**Malaise** – discomfort, uneasiness or indisposition

**Mesenchyme** – loosely organized undifferentiated mostly mesodermal cells that give rise to such structures as connective tissues, blood, lymphatics, bone and cartilage

**Morbidity** – a diseased state or being ill

**Mortality** – death, especially of large numbers; heavy loss of life

**Mucopurulent** – containing mucus and pus

**Mucus (membranes)** – a sticky fluid secreted by mucous membranes (a covering lining passages and cavities linked with the air)

**Multi-system syndrome** – multiple organ systems in the body are affected

**Myalgias** – tenderness or pain in the muscles

**Obligate intracellular parasite** – an organism living within the cell of a host without alternative options
Oocysts – a sporozoan zygote undergoing sporogenous development

Opportunitistic – being or caused by a usually harmless microorganism that can become pathogenic when the host's resistance is impaired

Pathogen – a disease causing organism/agent

Pathophysiological – causing disease or illness in a normally healthy body

Petechiae – a minuscule reddish or purplish spot containing blood that appears in skin or mucous membrane especially in some infectious diseases

Phagocytosis – the engulfing and usually the destruction of particulate matter by phagocytes

Photophobia – unusual intolerance to light

Proteinuria – protein in the urine

Protozoon – singular of Protozoa; any of a phylum or subkingdom (Protozoa) of chiefly motile and heterotrophic unicellular protists (as amoebas, trypanosomes, sporozoans and paramecia) that are represented in almost every kind of habitat and include some pathogenic parasites of humans and domestic animals

Pulmonary (edema) – relating to or with regard to the lungs (filling with fluid)

Renal – pertaining to the kidney

Reservoirs – any person, animal, arthropod, plant, soil or substance where an infectious agent normally lives and multiplies

Respiratory (tract) – the taking in of oxygen and the discharge of carbon dioxide (nose/mouth, pharynx, larynx, trachea, bronchi and lungs)

Retrosternal pain – pain behind the chest wall

Reticuloendothelial system – diffuse system of cells arising from mesenchyme and comprising all the phagocytic cells of the body except the circulating white blood cells

Rigors – a tremor caused by a chill

Septic (shock) – illness caused by organisms or their toxins (bacteria, esp. gram-negative; may be ‘cold and clammy’ or ‘hot and flushed’)

Septicemia – bacterial infection of the bloodstream

Signs – objective evidence of disease perceptible to the examining clinician

sp. or spp. – subspecies: singular and plural

Sporogenous – reproduction by spores; spore formation

Sporozoan – any of a large class (Sporozoa) of strictly parasitic protozoans that have a complicated life cycle usually involving both asexual and sexual generations often in different hosts and include important pathogens

Sputum – substance expelled by coughing or clearing the throat

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Supportive care – consists of balancing the patient’s fluids and electrolytes, maintaining their oxygen status and blood pressure and treating them for any complicating infections

Suppurative – associated with the generation of pus

Symptoms – subjective evidence of disease perceived by the patient

Systemic – pertains to the whole body

Vectors – an organism (as an insect) that transmits a pathogen

Viremic – the presence of virus in the blood of a host

Zoonotic (epi) – diseases in animals that are communicable to man under normal conditions (any disease of animals that attacks many animals in the same area)

Zygote – a cell formed by the union of two gametes; broadly: the developing individual produced from such a cell

**Characteristics of Biological Warfare Agents**

**Infectivity** - is the ease with which microorganisms establish themselves in a host species. Microorganisms with high infectivity cause disease with a very few organisms, while those with low infectivity require a larger number. High infectivity does not necessarily mean that the signs and symptoms of disease appear more quickly or that the illness is more severe

**Pathogenicity** - is the ability of an infectious agent to cause disease in a susceptible host

**Transmissibility** - Some biological agents can be spread directly person-to-person by touch or close contact. Indirect transmission on the other hand, e.g., arthropod vectors, may be a significant means of spread as well. In the context of BW casualty management, the ease with which an agent is passed from person-to-person (that is, its transmissibility) represents the principal concern

**Infective Dose or the Intoxicating Dose** – The entry of a sufficient number of microorganisms or quantity of toxin into the body from an exposure to an infectious agent. The agent may then multiply to produce disease
**Incubation Period** – The time between exposure and the appearance of signs and symptoms is known as the incubation period. The infective dose, virulence and route of entry are governed by two variables; the initial rate of replication and host immunological factors.

**Virulence** - The quickness and severity of illness caused by an agent or how severe the signs and symptoms are and the ability of a pathogen to overcome body defenses. Different microorganisms and different strains of the same microorganism can cause diseases of different quickness and severity.

**Lethality** – Lethality indicates the ease with which an agent causes death in a susceptible host/population.

**Stability** - An agent’s ability to survive and remain firmly established in nature is affected by its host/vector and various environmental factors including: temperature, relative humidity, atmospheric pollution and sunlight. A measurement of stability is an agent’s decay rate for example, "aerosol decay rate".

**Toxicity** - The amount of poison an agent produces which influences the severity of illness or injury.

**Additional Factors** - Other factors which may influence the suitability of a microorganism or toxin as a biological weapon include: availability, easy to produce, stability when stored or transported, cheap to produce, results in high mortality/morbidity rates, cause panic and disruption and are easy to spread.

**Alphabetical Listing of Biological Warfare Agents**

Abrin ............................................................ *Abrus precatorius* (Rosary pea)  
Anthrax ............................................................ *Bacillus anthracis*  
Botulism .......................................................... *Clostridium botulinum*  
Brucellosis ..................................................... *Brucella* spp.

**Emerging infectious diseases:**  
Encephalitis  
Nipah and Hendra ............................................ *Paramyxoviridae*  
(HPS) .............................................................. *Hantavirus*  

**Food safety threats:**  
(Epsilon toxin) .................................................. *Clostridium perfringens*  
(HUS) ............................................................... *Escherichia coli* O157:H7,  
(Salmonellosis) ............................................... *Salmonella* spp.  
(Shigellosis) .................................................... *Shigella* spp.  
(Staphylococcal enterotoxin B) ....................... *Staphylococcus aureus*
(Typhoid fever) .......................................... Salmonella typhi
Glanders .................................................. Burkholderia mallei
Melioidosis ................................................ Burkholderia pseudomallei
Plague ........................................................ Yersinia pestis
Psittacosis ................................................ Chlamydia psittaci
Q fever ...................................................... Coxiella burnetii
Ricin toxin ............................................... Ricinus communis (Castor beans)
Smallpox .................................................. Variola major
Tularemia .................................................. Francisella tularensis
Typhus fever ............................................. Rickettsia prowazekii
Viral encephalitis: ..................................... Alphaviruses
(Eastern equine encephalitis “EEE”, Venezuelan equine encephalitis “VEE” and Western equine encephalitis “WEE”)  

Viral hemorrhagic fever:
(Lassa, Machupo) ........................................ Arenaviruses
(Ebola, Marburg) ......................................... Filoviruses

Water safety threats:
(Cholera) ................................................ Vibrio cholerae
(Cryptosporidiosis) ................................. Cryptosporidium parvum

**Biological Warfare Agent Classification**

The arrangement or classification of biological agents into groups is important to the medical services in terms of detection, identification, prevention and treatment. Biological agents which may be used as weapons can be classified as follows:

**Bacteria** - Bacteria are small self-sufficient organisms, most of which may be grown on solid or in liquid culture media. The organisms have a structure consisting of nuclear material, cytoplasm and cell membrane. They reproduce by basically dividing. The diseases they produce are often disrupted by treatment with particular antibiotics.

**Rickettsiae** - Rickettsiae are *obligatory intracellular parasites (classified as bacteria)* which have characteristics common to both bacteria and viruses. Like bacteria, they possess metabolic enzymes and cell membranes, use oxygen and are vulnerable to broad-spectrum antibiotics. They resemble viruses in that they grow only within living cells.
**Chlamydia** - Chlamydia are *obligatory intracellular parasites* (*classified as bacteria*) incapable of reproducing on their own. Like bacteria, they are susceptible to broad-spectrum antibiotics. Like viruses, they require living cells for multiplication.

**Viruses** - Viruses are organisms which require living cells in which to replicate. They are therefore thoroughly dependent upon the cells of the host which they infect. They produce diseases which generally do not respond to antibiotics but which may be responsive to antiviral compounds, of which there are few available. Those that are available are usually of limited use.

**Fungi** - Fungi are primitive plants which do not use photosynthesis for growth or reproduction. They are anaerobic and draw nutrition from decaying vegetable matter. Most fungi form spores and self-sufficient forms are found in soil. Fungal diseases may respond to various antimicrobial treatments.

**Toxins** - Toxins are poisonous substances produced and derived from living plants, animals or microorganisms. Some toxins may also be produced or altered by chemical means. Toxins may respond to specific antisera (a solution of antibodies) and selected medical agents.

It may be useful to classify biological agents by the effects they produce, in an operational context. In order to provide assistance to the field commander on the consequences for continued operational effectiveness, this manual provides guidance for such a classification scheme by agent. Operational
categories should include all recognized variables likely to influence effectiveness, to include: lethality, transmissibility and persistence.

Categorization

A few examples of how BW agents are categorized are by their ability to cause the most; harm and social disruption or are simply available and easy to produce and disseminate.

Category A

The U.S. public health system and primary healthcare providers must be prepared to deal with various biological agents, including pathogens that are rarely seen in the United States. High-priority agents include organisms that pose a risk to national security because they:

- can be easily disseminated or transmitted from person to person
- result in high mortality rates and have the potential for major public health impact
- might cause public panic and social disruption
- require special action for public health preparedness

Anthrax ........................................... *Bacillus anthracis*
Botulism ....................................... *Clostridium botulinum*
Plague .......................................... *Yersinia pestis*
Smallpox ..................................... *Variola major*
Tularemia ...................................... *Francisella tularensis*

Viral hemorrhagic fever:
(Lassa, Machupo) ......................... *Arenaviruses*
(Ebola, Marburg) ......................... *Filoviruses*
Category B

Second highest priority agents include those that:

- are moderately easy to disseminate
- result in moderate morbidity rates and low mortality rates
- require specific enhancements of CDC's diagnostic capacity
- enhanced disease surveillance

Brucellosis ......................... *Brucella spp.*

**Food safety threats:**

(Epsilon toxin) ....................... *Clostridium perfringens*
(HUS) .................................. *Escherichia coli O157:H7*
(Salmonellosis) ...................... *Salmonella spp.*
(Shigellosis) ......................... *Shigella spp.*
(Staphylococcal enterotoxin B)  *Staphylococcus aureus*
(Typhoid fever) ..................... *Salmonella typhi*
Glanders ............................. *Burkholderia mallei*
Melioidosis .......................... *Burkholderia pseudomallei*
Psittacosis ......................... *Chlamydia psittaci*
Q fever ............................... *Coxiella burnetii*
Ricin toxin from ................... *Ricinus communis* (castor beans)
Typhus fever ....................... *Rickettsia prowazekii*

Viral encephalitis Alphaviruses (Eastern equine encephalitis, Venezuelan equine encephalitis and Western equine encephalitis)

**Water safety threats:**

(Cholera) ........................... *Vibrio cholerae*
(Cryptosporidiosis) ............. *Cryptosporidium parvum*

Category C

The third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of:

- availability
- ease of production and dissemination
- potential for high morbidity and mortality rates and major health impact.

**Emerging infectious diseases:**

**Encephalitis:**

Nipah and Hendra ............... *Paramyxoviridae*
(HPS) ................................. *Hantavirus*
Biological Warfare Agent Descriptions

Anthrax (Bacillus anthracis)

Infectivity & Pathogenicity –
Anthrax is a serious disease caused by the bacterium, Bacillus anthracis (B. anthracis) which can form spores. There are three types of anthrax and the symptoms are different depending on the type of the disease.

**Cutaneous:** The first symptom is a small sore that develops into a blister. The blister then develops into a skin ulcer with a black area in the center. The sore, blister and ulcer do not hurt.

**Inhalation:** The first symptoms of inhalation anthrax are like cold or flu symptoms and can include: a sore throat, mild fever and muscle aches. Later symptoms include: cough, chest discomfort, trouble breathing, tiredness and muscle aches. (Caution: Do not assume that just because a person has cold or flu symptoms that they have inhalation anthrax.)

**Gastrointestinal:** The first symptoms are nausea, loss of appetite, bloody diarrhea and fever, followed by severe stomach pain.

Transmissibility – Anthrax spread from one person to another is rare. Humans can become infected with anthrax by handling products from infected animals or by inhaling in anthrax spores from infected animal products like wool. People can also become infected with gastrointestinal anthrax by eating undercooked meat from infected animals.

**Infecive Dose or the Intoxicating Dose** – An effective exposure dose would be about 10,000 spores.
Incubation Period – Symptoms usually appear within 7 days of coming in contact with the bacterium for all three types of anthrax. For inhalation anthrax, symptoms can appear within two days or can take up to 42 days to appear and some reports say 60 days.

Virulence – Anthrax spores can be used as a bioterrorist weapon, as was the case in 2001, when B. anthracis spores had been intentionally distributed through the postal system, causing 22 cases of anthrax, including 5 deaths.

Lethality – Even if untreated, 80 percent of people who become infected with cutaneous anthrax do not die. Gastrointestinal anthrax is more serious because between one-fourth to more than half of cases lead to death. Inhalation anthrax is even more severe. Although case-fatality estimates for inhalational anthrax are based on incomplete information, the rate is extremely high, approximately 75%, even with all possible supportive care including appropriate antibiotics. Untreated, inhalation anthrax approaches a 100% death rate.

Stability – In the environment, anthrax can form spores (a version of the germ in a hard shell) that can live in the soil for years; but comes to life under the right conditions.

Toxicity – Anthrax does not produce a toxin.

Additional Factors – Anthrax can also be used as a weapon. This happened in the United States in 2001. Anthrax was deliberately spread through the postal system by sending letters with a powder containing anthrax. This caused 22 cases of anthrax infection.

Treatment - Early identification and treatment are important. Antibiotics are used to treat all three types of anthrax. In most cases, early treatment with antibiotics can cure cutaneous anthrax.

Treatment and prevention after exposure: Treatment is different for a person who is exposed to anthrax, but is not yet sick. Health-care providers will use antibiotics (such as ciprofloxacin, doxycycline or penicillin) combined with the anthrax vaccine to prevent anthrax infection.

Treatment after infection: Treatment is usually a 60-day course of antibiotics. Success depends on the type of anthrax and how soon treatment begins.

Prevention - Vaccination: there is a vaccine to prevent anthrax, but it is not yet available for the general public. Anyone who may be exposed to anthrax, including certain members of the U.S. armed forces, laboratory workers
and workers who may enter or re-enter contaminated areas, may get the vaccine. Also, in the event of an attack using anthrax as a weapon, people exposed might get the vaccine.

If you are showing symptoms of anthrax infection, call your health-care provider right away.

Contact local law enforcement immediately if you think that you may have been exposed to anthrax. This includes being exposed to a suspicious package or envelope that contains powder.
Botulism (*Clostridium botulinum*)

**Infectivity & Pathogenicity** - Botulism is a muscle-paralyzing disease caused by a toxin made by a bacterium called *Clostridium botulinum* (C. botulinum). It can live in an anaerobic environment and is a Gram-positive, spore-forming rod. Four types of botulism are recognized:

**Food-borne botulism**: symptoms begin within 6 hours to 2 weeks (most commonly between 12 and 36 hours) after ingesting toxin-containing food. Early signs of poisoning consist of noticeable tiredness, weakness and dizziness, usually followed by double vision and progressive difficulty in speaking and swallowing. Other signs include: difficulty breathing, abdominal swelling, drooping eyelids, dry mouth, constipation may also be common and muscle weakness that always descends through the body: first the shoulders are affected, then the upper arms, lower arms, thighs, calves and etc. Paralysis of breathing muscles can cause the inability to breathe and death, unless mechanical breathing is provided.

**Infant botulism**: first recognized in 1976, affects infants under 12 months of age. Clinical symptoms consist of constipation that occurs after a period of normal development. This is followed by poor feeding, tiredness, weakness, pooled oral secretions and wails or altered cry. Loss of head control is striking.

**Wound botulism**: the rarest form of botulism. The illness results when C. botulinum by itself or with other microorganisms infects a wound and produces toxins which reach other parts of the body via the bloodstream. Foods are not involved in this type of botulism.

**An undetermined category of botulism**: involves adult cases in which a specific food or wound source cannot be identified. It has been suggested that some cases of botulism assigned to this category might result from a carrier state in adults, who produce toxin in their bowels. Reports in the medical literature suggest the existence of a form of botulism similar to infant botulism, but occurring in adults. In these cases, the patients had surgical alterations of the gastrointestinal tract and/or antibiotic therapy. It is proposed that these procedures may have altered the normal gut flora and allowed C. botulinum to reach a balance and grow in the intestinal tract.
Transmissibility - botulism is not known to spread from one person to another.

**Food-borne botulism:** Most of the 10 to 30 outbreaks that are reported annually in the United States are associated with improperly processed, home-canned foods, but occasionally commercially produced foods have been involved in outbreaks. Sausages, meat products, canned vegetables and seafood products have been the most frequent cause for human botulism. The types of foods involved in botulism vary according to food preservation and eating habits in different regions. Any food that is favorable to growth and toxin production, that when processed allows spore survival and is not later heated before consumption can be associated with botulism. Almost any type of food that is not very acidic (pH above 4.6) can support growth and toxin production by C. botulinum. Botulinal toxin has been found in a large variety of foods, such as canned corn, peppers, green beans, soups, beets, asparagus, mushrooms, ripe olives, spinach, tuna fish, chicken and chicken livers, liver pate and luncheon meats, ham, sausage, stuffed eggplant, lobster and smoked and salted fish. Food-borne botulism can occur in all age groups.

**Food-borne botulism is a public health emergency because the contaminated food may still be available to other persons besides the patient.**

**Infant botulism:** is caused by the intake of C. botulinum spores which inhabit the bowels and produce toxin in the bowels of infants. Of the various possible environmental sources such as soil, cistern water, dust and foods, honey is the one dietary source of C. botulinum spores thus far positively linked to infant botulism by both laboratory and epidemiologic studies. The number of confirmed infant botulism cases has increased significantly as a result of greater awareness by health officials since its recognition in 1976. It is now internationally recognized, with cases being reported in more countries. Infant botulism occurs in a small number of susceptible infants each year who harbor C. botulinum in their bowels.

**Wound botulism:** is caused by toxin produced from a wound infected with C. botulinum.

**Infective Dose or the Intoxicating Dose** – a very small amount (a few nanograms) of toxin can cause illness.
Incubation Period – Onset of symptoms in food-borne botulism is usually 18 to 36 hours after intake of the food containing the toxin, although cases have varied from 4 hours to 8 days.

Virulence - There are generally between 10 to 30 outbreaks a year in the United States. Some cases of botulism may go undiagnosed because symptoms are short-lived or mild or misdiagnosed as Guillain-Barre syndrome.

Guillain-Barré (ghee-yan bah-ray) syndrome is a disorder in which the body's immune system attacks part of the peripheral nervous system. The first symptoms of this disorder include varying degrees of weakness or tingling sensations in the legs. In many instances, the weakness and abnormal sensations spread to the arms and upper body. These symptoms can increase in intensity until the muscles cannot be used at all and the patient is almost totally paralyzed.

Lethality – Incidence of the disease is low, but the mortality rate is high if not treated immediately and properly. All forms of botulism can be fatal and are considered medical emergencies. Death occurs in 70% of untreated cases.

Stability - The spores are heat-resistant and can survive in foods that are incorrectly or minimally processed. Seven types (A, B, C, D, E, F and G) of botulism are recognized, based on the antigenic specificity of the toxin produced by each strain. Types A, B, E and F cause human botulism. The toxin is heat sensitive and can be destroyed if heated at 80°C for 10 minutes or longer.

Toxicity - A rare but serious paralytic illness caused by a nerve toxin that is produced by the bacterium C. botulinum.

Additional Factors - Types C and D cause most cases of botulism in animals. Animals most commonly affected are wild fowl, poultry, cattle, horses and some species of fish. Although type G has been found in soil from Argentina, no outbreaks involving it have been recognized. The organism and its spores are widely distributed in nature. They occur in both cultivated and forest soils, bottom sediments of streams, lakes and coastal waters and in the intestinal tracts of fish and mammals and in the gills and viscera of crabs and other shellfish.

Treatment - Although botulism can be diagnosed by clinical symptoms alone, differentiation from other diseases may be difficult. The most direct and effective way to confirm the clinical diagnosis of botulism in the laboratory is to demonstrate the presence of toxin in the serum or feces of the patient or in the food which the patient consumed. Currently, the most
sensitive and widely used method for detecting toxin is the mouse neutralization test. This test takes 48 hours. Culturing of specimens takes 5-7 days. Treatment for food-borne botulism includes administration of botulin antitoxin and intensive respiratory care. For infant botulism the recommended treatment is primarily supportive care and antimicrobial therapy is not recommended.

**Prevention** - Proper canning methods must be used for preserving low-acid foods. Pressure processing is necessary to obtain the temperatures required to destroy the C. botulinum spore. The toxin can be destroyed by boiling for 10 minutes at sea level (add 1 minute for every 1,000 feet above sea level). When the bacteria grow, they can produce a gas which causes canned items to bulge.

Never taste food from leaking, bulging, or damaged cans; from cracked jars or with loose or bulging lids; from containers that spurt liquid when opened; or any canned food that has an abnormal odor or appearance.

Discard any suspected canned foods by placing the container in a heavy garbage bag marked ‘POISON’ and place the bag in a trash container that is not accessible to people, children or animals. Clean all surfaces that leaky containers may have contaminated with a chlorine/water solution (one tablespoon chlorine per gallon of warm water). Discard any sponges or cloths used for cleanup.

**Brucellosis (Brucella spp.)**

**Infectivity & Pathogenicity** - Brucellosis is an infectious disease caused by the bacteria of the genus Brucella. Symptoms are similar to influenza and may include fever, sweats, headaches, back pains and physical weakness. Severe infections of the central nervous systems or lining of the heart may occur. Brucellosis can also cause long-lasting symptoms that include: recurrent fevers, joint pain and weariness.

**Transmissibility** - Humans are generally infected in one of three ways and rarely a further way:

- Eating or drinking something that is contaminated with Brucella. The most common way to be infected is by eating or drinking contaminated milk products. When sheep, goats, cows or camels are infected, their milk is contaminated with the bacteria. If the milk is not pasteurized, these bacteria can be spread to the people who make the milk or cheeses, drink the milk or eat the cheeses.

- Inhaling the organism. Breathing in Brucella organisms is not a common route of infection, but it can be an important exposure for people in certain
occupations, such as those working in laboratories where the organism is cultured. The inhaling of organisms is often responsible for a large percentage of cases in slaughterhouse employees.

- Entering the body through skin wounds. Contamination of skin wounds may be a problem for persons working in slaughterhouses or meat packing plants or for veterinarians. Hunters may be infected through skin wounds or by accidentally eating the bacteria after cleaning deer, elk, moose or wild pigs that they have killed.

- Direct person-to-person spread of brucellosis is extremely rare. Mothers who are breast-feeding may pass on the infection to their infants. Sexual transmission has also been reported. For both sexual and breast-feeding transmission, if the infant or person at risk is treated for brucellosis, their risk of becoming infected will probably be eliminated within 3 days. Although uncommon, transmission may also occur via contaminated tissue transplantation.

**Infective Dose or the Intoxicating Dose** – Inhaling the organisms only requires a somewhat low concentration of organisms (as few as 10-100 bacteria) to cause infection in humans.

**Incubation Period** – Variable and difficult to find out; usually 5-60 days; 1 to 2 months is not uncommon and occasionally it takes several months.

**Virulence** - This disease, if untreated, can last days, months or infrequently a year or longer.

**Lethality** – Mortality is low (<2%) and is usually associated with endocarditis.

**Stability** - Various Brucella species affect sheep, goats, cattle, deer, elk, pigs, dogs and several other animals. These bacteria are primarily passed among animals and they cause disease in many different vertebrates.

**Toxicity** - Brucella species do not produce a toxin.

**Additional Factors** - Brucellosis is not very common in the United States, where 100 to 200 cases occur each year. But brucellosis can be very common in countries where animal disease control programs have not reduced the amount of disease among animals. It is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk are the Mediterranean Basin (Portugal, Spain, Southern France, Italy, Greece, Turkey and North Africa) South and Central America, Eastern Europe, Asia, Africa, the Caribbean and the Middle East. Unpasteurized cheeses, sometimes called "village cheeses" from these areas may represent a particular risk for tourists.
Treatment - Doctors can prescribe effective antibiotics; but treatment can be difficult. Usually, doxycycline and rifampin are used in combination for 6 weeks to prevent reoccurring infection. Depending on the timing of treatment and severity of illness, recovery may take a few weeks to several months.

Prevention - Do not consume unpasteurized milk, cheese or ice cream while traveling. If you are not sure that the dairy product is pasteurized, don't eat it. Hunters and animal herdsman should use rubber gloves when handling internal organs of animals. There is no vaccine available for humans.

Emerging infectious diseases:

HPS (Hantavirus)

Infectivity & Pathogenicity - The disease caused by the Hantavirus is called Hantavirus pulmonary syndrome (HPS). Hantavirus is found in the urine, saliva or droppings of infected deer mice and some other wild rodents. The disease begins as a flu-like illness. In the early stage, a person may experience fever, chills, muscle aches, headaches, nausea, vomiting and shortness of breath. The muscle aches are severe, involving the thighs, hips, back and sometimes the shoulder. Nevertheless, the disease progresses rapidly and infected people experience an abnormal fall in blood pressure and their lungs will fill with fluid.

Transmissibility - People can contract the Hantavirus infection through inhalation of airborne droplets of saliva or urine or through the dust of feces from infected wild rodents, especially the deer mouse. Transmission can also occur when contaminated material gets into broken skin or possibly, ingested in contaminated food or water. Person-to-person transmission in North America has not been reported. However, a recent outbreak of 18 cases of HPS in South America strongly suggests person-to-person transmission. Conversely, the viruses isolated in South America are genetically distinct from those described in North America. Cases of Hantavirus infection contracted in Canada and the United States have been connected to:

- Sweeping out a barn and other ranch buildings
- Trapping and studying mice
- Using compressed air and dry sweeping to clean up wood waste in a sawmill
- Handling grain contaminated with mouse droppings and urine
• Entering a barn infested with mice
• Planting or harvesting field crops
• Occupying previously vacant dwellings
• Disturbing rodent-infested areas while hiking or camping
• Living in dwellings with a sizable indoor rodent population

Infective Dose or the Intoxicating Dose – The sufficient number of microorganisms to produce disease is unknown.

Incubation Period – Due to the small number of HPS cases, the ‘incubation time’ is not positively known. However, on the basis of limited information, it appears that symptoms may develop between 1 and 5 weeks after exposure to urine, droppings or saliva of infected rodents.

Virulence - Some patients will develop coughing and shortness of breath within a few days. Others may go for as long as a week with the other symptoms before developing a cough and shortness of breath, followed by the abrupt onset of respiratory distress, often severe and fatal.

Lethality – Hantavirus causes a rare but serious lung disease called HPS. This disease is extremely serious since 50-60% of the people who get the disease die. Patients presenting with fulminant illness due to HPS have a poor prognosis despite ICU care. Severe respiratory failure, resulting in death, can occur within a few days of the early stage symptoms.

Stability - The deer mouse (Peromyscus maniculatus) is the main carrier of Hantavirus; however, other wild rodents can cause problems as well.

Toxicity - Hantavirus does not produce a toxin.

Additional Factors - Although HPS has been publicized as an emerging infectious disease, it is in fact only a newly identified disease that has been causing illness and death for years. Four Hantaviruses (Sin Nombre, Black Creek Canal, New York and Bayou) cause the HPS in the United States.

Treatment - There is no specific treatment or cure for Hantavirus infection. Treatment of patients with HPS remains supportive in nature. ICU management should include careful assessment, monitoring and adjustment of volume status and cardiac function. Fluids should be administered carefully due to the potential for capillary leakage. Supplemental oxygen should be administered if patients become hypoxic. Equipment and materials for intubation and mechanical ventilation should be readily available since onset of respiratory failure may be sudden. Patients should receive appropriate, broad-spectrum antibiotic therapy.
while awaiting confirmation of a diagnosis of HPS. Care during the initial stages of the disease should include fever and pain medications as needed.

Prevention

Since human infection occurs through inhalation of contaminated material, clean-up procedures must be performed in a way that limits the amount of airborne dust. People involved with general clean-up activities where there are not heavy accumulations of droppings should use a disposable high-efficiency particulate air (HEPA) mask. Workers involved in a more meticulous clean-up should wear rubber gloves, rubber boots and respiratory protective equipment that is equipped with a HEPA filter. For cleaning up rodent contaminated areas with heavy accumulations of droppings it may be necessary to use powered air-purifying (PARP) or air supplied respirators.

Dead mice, nests and droppings should be soaked thoroughly with a 1:10 solution of sodium hypochlorite (household bleach). The contaminated material should be placed in a plastic bag and disposed of by burning or burying. Gloves and other equipment used in the cleaning process should be disposed of in the same manner as other contaminated material. Please contact your local environmental authorities concerning approved disposal methods. All should thoroughly wash their hands with soap and water after removing the gloves.

Nipah & Hendra Virus Encephalitis (Paramyxoviridae)

**Infectivity & Pathogenicity** - Nipah is closely related (but not identical) to Hendra and they are newly recognized zoonotic viruses. Nipah was 'discovered' in 1999 and Hendra (formerly called equine morbillivirus) was 'discovered' in (1994). Both Nipah and Hendra are members of the virus family Paramyxoviridae. Only three human cases of Hendra virus disease have been recognized. Two of the three individuals known to be infected had a respiratory illness with severe flu-like signs and symptoms. Infection with Hendra virus was associated with an encephalitis (inflammation of the brain) distinguished by fever, drowsiness and more serious central nervous system involvement, such as coma, seizures and failure to sustain breathing. Illness with Nipah virus begins with 3-14 days of fever and headache. This is followed by drowsiness and disorientation characterized by mental confusion. These signs and symptoms can progress to coma within 24-48 hours. Some patients have had a respiratory illness during the early part of their infections.

**Transmissibility** - The mode of transmission from animal to animal and from animal to human is uncertain, but appears to require close contact with contaminated tissue or body fluids from infected animals. Nipah has
caused disease in animals and in humans, during contact with infected animals. Nipah antibodies have been detected in pigs, other domestic and wild animals. In Malaysia and Singapore, humans were infected with Nipah virus through close contact with infected pigs. The role of species other than pigs in transmitting infection to other animals has not yet been determined. It is unlikely that Nipah virus is easily transmitted to man, although previous outbreak reports suggest that Nipah virus is transmitted from animals to humans more readily than Hendra virus. It is not known how the virus is transmitted from bats to animals. Despite frequent contact between fruit bats and humans there is no serological evidence of human infection among bat carriers. Pigs were the apparent source of infection among most human cases in the Malaysian outbreak of Nipah, but other sources, such as infected dogs and cats, cannot be excluded. Human-to-human transmission of Nipah virus has not been reported. In Australia, humans became ill after exposure to body fluids and excretions of horses infected with Hendra virus. Accordingly, neither disease is known to have spread from human to human.

**Infective Dose or the Intoxicating Dose** – The sufficient number of microorganisms to produce disease is unknown.

**Incubation Period** – The Hendra and Nipah incubation period is between 4 and 18 days.

**Virulence** - Although the Paramyxoviridae group of viruses have only caused a few focal outbreaks, the biologic property of these viruses to infect a wide range of hosts and to produce a disease causing significant mortality in humans has made this emerging viral infection a public health concern. One of the three Hendra virus infections was noticeable by a delayed onset of progressive encephalitis. Serious nervous system disease with Nipah virus encephalitis has been marked by some sequelae, such as persistent convulsions and personality changes.

**Lethality** – Two of the three human patients infected with Hendra virus died. During the Nipah virus disease outbreak in 1998-99, about 40% of the patients with serious nervous system disease who entered hospitals died from the illness. Overall, fifty percent of Nipah symptomatic cases die.

**Stability** - The natural reservoir for Hendra virus is thought to be flying foxes (bats of the genus Pteropus) found in Australia. The natural reservoir for Nipah virus is still under investigation, but preliminary data suggest that bats of the genus Pteropus are also the reservoirs for Nipah virus in Malaysia. The bats are distributed across an area encompassing northern, eastern and south-eastern areas of Australia, Indonesia, Malaysia, the Philippines and some of the Pacific Islands. The bats do not become ill, but appear to be susceptible to infection by means of these viruses.
Hendra virus has caused disease in horses in Australia, and the human illness there were due to direct exposure to tissues and secretions from infected horses. Nipah virus caused a relatively mild disease in pigs in Malaysia and Singapore. Nipah virus was transmitted to humans, cats and dogs through close contact with infected pigs.

**Toxicity** – Neither Nipah or Hendra viruses are known to produce a toxin.

**Additional Factors** - The Nipah virus is named after the location where it was first detected in Malaysia and Hendra virus is named after the town where it first appeared in Australia.

**Outbreaks of Nipah and Hendra viruses:**

- From September 1998 - April 1999, there was a large outbreak of encephalitis in Malaysia. During the investigation of this outbreak, Nipah virus, a previously unrecognized virus, was identified as the causal agent. A total of 265 people were infected, of whom 105 died. Ninety-three percent of cases had occupational exposure to pigs.

- An associated outbreak among abattoir workers in Singapore during March 1999 led to 11 cases, with 1 death. These workers had been handling pigs that had been imported from the outbreak areas in Malaysia.

- There have been 3 recognized outbreaks of Hendra virus in Australia in 1994, 1995 and 1999. Three human cases, leading to 2 deaths were recorded in the 1994 and 1995 outbreaks. In 1995 a horse was infected, with associated human cases. The specific mode of virus transmission to the three Australian patients is not fully understood. All 3 individuals appear to have come by their infection as a consequence of close contact with horses which were ill and later died.

**Treatment** - No drug therapies have yet been proven to be effective in treating Nipah or Hendra infection. Treatment relies on providing intensive supportive care. There is some evidence that early treatment with the antiviral drug, ribavirin, can reduce both the duration of feverish illness and the severity of disease; however, the efficacy of this treatment in curing disease or improving survival is still uncertain.

**Prevention** - The risk of transmission of Nipah virus from sick animals to humans is thought to be low and transmission from person-to-person has not yet been documented, even in the context of a large outbreak. These diseases can be prevented by avoiding animals that are known to be
infected and using appropriate personal protective equipment devices and
good hand-hygiene when it is necessary to come into contact with
potentially infected animals. It is recommended that close contact with
body fluids and infected tissues be avoided if Nipah or Hendra infection is
suspected. As a result, the risk of spreading Nipah virus to health care
workers is thought to be low. On the other hand, transmission is
theoretically possible, as respiratory secretions do contain the virus,
without percutaneous (through a break in the skin barrier) exposure. This
is why it has been categorized as a biohazardous agent that should be
managed in a high-level biosecurity laboratory.

**Food Safety Threats:**

**Epsilon toxin (Clostridium perfringens)**

**Infectivity & Pathogenicity** - Clostridium perfringens (C. perfringens) is an
anaerobic, Gram-positive, spore-forming rod. C. perfringens poisoning is
diagnosed by its symptoms and the typical delayed onset of illness. The common
form of perfringens poisoning is characterized by intense abdominal cramps, gas
and diarrhea. The illness is usually over within 24 hours but less severe
symptoms in the elderly or infirm, may last for 1 to 2 weeks.

**Transmissibility** - In most instances, the actual cause of poisoning by C.
perfringens is temperature abuse of prepared foods. Small numbers of the
organisms are often present after cooking and multiply to food poisoning
levels during cool down and storage of prepared foods. C. perfringens is a
common infectious cause of outbreaks of food-borne illness in the United
States, especially outbreaks in which cooked beef is the implicated
source. Meats, meat products and gravy are the foods most frequently
implicated.

**Infective Dose or the Intoxicating Dose** – Infection is caused by ingestion of
large numbers (greater than 10 to the 8th) vegetative cells.

**Incubation Period** – Symptoms begin 8-22 hours after consumption of foods
containing C. perfringens bacteria.

**Virulence** - Enteritis necroticans is a more serious but rare illness caused by
ingesting food contaminated with Type C strains. Except in the case of
enteritis necroticans syndrome, complications are few in persons under 30
years of age. The young and elderly are the most frequent victims of C.
perfringens poisoning and elderly persons are more likely to experience
prolonged or severe symptoms.
**Lethality** – The illness caused by Type C strains is known as enteritis necroticans or pigbel disease. Deaths from pigbel syndrome are caused by infection and necrosis of the intestines and from resulting septicemia. A few deaths have been reported as a result of dehydration and other complications from food poisoning. Necrotic enteritis caused by C. perfringens is often fatal.

**Stability** - C. perfringens is widely distributed in the environment and frequently occurs in the intestines of humans and many domestic and feral animals. Spores of the organism persist in soil, sediments and areas subject to human or animal fecal pollution.

**Toxicity** – Some C. perfringens bacteria are capable of producing the food poisoning toxin. Toxin production in the digestive tract (or in test tubes) is associated with sporulation. The disease is, as a rule, a food infection; only one episode has ever implied the possibility of disease from preformed toxin.

**Additional Factors** - C. perfringens poisoning is one of the most commonly reported food-borne illnesses in the U.S. There were 1,162 cases in 1981, in 28 separate outbreaks. At least 10-20 outbreaks have been reported annually in the U.S. for the past 2 decades. Typically, dozens or even hundreds of person are affected. It is probable that many outbreaks go unreported because the implicated foods or patient feces are not tested routinely for C. perfringens or its toxin. CDC estimates that about 10,000 actual cases occur annually in the U.S. Institutional feeding (such as school cafeterias, hospitals, nursing homes, prisons, etc.) where large quantities of food are prepared several hours before serving is the most common circumstance in which C. perfringens poisoning occurs. Diagnosis is confirmed by detecting the toxin in the feces of patients. Bacteriological confirmation can also be done by finding exceptionally large numbers of the causative bacteria in implicated foods or in the feces of patients.

**Treatment** - Usually no treatment is needed, other than taking steps to prevent or treat dehydration. Antibiotics are not useful in Clostridium food poisoning.

**Prevention** - Thoroughly cook foods which contain meat and poultry (soups, stews, gravy, dressing, casseroles). Keep these cooked foods hot (at or above 140°F) or cold (at or below 40°F). Divide large portions of these foods into smaller portions for storage. Large containers of food take a long time for the center to cool to 40°F. This situation gives the bacteria the ideal conditions to grow rapidly. Reheat leftovers thoroughly (to at least 165°F) before serving. C. perfringens is called the ‘food service
germ’ because it often causes illness from food served in quantity and left for long periods on a steam table or at room temperature.

(HUS) *Escherichia coli* O157:H7

**Infectivity & Pathogenicity** - *Escherichia coli* (E. coli) O157:H7 is one of hundreds of strains of the bacterium E. coli. Sometimes O157:H7 is asymptomatic or causes severe bloody diarrhea, abdominal cramps and can occasionally lead to kidney failure. Usually little or no fever is present.

**Transmissibility** - O157:H7 is an emerging cause of food-borne illness. O157:H7 was first recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea; the outbreak was traced to contaminated hamburgers. Since then, most infections have come from eating undercooked ground beef. Contaminated meat looks and smells normal. Also, O157:H7 can be present on cow’s udders and transfer to equipment and get into raw milk. Meat can become contaminated during slaughter and organisms can be thoroughly mixed into beef when it is ground. Other known sources of infection are consumption of sprouts, lettuce, salami, unpasteurized milk and juice and swimming in or drinking sewage-contaminated water. Bacteria in diarrheal stools of infected persons can be passed from one person to another if hygiene or hand-washing habits are inadequate. Person-to-person contact in families and child care centers is also an important mode of transmission. This is particularly likely among toddlers who are not toilet trained. Family members and playmates of these children are at high risk of becoming infected.

**Infective Dose or the Intoxicating Dose** – Although the number of organisms required to cause disease is not known, it is suspected to be very small.

**Incubation Period** – Symptoms generally appear three to four days after exposure, but can be as short as one day or take as long as nine days to appear. The illness resolves in 5 to 10 days, typically a week. Young children typically shed the organism in their feces for a week or two after
their illness resolves. Older children rarely carry the organism without symptoms.

**Virulence** - In some persons, particularly children under 5 years of age and the elderly, the infection can cause a complication called hemolytic uremic syndrome (HUS) in which the red blood cells are destroyed and the kidneys fail. About 2%-7% of infections lead to this complication. In the United States, HUS is the principal cause of acute kidney failure in children and most cases of HUS are caused by O157:H7. Blood transfusions and kidney dialysis are often required. About one-third of persons with HUS have abnormal kidney function many years later and a few require long-term dialysis. Another 8% of persons with HUS have other lifelong complications, such as high blood pressure, seizures, blindness, paralysis and the effects of having part of their bowel removed.

**Lethality** – An estimated 73,000 cases of infection and 61 deaths occur in the United States each year. HUS is a life-threatening condition usually treated in an intensive care unit. Even with intensive care, the death rate for HUS is 3%-5%.

**Stability** - Most strains of E. coli are harmless and live in the intestines of healthy humans and animals.

**Toxicity** - O157:H7 produces a powerful toxin.

**Additional Factors** - The combination of letters and numbers in the name of the bacterium refers to the specific markers found on its surface and distinguishes it from other types of E. coli.

**Treatment** - Most persons recover without antibiotics or other specific treatment in 5-10 days. There is no evidence that antibiotics improve the course of disease and it is thought that treatment with some antibiotics may bring on kidney complications. Antidiarrheal agents, such as loperamide (Imodium) should also be avoided.

**Prevention** - Consumers can prevent E. coli O157:H7 infection by thoroughly cooking ground beef, avoiding unpasteurized milk and washing hands carefully. Because ground beef can turn brown before disease-causing bacteria are killed, use a digital instant-read meat thermometer inserted into several parts of the patty, including the thickest part, until it reads at least 160°F to ensure thorough cooking. Persons who cook ground beef without using a thermometer can decrease their risk of illness by not eating ground beef patties that are still pink in the middle.
If you are served an undercooked hamburger or other ground beef product in a restaurant, send it back for further cooking. You may want to ask for a new bun and a clean plate, too.

Avoid spreading harmful bacteria in your kitchen. Keep raw meat separate from ready-to-eat foods. Wash hands, counters and utensils with hot soapy water after touching raw meat. Never place cooked hamburgers or ground beef on the unwashed plate that held raw patties. Wash meat thermometers in between tests of patties that require further cooking.

Drink only pasteurized milk, juice or cider. Commercial juice with an extended shelf-life that is sold at room temperature (e.g. juice in cardboard boxes, vacuum sealed juice in glass containers) has been pasteurized, although this is generally not indicated on the label. Juice concentrates are also heated sufficiently to kill pathogens.

Wash fruits and vegetables thoroughly especially those that will not be cooked. Children under 5 years of age, immunocompromised persons and the elderly should avoid eating alfalfa sprouts until their safety can be assured. Methods to decontaminate alfalfa seeds and sprouts are being investigated.

Drink municipal water that has been treated with chlorine or other effective disinfectants. Avoid swallowing lake or pool water while swimming.

Make sure that persons with diarrhea, especially children, wash their hands carefully with soap after bowel movements to reduce the risk of spreading infection and that persons wash hands after changing soiled diapers. Anyone with a diarrheal illness should avoid swimming in public pools or lakes, sharing baths with others and preparing food for others.

Because the organism lives in the intestines of healthy cattle, preventive measures on cattle farms and during meat processing are being investigated. O157:H7 will continue to be an important public health concern as long as it contaminates meat. Preventive measures may reduce the number of cattle that carry it and the contamination of meat during slaughter and grinding. Research into such prevention measures is just beginning.

**Salmonellosis (Salmonella spp.)**

**Infectivity & Pathogenicity** - Salmonella bacteria (S. spp.) are a gram-negative rod-shaped bacilli of which, there are many different types. Salmonella serotype Typhimurium and serotype Enteritidis are the most common in the United States.
Most persons infected with Salmonella spp. develop myalgia, headache, nausea, vomiting, fever (38°C to 39°C) chills and at least two-thirds of patients complain of abdominal cramps; however, the cardinal manifestation is diarrhea (sometimes bloody).

Enteric fevers are severe systemic forms of salmonellosis. Any species of Salmonella may cause this type of disease. Enteric fevers may be preceded by gastroenteritis, which usually resolves before the onset of systemic disease. The symptoms of enteric fevers are nonspecific and include fever, anorexia, headache, myalgias and constipation.

Transmissibility - S. spp. are usually transmitted to humans by eating foods contaminated with animal feces. Contaminated foods are often of animal origin, such as: beef, poultry, milk or eggs, but all foods, including vegetables may become contaminated and they usually look and smell normal, undercooked chicken and raw eggs are a particular high risk food. Food may also become contaminated by the unwashed hands of an infected food handler, who forgot to wash their hands with soap after using the bathroom. S. spp. may also be found in the feces of some pets, especially those with diarrhea and people can become infected if they do not wash their hands after contact with these feces. Reptiles are particularly likely to harbor S. spp. and people should always wash their hands immediately after handling a reptile, even if the reptile is healthy. Adults should be alert that children wash their hands after handling a reptile.

Infecive Dose or the Intoxicating Dose – As few as 15-20 cells; depends upon age and health of the individual and strain differences among the members of the S. spp. group.

Incubation Period – Symptoms for S. spp. gastroenteritis (food poisoning) depends on the dose of bacteria and usually starts 6 to 72 hours after ingestion. Enteric fever symptoms begin after an incubation period of 10 to 14 days.
Virulence - The illness usually lasts 2 to 7 days and most persons recover without treatment. However, in some persons the diarrhea may be so severe that the patient needs to be hospitalized. The elderly, infants and those with impaired immune systems are more likely to have a severe illness.

Lethality – Enteric fevers are severe infections and may be fatal if antibiotics are not promptly administered. Occasionally a localized infection progresses to sepsis, estimated to be 2% of cases each year, which leads to chronic arthritis and >500 fatalities.

Stability - S. spp. live in the intestinal tracts of humans and other animals, including birds. The most common animal reservoirs are chickens, turkeys, pigs and cows; dozens of other domestic and wild animals also harbor these organisms. Approximately 0.1% of those infected with non-typhoidal S. spp. become chronic carriers. The carrier state may last from many weeks to years. Thus, human as well as animal reservoirs exist.

Toxicity - S. spp. do not produce a toxin.

Additional Factors - S. spp. have been known to cause illness for over 100 years. They were discovered by an American scientist named Salmon, for whom they are named.

Treatment - S. spp. infections usually resolve in 5-7 days and often do not require treatment unless the patient becomes severely dehydrated; antibiotics are not usually necessary unless the infection spreads from the intestines, then it can be treated with ampicillin, gentamicin, trimethoprim/sulfamethoxazole or ciprofloxacin. Persons with severe diarrhea may require rehydration, often with intravenous fluids. Unfortunately, some S. spp. bacteria have become resistant to antibiotics, largely as a result of the use of antibiotics to promote the growth of feed animals.

Prevention - There is no vaccine to prevent salmonellosis, as there is with Typhoid fever. Since foods of animal origin may be contaminated with S. spp., people should not eat raw or undercooked eggs, poultry or meat. Raw eggs may be unrecognized in some foods such as homemade hollandaise sauce, Caesar and other homemade salad dressings, tiramisu, homemade ice cream, homemade mayonnaise, cookie dough and frostings. Persons also should not consume raw or unpasteurized milk or other dairy products. Produce should be thoroughly washed before consuming. Cross-contamination of foods should be avoided. Uncooked meats should be kept separate from produce, cooked foods and ready-to-eat foods. Hands, cutting boards, counters, knives and other utensils
should be washed thoroughly after handling uncooked foods. Hand should be washed before handling any food and between handling different food items. People who have salmonellosis should not prepare food or pour water for others until they have been shown to no longer be carrying the S. sp. bacterium. People should wash their hands after contact with animal feces. Since reptiles are particularly likely to have S. spp., everyone should immediately wash their hands after handling reptiles. Reptiles (including turtles) are not appropriate pets for small children and should not be in the same house as an infant.

**Shigellosis (Shigella spp.)**

**Infectivity & Pathogenicity** - Shigellosis is an infectious disease caused by spp. of bacteria called Shigella. There are several different kinds of Shigella bacteria: Shigella sonnei, also known as "Group D" Shigella, accounts for over two-thirds of the shigellosis in the United States. A second type of Shigella bacteria, Shigella flexneri or "group B" Shigella, accounts for almost all of the rest. Other types of Shigella are rare in this country, though they continue to be important causes of disease in the developing world. Most people that are infected with Shigella develop diarrhea (watery or often bloody) fever, malaise and stomach cramps. Shigellosis usually resolves in 5 to 7 days. Some persons who are infected may be asymptomatic.

**Transmissibility** - Most Shigella infections are the result of the bacterium passing from stools or soiled fingers of one person to the mouth of another person. This happens when basic hygiene and hand-washing habits are inadequate. It is particularly likely to occur among toddlers who are not fully toilet-trained. Family members and playmates of such children are at high risk of becoming infected.

Shigella infections may be acquired from eating contaminated food. Contaminated food may look and smell normal. Food may become contaminated by infected food handlers who forget to wash their hands with soap after using the bathroom. Vegetables can become contaminated if they are harvested from a field with sewage in it. Flies can breed in infected feces and then contaminate food. Shigella infections can also be acquired by drinking or swimming in contaminated water. Water may become contaminated if sewage runs into it or if someone with shigellosis swims in it.
Infective Dose or the Intoxicating Dose – A small amount (10 to 200 organisms) is sufficient to cause infection.

Incubation Period – Symptoms usually start a day or two after exposure to the bacterium.

Virulence - Reiter's syndrome is a late complication of S. flexneri infection, especially in persons with the genetic marker HLA-B27. HUS can occur after S. dysenteriae type 1 infection. Convulsions may occur in children; the mechanism may be related to a rapid rate of temperature elevation or metabolic alterations.

Lethality – Shigella dysenteriae type 1 causes deadly epidemics in the developing world. Antidiarrheal agents such as loperamide (Imodium*) or diphenoxylate with atropine (Lomotil*) are likely to make the illness worse and should be avoided.

Stability - Because many milder cases are not diagnosed or reported, the actual number of infections may be twenty times greater. Shigellosis is particularly common and causes recurrent problems in settings where hygiene is poor and can sometimes sweep through entire communities. Shigellosis is more common in summer than winter. In the developing world, shigellosis is far more common and is present in most communities most of the time. Shigella are present in the diarrheal stools of infected persons while they are sick and for a week or two afterwards.

Toxicity - Shigella does not produce a toxin.

Additional Factors - Shigella was discovered over 100 years ago by a Japanese scientist named Shiga, for whom they are named. It is important for the public health department to know about cases of shigellosis. It is important for clinical laboratories to send isolates of Shigella to the City, County or State Public Health Laboratory so the specific type can be determined and compared to other Shigella. If many cases occur at the same time, it may mean that a restaurant, food or water supply has a problem which needs correction by the public health department. If a number of cases occur in a day-care center, the public health department may need to coordinate efforts to improve hand-washing among the staff, children and their families. When a community-wide outbreak occurs, a community-wide approach to promote hand-washing and basic hygiene among children can stop the outbreak. Improvements in hygiene for vegetables and fruit picking and packing may prevent shigellosis caused by contaminated produce.
Treatment - Shigellosis can usually be treated with antibiotics. The antibiotics commonly used for treatment are ampicillin, trimethoprim/sulfamethoxazole, nalidixic acid or ciprofloxacin. Appropriate treatment kills the Shigella bacteria that might be present in the patient's stools and shortens the illness. Unfortunately, some Shigella bacteria have become resistant to antibiotics and using antibiotics to treat shigellosis can actually make the germs more resistant in the future. Persons with mild infections will usually recover quickly without antibiotic treatment. Therefore, when many persons in a community are affected by shigellosis, antibiotics are sometimes used selectively to treat only the more severe cases.

Prevention - There is no vaccine to prevent shigellosis. However, the spread of Shigella from an infected person to other persons can be stopped by frequent and careful hand-washing with soap and water by all age groups. Frequent, supervised hand-washing of all children should be followed in day care centers and in homes with children who are not completely toilet-trained (including children in diapers). When possible, young children with a Shigella infection who are still in diapers should not be in contact with uninfected children. If a child in diapers has shigellosis, everyone who changes the child's diapers should be sure the diapers are disposed of properly in a closed-lid garbage can and should wash their hands carefully with soap and warm water immediately after changing the diapers. After use, the diaper changing area should be wiped down with a disinfectant such as household bleach, Lysol® or bactericidal wipes.

People who have shigellosis should not prepare food or pour water for others until they have been shown to no longer be carrying the Shigella bacterium. Basic food safety precautions and regular drinking water treatment prevents shigellosis. At swimming beaches, having enough bathrooms near the swimming area helps keep the water from becoming contaminated.

Simple precautions taken while traveling to the developing world can prevent getting shigellosis. Drink only treated or boiled water and eat only cooked hot foods or fruits you peel yourself. The same precautions prevent traveler's diarrhea in general.

Staphylococcal enterotoxin B [SEB] (Staphylococcus aureus)

Infectivity & Pathogenicity - Staphylococcal enterotoxins produce a variety of toxic effects; at least seven distinct Staphylococcal enterotoxins have been identified, SEB is one of the toxins produced by the Staphylococcus aureus (S. aureus) bacteria. SEB toxin causes a noticeably different set of symptoms when
inhaled than it normally produces when ingested. General symptoms for both include: sudden onset of fever, chills, headache, myalgias and conjunctival infection. Ingestion of SEB generally results in gastrointestinal symptoms: nausea, vomiting and diarrhea. Whereas, inhaled symptoms include: fatigue, nonproductive cough, trouble breathing, nausea, vomiting and diarrhea. Fever, cough, sternal tightness, anorexia, nausea and vomiting are prominent features of inhalational intoxication; fatigue and malaise are observed as well. While diarrhea is reported in a few cases, it is not a prominent finding with SEB intoxication by inhalation.

More severe cases may develop: trouble breathing, retrosternal pain and fluid losses can be obvious. The fever may last up to five days and range from 103° to 106° F, with varying extents of chills and prostration. The nonproductive cough may persist up to four weeks. Physical examination in patients with SEB infection is often ordinary. Eye infection may be present and positional hypotension may develop due to fluid losses. The chest X-ray is also generally normal, but in severe cases increased spaces between tissues is noticeable, a lung may collapse and possibly; obvious fluid or an ARDS picture may develop.

Transmissibility - (SEB) is one of the fever producing toxins that commonly cause food poisoning in humans. SEB thrives in unrefrigerated meats, dairy and bakery products. Therefore, SEB is generally transmitted by eating contaminated foods. It is not possible to spread SEB from person-to-person. Often these cases have been clustered, due to common source exposure in a setting such as a church picnic or other community event in which contaminated food is consumed.

Infective Dose or the Intoxicating Dose – Orally, 25 micrograms of toxin induces vomiting in humans. When inhaled SEB causes symptoms at very low doses in humans; a dose much lower than the lethal dose by the inhaled route would be sufficient to incapacitate 50 percent of those soldiers exposed. This toxin could also be used (theoretically) in a Special Forces or terrorist mode to sabotage food or small volume water supplies.
Incubation Period – Symptoms of SEB begin 4-10 hours after eating contaminated foods and usually start within 3 to 12 hours after inhalation of the toxin.

Virulence - Inhalation of SEB can induce extensive pathophysiological changes to include widespread systemic damage and even septic shock.

Lethality – Significant morbidity is produced in individuals who are exposed to SEB by entry into the body. Although this toxin would not be likely to produce significant mortality on the battlefield, it could render up to 80 percent or more of exposed personnel clinically ill and unable to perform their mission for 1-2 weeks. Relevant battlefield exposures to SEB are projected to cause illness and incapacitation. However, higher exposure levels can presumably lead to septic shock and death. Therefore, even though SEB is not generally thought of as a lethal agent, it may severely incapacitate soldiers, making it an extremely important toxin to consider.

Stability - SEB is a relatively robust protein that is easily aerosolized and that is stable in aerosol form. SEB toxins are heat stable.

Toxicity - S. aureus produces a number of exotoxins, one of which is SEB. Such toxins are referred to as exotoxins since they are excreted from the organism; however, they normally exert their effects on the intestines and thereby are called enterotoxins.

Additional Factors - SEB has caused countless endemic cases of food poisoning. SEB also has been demonstrated to cause a nonmenstrual toxic shock syndrome (TSS). An SEB attack would cause cases to present in large numbers over a very short period of time, probably within a single 24 hour period. Naturally occurring pneumonias or influenza would involve patients presenting over a more prolonged interval of time. Because the symptoms of SEB illness may be similar to several respiratory pathogens such as influenza, adenovirus and mycoplasma, the diagnosis may initially be unclear. All of these might present with fever, nonproductive cough, myalgia and headache. Naturally occurring staphylococcal food poisoning cases would not present with pulmonary symptoms. SEB illness tends to progress rapidly to a fairly stable clinical state, whereas pulmonary anthrax, tularemia pneumonia or pneumonic plague would all progress if left untreated. Tularemia and plague, as well as Q fever, would be diagnosed by chest x-ray. SEB inhalation would not be characterized by these findings; respiratory difficulties occur late rather than early as with SEB inhalation. Although fairly rapidly disabling, the SEB toxin has a very high lethal dose making it attractive to the military. However, stress and exhaustion can make the toxin much more lethal.
**Treatment** - Currently, therapy is limited to supportive care. Close attention to oxygenation and hydration are important and in severe cases with pulmonary edema, ventilation with positive end expiratory pressure and diuretics might be necessary. Acetaminophen for fever and cough suppressants may make the patient more comfortable. The value of steroids is unknown. Most patients would be expected to do quite well after the initial acute phase of their illness, but most would generally be unfit for duty for one to two weeks.

**Prevention** - Although there is currently no human vaccine for immunization against SEB intoxication, several vaccine candidates are in development. Preliminary animal studies have been encouraging and a vaccine candidate is nearing transition to advanced development and testing in man. Experimentally, passive immunotherapy can reduce mortality, but only when given within 4-8 hours after inhaling SEB.

Isolation and Decontamination: Standard Precautions for healthcare workers. Wash with Hypochlorite (0.5% for 10-15 minutes) and/or soap and water. Destroy any food that may have been contaminated.

**Typhoid fever (Salmonella typhi)**

**Infectivity & Pathogenicity** - Once Salmonella typhi (S. typhi) bacteria are ingested, they multiply and spread into the bloodstream. Typhoid fever has an insidious onset characterized by a sustained fever as high as 103° to 104° F (39° to 40° C). Patients may also feel weak or have stomach pains, headache, constipation, malaise, chills or loss of appetite. In some cases, patients have a rash of flat, rose-colored spots. The only way to know for sure if an illness is typhoid fever is to have samples of stool or blood tested for the presence of S. typhi.

**Transmissibility** - You can get typhoid fever if you eat food or drink beverages that have been handled by a person who is shedding S. typhi or if sewage contaminated with S. typhi bacteria gets into the water you use for drinking or washing food. Therefore, typhoid fever is more common in areas of the world where hand-washing is less frequent and water is likely to be contaminated with sewage. Also, flies may spread the bacteria directly from stool to food. Rarely, hospital workers who have not taken adequate precautions develop typhoid fever.
after handling soiled bed linens or contaminated bandages from infected people.

**Infective Dose or the Intoxicating Dose** – As few as 15-20 cells; depends upon age and health of the individual and strain differences.

**Incubation Period** – May be from 3-90 days but usually 7-14 days.

**Virulence** - The hallmark of typhoid fever is the invasion of and multiplication within the liver, spleen, lymph nodes and Peyer patches of the ileum. Stool culture findings are positive for several days after S. typhi ingestion and do not become negative until after the onset of clinical illness. The organisms travel to the intestinal lymph nodes, multiply and then enter the blood stream to seed other tissues. Stupor, coma and shock are signs of severe infection and a poor ending.

**Lethality** – Typhoid fever is a life-threatening illness caused by the bacterium S. typhi. Persons given antibiotics usually begin to feel better within 2 to 3 days and deaths rarely occur. Persons who do not get treatment may continue to have fever for weeks or months with confusion, delirium and intestinal perforation; death rates range between 12% and 30%. However, case fatality rates of 10-50% have been reported from endemic countries when diagnosis is delayed or in cases of severe typhoid fever not treated with high-dose corticosteroid therapy and antibiotics. Typically, people who die are malnourished, very young or very old.

**Stability** - S. typhi lives only in humans. Persons with typhoid fever carry the bacteria in their bloodstream and intestinal tract. In addition, a small number of persons, called carriers, recover from typhoid fever but continue to carry the bacteria. Approximately 3% of persons infected with S. typhi, who do not receive treatment, become chronic carriers and continue to pass bacteria in their stool for more than a year. Some of these carriers never have symptoms. Both ill persons and carriers shed S. typhi in their feces.

**Toxicity** - S. typhi does not produce a toxin.

**Additional Factors** - In the United States about 400 cases occur each year and 70% of these are acquired while traveling internationally. Typhoid fever is still common in the developing world, where it affects about 12.5 million persons each year. If you are planning to travel outside the United States, you should know about typhoid fever and what steps you can take to protect yourself. Typhoid fever is common in most parts of the world except in industrialized regions such as the United States, Canada, Western Europe, Australia and Japan. Therefore, if you are traveling to the developing world, you should consider taking precautions. Over the past 10 years, travelers from the United States to Asia, Africa and Latin
America have been especially at risk. Most of the estimated 2,000 carriers in the United States are older women with chronic gallbladder disease. In the past, one such woman (a cook named Mary Mallon) was responsible for spreading typhoid fever to numerous people and became known as Typhoid Mary.

**Treatment** - Taking antibiotics **will not** prevent typhoid fever; they only help treat it. With prompt antibiotic therapy, more than 99% of the people with typhoid fever are cured, although convalescence may last several months. The antibiotic chloramphenicol is used worldwide, but increasing resistance to it has prompted the use of other antibiotics (such as trimethoprim-sulfamethoxazole or ciprofloxacin). Corticosteroids may be given to reduce brain inflammation if the person is delirious, comatose or in shock.

**Prevention** - Two basic actions can protect you from typhoid fever:

1. If you are traveling to a country where typhoid is common, you should consider being vaccinated against typhoid. Visit a doctor or travel clinic to discuss your vaccination options. Remember that you will need to complete your vaccination at least 1 week before you travel so that the vaccine has time to take effect. Typhoid vaccines lose effectiveness after several years; if you were vaccinated in the past, check with your doctor to see if it is time for a booster vaccination.

2. Avoid risky foods and drinks.

   - If you drink water, buy it bottled or bring it to a rolling boil for 1 minute before you drink it. Bottled carbonated water is safer than uncarbonated water.
   - Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.
   - Eat foods that have been thoroughly cooked and that are still hot and steaming.
   - Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well.
   - When you eat raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.
   - Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street and many travelers get sick from food bought from street vendors.

"Boil it, cook it, peel it or forget it"
Glanders (Burkholderia mallei)

Infectivity & Pathogenicity - Glanders is an infectious disease that is caused by the bacterium Burkholderia mallei (B. mallei). Generalized symptoms of glanders include: fever, muscle aches, chest pain, muscle tightness and headache. Additional symptoms have included: excessive tearing of the eyes, light sensitivity and diarrhea. Specific symptoms of glanders depend upon the route of infection. The types of infection include:

- Localized infections: if there is a cut or scratch in the skin, a localized infection with ulceration will develop within 1 to 5 days at the site where the bacteria entered the body. Swollen lymph nodes may also be noticeable. Infections involving the mucous membranes in the eyes, nose and respiratory tract will cause increased mucus production from the involved sites.
- Chronic infections: the chronic form of glanders involves multiple suppurative abscesses within the muscles of the arms and legs or the spleen or liver.
- Pulmonary infections: chest X-rays will show restricted infection in the lobes of the lungs; pneumonia, suppurative abscesses in the lungs and fluid in the lungs can occur.
- Bloodstream infections: systemic invasion can occur with resulting chronic abscessation.

Transmissibility - Glanders is primarily a disease involving horses, but it also affects mules, burros and donkeys (Equidae) and can be naturally contracted by goats, dogs and cats. Human infection, although not seen in the United States since 1945, has occurred rarely and sporadically among laboratory workers and those in direct and prolonged contact with infected, domestic animals. Glanders is transmitted to humans by direct contact with infected animals. The bacteria enter the body through the skin and through mucosal surfaces of the eyes and nose. There have been sporadic cases documented in veterinarians, horse caretakers and laboratorians. In addition to animal exposure, cases of human-to-human transmission have been reported.

Source: www.vet.uga.edu
These cases included two suggested cases of sexual transmission and several cases in family members who cared for the patients.

**Infective Dose or the Intoxicating Dose** – B. mallei is an organism that is associated with infections in laboratory workers because so very few (possibly 1-10) organisms are required to cause disease.

**Incubation Period** – Symptoms may begin in 1 to 14 days after exposure; usually 10 to 14 days depending on the inhaled dose and agent virulence.

**Virulence** - The attack rates caused by laboratory aerosols have been as high as 46% and cases have been severe. Mortality will be high despite antibiotic use. In the hamster 1 to 10 organisms administered by aerosol is lethal.

**Lethality** – The acute forms are more common in Equidae and death typically follows in 3 to 4 weeks. Glanders bloodstream infections are usually fatal within 7 to 10 days.

**Stability** - The United States has not seen any naturally occurring cases since the 1940s. However, it is still commonly seen among domestic animals in Africa, Asia, the Middle East, Central and South America. B. mallei only exist in infected susceptible hosts and are not found in water, soil or plants.

**Toxicity** - B. mallei does not produce a toxin.

**Additional Factors** - The organism has been considered as a potential agent for biological warfare and of biological terrorism. Occurrence in the absence of animal contact and/or in a human epidemic form is presumptive evidence of a BW attack.

**Treatment** - Because human cases of glanders are rare, there is limited information about antibiotic treatment of the organism in humans. Sulfadiazine has been found to be effective in experimental animals and in humans. B. mallei are usually susceptible to tetracyclines, ciprofloxacin, streptomycin, novobiocin, gentamicin, imipenem, ceftrazidime and the sulfonamides. Resistance to chloramphenicol has been reported.

**Prevention** - There is no vaccine available for glanders. In countries where glanders is endemic in animals, prevention of the disease in humans involves identification and elimination of the infection in the animal population. Within the health care setting, transmission can be prevented by using common blood and body fluid precautions. Post-exposure chemoprophylaxis may be tried with TMP-SMX.
Melioidosis (*Burkholderia pseudomallei*)

**Infectivity & Pathogenicity** - Melioidosis, also called Whitmore’s disease, is an infectious disease caused by the bacterium *Burkholderia pseudomallei* (B. pseudomallei). Melioidosis presents and looks similar to glanders disease, but the environmental sources, frequency and distribution of melioidosis are different from glanders. Illness from melioidosis can be categorized as acute, chronic or localized infection.

- **Acute, localized infection**: This form of infection is generally restricted to a nearby lymph gland and results from B. pseudomallei getting into the body through a break in the skin. The acute form of melioidosis can produce fever and general muscle aches and may advance rapidly to infect the bloodstream.

- **Pulmonary infection**: This form of the disease can produce a medical picture of mild upper airway inflammation to severe lung inflammation. The onset of pulmonary melioidosis is typically accompanied by a high fever, headache, loss of appetite and general muscle soreness. Chest pain is common, but a nonproductive or productive cough with normal sputum is the hallmark of this form of melioidosis.

- **Acute bloodstream infection**: Patients with underlying illness such as HIV, kidney failure and diabetes are affected by this type of the disease, which usually results in shock. The symptoms of the bloodstream infection vary depending on the site of original infection, but they generally include breathing problems, severe headache, fever, diarrhea, development of pus-filled areas on the skin, muscle tenderness and disorientation. This is typically an infection of short duration and pus-filled areas will be found throughout the body.

- **Chronic suppurative infection**: Chronic melioidosis is an infection that involves the organs of the body. These typically include the joints, internal organs, lymph nodes, skin, brain, liver, lung, bones and spleen.

**Transmissibility** - Humans and many animal species are susceptible to melioidosis. These include sheep, goats, horses, swine, cattle, dogs and...
cats. All are believed to acquire the infection by inhalation of dust, intake of contaminated water and contact with contaminated soil especially through skin abrasions and for military troops, by contamination of war wounds. Melioidosis can also be contracted by humans from infected domestic animals. Person-to-person transmission can occur after contact with blood or body fluids. There is one report of transmission to a sister with diabetes who was the caretaker for her brother who had chronic melioidosis. Two cases of sexual transmission have been reported. Transmission in both cases was preceded by a medical history of chronic prostate problems in the source patient.

**Infective Dose or the Intoxicating Dose** – Infection with a high inoculum such as following; near-drowning or as might be expected following a bioterrorist attack, tends to result in shorter incubation periods, even as short as a few hours

**Incubation Period** – The incubation period is not clearly defined, but may range from 2 days to many years. Infections from aerosolized forms in biological weapons are expected to have an incubation period of 10-14 days.

**Virulence** - Acute disease is defined by symptoms lasting less than 2 months, whereas chronic disease is defined by the presence of symptoms for more than 2 months. Like tuberculosis, melioidosis has the capacity to become latent and be reactivated at a later time. Melioidosis is diagnosed by isolating B. pseudomallei from the blood, urine, sputum or skin lesions. Detecting and measuring antibodies to the bacteria in the blood is another means of diagnosis.

**Lethality** – Untreated patients with septicemia have fatal outcomes. Before antibiotics, the death rate for septicemic disease was 95%. Currently, it is greater than 50% for septicemic disease and 20% for localized disease despite treatment. Overall, mortality is 40%. The type of infection and the course of treatment can usually predict any long-term problems.

**Stability** - B. pseudomallei can survive for months to years in soil and water, but can be readily destroyed by heat. Moist heat of 121°C for at least 15 min or dry heat of 160-170°C for at least 1 hour is recommended for disinfection. The organism is also susceptible to numerous disinfectants, including 1% sodium hypochlorite, 70% ethanol, glutaraldehyde and formaldehyde.

**Toxicity** - Melioidosis does not produce a toxin.
Additional Factors - B. pseudomallei is an organism that has been considered as a potential agent for biological warfare and biological terrorism. Melioidosis is endemic in Southeast Asia, with the greatest concentration of cases reported in Vietnam, Cambodia, Laos, Thailand, Malaysia, Myanmar (Burma) and northern Australia. Additionally, it is seen in the South Pacific, Africa, India and the Middle East. In many of these countries, B. pseudomallei are so prevalent that it is a common contaminant found on laboratory cultures. In Southeast Asia, the organism has been repeatedly isolated from agriculture fields, with infection occurring primarily during the rainy season. Moreover, it has been a common pathogen isolated from troops of all nationalities that have served in areas with endemic disease. A few isolated cases of melioidosis have occurred in the Western Hemisphere in Mexico, Panama, Ecuador, Haiti, Brazil, Peru, Guyana and in the states of Hawaii and Georgia. In the United States, confirmed cases range from none to five each year and occur among travelers and immigrants.

Treatment - Most cases of melioidosis can be treated with appropriate antibiotics. B. pseudomallei are usually sensitive to imipenem, penicillin, doxycycline, amoxicillin-clavulanic acid, azlocillin, ceftazidime, ticarcillin-vulanic acid, ceftriaxone and aztreonam. Treatment should be initiated early in the course of the disease.

Prevention - There is no vaccine for melioidosis. Prevention of the infection in endemic-disease areas can be difficult since contact with contaminated soil is so common. Persons with diabetes and skin lesions should avoid contact with soil and standing water in these areas. Wearing boots during agricultural work can prevent infection through the feet and lower legs. In health care settings, using common blood and body fluid precautions can prevent transmission.

Plague (Yersinia pestis)

Infectivity & Pathogenicity - Plague is caused by Yersinia pestis (Y. pestis) a bacterium found in rodents and their fleas in many areas around the world. Pneumonic plague affects the lungs and is transmitted when a person inhales Y. pestis particles from the air. Symptoms of pneumonic plague are usually fever, weakness and rapidly developing pneumonia with shortness of breath, chest pain, cough and sometimes bloody or watery sputum. Nausea, vomiting and abdominal pain may also
occur. Bubonic plague symptoms include swollen, tender lymph glands called buboes. If bubonic plague is not treated, however, the bacteria can spread through the bloodstream and infect the lungs, causing a secondary case of pneumatic plague. Accordingly, buboes are not always present in pneumatic plague.

**Transmissibility** - Pneumatic plague can be transmitted from person to person; bubonic plague cannot. Pneumatic plague occurs when Y. pestis infects the lungs. Pneumatic plague is transmitted by inhaling Y. pestis suspended in respiratory droplets from a person or animal with pneumatic plague. Respiratory droplets are spread most readily by coughing or sneezing. Becoming infected in this way usually requires direct and close (within 6 feet) contact with the ill person or animal. Pneumatic plague may also occur if a person with bubonic or septicemic plague is untreated and the bacteria spread to the lungs. Bubonic plague is transmitted through the bite of an infected flea or exposure to infected material through a break in the skin.

**Infective Dose or the Intoxicating Dose** – Some Y. pestis in the flea are regurgitated when the flea gets its next blood meal thus transferring the infection to a new host. While growing in the flea, Y. pestis loses its capsular layer. Most of the organisms are phagocytosed and killed by leukocytes in the human host. A few bacilli are taken up by tissue macrophages. The organisms then kill the macrophage and are released into the extracellular environment, where they resist phagocytosis.

**Incubation Period** – One to three days (pneumatic) or two to six days (bubonic) after becoming infected with the bacteria. Within hours of the initial flea bite, the infection spills out into the bloodstream, leading to involvement of the liver, spleen, and lungs.

**Virulence** - The macrophages are unable to kill Y. pestis and provide a protected environment for the organisms to synthesize their virulence factors. The Y. pestis quickly spread to the draining lymph nodes, which become hot, swollen, tender and hemorrhagic. This gives rise to the characteristic black buboes responsible for the name of this disease. Septicemia with regional lymph node involvement (bubonic plague, 85-90% of the cases) Septicemia without lymph node involvement (primary septicemic plague, 10-15% of the cases); depends on level of lymph node inflammatory response.

Complications: The most common complication of bubonic and septicemic plague is disseminated intravascular coagulation (DIC) pneumonia and meningitis.
Death: The patient usually dies of endotoxic shock.

**Lethality** – A number of bubonic patients develop a severe bacterial pneumonia, exhaling large numbers of viable organisms into the air during coughing fits. 50 to 60 percent of untreated patients will die if untreated. As the epidemic of bubonic plague develops (especially under conditions of severe overcrowding, malnutrition and heavy flea infestation) it eventually shifts into a predominately pneumonic form, which is far more difficult to control and which has 100 percent mortality. Without early treatment, pneumonic plague usually leads to respiratory failure, shock and rapid death.

**Stability** - The World Health Organization reports 1,000 to 3,000 cases of plague worldwide every year. Averages of 5 to 15 cases occur each year in the western United States. These cases are usually scattered and occur in rural to semi-rural areas. Most cases are of the bubonic form of the disease. Naturally occurring pneumonic plague is uncommon, although small outbreaks do occur. Both types of plague are readily controlled by standard public health response measures.

**Toxicity** - Y. pestis does not produce a toxin.

**Additional Factors** - Y. pestis used in an aerosol attack could cause cases of the pneumonic form of plague if someone inhales the Y. pestis particles, in an aerosol release during a bioterrorism attack. Once people have the disease, the bacteria can spread to others who have close contact with them. Because of the delay between being exposed to the bacteria and becoming sick, people could travel over a large area before becoming contagious and then possibly infecting others. Controlling the disease would then be more difficult. A bio-weapon carrying Y. pestis is possible because the bacterium occurs in nature and could be isolated and grown in quantity in a laboratory. Even so, manufacturing an effective weapon using Y. pestis would require advanced knowledge and technology.

**Treatment** - To prevent a high risk of death, antibiotics should be given within 24 hours of the first symptoms. Several types of antibiotics are effective for curing the disease and for preventing it. Available oral medications are a tetracycline (such as doxycycline) or a fluoroquinolone (such as ciprofloxacin). For injection or intravenous use; streptomycin or gentamicin antibiotics are used. Early in the response to a bioterrorism attack, these drugs would be tested to determine which is most effective against the particular weapon that was used.
Currently, no plague vaccine is available in the United States. Research is in progress, but we are not likely to have vaccines for several years or more.

**Prevention** - People having direct and close contact with someone with pneumonic plague should wear tightly fitting disposable surgical masks. Patients with the disease should be isolated and medically supervised for at least the first 48 hours of antibiotic treatment. People who have been exposed to a contagious person can be protected from developing plague by receiving prompt antibiotic treatment.

**Psittacosis (Chlamydia psittaci)**

**Infectivity & Pathogenicity** - Psittacosis refers to any infection or disease caused by Chlamydia psittaci, one of several microorganisms in the genus Chlamydia. Parrot disease, ornithosis and chlamydiosis are other names for psittacosis. Psittacosis is primarily a lung disease but it can involve several organs. Some reports show that inflammation of the liver, lining of the heart cavity, the heart muscle and the brain can occur. Signs and symptoms may be insidious or acute with headache, photophobia, fever, sweating, chills, nausea, vomiting, diarrhea, general malaise, weakness or fatigue, muscle and chest pain and anorexia. The temperature gradually rises and cough develops—initially dry but at times mucopurulent. The temperature remains elevated for 2 to 3 weeks then falls slowly. The course may be mild or severe, depending on the patient's age and the extent of pneumonia.

**Transmissibility** - Humans can become infected with Chlamydia psittaci by inhaling the organism when the urine, respiratory secretion or dried feces of infected birds are dispersed in the air as very fine droplets or dust particles. Other sources of exposure include mouth-to-beak contact, a bite from an infected bird and handling the plumage and tissues of infected birds. Person-to-person transmission of the disease is rare. However, it may occur when a person is exposed to infectious, aerosolized droplets from another person experiencing sudden, very forceful coughing during the acute illness.
**Infective Dose or the Intoxicating Dose** – Since each gram of stool from diseased birds can infect 10,000 other birds, the agent's power to cause psittacosis becomes very pertinent. Transient exposure to infected birds may cause symptomatic infection, even in visitors to pet shops.

**Incubation Period** – Signs and symptoms begin 1 to 4 weeks after exposure; generally in humans within four to 15 days after exposure. However, the time between exposure to Chlamydia psittaci and the onset of illness in caged birds can range from three days to several weeks. The birds can have a latent infection and be asymptomatic. Stress associated with nutritional deficiencies, overcrowding, breeding, egg-laying and prolonged transport may cause these birds with a latent infection to shed infectious agents intermittently or sometimes continuously for weeks or months in their feces and nasal discharges.

**Virulence** - The course of the disease is variable, a mild flu-like illness to severe pneumonia; in mild cases, fever may continue for three weeks or more and in severe cases can result in death. A gradual convalescence may be prolonged, especially in severe cases. A progressive, pronounced increase in pulse and respiratory rates is an ominous sign.

**Lethality** – The mortality rate prior to the advent of antimicrobial treatment was approximately 15-20%. Mortality may reach 30% in severe untreated cases and even higher rates are reported with virulent strains. The mortality rate is now less than 1% with appropriate antibiotic therapy; so, with proper treatment, psittacosis is rarely fatal.

**Stability** - Chlamydia psittaci infects wild and domestic birds and poultry. Birds which contract the infection include parrots, canaries, pigeons, chickens, ducks and turkeys. Psittacosis is found worldwide. The incidence seems to be increasing in developed countries, which is correlated to the import of exotic birds.

**Toxicity** - Psittacosis does not produce a toxin.

**Additional Factors** - Even if you have had psittacosis, you can still get it again.

**Treatment** - For accurate diagnosis of psittacosis, a doctor must know that the person has been exposed to birds and that the suspected birds are infected with Chlamydia psittaci. Laboratory examinations can identify the organism and detect the signs of infection. Patients who develop psittacosis require treatment with specific drugs. The disease is very responsive to tetracycline but is resistant to penicillin.
Prevention - Because other persons may become infected by inhaling cough droplets and sputum, strict patient isolation should be instituted when the diagnosis is suspected on clinical and epidemiologic grounds. Spread by imported birds is controlled with a mandatory 45-day course of chlortetracycline-treated feed, which generally, but not always, eliminates causative organisms from the birds' blood and feces. This measure may also be useful in controlling the disease in turkeys raised for market. Avoid birds that are sick. Signs of illness in birds may include runny eyes, runny noses or diarrhea and birds that are thin or have ruffled feathers. Buy birds of the parrot family from dealers with exotic bird permits; birds are more likely to be infected if they are brought into the country illegally. Keep new birds away from other birds for 30 to 45 days; have the birds tested or treated for psittacosis before they are added to a group of other birds. Clean all bird cages, food bowls and water bowls every day and disinfect them at least once a week. To disinfect items, use a household bleach mixture [1½ cups of bleach in 1 gallon of water] Lysol® or rubbing alcohol. Wash the item with a household detergent, rinse with water, soak in disinfectant for 5 minutes and then rinse again. When cleaning birdcages; spray the floor of the birdcage with a disinfectant before cleaning to cut down on the dust that you could breathe. For new birds or cage changes, throw away wooden perches and other things that cannot be disinfected. Take sick birds to a veterinarian for treatment. Report all bird and human cases of psittacosis to your local health department.

Q fever (Coxiella burnetii)

Infectivity & Pathogenicity - Q fever is caused by a microbe called Coxiella burnetii (C. burnetii). Many infections are asymptomatic. Common symptoms resemble a serious case of the flu with high fever, chills and sweating, a general feeling of sickness and loss of appetite. Some patients develop a slight, dry cough because of a lung inflammation known as pneumonitis. Sometimes, Q fever strikes as a sudden illness, affecting a large number of people in the same workplace. A small percentage of patients develop hepatitis or liver disease and jaundice, a yellowing of the skin and darkening of the urine, caused by a malfunctioning of the liver. Most symptoms disappear after 7-10 days. However, afflicted people can feel generally ill with loss of appetite for several weeks.

Transmissibility - Q fever is an infectious disease that spreads from animals to humans. People acquire the infection by inhaling infectious aerosols and contaminated dusts generated by animals or animal products. Q fever is a special concern with pregnant animals, especially around the time they give birth or abort. In pregnant animals, the Q fever microbe builds up to enormous numbers in certain tissues and fluids. These include: the uterus.
or womb, the placenta, which surrounds the offspring in the womb, the mammary glands or udders, birth fluids and milk.

C. burnetii become airborne in tiny droplets of mists or aerosols and spread to humans when: animals give birth; during processing of infected tissues from slaughtered animals; at milking or during the processing of milk or during animal surgery. People usually contract Q fever when they breathe in the Q fever microbe. People can also get Q fever by drinking infected milk, but most infections are spread through the air. Person to person transmission occurs rarely, if ever.

**Infective Dose or the Intoxicating Dose** – As few as ten Q fever microbes can start an infection. However, a single C. burnetii organism may cause disease in a susceptible person.

**Incubation Period** – Varies depending on the number of organisms that initially infect the patient. Infection with greater numbers of organisms will result in shorter incubation periods. Most patients become ill within 2-3 weeks after exposure.

**Virulence** - Studies show that one gram of placenta from an infected sheep can contain over one billion Q fever microbes.

**Lethality** – Those who recover fully from infection may possess lifelong immunity against re-infection. Only 1%-2% of people with acute Q fever die of the disease. However, chronic Q fever, characterized by infection that persists for more than 6 months although uncommon is a much more serious disease. Patients who have had acute Q fever may develop the chronic form as soon as 1 year or as long as 20 years after initial infection. A serious complication of chronic Q fever is endocarditis, generally involving the aortic heart valves, less commonly the mitral valve. Most patients who develop chronic Q fever have pre-existing valvular heart disease or have a history of vascular graft. Transplant recipients, patients with cancer and those with chronic kidney disease are also at risk of developing chronic Q fever; as many as 65% of persons with chronic Q fever may die of the disease.

**Stability** - C. burnetii can survive for months and even years in dust or soil and is rather resistant to heat and drying. Infected animals release the microbe in milk and manure. Cattle, sheep and goats are the primary reservoirs of the C. burnetii microbe which is usually found in tissues that are involved in birth--the uterus, placenta and birth fluids. Infection has been noted in a wide variety of other animals, including other species of livestock and in domesticated pets. C. burnetii does not usually cause clinical disease in these animals, although abortion in goats and sheep has been linked to C. burnetii infection.
**Toxicity** - C. burnetii does not produce a toxin.

**Additional Factors** - This agent could be developed for use in biological warfare and is considered a potential terrorist threat.

**Treatment** - Doxycycline is the treatment of choice for acute Q fever. Antibiotic treatment is most effective when initiated within the first 3 days of illness. Frequently, a dose of 100 mg of doxycycline taken orally twice a day for 15-21 days is prescribed. Quinolone antibiotics have demonstrated good in vitro activity against C. burnetii and may be considered by the physician. Therapy should be started again if the disease relapses. Patients usually recover promptly when treatment is started without delay. Chronic Q fever is much more difficult to treat effectively and often requires the use of multiple drugs. Two different treatment protocols have been evaluated: 1) doxycycline in combination with quinolones for at least 4 years and 2) doxycycline in combination with hydroxychloroquine for 1.5 to 3 years. The second therapy leads to fewer relapses, but requires routine eye exams to detect accumulation of chloroquine. Surgery to remove damaged valves may be required for some cases of Chronic Q fever.

**Prevention** - For most effective prevention, the C. burnetii microbe should be eliminated from animals. Eradication programs, however, are not yet available because Q fever spreads so effectively among animals. A vaccine for Q fever has been developed and has successfully protected humans in occupational settings in Australia. However, this vaccine is not commercially available in the United States. Persons wishing to be vaccinated should first have a skin test to determine a history of previous exposure. Individuals who have previously been exposed to C. burnetii should not receive the vaccine because severe reactions, localized to the area of the injected vaccine, may occur. A vaccine for use in animals has also been developed, but it is not available in the United States.

Protective clothing should be worn by workers exposed to animal tissue. Contaminated clothing should be labeled with a biohazard warning and washed using laundry procedures for disinfection. No eating, drinking, smoking or nail biting should be allowed in animal holding facilities. Hands should be washed frequently. Animal tissue should be handled with care, especially tissue involved in birth. Production and exposure to aerosols from animal tissues should be minimized. Respiratory protection devices suitable for preventing aerosol inhalation should be used by workers at increased risk of inhaling contaminated droplets.
Smallpox (Variola major)

Infectivity & Pathogenicity - The name smallpox is derived from the Latin word for spotted and refers to the raised bumps that appear on the face and body of an infected person. Smallpox is caused by the Variola virus that emerged in human populations thousands of years ago. There are two clinical forms of smallpox.

Variola major is the severe and most common form of smallpox, with a more extensive rash and higher fever. There are four types of Variola major smallpox:

- ordinary (the most frequent type, accounting for 90% or more of cases)
- modified (mild and occurring in previously vaccinated persons)
- flat
- hemorrhagic (both rare and very severe)

Variola minor is a less common presentation of smallpox and a much less severe disease, with death rates historically of 1% or less.

The first symptoms of smallpox include fever, malaise, head and body aches and sometimes vomiting. The fever is usually high, in the range of 101° to 104° Fahrenheit (F). At this time, people are usually too sick to carry on their normal activities. This is called the prodrome phase and may last for 2 to 4 days.

Early Rash (Duration: about 4 days) Most contagious: A rash emerges first as small red spots on the tongue and in the mouth. These spots develop into sores that break open and spread large amounts of the virus into the mouth and throat. At this time, the person becomes most contagious. Around the time the sores in the mouth break down, a rash appears on the skin, starting on the face and spreading to the arms and legs and then to the hands and feet. Usually the rash spreads to all parts of the body within 24 hours. As the rash appears, the fever usually falls and the person may start to feel better. By the third day of the rash, the rash becomes raised bumps. By the fourth day, the bumps fill with a thick, opaque fluid and often have a depression in the center that looks like a bellybutton. (This is
a major distinguishing characteristic of smallpox.) Fever often will rise again at this time and remain high until scabs form over the bumps.

**Pustular Rash** (Duration: about 5 days) **Contagious:** The bumps become pustules—sharply raised, usually round and firm to the touch as if there’s a small round object under the skin. People often say the bumps feel like BB pellets embedded in the skin.

**Pustules and Scabs** (Duration: about 5 days) **Contagious:** The pustules begin to form a crust and then scab. By the end of the second week after the rash appears most of the sores have scabbed over.

**Resolving Scabs** (Duration: about 6 days) **Contagious:** The scabs begin to fall off, leaving marks on the skin that eventually become pitted scars. Most scabs will have fallen off three weeks after the rash appears. Once all the scabs have fallen off the person is no longer contagious.

**Transmissibility** - Generally, direct and fairly prolonged face-to-face contact is required to spread smallpox from one person to another. Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects such as bedding or clothing. Rarely, smallpox has been spread by virus carried in the air in enclosed settings such as buildings, buses and trains. Smallpox is not known to be transmitted by insects or animals.

**Infective Dose or the Intoxicating Dose** – The sufficient number of microorganisms to produce disease is unknown; however, direct and fairly prolonged face-to-face contact is required to spread smallpox.

**Incubation Period** – A person with smallpox is sometimes contagious with onset of fever (prodrome phase) but the person becomes most contagious with the onset of rash. At this stage the infected person is usually very sick and not able to move around in the community. The infected person is contagious until the last smallpox scab falls off. The incubation period averages about 12 to 14 days but can range from 7 to 17 days. During this time, people are not contagious.

**Virulence** - The person is contagious to others until all of the scabs have fallen off.

**Lethality** – Smallpox is a serious, contagious and sometimes fatal infectious disease. Historically, Variola major has an overall fatality rate of about 30% however; flat and hemorrhagic smallpox is usually fatal.

**Stability** - Humans are the only natural hosts of Variola. Except for laboratory stockpiles, the variola virus has been eliminated.
Toxicity - Smallpox does not produce a toxin.

Additional Factors - Smallpox outbreaks have occurred from time to time for thousands of years, but the disease is now eradicated after a successful worldwide vaccination program. The last case of smallpox in the United States was in 1949. The last naturally occurring case in the world was in Somalia in 1977.

After the disease was eliminated from the world, routine vaccination against smallpox among the general public was stopped because it was no longer necessary for prevention. There is no specific treatment for smallpox disease. However, in the aftermath of the events of September and October, 2001, there is heightened concern that the Variola virus might be used as an agent of bioterrorism. For this reason, the U.S. government is taking precautions for dealing with a smallpox outbreak.

Tularemia (Francisella tularensis)

Infectivity & Pathogenicity - Tularemia is a potentially serious illness that occurs naturally in the United States and it is caused by the bacterium Francisella tularensis (F. tularensis) found in animals; especially rodents, rabbits and hares. Symptoms of tularemia could include: sudden fever, chills, headaches, diarrhea, muscle aches, joint pain, dry cough and/or progressive weakness. Other symptoms of tularemia depend on how a person was exposed to the tularemia bacteria. These symptoms can include: ulcers on the skin or mouth, swollen and painful lymph glands, swollen and painful eyes and a sore throat. Furthermore, people can also catch pneumonia and develop chest pain, bloody sputum and can have trouble breathing and even sometimes stop breathing.

Transmissibility - People can get tularemia many different ways: being bitten by an infected tick, deerfly or other insect; handling infected animal carcasses; eating or drinking contaminated food or water; or breathing in
the bacteria. Tularemia is not known to spread from person to person. People who have tularemia do not need to be isolated.

**Infective Dose or the Intoxicating Dose** – A small number (10-50 or so organisms) can cause disease.

**Incubation Period** – Symptoms usually appear 3 to 5 days after exposure to the bacteria, but can take as long as 14 days.

**Virulence** – F. tularensis is one of the most infectious pathogenic bacteria known. It requires inoculation or inhalation of as few as 10 organisms to cause disease.

**Lethality** – The disease can be fatal if it is not treated with the right antibiotics. People who have been exposed to the tularemia bacteria should be treated as soon as possible.

**Stability** – Most United States cases of natural F. tularensis are found in the south central and western States. F. tularensis is found in widely diverse animal hosts and habitats and can be recovered from contaminated water, soil and vegetation. A variety of small mammals, including voles, mice, water rats, squirrels, rabbits and hares are natural reservoirs of infection. They acquire infection through tick, fly and mosquito bites and by contact with contaminated environments. Under natural conditions, F. tularensis can survive for extended periods in a cold, moist environment. Epizootics with sometimes extensive die-offs of animal hosts may herald outbreaks of tularemia in humans.

**Toxicity** - Tularemia does not produce a toxin.

**Additional Factors** - If F. tularensis were used as a weapon, the bacteria would likely be made airborne for exposure by inhalation. People who inhale an infectious aerosol would generally experience severe respiratory illness, including life-threatening pneumonia and systemic infection, if they are not treated. The bacteria that cause tularemia occur widely in nature and could be isolated and grown in quantity in a laboratory, although manufacturing an effective aerosol weapon would require considerable sophistication. Information is not available about survivability of an intentionally released aerosol form of F. tularensis, but the working group predicts a short half-life due to desiccation, solar radiation, oxidation and other environmental factors and a very limited risk from secondary dispersal. Following an urban release, the risk to humans of acquiring tularemia from infected animals or arthropods is likely small and can be reduced by educating the public to avoid sick or dead animals and to take precautions to protect against biting arthropods.
Treatment - In a contained casualty setting, where individual patient management is possible, IV antibiotic therapy is recommended. Streptomycin is the drug of choice. Gentamicin, which is more widely available and can be used intravenously, is an acceptable alternative. Treatment with aminoglycosides should be continued for 10 days. Tetracyclines and chloramphenicol are also used, but relapses and primary treatment failures occur at a higher rate with these agents than with aminoglycosides and they should be given for at least 14 days to avoid relapse. Both streptomycin and gentamicin are recommended as first-line treatment of tularemia in children.

In a mass casualty setting, doxycycline and ciprofloxacin, administered orally, are the preferred choices for treatment of both adults and children.

Since it is unknown whether drug-resistant organisms might be used in a bioterrorist event, antimicrobial susceptibility testing of isolates should be conducted quickly and treatments altered according to test results and clinical responses.

Antibiotics for treating patients infected with tularemia in a bioterrorist event are included in the national pharmaceutical stockpile maintained by CDC, as are ventilators and other emergency equipment.

Prevention - Use insect repellent containing DEET on your skin or treat clothing with repellent containing permethrin, to prevent insect bites. Wash your hands often, using soap and warm water, especially after handling animal carcasses. Be sure to cook your food thoroughly and that your water is from a safe source. A vaccine for tularemia is under review by the Food and Drug Administration but is not currently available in the United States.

Typhus fever (*Rickettsia prowazekii*)

Infectivity & Pathogenicity - Typhus fever, also called Louse-borne typhus fever, Typhus exanthematicus, Brill-zinsser disease, Classic, European or Epidemic typhus, is a potentially fatal, infectious disease caused by the bacterium *Rickettsia prowazekii* (*R. prowazekii*) a Gram negative, obligate intracellular bacterium. Common symptoms include fever to 104° F in several days and it remains high, headache is generalized and intense, cough in 70% of patients, chills, weakness, falling blood pressure, stupor, delirium and muscle aches. Typhus fever also causes on the 4th to 6th day a maculopapular rash. The rash starts on the back, chest, stomach and then spreads to the arms and legs. The rash spreads to the rest of the body except for the face, palms and soles of the feet. The early rash is faint and rose colored and fades with pressure Later the lesions become
dull, red, and do not fade. People with severe typhus may also develop petechiae.

**Transmissibility** - Typhus fever is transmitted by body lice, which become contagious by feeding on the blood of infected humans. The lice then defecate while feeding on another person and the feces, which contain the R. prowazekii bacteria, can get rubbed into small wounds such as those caused by scratching lice-infected areas. It is the feces, not the bite of the louse that transmits the illness to humans. It is also possible to become infected through contact with the mucous membranes of the mouth and eyes or by inhaling the dust of dried lice feces. Typhus fever is not spread directly from person-to-person.

**Infective Dose or the Intoxicating Dose** – The sufficient number of microorganisms to produce disease is unknown however, the intensity of the infectious material and the susceptibility of the patient are the main considerations.

**Incubation Period** – The symptoms may appear from 1 to 2 weeks after the flea bite, usually within 12 days.

**Virulence** - A person cannot get typhus fever more than once.

**Lethality** – Without treatment death may occur in 10 to 60% of patients with epidemic typhus. Patients over the age of 60 have the highest risk of death. With timely antibiotic therapy, the affected person is expected to recover completely.

**Stability** - Humans are the reservoir. Lice infected with R. prowazekii excrete organisms in the feces after 2 to 6 days and die prematurely, within 2 weeks. Bacteria can survive in the feces and the dead lice for weeks. Typhus fever would seem to have been observed in almost all parts of the world; but it has most frequently prevailed in temperate or cold climates.

**Toxicity** - Typhus fever does not produce a toxin.

**Additional Factors** - Typhus fever is considered dangerous and could be used as a biological weapon. However, because it would be difficult to deliver and easy to treat it is not considered a very likely agent. The best accounts of the disease are those given by old English writers, who narrate its ravages in towns and describe many black assizes, in which it
was carried by prisoners and brought into court to the judges, jurymen and court officials, with fatal effect.

**Treatment** - Effective treatment is possible with antibiotics such as doxycycline, chloramphenicol or ciprofloxacin.

**Prevention** - Avoid contact with Pediculus corporis as it is the most common louse vector; however, Pediculus capitis and Phthirus pubis also transmit the disease. Laundering of louse-infested clothing is the most effective means to avoid person-to-person spread of lice and prevent epidemic typhus. Wear protective clothing (e.g., long-sleeved shirts, long pants) in endemic areas.

**Viral encephalitis (Alphaviruses)**

**Infectivity & Pathogenicity** - Alphaviruses include: Barmah Forest Fever, Chikungunya Fever, Eastern Equine Encephalitis (EEE) Ross River Fever, Semliki Forest Disease, Venezuelan Equine Encephalitis (VEE) and Western Equine Encephalitis (WEE). VEE virus is an arthropod-borne alphavirus that is endemic in northern South America, Trinidad, Central America, Mexico and Florida. Eight serologically distinct viruses belonging to the VEE complex have been associated with human disease; the two most important of these pathogens are designated subtype I, variants A/B and C. Symptoms are similar to those of many other zoonotic viral infections that cause fever and headache e.g., Dengue, Japanese Encephalitis, St Louis Encephalitis and West Nile Encephalitis. Unlike these infections, which are caused by a Flavivirus, VEE is caused by an enveloped single-stranded RNA virus of the Togaviridae family, Alphavirus genus. Alphaviruses are viruses that attack the brain; with sudden onset of illness with generalized malaise, spiking fevers, rigors, severe headache, photophobia and myalgias. Nausea, vomiting, cough, sore throat and diarrhea may follow.

**Transmissibility** - Natural infections are acquired by the bites of a wide variety of mosquitoes. Equidae serve as amplifying hosts and source of mosquito infection. Outbreaks of alphaviruses usually occur in the summer.

**Infective Dose or the Intoxicating Dose** – the epizootic viruses depend on equines as the primary hosts and on being circulated via equinophilous mosquitoes, which transmit the infection from a viremic equine to a susceptible equine, human or other vertebrate.
Incubation Period – The incubation period lasts from two to five days.

Virulence - These agents also cause severe disease in Equidae. In natural human epidemics, severe and often fatal encephalitis in Equidae always precedes disease in humans.

Lethality – Nearly 100 percent of those infected suffer an overt illness. Recovery from an infection results in excellent short-term and long-term immunity. Full recovery takes 1-2 weeks. VEE and WEE are less likely to cause brain-related symptoms. VEE has a death rate of less than 1 percent; WEE has a death rate of less than 3 percent. EEE, the most serious of the infections, has a high death rate (up to 35 percent). It also has a high rate of causing injury to the brain.

Stability - Unlike many viruses, these viruses are relatively stable in the environment. However, the virus is rather easily killed by heat and disinfectants.

Toxicity - Alphaviruses do not produce a toxin.

Additional Factors - Some species of the Alphavirus genus have characteristics that make them suited for weaponization, a fact that was recognized in the 1930s and 1940s. VEE was weaponized by the United States in the 1950's and 1960's before the U.S. offensive bio-warfare program was terminated. Other countries have been or are suspected to have weaponized this agent. Since VEE (known attempts) and other Alphaviruses are a potential threat for genetic manipulation; they could be used to create a more successful biological weapon. VEE and the other Alphaviruses could theoretically be produced in either a wet or dried form. Given that they are stable during storage; can be made in large amounts and delivered effectively via an aerosol route, they are considered to be easily weaponized. These bio-agents could then (theoretically) be delivered against friendly forces or populations in a manner similar to the other agents. If this virus was deployed efficiently, it could incapacitate thousands of people for a week or more and cause untold psychological stress to millions. As such, VEE remains the most likely potentially potent biological weapon of this group of Alphaviruses.

Treatment - There is no specific treatment or established cure for alphaviruses. Supportive care (intravenous fluids, medicine to control fever and pain) is the standard treatment.

Prevention - Avoid contact with arthropods, in particular, mosquitoes. In areas at risk for epizootics/epidemics, the most practical and effective measure on the national level is the systematic vaccination of equines. With this
measure, it is possible to eliminate the mosquitoes' main source of the virus from the epizootic/epidemic cycle and thus prevent epizootics (with economic losses) and subsequent epidemics (with high human morbidity).

Since VEE is similar to many other viruses, it is potentially susceptible to genetic manipulation; this characteristic has proven useful for researchers aiming to develop more effective vaccines. A live attenuated VEE vaccine has been used in horses and a live, attenuated vaccine for humans is available as an investigational new drug and a formalin-inactivated, killed vaccine is available for boosting antibody titers in those initially receiving the live vaccine, although further investigation of its protective effects is needed.

Viral hemorrhagic fevers (VHF’s) arenaviruses (e.g., Lassa, Machupo) and filoviruses (e.g., Ebola, Marburg)

**Infectivity & Pathogenicity** - VHF’s refer to a group of illnesses that are caused by several distinct families of viruses. They are all RNA viruses and covered or enveloped, in a fatty (lipid) coating. VHF’s are caused by viruses of four distinct families: arenaviruses, filoviruses, bunyaviruses and flaviviruses.

In general, the term VHF is used to describe a severe multi-system syndrome. Characteristically, the vascular system is damaged and the body's ability to regulate itself is impaired. Specific signs and symptoms vary by the type of VHF, but initial signs and symptoms often include obvious fever, fatigue, dizziness, muscle aches, loss of strength and exhaustion. Severely ill patient cases may also show shock, nervous system malfunction, coma, delirium and seizures and often show signs of bleeding under the skin, in internal organs or from body orifices like the mouth, eyes or ears. In spite of this, the bleeding, in and of itself, is rarely life-threatening and patients rarely die because of the blood loss. Some types of VHF are also associated with kidney failure or hemorrhagic fever with renal syndrome (HFRS).

Ebola hemorrhagic fever (EHF) onset of illness is abrupt and characterized by: fever, headache, joint and muscle aches, sore throat and weakness, followed by diarrhea, vomiting and stomach pain. A rash, red eyes, hiccups and internal and external bleeding may be seen in some patients. The Ebola virus has a very specific tropism for liver cells and cells of the reticuloendothelial system, e.g. macrophages; massive destruction of the liver is a hallmark feature of EHF.
With Marburg (MHF) the onset of the disease is sudden and is marked by fever, chills, headache and myalgia. Around the fifth day after the onset of symptoms, a maculopapular rash, most prominent on the trunk (chest, back, stomach) may occur. Nausea, vomiting, chest pain, sore throat, abdominal pain and diarrhea may then appear. Symptoms become increasingly severe and may include jaundice, inflammation of the pancreas, severe weight loss, delirium, shock, liver failure and multi-organ dysfunction.

Lassa fever (LHF) signs and symptoms include: fever, retrosternal pain, sore throat, back pain, cough, abdominal pain, vomiting, diarrhea, conjunctivitis, facial swelling, proteinuria and mucosal bleeding. Neurological problems have also been described, including hearing loss, tremors and encephalitis.

With Machupo early clinical manifestations in humans are characterized by nonspecific signs and symptoms including: fever, headache, fatigue, myalgia and arthralgia. Later in the course of disease (usually within 7 days of onset) patients may develop hemorrhagic signs, including bleeding from the oral and nasal mucosa and from the bronchopulmonary, gastrointestinal and genitourinary tracts.

**Transmissibility** - Viruses causing hemorrhagic fever are initially transmitted to humans when the activities of infected reservoir hosts or vectors and humans overlap. For the most part, rodents and arthropods are the main reservoirs for viruses causing VHF’s. Arthropods such as, ticks and mosquitoes, serve as vectors for some of the illnesses. Examples of rodent hosts are the cotton rat, deer mouse, house mouse, and other field rodents. The multimammate rat for Lassa fever and investigations have established the rodent Calomys callosus, which is indigenous to the disease-endemic region of northern Bolivia, as the reservoir for the Machupo virus. The exact origin, locations and natural habitat or natural reservoir of the Ebola and Marburg viruses remain unknown. However, on the basis of available evidence and the nature of similar viruses, researchers believe that the viruses are zoonotic and are normally maintained in an animal host that is native to the African continent. Just how the animal host first transmits Ebola and Marburg viruses to humans is unknown. The viruses carried in rodent reservoirs are transmitted when humans have contact with urine, fecal matter, saliva or other body excretions from infected rodents. The viruses associated with arthropod vectors are spread most often when the vector mosquito or tick bites a human or when a human crushes a tick. However, some of these vectors may spread the virus to animals, livestock, for example: Humans then become infected when they care for or slaughter the animals.
Some viruses that cause hemorrhagic fever can spread from one person to another, a few better than others, once an initial person has become infected; Ebola, Lassa, Marburg and Machupo hemorrhagic fever viruses are all examples. This type of secondary transmission of the virus can occur directly, through close contact with infected people or their body fluids. Unlike the other arenaviruses, Lassa virus can be fairly easily transmitted from human to human. Humans can contract the disease from other humans via aerosol transmission (coughing) or from direct contact with infected human blood, urine or semen. Lassa virus has been isolated from semen 6 weeks after acute illness; the virus can be transmitted to sexual partners by convalescent men. It can also occur indirectly, through contact with objects contaminated with infected body fluids. For example, contaminated syringes and needles have played an important role in spreading infection in outbreaks of EHF and Lassa.

**Infective Dose or the Intoxicating Dose** – The sufficient number of organisms to produce disease is unknown however, a viremic vector would be assumed necessary. With the Ebola virus, a most important finding is that acutely ill patients are intensely viremic. This finding would also be assumed with Marburg as well as they are both filoviruses. With Lassa the virus cannot be spread through casual contact. With Machupo virus, exposed persons may become infected by inhaling virus shed in aerosolized secretions or excretions of infected rodents, by eating food contaminated with rodent excreta; or by direct contact of excreta with abraded skin or mouth mucous membranes.

**Incubation Period** – The incubation period for EHF ranges from 2 to 21 days, with 7-14 days the most common interval. MHF has an incubation period of 5-10 days. Signs and symptoms of LHF are usually about 10 days after the patient comes into contact with the virus; but ranges from 1-24 days. Most patients display symptoms for 4 to 5 days before seeking hospital treatment. Machupo virus demonstrated an incubation period of 7 to 14 days.

**Virulence** - Even in small quantities, the Ebola virus can reproduce rapidly if exposed to an area that is easily infected (such as the eyes). Close personal contact with persons who are infected but who do not yet show signs of active disease is unlikely to result in infection. Recent studies, however, indicate that even in the earlier stages of EHF infection the virus can be present on the surface of the skin of the person who is infected with the virus (either through secretions of sweat through the skin or in the later stages of the disease - through the virus escaping through the skin cells). The Ebola and Marburg viruses are among the most virulent pathogens known to infect humans. Though caused by different viruses,
the two diseases are clinically almost indistinguishable. Both diseases are rare, but have a capacity to cause dramatic outbreaks with high fatality.

Complications of LHF in a minority of survivors may include hair loss, inflammation of the iris, temporary blindness and temporary or permanent deafness. The most common complication of Lassa fever is deafness. Various degrees of deafness occur in approximately one-third of cases and in many cases hearing loss is permanent. As far as it is known, the severity of the disease does not affect this complication: deafness may develop in mild as well as in severe cases. Spontaneous abortion is another serious complication. Many infections may be mild or asymptomatic.

Risks with Machupo are that approximately a third of patients develop delirium, convulsions or serious hemorrhages.

**Lethality** – While some types of VHF’s can cause relatively mild illnesses, many of these viruses cause severe, life-threatening disease. With a few noteworthy exceptions, there is no cure or established drug treatment for VHF’s.

Since the Ebola virus was discovered there have been approximately 1,850 cases with over 1,200 deaths or 65%. For MHF case fatality rates have varied greatly, from 25% in the initial laboratory-associated outbreak in 1967, to more than 80% in the Democratic Republic of Congo from 1998-2000 and in Angola as of 5 June 2005, a reported 423 cases of which, 357 were fatal or 84%.

In endemic areas, LHF is mild or asymptomatic in approximately 80% of those infected and the overall mortality rate is 1%. In natural infections, approximately 20% of infected individuals develop severe disease and 15-20% of hospitalized patients die. Infections in pregnant women are generally more serious: mortality rates range from 30 to 50%, and 95% of the pregnancies end in abortion. Occasional epidemics of LHF occur; during such outbreaks, the case-fatality rate may be as high as 50%.

Estimates of the mortality rate for Machupo range from 5 to 30%.

**Stability** - Humans are not the natural reservoir for any of these viruses. VHF survival is dependent on an animal or insect host, called the natural reservoir. The viruses are geographically restricted to the areas where their host species live. Humans are infected when they come into contact with infected hosts. However, with some viruses, after the accidental transmission from the host, humans can transmit the virus to one another. Human cases or outbreaks of VHF’s caused by these viruses occur
sporadically and irregularly. The occurrence of outbreaks cannot be easily predicted.

Infections with Ebola virus are acute; there is no carrier state. The natural reservoir of the Ebola virus is unknown despite extensive studies, but seems to reside in the rain forests on the African continent and in the Western Pacific. Although non-human primates have been a source of infection for humans, they are not thought to be the reservoir. They, like humans, are believed to be infected directly from the natural reservoir or through a chain of transmission from the natural reservoir. On the African continent, Ebola infections of human cases have been linked to direct contact with gorillas, chimpanzees, monkeys, forest antelope and porcupines found dead in the rainforest. So far, the Ebola virus has been detected in the wild in carcasses of chimpanzees (in Côte-d’Ivoire and Republic of Congo) gorillas (Gabon and Republic of Congo) and duikers (Republic of Congo). Different hypotheses have been developed to try to explain the origin of Ebola outbreaks. Laboratory observation has shown that bats experimentally infected with Ebola do not die and this has raised speculation that these mammals may play a role in maintaining the virus in the tropical forest.

Extensive ecological studies are underway in the Republic of Congo and Gabon to identify the Ebola’s natural reservoir.

Marburg virus is indigenous to Africa. While the geographic area to which it is native is unknown, this area appears to include at least parts of Uganda, Western Kenya and perhaps Zimbabwe. As with the Ebola virus, the actual host for Marburg virus remains a mystery with no definite clues. Lassa virus is found in Guinea, Liberia, Sierra Leone and regions of Nigeria. Lassa infection in rodents persists and the virus is shed throughout the life of the animal.

Machupo virus can infect rodents and non-human primates. Rhesus monkeys, Geoffrey’s tamarin, African green monkeys, marmosets, guinea pigs and infant mice develop clinical signs after experimental infection. Infections in the reservoir host, the vespertine mouse (Calomys callosus) are asymptomatic. Machupo occurs in Bolivia. Related viruses are seen in other South American countries.

**Toxicity** - Viral hemorrhagic fevers do not produce a toxin.

**Additional Factors** - The viruses that cause VHF’s are distributed over much of the globe. However, because each virus is associated with one or more particular host species, the virus and the disease it causes are usually seen only where the host species live(s). Some hosts, such as the rodent species carrying several of the New World arenaviruses, live in
geographically restricted areas. Therefore, the risk of getting VHF’s caused by these viruses is restricted to those areas. Other hosts range over continents, such as the rodents that carry viruses which cause various forms of HPS in North and South America or the different set of rodents that carry viruses which cause HFRS in Europe and Asia. A few hosts are distributed nearly worldwide, such as the common rat. It can carry Seoul virus, a cause of HFRS; therefore, humans can get HFRS anywhere where the common rat is found.

While people usually become infected only in areas where the host lives, occasionally people become infected by a host that has been exported from its native habitat. For example, the first outbreaks of MHF, in Marburg and Frankfurt, Germany and in Yugoslavia, occurred when laboratory workers handled imported monkeys infected with Marburg virus. Occasionally, a person becomes infected in an area where the virus occurs naturally and then travels elsewhere. If the virus is a type that can be transmitted further by person-to-person contact, the traveler could infect other people. In 1996 a medical professional treating patients with EHF in Gabon unknowingly became infected. When he later traveled to South Africa and was treated for EHF in a hospital, the virus was transmitted to a nurse. She became ill and died. Because more and more people travel each year, outbreaks of these diseases are becoming an increasing threat in places where they rarely, if ever, have been seen before.

The Special Pathogens Branch (SPB) primarily works with hemorrhagic fever viruses that are classified as bio-safety level four (BSL-4) pathogens. A list of these viruses appears in the SPB disease information index. The Division of Vector-Borne Infectious Diseases, also in the National Center for Infectious Diseases, works with the non-BSL-4 viruses that cause two other hemorrhagic fevers, dengue hemorrhagic fever and yellow fever.

**Treatment** - Patients receive supportive therapy, but generally speaking, there is no other treatment or established cure for VHF’s. Ribavirin, an anti-viral drug, has been effective in treating some individuals with Lassa fever or HFRS. Treatment with convalescent-phase plasma has been used with success in some patients with Argentine hemorrhagic fever.

**Prevention** - With the exception of yellow fever and Argentine hemorrhagic fever, for which vaccines have been developed, no vaccines exist that can protect against these diseases. Therefore, prevention efforts must concentrate on avoiding contact with host species. Because many of the hosts that carry hemorrhagic fever viruses are rodents, disease prevention efforts include: controlling rodent populations; discouraging rodents from
entering or living in homes or workplaces and encouraging safe cleanup of rodent nests and droppings.

For hemorrhagic fever viruses spread by arthropod vectors, prevention efforts often focus on community-wide insect and arthropod control. In addition, people are encouraged to use insect repellent, proper clothing, bed nets, window screens and other insect barriers to avoid being bitten.

If prevention methods fail and a case of VHF do occur, efforts should focus on preventing further transmission from person to person, if the virus can be transmitted in this way. For those hemorrhagic fever viruses that can be transmitted from one person to another, avoiding close physical contact with infected people and their body fluids is the most important way of controlling the spread of disease. Barrier nursing or infection control techniques include isolating infected individuals and wearing protective clothing. Other infection control recommendations include proper use, disinfection and disposal of instruments and equipment used in treating or caring for patients with VHF, such as needles and thermometers.

**Water safety threats:**

**Cholera (Vibrio cholerae)**

**Infectivity & Pathogenicity** - Cholera is an acute, diarrheal illness caused by infection of the intestine with the bacterium Vibrio cholerae (V. cholerae). The infection is often mild or asymptomatic, but sometimes can be severe. Approximately one in twenty infected persons has severe disease characterized by profuse watery diarrhea, vomiting, leg cramps and circulatory collapse. In these persons rapid loss of body fluids lead to dehydration and shock.

**Transmissibility** - The natural reservoir of the organism is not known. It was long assumed to be humans, but some evidence suggests that it is the aquatic environment. A person may get cholera by drinking water or eating food contaminated with the cholera bacterium. In an epidemic, the source of the contamination is usually the feces of an infected person. The disease can spread rapidly in areas with inadequate treatment of sewage and drinking water. The disease is not likely to spread directly from one
person to another; therefore, casual contact with an infected person is not a risk for becoming ill.

**Infective Dose or the Intoxicating Dose** – *V. cholerae* are sensitive to acid and most die in the stomach. Surviving virulent organisms may adhere to and colonize the small bowel, where they secrete the potent *cholera enterotoxin*. Gastric acid, mucus secretion and intestinal motility are the prime nonspecific defenses against *V. cholerae*. Breastfeeding in endemic areas is important in protecting infants from disease.

**Incubation Period** – From a few hours to five days, usually two to three days.

**Virulence** - In general, isolates of *V. cholerae O1* or *O139* that produce toxin are considered fully virulent and capable of causing epidemic cholera.

**Lethality** – With prompt rehydration, less than 1% of cholera patients die. Without treatment, death can occur within hours. In its extreme manifestation, cholera is one of the most rapidly fatal illnesses known. A healthy person may become hypotensive within an hour of the onset of symptoms and may die within 2-3 hours if no treatment is provided. More commonly, the disease progresses from the first liquid stool to shock in 4-12 hours, with death following in 18 hours to several days.

**Stability** - Although *V. cholerae O1* and *O139* are easily killed by drying, sunlight and acidity (they die rapidly in solutions below pH 6) nonetheless, they are quite tolerant of alkaline conditions. *V. cholerae* grow well on a variety of moist alkaline foods from which other competing organisms have been eliminated by previous cooking. Cooked rice is an excellent growth medium, as are lentils, millet and other cooked grains and legumes with neutral pH. The cholera bacterium may also live in the environment in brackish rivers and coastal waters. Shellfish eaten raw have been a source of cholera and a few persons in the United States have contracted cholera after eating raw or undercooked shellfish from the Gulf of Mexico. Fruits and vegetables grown in sewage and eaten without cooking or other decontaminating procedures are potential vehicles of cholera transmission. Freezing foods or drinks does not prevent cholera transmission.
Toxicity - Generally, non epidemic cholera does not produce a toxin; however, epidemic V. cholerae O1 & O139 do produce an enterotoxin.

Additional Factors - In the United States, because of advanced water and sanitation systems, cholera is not a major threat. Cholera has been very rare in industrialized nations for the last 100 years; however, the disease is still common today in other parts of the world, including the Indian subcontinent and sub-Saharan Africa. In January 1991, epidemic cholera appeared in South America and quickly spread to several countries. A few cases occurred in the United States among persons who traveled to South America or ate contaminated food. Because of this everyone, especially travelers should be aware of how the disease is transmitted and what can be done to prevent it.

Treatment - Cholera can be simply and successfully treated by immediate replacement of the fluid and salts lost through diarrhea. Patients can be treated with oral rehydration solution, a prepackaged mixture of sugar and salts to be mixed with water and drunk in large amounts. This solution is used throughout the world to treat diarrhea. Severe cases also require intravenous fluid replacement.

Antibiotics shorten the course and diminish the severity of the illness, but they are not as important as rehydration. Persons who develop severe diarrhea and vomiting in countries where cholera occurs should seek medical attention promptly.

Prevention - A simple rule of thumb is: "Boil it, cook it, peel it or forget it."

- Drink only water that you have boiled or treated with chlorine or iodine.
- Other safe beverages include tea and coffee made with boiled water and carbonated bottled beverages with no ice.
- Eat only foods that have been thoroughly cooked and are still hot or fruit that you have peeled yourself.
- Avoid undercooked or raw fish or shellfish, including ceviche.
- Make sure all vegetables are cooked and avoid salads.
- Avoid foods and beverages from street vendors.
- Do not bring perishable seafood back to the United States

At the present time, the manufacture and sale of the only licensed cholera vaccine in the United States (Wyeth-Ayerst) has been discontinued. It has not been recommended for travelers because of the brief and incomplete immunity it offers. No cholera vaccination requirements exist for entry or exit in any country.
Two recently developed vaccines for cholera are licensed and available in other countries (Dukoral®, Biotec AB and Mutacol®, Berna). Both vaccines appear to provide a somewhat better immunity and fewer side-effects than the previously available vaccine. However, neither of these two vaccines is recommended for travelers nor are they available in the United States.

**Cryptosporidiosis (e.g., Cryptosporidium parvum)**

**Infectivity & Pathogenicity**
Cryptosporidium parvum, a single-celled animal, i.e., a protozoon, is an obligate intracellular parasite. It lives on (or just under) the surface of the cells lining the small intestine, reproduces asexually and oocysts are passed in the feces. It has been given additional species names when isolated from different hosts; a total of 21 species of have been identified. It is currently thought that the form infecting humans is the same species that causes disease in young calves. In immunocompetent patients, cryptosporidiosis is an acute, yet self-limiting diarrheal illness, 1-3 week duration, but it can last for up to 6 weeks and symptoms include: Frequent, watery diarrhea, nausea, vomiting, abdominal cramps and low-grade fever but, may alternatively, be asymptomatic. Pulmonary and tracheal cryptosporidiosis in humans is associated with coughing and frequently a low-grade fever; these symptoms are often accompanied by severe intestinal distress. For immunocompromised persons, the illness is much more severe: Debilitating, cholera-like diarrhea (up to 20 liters/day) severe abdominal cramps, malaise, low-grade fever, weight loss and anorexia.

**Transmissibility** - Some strains appear to be adapted to certain hosts but cross-strain infectivity occurs and may or may not be associated with illness. The species or strain infecting the respiratory system is not currently distinguished from the form infecting the intestines. Cryptosporidium sp. infects many herd animals cows, goats, sheep among domesticated animals and deer and elk.
among wild animals. Oocysts are shed in the infected host’s feces. Cryptosporidium spp. could occur, theoretically, on any food touched by a contaminated food handler. Incidence is higher in child day care centers that serve food. Fertilizing salad vegetables with manure is another possible source of human infection. Large outbreaks are usually associated with contaminated water supplies.

**Infective Dose or the Intoxicating Dose** – The infective stage of the organism, the oocyst is 3 μm in diameter or about half the size of a red blood cell. Less than 10 organisms and presumably, one organism can initiate an infection.

**Incubation Period** – An incubation period of 2-14 days follows ingestion of the oocysts.

**Virulence** - In most patients infected with cryptosporidiosis the infection causes a short term, mild diarrhea. Since such symptoms are associated with a number of ailments, infected individuals may not seek medical treatment, and the infection may subside on its own. Thus, it is difficult to say how many people are infected. On the other hand, in persons with compromised immune systems, this parasite can cause a pronounced, chronic diarrhea; in severe cases the infected individual may produce up to 20 liters/day of stools and this may go on for weeks or months.

**Lethality** – The mechanism of disease is not known; however, the intracellular stages of the parasite can cause severe tissue alteration. Needless to say, such an infection, if not fatal unto itself, can worsen other opportunistic infections common in immunocompromised hosts.

**Stability** - Oocysts can remain viable for about 18 months in a cool, damp or wet environment. They are quite common in rivers and lakes, especially where there has been sewage or animal contamination. The sporocysts are resistant to most
chemical disinfectants, but are susceptible to drying and the ultraviolet portion of sunlight. They can survive most environments for long periods of time due to its hardy cyst and inhabits all climates and locales.

**Toxicity** - Cryptosporidium parvum does not produce a toxin.

**Additional Factors** - Direct human surveys indicate a prevalence of about 2% of the population in North America. Serological surveys indicate that 80% of the population has had cryptosporidiosis. The extent of illness associated with reactive sera is not known. Recent studies indicate that Cryptosporidium oocysts are present in 65-97% of surface water in the U.S. The forms that infect avian hosts and those that infect mice are not thought capable of infecting humans.

**Treatment**

Although there is no standard treatment for cryptosporidiosis, the symptoms can be treated. Most people who have a healthy immune system will recover without treatment. If you have diarrhea, drink plenty of fluids to prevent dehydration. Rapid loss of fluids from diarrhea may be especially life threatening to babies; therefore, parents should talk to their health care provider about fluid replacement therapy options for infants. Antidiarrheal medicine may help slow down diarrhea, but talk to your health care provider before taking it. A new drug, nitazoxanide, has been approved for treatment of diarrhea caused by Cryptosporidium in healthy children less than 12 years old. Consult with your health care provider for more information.

People who are in poor health or who have a weakened immune system are at higher risk for more severe and more prolonged illness. For persons with AIDS, anti-retroviral therapy that improves immune status will also decrease or eliminate symptoms of Cryptosporidium. However, even if symptoms disappear, cryptosporidiosis is usually not curable and the symptoms may return if the immune status worsens. See your health care provider to discuss anti-retroviral therapy used to improve your immune status.

**Prevention** - Practice good hygiene

- Wash hands thoroughly with soap and water.
- Wash hands after using the toilet and before handling or eating food (especially for persons with diarrhea).
- Wash hands after every diaper change, especially if you work with diaper-aged children, even if you are wearing gloves.
- Protect others by not swimming if you are experiencing diarrhea (essential for children in diapers).

**Avoid water that might be contaminated.**

- Do not swallow recreational water
- Do not drink untreated water from shallow wells, lakes, rivers, springs, ponds and streams.
- Do not drink untreated water during community-wide outbreaks of disease caused by contaminated drinking water.
- Do not use untreated ice or drinking water when traveling in countries where the water supply might be unsafe.
- In the United States, nationally distributed brands of bottled or canned carbonated soft drinks are safe to drink. Commercially packaged non-carbonated soft drinks and fruit juices that do not require refrigeration until after they are opened (those that are stored unrefrigerated on grocery shelves) also are safe.

If you are unable to avoid using or drinking water that might be contaminated, then you can make the water safe to drink by doing one of the following:

- Heat the water to a rolling boil for at least 1 minute.

**OR**

- Use a filter that has an absolute pore size of at least 1 micron or one that has been NSF rated for "cyst removal."

Do not rely on chemicals to disinfect water and kill Cryptosporidium. Because it has a thick outer shell, this particular parasite is highly resistant to disinfectants such as chlorine and iodine.

Avoid food that might be contaminated.

- Wash and/or peel all raw vegetables and fruits before eating.
- Use safe, uncontaminated water to wash all food that is to be eaten raw.
- Avoid eating uncooked foods when traveling in countries with minimal water treatment and sanitation systems.

Take extra care when traveling.

If you travel to developing nations, you may be at a greater risk for Cryptosporidium infection because of poorer water treatment and food sanitation. Warnings about food, drinks and swimming are even more important when visiting developing countries. Avoid foods and drinks, in particular raw fruits and vegetables, tap water or ice made from tap water, unpasteurized milk or dairy products, and items purchased from street vendors. These items may be contaminated with Cryptosporidium. Steaming-hot foods, fruits you peel yourself, bottled and canned processed drinks, and hot coffee or hot tea are probably safe. Talk with your health care provider about other guidelines for travel abroad.

Avoid fecal exposure during sexual activity.
Biotoxins

Simply put, a biotoxin is a toxic substance produced by a living organism. The toxic substance may in fact be a chemical but, due to its biological origin, it is classified in the biological section under biotoxins.

Abrin (Abrus precatorius)

Abrin is a natural poison that is found in the seeds of a plant called the rosary pea or jequirity pea. These seeds are red with a black spot covering one end. Abrin is similar to ricin, a toxin that is also found in the seeds of a plant (the castor bean plant). However, abrin is much more poisonous than ricin. Abrin can be made in the form of a powder, a mist or a pellet or it can be dissolved in water. Powdered abrin is yellowish-white in color. Abrin is a stable substance, meaning that it can last for a long time in the environment despite extreme conditions such as very hot or very cold temperatures.

Abrin is not known to have been used in any wars or terrorist attacks. The rosary pea, which is the source of abrin, is common to many tropical areas throughout the world and is sometimes used as an herbal remedy. The seeds of the rosary pea have been used to make beaded jewelry, which can lead to abrin poisoning if the seeds are swallowed. Abrin has some potential medical uses, such as, in treatment to kill cancer cells.

It would take a deliberate act to obtain abrin from rosary pea seeds and use it to poison people. Accidental exposure to abrin is not likely. You could inhale abrin if it is in the form of a mist or a powder. You could be exposed if you touch surfaces on which abrin particles or droplets have landed or if particles or droplets of abrin land on your skin or in your eyes. You could eat abrin if it is in food or water. Pellets of abrin or abrin dissolved in a liquid could be injected into a person’s body. Abrin poisoning is not contagious. It cannot be spread from person to person through casual contact.
Abrin works by getting inside the cells of a person’s body and preventing the cells from making the proteins they need. Without the proteins, cells die. Eventually, this is harmful to the whole body and death may occur. Effects of abrin poisoning depend on whether abrin was inhaled, swallowed or injected.

**Signs and symptoms of abrin exposure** - The major symptoms of abrin poisoning depend on the route of exposure and the dose received, though many organs may be affected in severe cases. Initial symptoms of abrin poisoning by inhalation may occur within 8 hours of exposure. Following ingestion of abrin, initial symptoms may occur in less than 6 hours but usually are delayed for 1 to 3 days.

- **Inhalation**: Within a few hours of inhaling significant amounts of abrin, the likely symptoms would be respiratory distress (difficulty breathing), fever, cough, nausea, and tightness in the chest. Heavy sweating may follow as well as fluid building up in the lungs (pulmonary edema). This would make breathing even more difficult, and the skin might turn blue. Excess fluid in the lungs would be diagnosed by x-ray or by listening to the chest with a stethoscope. Finally, low blood pressure and respiratory failure may occur, leading to death.

- **Ingestion**: If someone swallows a significant amount of abrin, he or she would develop vomiting and diarrhea that may become bloody. Severe dehydration may be the result, followed by low blood pressure. Other signs or symptoms may include hallucinations, seizures, and blood in the urine. Within several days, the person’s liver, spleen, and kidneys might stop working, and the person could die.

- **Skin and eye exposure**: Abrin in the powder or mist form can cause redness and pain of the skin and the eyes.

Death from abrin poisoning could take place within 36 to 72 hours of exposure, depending on the route of exposure (inhalaion, ingestion, or injection) and the dose received. If death has not occurred in 3 to 5 days, the victim usually recovers.

Showing these signs and symptoms does not necessarily mean that a person has been exposed to abrin.

**Treatment** - Because no antidote exists for abrin, the most important factor is avoiding abrin exposure in the first place. If exposure cannot be avoided, the most important factor is then getting the abrin off or out of the body as quickly as possible. Abrin poisoning is treated by giving victims supportive medical care to minimize the effects of the poisoning. The types of supportive medical care would depend on several factors, such as the route by which victims were poisoned (that is, whether poisoning was by inhalation, ingestion, or skin or eye exposure).
Care could include such measures as helping victims breathe, giving them intravenous fluids (fluids given through a needle inserted into a vein), giving them medications to treat conditions such as seizure and low blood pressure, flushing their stomachs with activated charcoal (if the abrin has been very recently ingested), or washing out their eyes with water if their eyes are irritated.

If there is a suspicion that people have breathed abrin, a potential clue would be that a large number of people who had been close to each other suddenly develop fever, cough and have excess fluid in their lungs. These symptoms could be followed by severe breathing problems and possibly death. No widely available, reliable test exists to confirm that a person has been exposed to abrin.

**Prevention & Protection** – First, get fresh air by leaving the area where the abrin was released. Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to abrin.

- **Outdoor Release** move away from the area where the abrin was released.
- **Indoor Release** get out of the building.

If you are near a release of abrin, emergency coordinators may tell you to either evacuate the area or to “shelter in place” inside a building to avoid being exposed to the chemical.

If you think you may have been exposed to abrin, you should remove your clothing, rapidly wash your entire body with soap and water, and get medical care as quickly as possible.

- Quickly take off clothing that may have abrin on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head.
- If you are helping other people remove their clothing, try to avoid touching any contaminated areas, and remove the clothing as quickly as possible.

**Washing yourself:**

- As quickly as possible, wash any abrin from your skin with large amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.
If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and put them with the contaminated clothing. Do not put the contacts back in your eyes (even if they are not disposable contacts). If you wear eyeglasses, wash them with soap and water. You can put your eyeglasses back on after you wash them.

Disposing of your clothes:

- After you have washed yourself, place your clothing inside a plastic bag. Avoid touching contaminated areas of the clothing. If you can't avoid touching contaminated areas, or you aren't sure where the contaminated areas are, wear rubber gloves or put the clothing in the bag using tongs, tool handles, sticks, or similar objects. Anything that touches the contaminated clothing should also be placed in the bag. If you wear contacts, put them in the plastic bag, too.

- Seal the bag, and then seal that bag inside another plastic bag. Disposing of your clothing in this way will help protect you and other people from any chemicals that might be on your clothes.

- When the local or state health department or emergency personnel arrive, tell them what you did with your clothes. The health department or emergency personnel will arrange for further disposal. Do not handle the plastic bags yourself.

Ricin (*Ricinus communis*)

Ricin is a poison that can be made from the waste left over from processing castor beans. It can be in the form of a powder, a mist or a pellet or it can be dissolved in water or weak acid. It is a stable substance; it is not affected to a large extent by extreme conditions, i.e., very hot or very cold temperatures.

Castor beans are processed throughout the world to make castor oil. Ricin is part of the waste mash produced when castor oil is made. Ricin has some potential medical uses, such as, bone marrow transplants and cancer treatment (to kill cancer cells).
It would take a deliberate act to make ricin and use it to poison people. Accidental exposure to ricin is highly unlikely. People can inhale ricin mist or powder and be poisoned. Ricin can also get into water or food and then be swallowed. Pellets of ricin or ricin dissolved in a liquid can be injected into a person’s body. Depending on the route of exposure (such as injection or inhalation) as little as 500 micrograms of ricin can be enough to kill an adult. A 500-microgram dose of ricin would be about the size of the head of a pin. A greater amount would likely be needed to kill people if the ricin were swallowed.

In 1978, Georgi Markov, a Bulgarian writer and journalist who was living in London, died after he was attacked by a man with an umbrella. The umbrella had been rigged to inject a poison ricin pellet under Markov’s skin. Some reports have indicated that ricin may have been used in the Iran-Iraq war during the 1980s and that quantities of ricin were found in Al Qaeda caves in Afghanistan. Ricin poisoning is not contagious. It cannot be spread from person to person through casual contact.

Ricin works by getting inside the cells of a person’s body and preventing the cells from making the proteins they need. Without the proteins, cells die. Eventually this is harmful to the whole body and death may occur. Effects of ricin poisoning depend on whether ricin was breathed in, swallowed or injected.

**Signs and symptoms of ricin exposure** - The major symptoms of ricin poisoning depend on the route of exposure and the dose received, though many organs may be affected in severe cases. Initial symptoms of ricin poisoning by inhalation may occur within 8 hours of exposure. Following ingestion of ricin, initial symptoms typically occur in less than 6 hours.

- **Inhalation**: Within a few hours of inhaling significant amounts of ricin, the likely symptoms would be respiratory distress (difficulty breathing), fever, cough, nausea, and tightness in the chest. Heavy sweating may follow as well as fluid building up in the lungs (pulmonary edema). This would make breathing even more difficult, and the skin might turn blue. Excess fluid in the lungs would be diagnosed by x-ray or by listening to the chest with a stethoscope. Finally, low blood pressure and respiratory failure may occur, leading to death. In cases of known exposure to ricin, people having respiratory symptoms that started within 12 hours of inhaling ricin should seek medical care.

- **Ingestion**: If someone swallows a significant amount of ricin, he or she would develop vomiting and diarrhea that may become bloody.
Severe dehydration may be the result, followed by low blood pressure. Other signs or symptoms may include hallucinations, seizures, and blood in the urine. Within several days, the person’s liver, spleen, and kidneys might stop working, and the person could die.

- **Skin and eye exposure**: Ricin in the powder or mist form can cause redness and pain of the skin and the eyes.

Death from ricin poisoning could take place within 36 to 72 hours of exposure, depending on the route of exposure (inhalation, ingestion, or injection) and the dose received. If death has not occurred in 3 to 5 days, the victim usually recovers.

Showing these signs and symptoms does not necessarily mean that a person has been exposed to ricin.

**Treatment** - Because no antidote exists for ricin, the most important factor is avoiding ricin exposure in the first place. If exposure cannot be avoided, the most important factor is then getting the ricin off or out of the body as quickly as possible. Ricin poisoning is treated by giving victims supportive medical care to minimize the effects of the poisoning. The types of supportive medical care would depend on several factors, such as the route by which victims were poisoned (that is, whether poisoning was by inhalation, ingestion, or skin or eye exposure). Care could include such measures as helping victims breathe, giving them intravenous fluids (fluids given through a needle inserted into a vein), giving them medications to treat conditions such as seizure and low blood pressure, flushing their stomachs with activated charcoal (if the ricin has been very recently ingested), or washing out their eyes with water if their eyes are irritated.

**Prevention & Protection**

First, get fresh air by leaving the area where the ricin was released. Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to ricin.

- **Outdoor Release** move away from the area where the ricin was released.
- **Indoor Release** get out of the building.

If you are near a release of ricin, emergency coordinators may tell you to either evacuate the area or to “shelter in place” inside a building to avoid being exposed to the chemical.
If you think you may have been exposed to ricin, you should remove your clothing, rapidly wash your entire body with soap and water, and get medical care as quickly as possible.

Removing your clothing:

- Quickly take off clothing that may have ricin on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head.
- If you are helping other people remove their clothing, try to avoid touching any contaminated areas, and remove the clothing as quickly as possible.

Washing yourself:

- As quickly as possible, wash any ricin from your skin with large amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.
- If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and put them with the contaminated clothing. Do not put the contacts back in your eyes (even if they are not disposable contacts). If you wear eyeglasses, wash them with soap and water. You can put your eyeglasses back on after you wash them.

Disposing of your clothes:

- After you have washed yourself, place your clothing inside a plastic bag. Avoid touching contaminated areas of the clothing. If you can't avoid touching contaminated areas, or you aren't sure where the contaminated areas are, wear rubber gloves, turn the bag inside out and use it to pick up the clothing, or put the clothing in the bag using tongs, tool handles, sticks, or similar objects. Anything that touches the contaminated clothing should also be placed in the bag. If you wear contacts, put them in the plastic bag, too.
- Seal the bag, and then seal that bag inside another plastic bag. Disposing of your clothing in this way will help protect you and other people from any chemicals that might be on your clothes.
- When the local or state health department or emergency personnel arrive, tell them what you did with your clothes. The health department or emergency personnel will arrange for further disposal. Do not handle the plastic bags yourself.
Strychnine

Strychnine is a white, odorless, bitter crystalline powder that can be taken by mouth, breathed in or mixed in a solution and given through a needle into a vein. Strychnine is a strong poison; only a small amount is needed to produce severe effects in people. Strychnine poisoning can cause extremely serious adverse health effects, including death.

The primary natural source of strychnine is the plant *Strychnos nux vomica*. This plant is found in southern Asia (India, Sri Lanka and East Indies) and Australia. In the past, strychnine was available in a pill form and was used to treat many human ailments. Today, strychnine is used primarily as a pesticide, particularly to kill rats. Uncommonly, strychnine is found mixed with street drugs such as LSD, heroin and cocaine.

Following the release of strychnine into water, you could be exposed by drinking the contaminated water. Following contamination of food with strychnine, you could be exposed by eating the contaminated food. It is also possible to absorb strychnine through the membranes in the nose, eyes or mouth. A person can be poisoned by inhaling strychnine powder that has been released in the air. Strychnine could be smoked or snorted as a component of street drugs. Poisoning has been reported from strychnine given through a needle into a vein and through the nose.

The extent of poisoning caused by strychnine depends on the amount and route of strychnine exposure and the person's condition of health at the time of the exposure. Strychnine prevents the proper operation of the chemical that controls
nerve signals to the muscles. The chemical controlling nerve signals works like the body’s ‘off switch’ for muscles. When this off switch does not work correctly, muscles throughout the body have severe, painful spasms. Even though the person is conscious and thinking is not affected at first (except that the person is very excitable and in pain) eventually the muscles tire and the person can’t breathe.

**Immediate signs and symptoms of strychnine exposure** - Following the ingestion of strychnine, symptoms of poisoning usually appear within 15 to 60 minutes. People exposed to low or moderate doses of strychnine by any route will have the following signs or symptoms:

- Agitation
- Apprehension or fear
- Ability to be easily startled
- Restlessness
- Painful muscle spasms possibly leading to fever and to kidney and liver injury
- Uncontrollable arching of the neck and back
- Rigid arms and legs
- Jaw tightness
- Muscle pain and soreness
- Difficulty breathing
- Dark urine
- Initial consciousness and awareness of symptoms

People exposed to high doses of strychnine may have the following signs and symptoms within the first 15 to 30 minutes of exposure:

- Breathing failure, possibly leading to death
- Brain death

**Treatment** - Strychnine treatment consists of removing the drug from the body and getting supportive medical care in a hospital setting. Supportive care includes giving intravenous fluids, medications for convulsions and spasms and cooling measures for high temperature.

**Prevention & Protection** - Get fresh air by leaving the area where the strychnine was released. Moving to an area with fresh air is a good way to reduce the possibility of death from exposure to strychnine.

- **Outdoor Release** move away from the area where the abrin was released.
- **Indoor Release** get out of the building.
However, since strychnine intake by mouth is likely to be the primary route of exposure avoid any further intake and call 911 immediately. Recovery from strychnine exposure is possible with early hospital treatment. Therefore, the best thing to do is get medical care as quickly as possible. Do not induce vomiting or give fluids to drink.

If you think you may have been exposed to abrin, ricin or strychnine, you should remove your clothing, rapidly wash your entire body with soap and water and get medical care as quickly as possible.

**Removing your clothing:**

- Quickly take off clothing that may have abrin, ricin or strychnine on it. Any clothing that has to be pulled over the head should be cut off the body instead of pulled over the head.
- If you are helping other people remove their clothing, try to avoid touching any contaminated areas and remove the clothing as quickly as possible.

**Washing yourself:**

- As quickly as possible, wash any abrin, ricin or strychnine from your skin with copious amounts of soap and water. Washing with soap and water will help protect people from any chemicals on their bodies.
- If your eyes are burning or your vision is blurred, rinse your eyes with plain water for 10 to 15 minutes. If you wear contacts, remove them and put them with the contaminated clothing. Do not put the contacts back in your eyes (even if they are not disposable contacts). If you wear eyeglasses, wash them with soap and water. You can put your eyeglasses back on after you wash them.

**Disposing of your clothes:**

- After you have washed yourself, place your clothing inside a plastic bag. Avoid touching contaminated areas of the clothing. If you can't avoid touching contaminated areas or you aren't sure where the contaminated areas are, wear rubber gloves or put the clothing in the bag using tongs, tool handles, sticks or similar objects. Anything that touches the contaminated clothing should also be placed in the bag. If you wear contacts, put them in the plastic bag, too.
- Seal the bag and then seal that bag inside another plastic bag. Disposing of your clothing in this way will help protect you and other people from any chemicals that might be on your clothes.
- When the local or state health department or emergency personnel arrive, tell them what you did with your clothes. The health
department or emergency personnel will arrange for further disposal. Do not handle the plastic bags yourself.

**Other Biotoxins**

**Brevetoxin**
After oral ingestion, brevetoxin poisoning is characterized by a combination of gastrointestinal and neurologic signs and symptoms. The incubation period ranges from 15 minutes to 18 hours. Gastrointestinal symptoms include abdominal pain, vomiting, and diarrhea. Neurologic symptoms include paresthesias, reversal of hot and cold temperature sensation, vertigo, and ataxia. Inhalational exposure to brevetoxin results in cough, dyspnea, and bronchospasm.

**Colchicine**
Ingestion of colchicine typically leads to profuse vomiting and diarrhea, which can be bloody, followed by hypovolemic shock and multisystem organ failure within 24-72 hours. Coma, convulsions, and sudden death might also occur. Subsequent complications include bone marrow suppression with resultant leukopenia, thrombocytopenia (nadir in 4-7 days), and possibly sepsis.

**Digitalis**
Signs and symptoms of acute digitalis (digoxin or digitoxin) poisoning by ingestion include primarily gastrointestinal effects (nausea and vomiting), hyperkalemia, and cardiovascular effects (bradydysrhythmias [heart rate <60 or atrioventricular block] or tachydysrhythmias [ventricular tachycardia/fibrillation or atrial tachycardia with 2:1 block])

**Nicotine**
After oral ingestion of nicotine, signs and symptoms of nicotine poisoning mimic those for nerve agent or organophosphate poisoning and typically include excess oral secretions, bronchorrhea, diaphoresis, vomiting (common, especially among children), diarrhea, abdominal cramping, confusion, and convulsions. Although tachycardia and hypertension are common, bradycardia and hypotension might also occur as a result of a severe poisoning.

**Saxitoxin**
Exposure to saxitoxin might cause numbness of the oral mucosa within 30 minutes after ingestion. In severe poisoning, signs and symptoms typically progress rapidly, including paresthesias, a floating sensation, muscle weakness, vertigo, and cranial nerve dysfunction. Respiratory failure and death might occur from paralysis.
**Tetrodotoxin**

Trichothecene mycotoxins might be weaponized and dispersed through the air or mixed in food or beverages. Initially, route-specific effects are typically prominent. Dermal exposure leads to burning pain, redness, and blisters, and oral exposure leads to vomiting and diarrhea. Ocular exposure might result in blurred vision, and inhalational exposure might cause nasal irritation and cough. Systemic symptoms can develop with all routes of exposure and might include weakness, ataxia, hypotension, coagulopathy, and death.

**Trichotheceae**

Trichothecene mycotoxins might be weaponized and dispersed through the air or mixed in food or beverages. Initially, route-specific effects are typically prominent. Dermal exposure leads to burning pain, redness, and blisters, and oral exposure leads to vomiting and diarrhea. Ocular exposure might result in blurred vision, and inhalational exposure might cause nasal irritation and cough. Systemic symptoms can develop with all routes of exposure and might include weakness, ataxia, hypotension, coagulopathy, and death.
Process of Weaponized Plant Toxins

PLANT TOXINS

- Full sun or wide spectrum lighting
- Planting the seed 5-10 days for germination in commercial soil
- Plant height 8 feet flowers need to be pollinated yields 6-10 beans
- Castor Bean: Ricin is 5% of weight in shell
- Acetone dissolves ricin
- Crystals separated by evaporation gravity or centrifuge
- View crystals
- FINAL: Test crystals on animal for effectiveness

NOTICE TO RESPONDERS.....BE WATCHFUL OF SUSPECT PERSONS HAVING ANIMALS ON SITE FOR POSSIBLE TESTING. THIS IS A TELL TALE SIGN THE SUSPECT IS DEVELOPING A WEAPONIZED AGENT.
Process of Weaponized Aerobic Bacteria Manufacture

AEROBIC BACTERIA

Obtain a sample from nature or through scientific research facility.

Culture the medium
70-98°F
O₂ & light

OR

Grow bacteria in animals

Using the initial growth, grow larger amounts in a proper medium

Separate bacteria from growth vessel through use of a centrifuge

and grind until proper size for use

Test the bacteria

Weapon Use

NOTICE TO RESPONDERS…..BE WATCHFUL OF SUSPECT PERSONS HAVING ANIMALS ON SITE FOR POSSIBLE TESTING. THIS IS A TELL TALE SIGN THE SUSPECT IS DEVELOPING A WEAPONIZED AGENT.
Process of Anaerobic Bacteria Manufacture with Weaponized Toxin Separation

ANAEROBIC BACTERIA WITH TOXIN SEPARATION

Obtain a sample from nature or through scientific research facility.

Grow bacteria in animals

Physical Separation

Separate bacteria from growth vessel

Chemical Separation

Product

Test on animals

Deploy weapon

Culture the medium 70-98F O2 & light

Using the initial growth, grow larger amounts in a proper medium and grind until proper size for use

NOTE: The same process is used for beer making and a home brew kit could be used for bacteria making.

NOTICE TO RESPONDERS.....BE WATCHFUL OF SUSPECT PERSONS HAVING ANIMALS ON SITE FOR POSSIBLE TESTING. THIS IS A TELL TALE SIGN THE SUSPECT IS DEVELOPING A WEAPONIZED AGENT.
Process of Weaponized Virus Manufacture

VIRUSES

Obtain a sample from nature or through scientific research facility.

Test virulence of the virus

Test vector transmission

Deploy weapon

If the test animal dies the virus and vectors are ready

Allow vectors to feed on infected animals

Use a live growth medium (usually eggs) proper temp 98F

NOTICE TO RESPONDERS…..BE WATCHFUL OF SUSPECT PERSONS HAVING ANIMALS ON SITE FOR POSSIBLE TESTING. THIS IS A TELL TALE SIGN THE SUSPECT IS DEVELOPING A WEAPONIZED AGENT.
<table>
<thead>
<tr>
<th>AGENT</th>
<th>DETECTION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthrax</td>
<td>I: 1–6 d. FLS. Possible widened mediastinum. Gram stain (gram-positive rod) of blood and blood culture (late).</td>
<td>TBI: treatment may be delayed 24 h. until cultures from incident site available. PEP (only if instructed by govt. officials): ciprofloxacin or doxycycline po x 8 wks. Severe cases: ciprofloxacin, doxycycline, or penicillin IV.</td>
</tr>
<tr>
<td>Cholera</td>
<td>I: 4 h–5 d. Severe gastroenteritis with &quot;rice water&quot; diarrhea.</td>
<td>Oral rehydration with WHO solution or IV hydration. Tetracycline, doxycycline (dosage as below or 300 mg one time) po for 3 d. Ciprofloxacin or norfloxacin po for 3 d. if resistant strains.</td>
</tr>
<tr>
<td>Plague</td>
<td>I: 2-3 d. FLS. CXR: patchy infiltrates or consolidation. Gram stain of lymph node aspirate, sputum, or CSF (gram negative, non-spore forming rods).</td>
<td>Isolation. PEP: doxycycline or ciprofloxacin for 7 days. Symptomatic: gentamicin or doxycycline IV for 10–14 days. Meningitis: chloramphenicol.</td>
</tr>
<tr>
<td>Tularemia</td>
<td>I: 2-10 d. FLS.</td>
<td>Gentamicin for 10–14 d.</td>
</tr>
<tr>
<td>Q Fever</td>
<td>I: 10-40 d. FLS.</td>
<td>Most cases self-limited. Tetracycline or doxycycline po for 5–7 d.</td>
</tr>
<tr>
<td>Smallpox</td>
<td>I: 7-17 (avg. 12) d. FLS. Later erythematous rash that progresses to pustular vesicles. Electron or light microscopy of pustular scrapings. PCR.</td>
<td>Isolation. PEP: vaccinia vaccine scarification and vaccinia immune globulin IM.</td>
</tr>
<tr>
<td>Viral Encephalitides</td>
<td>I: 1-6 d. FLS. Immunoassay.</td>
<td>Supportive.</td>
</tr>
<tr>
<td>Viral Hemorrhagic Fevers</td>
<td>I: 4-21 d. FLS. Easy bleeding and petechiae. Enzyme immunoassay.</td>
<td>Isolation. Supportive care. Some respond to ribavirin.</td>
</tr>
<tr>
<td>Staphylococcus Enterotoxin B</td>
<td>I: 3-12 h. FLS.</td>
<td>Supportive.</td>
</tr>
<tr>
<td>Ricin</td>
<td>I: 18-24 h. FLS, pulmonary edema, and severe respiratory distress.</td>
<td>Supportive.</td>
</tr>
<tr>
<td>T-2 Mycotoxins</td>
<td>I: 2-4 h. Skin, respiratory and GI symptoms.</td>
<td>Supportive.</td>
</tr>
</tbody>
</table>

Abbreviations: CSF: cerebro-spinal fluid. CXR: chest x-ray. d: days. h: hours. FLS: flu-like symptoms. GI: gastro-intestinal. I: incubation period. PCR: polymerase chain reaction. PEP: post-exposure prophylaxis. TBI: threatened biologic incident. WHO: World Health Organization. Dosages: Chloramphenicol: 50-75 mg/kg/d, divided q 6 hrs. Ciprofloxacin: po: 500 mg q 12 h.; IV: 400 mg q 8-12 h. Doxycycline: po: 100 mg q 12 hrs; IV: 200 mg initially then 100 mg q 12 h. Erythromycin: po: 500 mg q 6 h. Gentamicin: 3-5 mg/kg/d. Norfloxacin: po: 400 mg. Penicillin: IV: 2 million units q 2 h. Tetracycline: po: 500 mg q 6 h. Streptomycin: IM: 15 mg/kg, BID. Vaccinia immune globulin: IM: 0.6 mL/kg. WHO solution: 3.5 g NaCl, 2.5 g NaHCO₃, 1.5 g KCl and 20 g of glucose per liter of water.
<table>
<thead>
<tr>
<th>Agent Type</th>
<th>Name of Agent</th>
<th>Rate of Action</th>
<th>Effective Dosage</th>
<th>Symptoms/Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteria</strong></td>
<td>Bacillus anthracis</td>
<td>Incubation: 1 to 6 days; Length of illness: 1 to 2 days; Extremely high mortality rate</td>
<td>8,000 to 50,000 spores</td>
<td>Fever and fatigue; often followed by a slight improvement, then abrupt onset of severe respiratory problems; shock; pneumonia and death within 2 to 3 days</td>
</tr>
<tr>
<td></td>
<td>Yersinia pestis</td>
<td>Incubation: 2 to 10 days; Length of illness: 1 to 2 days; Variable mortality rate</td>
<td>100 to 500 organisms</td>
<td>Malaise, high fever, tender lymph nodes, skin lesions, possible hemorrhages, circulatory failure, and eventual death</td>
</tr>
<tr>
<td></td>
<td>Brucella suis</td>
<td>Incubation: 5 to 60 days; 2% mortality rate</td>
<td>100 to 1,000 organisms</td>
<td>Flu-like symptoms, including fever and chills, headache, appetite loss, mental depression, extreme fatigue, aching joints, sweating, and possibly gastrointestinal symptoms.</td>
</tr>
<tr>
<td></td>
<td>Pasturella tularensis</td>
<td>Incubation: 1 to 10 days; Length of illness: 1 to 3 weeks; 30% mortality rate</td>
<td>10 to 50 organisms</td>
<td>Fever, headache, malaise, general discomfort, irritating cough, weight loss</td>
</tr>
<tr>
<td><strong>Rickettsiae</strong></td>
<td>Coxiella burnetti</td>
<td>Incubation: 2 to 14 days; Length of illness: 2 to 14 days; 1% mortality rate</td>
<td>10 organisms</td>
<td>Cough, aches, fever, chest pain, pneumonia</td>
</tr>
<tr>
<td><strong>Viruses</strong></td>
<td>Variola virus</td>
<td>Incubation: average 12 days; Length of illness: several weeks; 35% mortality rate in unvaccinated individuals</td>
<td>10 to 100 organisms</td>
<td>Malaise, fever, vomiting, headache appear first, followed 2 to 3 days later by lesions; Highly infectious</td>
</tr>
<tr>
<td>Toxins</td>
<td>Incubation/Length of Illness</td>
<td>Number of Organisms</td>
<td>Symptoms</td>
<td></td>
</tr>
<tr>
<td>--------</td>
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<td></td>
</tr>
<tr>
<td>Venezuelan equine encephalitis virus</td>
<td>1 to 5 days &lt;br&gt;1 to 2 weeks Low mortality rate</td>
<td>10 to 100 organisms</td>
<td>Sudden onset of fever, severe headache, and muscle pain. Nausea, vomiting, cough, sore throat and diarrhea can follow</td>
<td></td>
</tr>
<tr>
<td>Yellow fever virus</td>
<td>3 to 6 days &lt;br&gt;1 to 2 weeks 5% mortality rate</td>
<td>1 to 10 organisms</td>
<td>Severe fever, headache, cough, nausea, vomiting, vascular complications (including easy bleeding, low blood pressure)</td>
<td></td>
</tr>
<tr>
<td>Saxitoxin</td>
<td>&lt;br&gt;Produced by blue-green algae commonly ingested by shellfish, mussels in particular</td>
<td>Time to effect: minutes to hours &lt;br&gt;Length of illness: Fatal after inhalation of lethal dose</td>
<td>10 micrograms per kilogram of body weight</td>
<td>Dizziness, paralysis of respiratory system, and death within minutes</td>
</tr>
<tr>
<td>Botulinum toxin</td>
<td>&lt;br&gt;Causes botulism &lt;br&gt;Produced by Clostridium botulinum bacterium</td>
<td>Time to effect: 24 to 36 hours &lt;br&gt;Length of illness: 24 to 72 hours 65% mortality rate</td>
<td>.001 microgram per kilogram of body weight</td>
<td>Weakness, dizziness, dry throat and mouth, blurred vision, progressive weakness of muscles. Interruption of neurotransmission leading to paralysis. Abrupt respiratory failure may result in death</td>
</tr>
<tr>
<td>Ricin</td>
<td>&lt;br&gt;Derived from castor beans</td>
<td>Time to effect: few hours &lt;br&gt;Length of illness: 3 days High mortality rate</td>
<td>3 to 5 micrograms per kilogram of body weight</td>
<td>Rapid onset of weakness, fever, cough, fluid build-up in lungs, respiratory distress</td>
</tr>
<tr>
<td>Staphylococcal enterotoxin B (SEB)</td>
<td>&lt;br&gt;Produced by Staphylococcus aureus</td>
<td>Time to effect: 3 to 12 hours &lt;br&gt;Length of illness: Up to 4 weeks</td>
<td>30 nanograms per person</td>
<td>Fever, chills, headache, nausea, cough, diarrhea, and vomiting</td>
</tr>
</tbody>
</table>
**Agri-Terror**

Intelligence has been gathered to indicate agriculture as a possible target for terrorism. This potential is called agri-terror. Terrorist organizations know that if they can contaminate the food supply it will harm or kill large numbers of people before intervention can be established. The other advantage to agri-terror is that it would hurt the economy because of the large amount of agricultural business the United States performs. Certain agricultural aspects are at a higher risk than others but any agricultural aspect could be substantial for an attack.

**Anti-Plant Biological Agents**¹

**Rice Blast**
- Fungal disease causing lesions on leaves
- Up to 60% crop losses possible

**Stem Rust**
- Fungal disease affecting cereal crops (e.g., wheat, barley)
- Produces pustules on stems, leaves
- Can cause significant crop losses

**Sugarbeet Curly Top Virus**
- Viral disease causing dwarfed leaves and swollen veins
- Transmitted by beet leafhopper, an insect that can migrate over long distances and attack many different types of plants
- Can be controlled through insecticides

**Tobacco Mosaic Virus**
- Viral disease affecting wide range of plant species
- Causes leaf blotching in mosaic patterns and stunted growth in younger plants

**Anti-Animal Biological Agents**

**Aspergillus**
- Fungal disease caused by Aspergillus fumigatus infecting poultry
- Causes lethargy, loss of appetite, and, in extreme cases, paralysis

**Foot and Mouth Disease**
- Highly contagious viral disease infecting cloven hooved animals (e.g., cattle, pigs, sheep, goats)
- Up to 50% mortality rates in young animals; can cause dramatic production decreases in adults
• Incubation period generally between 2 and 8 days
• Causes fever, loss of appetite, interruption in milk production, blisters (particularly around feet and mouth)
• Considered one of the most feared animal diseases because of its high degree of contagiousness and the large number of species affected

Heartwater
• Caused by rickettsia Cowdria ruminantium
• Disease attacks ruminants, including cattle, sheep, goats and deer
• Transmitted by ticks
• Mortality rates range from 40% to 100%
• Results in loss of appetite, respiratory distress
• No effective treatment or vaccine available

Newcastle
• Disease Highly contagious viral disease infecting poultry
• Causes gastrointestinal, respiratory and nervous problems
• Up to 100% mortality rate
• Incubation period generally between 5 and 6 days; in severe cases, birds can die within 1 or 2 days
• Vaccine available

Rinderpest
• Highly contagious viral disease infecting cattle
• Also referred to as cattle plague
• Spread primarily through direct contact and infected drinking water
• Causes fever, frothy saliva, diarrhea
• Vaccine available
1) The time between exposure and development of symptoms is called the _____________?
   a. Incubation Period
   b. Intermodal Period
   c. Contamination Period
   d. Control Period

2) Which biological agents respond well to antibiotic therapy?
   a. Toxins
   b. Bacterial Agents
   c. Viruses
   d. Blister Agents

3) Which of the following is NOT an example of a viral agent?
   a. Anthrax
   b. Influenza
   c. Smallpox
   d. Ebola

4) Poisonous substances which are produced and derived from living plants animals or microorganisms, but or not alive or contagious are called:
   a. Toxins
   b. Bacterial Agents
   c. Viruses
   d. Blister Agents

5) Responders are likely to be called to respond to a terrorist incident where multiple persons have been exposed to a biological agent and have developed symptoms at the same event?
   a. True
   b. False
Module 2
Unit 7
Scope of Module 2, Unit 7

It is expected that Performance – Defensive (Operations) level personnel have a basic understanding of the mechanics of radiation. This unit describes the fundamentals of radioactivity as well as the increments of measurement so responders can safely perform defensive operations at a radiological incident.

Learning Objective

At the completion of this unit students will describe the basic terms associated with radioactivity and be able to safely measure radioactivity for safe operation.

Student Performance Objectives

- Describe the physical properties of atomic structure.
- Describe the difference in non-ionizing and ionizing radiation.
- Describe the emission of an atomic particle as the cause for ionizing radiation.
- Describe the four types of nuclear radiation.
- Describe the basic difference between nuclear and chemical explosions.
- Describe the 3 general protection measures against radiation.
- Describe how roentgen converts to other nuclear measurements.
- Describe the difference between contamination and exposure.
- Describe the investigatory alarm levels for radiation detection.
- Describe the turn back alarm level for radiation detection.

Resource List

- Student Manual (Module 2)
Introduction

A radioactive material is any material containing unstable or radioactive atoms that break up or decay and emit radiation in the process.

Before we get into the specific types of radiation and their hazards we need to understand some of the basics of radioactive materials.

- All matter is made up of atoms and the center of the atom is called the nucleus.
- All atoms have three basic components, electrons, protons, and neutrons.

Atomic Physical Properties

The simplest structural unit of any element that can exist, while retaining the chemical and physical characteristics of the element, is called an atom. An atom is composed of a central nucleus containing most of its mass and electrons orbiting in shells around the nucleus. The nucleus consists of a number of fundamental particles, the most important of which are the protons and neutrons.

Atomic Structure - An atom is composed of a central nucleus containing most of its mass and electrons orbiting around the nucleus. The nucleus consists of two fundamental particles, protons and neutrons.

Elements - All substances are composed of one or more of over 100 different kinds of basic materials known as elements. There are 91 naturally occurring and at least 11 artificially produced elements.
**Electrons** - Electrons are negatively charged particles. They orbit the nucleus at discrete energy levels referred to as electron shells.

**Proton** - The proton is a particle having a positive charge. The proton's mass is approximately 1845 times greater than that of the electron.

**Neutron** - The neutron is an uncharged particle having a mass slightly greater than that of the proton.

NOTE: The composition of an atom is mostly empty space. If we were to make the nucleus or center of the atom the size of a marble, the first electron orbit would be about 800 feet away. This helps you visualize the location of the electrons as it relates to the nucleus.

**Electrical Charge** - Atoms are electrically neutral when the number of negatively charged electrons orbiting the nucleus equals the number of positively charged protons within the nucleus. When the number of electrons is greater than or less than the number of protons in the nucleus, atoms are not electrically neutral and carry a net negative or positive charge. They are then termed ions and are chemically reactive, tending to combine with other ions of opposite net charge. When atoms are combined in molecules, they may share electrons to achieve stability of electron shell structure.

<table>
<thead>
<tr>
<th>H⁺ : a positively charged hydrogen ion</th>
<th>H : the hydrogen atom</th>
<th>H⁻ : a negatively charged hydrogen ion</th>
</tr>
</thead>
</table>

**Nuclear Detonation**

Energy released in a nuclear explosion is not produced by chemical reactions. Rather, it results from so-called nuclear reaction, fission and fusion, in which fundamental changes occur in the composition of the nuclei of the reacting material rather than in the electron shells as is the case in chemical reactions. In
these nuclear reactions, mass is actually converted to energy, and the amount of energy produced is many orders of magnitude greater than that available from chemical reactions. To fully appreciate the nature of these reactions, certain basic concepts related to physical atomic structure and nuclear reactions must first be understood.

**Isotopes**

Atoms of different elements have different numbers of protons in their nuclei. The term atomic number describes the number of protons in a nucleus. Although all the nuclei of a given element will have the same atomic number, they may have different atomic masses because they may contain different numbers of neutrons. Generally, this does not affect the chemical properties of the different atoms since the numbers of protons are not changed but does have profound effects upon nuclear stability of the different atoms. The total number of protons and neutrons in an atomic nucleus is referred to as the atomic mass number. Atomic species which have identical atomic numbers but different atomic mass numbers are called isotopes.

The stable isotopes of elements have very definite ratios of neutrons to protons in their nuclei. As atomic mass numbers increase, the ratio of neutrons to protons increases according to a definite pattern. If isotopes vary from this pattern, they are relatively unstable.

**Fission**

Fission is a nuclear process in which a heavier unstable nucleus divides or splits into two or more lighter nuclei, with the release of substantial amounts of energy. The materials used to produce nuclear explosions by fission are those isotopes of uranium or plutonium which undergo fission most readily. These are 235U (235 Uranium) and 239Pu (239 Plutonium). When a free neutron of the proper energy is captured by the nucleus of a fissionable atom, the resulting unstable nucleus will "split" producing two or more fission products.

**Fusion**

Fusion is a process in which two nuclei join, forming a larger nucleus and releasing energy. Nuclear fusion is the
energy source which causes stars to shine, and hydrogen bombs to explode.

It takes considerable energy to force nuclei to fuse, even those of the least massive element, hydrogen. But the fusion of lighter nuclei, which creates a heavier nucleus and a free neutron, will generally release even more energy than it took to force them together -- an exothermic process that can produce self-sustaining reactions.

The energy released in most nuclear reactions is much larger than that for chemical reactions, because the binding energy that glues a nucleus together is far greater than the energy that holds electrons to a nucleus.

**Radiation**

Radiation is the emitting of energy from an atom in the form of either particles or electromagnetic waves. There are two classification types of radiation:

**Non-ionizing Radiation**. Waves of energy such as radiant heat, radio waves and visible light. Non-ionizing radiation is thought to be essentially harmless below the levels that cause heating. The amount of energy carried in these waves are small compared to ionizing radiation. Such examples of non-ionizing radiation include infrared waves, microwaves lasers and visible light. Non-ionizing radiation does not have enough energy to remove electrons from their shells in the atomic structure.

**Ionizing Radiation**. Ionizing radiation is radiation in which an individual particle (for example, a photon, electron, or helium nucleus) carries enough energy to
Ionize an atom or molecule. Ionizing radiation does have enough energy to remove electrons from atoms. Nuclear radiation is ionizing radiation. It is characterized by its ability to create charged particles, or ions, in anything which it strikes. Exposure to low levels of ionizing radiation can produce short or long-term cellular changes in people with potentially harmful effects, such as cancer and leukemia. X-rays are a familiar form of ionizing radiation.

Radioactivity

The nuclei of certain naturally occurring isotopes, and of others produced artificially, contain excess energy, i.e., they are unstable. To attain stability, nuclei with excess energy emit that energy in the form of nuclear, ionizing radiation and, in that process, frequently change into different elements. (See paragraph 215e.) (Ionizing radiation is defined as radiation capable of removing an electron from a target atom or molecule, forming an ion pair.) Isotopes, the nuclei of which emit ionizing radiations to achieve stability, are termed radioactive. Radioactive isotopes are referred to as radioisotopes or radionuclides.

Radioactive Decay - Radioactive decay is the process by which radionuclides decay, emitting ionizing radiation. Such nuclear reactions involve a change in the composition of the nucleus, in contrast to chemical reactions which involve only an exchange or sharing of electrons. The observed forms of decay are alpha decay, beta decay, electron capture, neutron emission, positron emission, proton emission, and spontaneous fission. The latter five forms of decay occur very quickly within products of nuclear reactions, and hence are not often
seen on earth outside a nuclear reactor. By contrast alpha and beta decay are seen in the decay chains of radioactive materials.

**Half-Life** - Half-life is defined as the time required for half of the atoms of a given sample of radioisotope to decay. Half-life values range from fractions of a millionth of a second to billions of years. Theoretically, no matter how many half-lives have passed, some small number of nuclei would remain. However, since any given sample of radioactive material contains a finite number of atoms, it is possible for all of the atoms eventually to decay.

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**Types of Nuclear Radiation**

**Alpha**

Alpha particles (α) or alpha rays are a form of particle radiation which are highly ionizing and have low penetration. They consist of two protons and two neutrons bound together into a particle that is identical to a helium nucleus, and can be written as He2+.

Alpha rays are easily absorbed by materials and can travel only a few centimeters in air. They can be absorbed by tissue paper or the outer layers of human skin and so are not generally dangerous to life unless the source is ingested or inhaled. If alpha radiation does enter the body, however, it is the most dangerous form of ionizing radiation. They are the most strongly ionizing, and with large enough doses can cause any or all of the symptoms of radiation poisoning.

Most smoke detectors contain a small amount of the alpha emitter americium-241. This isotope is extremely dangerous if inhaled or ingested, but the danger is minimal if the source is kept sealed.

Alpha are the largest of the common radioactive particles. They travel only 2 to 3 inches in air and can be stopped by a sheet of paper. The greatest health hazard from alpha particles exists when they enter the body through inhalation, ingestion, or absorption.
Beta

This radiation is in the form of beta (β) particles, which are high-energy electrons or positrons ejected from a nucleus in a process known as beta decay. There are two forms of beta decay, β- and β+, which respectively give rise to the electron and positron.

The range of the beta particle is considerably greater than that of an alpha particle and travels longer distances between interactions. Since Beta Particles travel a longer distance and they can have a positive (β+) or negative charge (β-) they are either attracted or repulsed from other atomic nucleus and thus follow a drunken man's path.

Beta particles generally have a range about ten times as far as alpha particles and an ionizing power about a tenth of that of alpha particles. They are stopped completely by a few millimeters of aluminum.

The electron gun inside a television tube could also be considered a source of beta radiation, which is absorbed by the phosphor coating inside the tube to create light.

Beta Particles (β particle) which is the same size as an electron, and can penetrate materials much further than the large alpha particles. Beta particles can penetrate the skin, but cannot penetrate internal organs. They can travel several yards in air, and can be stopped by a thin piece of metal or an inch of wood.

Gamma & X-Ray

Gamma radiation presents a high external hazard. Shielding for gamma radiation requires materials of high density, such as lead or concrete. Gamma radiation and X-rays are
essentially the same thing. Gamma radiation is primarily an external hazard.

Gamma rays (Y) are an energetic form of electromagnetic radiation produced by radioactivity or other nuclear or subatomic processes such as electron-positron annihilation. Gamma rays are a form of ionizing radiation; they are more penetrating than either alpha or beta radiation, but less ionizing. Gamma rays are distinguished from X rays by their origin. Gamma rays are produced by nuclear transitions while X-rays are produced by energy transitions due to accelerating electrons. Because it is possible for some electron transitions to be of higher energy than nuclear transition, there is an overlap between low energy gamma rays and high energy X-rays.

Shielding for (Y) rays requires large amounts of mass. Shields that reduce gamma ray intensity by 50% include 1 cm (0.4 inches) of lead, 6 cm (2.4 inches) of concrete or 9 cm (3.6 inches) of packed dirt.

Gamma rays from nuclear fallout would probably cause the largest number of casualties in the event of the use of nuclear weapons in a nuclear war. An effective fallout shelter reduces human exposure at least 1000 times.

Gamma rays are less ionizing than either alpha or beta rays. However, reducing human danger requires thicker shielding. They produce damage similar to that caused by X-rays, such as burns, cancer, and genetic mutations.

Gamma Rays are the most dangerous form of common radiation because of the speed at which it moves. Gamma rays have the ability to pass through human tissue and can cover great distances. The range of gamma waves depends upon the energy of the source material.

**Neutron**

Neutron radiation is made up of neutrons released from the nucleus of an atom. This generally occurs as the result of a breaking of the nuclear structure. As a result, there are virtually no "natural" neutron emitters. Neutron radiation is most often seen associated with nuclear reactors or atomic weapons. Neutrons are both an internal and external hazard.

**Interaction with Matter**

Ionizing radiation interacts with matter in one of two ways. It is either scattered or absorbed. Both result in deposition of energy in the target system. The mechanisms of absorption are of particular interest because:

1. Absorption in body tissue may result in physiological injury.
2. Absorption is a phenomenon upon which the detection of ionizing radiation is based.
The degree of absorption or type of interaction is a primary factor in determining shielding requirements.

Transfer of energy from an incident photon or particle to the atoms of an absorbing target material may occur by several mechanisms.

1. **Excitation.** This process involves the addition of energy to an atomic or molecular system, thereby transferring it from its ground or stable state to an excited or unstable state. Depending upon the type of interaction, either the atomic nucleus or one of its orbital electrons may absorb the excitation energy.

   (a) Electron excitation occurs when relatively small amounts of energy are transferred. Here the electrons may only be moved to a higher energy level in the atom.

   (b) An excited electron will not retain its energy but will tend to return to its original energy level either by emitting the excess energy in the form of a photon of electromagnetic radiation (x-ray) or by transferring its energy to the electrons of other atoms or molecules.

2. **Ionization.** As indicated previously, ionization is any process which results in the removal of an electron (negative charge) from an atom or molecule thereby leaving the atom or molecule with a net positive charge. Ionization occurs if alpha or beta particles, or gamma photons transfer sufficient energy to dislodge one of the electrons from the outer orbital shells of the target atom. Each ionization event produces an ion pair consisting of a free electron and the positively charged remainder of the atom.

   **Nuclear Explosion vs. Chemical Explosion**

   **Conventional Chemical Explosion** - The molecules of conventional chemical explosives are considered to be in a high-energy or unstable state. When such a system is made to react, products of greater stability are formed and energy is released. With a conventional explosive, such as trinitrotoluene (TNT), the energy is derived from a sudden, violent chemical reaction, altering various bonds between the molecules of the explosive's chemical compounds, i.e.

   \[ 2 \text{Molecules TNT} + \text{Heat} = \text{Reaction Products} + \text{Energy}. \]
The amount of energy released in such a reaction is directly proportional to the difference between the total binding energy contained within the initial, unstable system and that contained within the final, more stable system. This net energy release is called the heat of explosion.

**Nuclear Detonations** - Energy released in a nuclear explosion is not produced by chemical reactions. Rather, it results from so-called nuclear reaction, fission and fusion, in which fundamental changes occur in the composition of the nuclei of the reacting material rather than in the electron shells as is the case in chemical reactions. In these nuclear reactions mass is actually converted to energy, and the amount of energy produced is greater than that available from chemical reactions. To fully appreciate the nature of these reactions, certain basic concepts related to atomic structure and nuclear reactions must first be understood.

**Nuclear Explosive Device vs. Explosive Radioactive Dispersion Device (RDD)**

**Nuclear Explosive Device**. This is a device designed with the intent to create a compressed critical state known as critical mass, of the radioactive matter in the nuclear device. Once this level of critical mass is obtained the product would be nuclear fission. The result is the widely known mushroom cloud explosion of a nuclear device.

**Explosive Radioactive Dispersion Device (RDD)**. This is otherwise known as a "Dirty Bomb". The fundamental characteristics of the RDD is to place a chemical explosive on a radioactive substance for the purpose of propelling the radioactive material out into the environment for strategic dissemination. This explosion will not yield fission and it is not the intent to create a nuclear explosion. The main purpose of the RDD is to disperse radioactive material causing contamination of people and property.

Source: www.atomicarchive.com

"Fat Man Bomb" that was dropped over Nagasaki, Japan on August 9, 1945.
Simple Radiological Dispersal Device (SRD) – This is defined as any act, container or any other device used to release radiological material for use as a weapon.

Radiological Exposure Device - A device whose purpose is to expose people to radiation, rather than to disperse radioactive material into the air, as would an RDD. An RED could be constructed from unshielded or partially shielded radioactive materials in any form placed in any type of container.

General Effects of Nuclear Explosion

While the destructive action of conventional explosions is due almost entirely to the transmission of energy in the form of a blast wave with resultant mechanical damage, the energy of a nuclear explosion is transferred to the surrounding medium in three distinct forms: blast; thermal radiation; and nuclear radiation. The distribution of energy among these three forms will depend on the yield of the weapon, the location of the burst, and the characteristics of the environment. For a low altitude atmospheric detonation of a moderate sized weapon in the kiloton range, the energy is distributed roughly as follows:

1. 50% as blast
2. 35% as thermal radiation
3. 15% as nuclear radiation (including 5% as initial ionizing radiation made up of mostly neutrons and gamma rays which are emitted within the first minute of detonation.)

Types of Nuclear Bursts

Air Bursts
Surface Bursts
Subsurface Bursts
High Altitude Bursts

Nuclear Blast

Blast and thermal effects occur to some extent in all types of explosions, whether conventional or nuclear. The release of ionizing radiation, however, is a phenomenon unique to nuclear explosions and is an additional casualty producing mechanism superimposed on blast and thermal effects. This radiation is basically of two kinds, electromagnetic and particulate, and is emitted not only at the time of detonation (initial radiation) but also for long periods of time afterward (residual radiation). Initial or prompt nuclear radiation is that ionizing radiation emitted within the first
minute after detonation and results almost entirely from the nuclear processes occurring at detonation. Residual radiation is defined as that radiation which is emitted later than 1 minute after detonation and arises principally from the decay of radioisotopes produced during the explosion.

**Initial Radiation** – This is the electromagnetic radiation that is emitted at the time of detonation and up to one minute after detonation. It is usually the resultant radioactive energy released during nuclear fission.

**Residual Radiation** – This is the radiation that is emitted immediately after detonation and for long periods thereafter. The principle cause for residual radiation is the left over particles from the initial radioactive substance that did not acquire complete fission. Residual radiation is also comprised of the following:

*Fission Products* – This is the products that were spawn as a result of the initial nuclear fission reaction. Residual fission products will be determined by the type of nuclear fuel used in the reaction.

*Unfissioned Nuclear Material* – This is the remnants of the nuclear fuel that did not sustain complete fission. The result is residual radiation produced by the each particle of the original nuclear fuel used.

*Neutron-Induced Activity* – As discussed earlier in nuclear fission, the neutrons are the catalyst for sustaining continued nuclear fission. As a result of the fission the neutron activity to sustain the fission will be induced thereby increasing the neutron radiation.

**Fallout** – Because of initial radiation and residual radiation the environment will be contaminated with the parts of the nuclear material. This contamination will continue to release from the environmental objects that captured it. The result is radioactive material being caught in clouds, dirt, dust, rain and wind. As the environmental factors move and spread the residual radioactive material will continue to fallout into the surrounding environment. Depending on the environmental factors, carrying the radioactive materials will dictate how widespread the fallout will be. Some instances of fallout may be felt worldwide, local or in meteorological environments.

**Nuclear Blast (Burst) Mechanisms for Injury**

- Direct Blast Injury
- Missile Injury
- Crush Injury
- Thermal Injury
Flash Injury
Radiation Exposure

**Radiation Biological Cellular Effects**

Biological cellular effects are the actual observed effect of radiation on all biological specimen, including human beings. The amount of damage is basically similar for all the different kinds of doses of ionizing radiation, however the length of the dose will determine the amount of cellular damage that has occurred.

**Radiation Exposure**

The effects of radiation on the human body are not unique, only the mechanism. Radiation can produce products in the cell that can result in cell death; or it can damage molecules that regulate vital cell processes (e.g. DNA, RNA, proteins).

Cells can repair certain levels of damage. At low doses, such as those received every day from background radiation, cellular damage is rapidly repaired. At higher doses, significantly more cells are damaged and some cell death may result. At extremely high doses, cells cannot be replaced quickly enough, and tissues fail to function.

Exposure guidelines for radioactive materials can be summed up using the three primary means of controlling radiation doses are: Time, Distance and Shielding.

- **Time** - the shorter the exposure time, the less the exposure. Remember that radiation exposures are additive in their effects upon the body or any other subject. Site safety and control procedures to monitor all entry operations are critical.

- **Distance** - the closer you are to the source, the greater the exposure. The energy emitted from a radioactive source declines as one moves further away from the source. The Inverse Square Law is a simple tool for applying this safety concept. Simply stated, if you double the distance from a point radiation source, the radiation intensity is lowered by one-fourth. If you increase the distance ten times, the radiation intensity is one-hundredth of the original value.

- **Shielding** - while personal protective clothing can offer protection against alpha particles, it will provide limited protection against beta particles and no protection against gamma radiation. Therefore, dense materials must be kept between you and the gamma source. Common shielding materials include lead, cement, and even water. Any shielding material is better than none.

Because there is some small risk from exposure to radiation at even low doses, you should practice the basic concept known as "As-Low-As Reasonably Achievable (ALARA). Remember that the radiation levels
diminish with the square of the distance between yourself and the radioactive source. The further away from the source you are, the safer you will be.

**Exposure Prompt and Delayed Effects**

Radiation effects can be categorized by when they appear.

- Prompt effects: such as nausea, vomiting, fatigue seen immediately after large doses of radiation, delivered over short periods of time.

- Delayed effects: things like cataract formation, cancer induction, or genetic problems that may appear months or years after a radiation exposure.

**Radioactive Materials Used in Crimes**

**Americium** - Americium-241 is used in smoke detectors and other instruments and is also a fallout product of nuclear weapon detonations. It is a decay daughter of plutonium and is mainly an alpha emitter. It is detectable with standard radiation instruments because of its emission of a 60 keV gamma ray. Note: keV = kiloelectron volt. Seventy-five percent of an initial lung burden is absorbed with 10% of the particles remaining in the lung. Gastrointestinal absorption of Americium is minimal, but it may be absorbed rapidly through skin wounds.

**Cesium** - Cesium-137 is commonly found in radiotherapy devices. It emits both gamma rays and beta radiation and can easily be detected by gamma detection instruments. Cesium-137 was used by Chechen terrorists in the April 2002 RDD threat in Moscow.

**Cobalt** - Cobalt-60 is used in medical radiotherapy devices, metallurgical radiography, and commercial food irradiators. It generates high energy gamma rays and beta particles. It is easily detectable with a gamma detection instrument.

**Depleted Uranium** - Depleted Uranium emits alpha, beta, and some gamma radiation and is not considered a radiation threat. It is found in armor-piercing munitions, armor, and in aircraft counterweights. It can easily be detected with an end-window Geiger-Mueller counter.

**Iodine** - Iodine-131, 132, 134, and 135 will be found in nuclear reactor accidents such as the Chernobyl disaster. Radioactive iodine is a normal fission product found in reactor fuel rods. It is released by rupturing the reactor core and its containment vessel. Most of the radiation will be beta particles with some gamma rays.
Phosphorus - Phosphorus-32 is found in research laboratories and in medical facilities where it is used as a tracer. It has a strong beta particle and can be detected with the beta shield open on a beta-gamma detector.

Safety Recommendations

NOTE: The safety recommendations described in this portion of the manual are for reference only. They are valid references but your agency administrators must set up a policy for your agencies safe response.

A Dosimeter is a small, pocket-sized device used for monitoring radiation exposure of personnel. It measures the accumulated radiation exposure. When using a personal dosimeter it is important to know basic terminology for biological absorption.

Radiation Activity and Measurement

Measurement

Radioactive activity is measured in common units which are an older measurement format and System International (SI) Units which are currently being used throughout the international community.

<table>
<thead>
<tr>
<th>Type of measurement</th>
<th>Radioactivity</th>
<th>Absorbed Dose</th>
<th>Dose Equivalent</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Units</td>
<td>curie (Ci)</td>
<td>rad</td>
<td>rem</td>
<td>roentgen (R)</td>
</tr>
<tr>
<td>SI Units</td>
<td>becquerel (Bq)</td>
<td>gray (Gy)</td>
<td>sievert (Sv)</td>
<td>coulomb/kilogram (C/kg)</td>
</tr>
</tbody>
</table>

Following is a list of prefixes and their meanings that are often used in conjunction with SI units:

<table>
<thead>
<tr>
<th>Multiple</th>
<th>Prefix</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10^{12}$</td>
<td>tera</td>
<td>T</td>
</tr>
<tr>
<td>$10^9$</td>
<td>giga</td>
<td>G</td>
</tr>
<tr>
<td>$10^6$</td>
<td>mega</td>
<td>M</td>
</tr>
<tr>
<td>$10^3$</td>
<td>kilo</td>
<td>k</td>
</tr>
<tr>
<td>$10^{-2}$</td>
<td>centi</td>
<td>c</td>
</tr>
<tr>
<td>$10^{-3}$</td>
<td>milli</td>
<td>m</td>
</tr>
<tr>
<td>$10^{-6}$</td>
<td>micro</td>
<td>μ</td>
</tr>
<tr>
<td>$10^{-9}$</td>
<td>nano</td>
<td>n</td>
</tr>
</tbody>
</table>
yotta (Y) $1,000,000,000,000,000,000,000,000,000 = 10^{24} = 1$ septillion  
setta (Z) $1,000,000,000,000,000,000,000 = 10^{21} = 1$ sextillion  
exa (E) $1,000,000,000,000,000,000 = 10^{18} = 1$ quintillion  
peta (P) $1,000,000,000,000,000 = 10^{15} = 1$ quadrillion  
tera (T) $1,000,000,000,000 = 10^{12} = 1$ trillion  
giga (G) $1,000,000,000 = 10^{9} = 1$ billion  
mega (M) $1,000,000 = 10^{6} = 1$ million  
kilo (k) $1,000 = 10^{3} = 1$ thousand  
hecto (h) $100 = 10^{2} = 1$ hundred  
deka (da) $10 = 10 = 10$  
deci (d) $0.1 = 10^{-1} = 1$ tenth  
centi (c) $0.01 = 10^{-2} = 1$ hundredth  
milli (m) $0.001 = 10^{-3} = 1$ thousandth  
micro (µ) $0.000 001 = 10^{-6} = 1$ millionth  
nano (n) $0.000 000 001 = 10^{-9} = 1$ billionth  
pico (p) $0.000 000 000 001 = 10^{-12} = 1$ trillionth  
fermto (f) $0.000 000 000 000 001 = 10^{-15} = 1$ quadrillionth  
atto (a) $0.000 000 000 000 000 001 = 10^{-18} = 1$ quintillionth  
zepto (z) $0.000 000 000 000 000 000 001 = 10^{-21} = 1$ sextillionth  
yocto (y) $0.000 000 000 000 000 000 000 001 = 10^{-24} = 1$ septillionth

### Measurement Conversion

<table>
<thead>
<tr>
<th>Common Units converted to SI units</th>
<th>SI units converted to Common Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The curie (Ci) is replaced by the becquerel (Bq)</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>Becquerel (Bq)</strong> replaces the curie (Ci)</td>
</tr>
<tr>
<td>1 kilocurie (kCi) = 37 terabecquerel (TBq)</td>
<td>1 terabecquerel (TBq) ~ 27 curie (Ci)</td>
</tr>
<tr>
<td>1 curie (Ci) = 37 gigabecquerel (GBq)</td>
<td>1 gigabecquerel (GBq) ~ 27 millicurie (mCi)</td>
</tr>
<tr>
<td>1 millicurie (mCi) = 37 megabecquerel (MBq)</td>
<td>1 megabecquerel (MBq) ~ 27 microcurie (µCi)</td>
</tr>
<tr>
<td>1 microcurie (µCi) = 37 kilobecquerel (kBq)</td>
<td>1 kilobecquerel (kBq) ~ 27 nanocurie (nCi)</td>
</tr>
<tr>
<td>1 nanocurie (nCi) = 37 becquerel (Bq)</td>
<td>1 becquerel (Bq) ~ 27 picocurie (pCi)</td>
</tr>
<tr>
<td>1 picocurie (pCi) = 37 millibecquerel (mBq)</td>
<td>* 1 Bq = 1s&lt;sup&gt;-1&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>The rad (rad) is replaced by the gray (Gy)</strong></td>
<td><strong>The gray (Gy) replaces the rad (rad)</strong></td>
</tr>
<tr>
<td>1 kilorad (krad) = 10 gray (Gy)</td>
<td>1 gray (Gy) = 100 rad (rad)</td>
</tr>
<tr>
<td>1 rad (rad) = 10 milligray (mGy)</td>
<td>1 milligray (mGy) = 100 millirad (mrad)</td>
</tr>
<tr>
<td>1 millirad (mrad) = 10 microgray (µGy)</td>
<td>1 microgray (µGy) = 100 microrad (µrad)</td>
</tr>
<tr>
<td>1 microrad (µrad) = 10 nanogray (nGy)</td>
<td>1 nanogray (nGy) = 100 nanorad (nrad)</td>
</tr>
<tr>
<td><strong>The roentgen (R) is replaced by coulomb/kg (C/kg)</strong></td>
<td><strong>Coulomb/kg (C/kg) replaces the roentgen (R)</strong></td>
</tr>
<tr>
<td>1 kiloroentgen (kR) ~ 258 milli coulomb/kg (mC/kg)</td>
<td>1 coulomb/kg (C/kg) ~ 3876 roentgen (R)</td>
</tr>
<tr>
<td>1 roentgen (R) ~ 258 micro coulomb/kg (µC/kg)</td>
<td>1 milli coulomb/kg (mC/kg) ~ 3876 milli roentgen (mR)</td>
</tr>
<tr>
<td>1 milliroentgen (mR) ~ 258 nanocoulomb/kg (nC/kg)</td>
<td>1 micro coulomb/kg (µC/kg) ~ 3876 micro roentgen (µR)</td>
</tr>
<tr>
<td>1 microroentgen (µR) ~ 258 picocoulomb/kg (pC/kg)</td>
<td>1 nanocoulomb/kg (nC/kg) ~ 3876 nano roentgen (nR)</td>
</tr>
</tbody>
</table>
The "System International" of units (SI system) for radiation measurement is now the official system of measurement, and uses the "gray" (Gy) and "sievert" (Sv) for absorbed dose and equivalent dose respectively.

Conversions are as follows:

- 1 Gy = 100 rad
- 1 mGy = 100 mrad
- 1 Sv = 100 rem
- 1 mSv = 100 mrem

The term activity is used to describe "how much" of a radioactive material is in a given container or area. It describes the number of nuclear transformations that can occur per unit time. The becquerel (Bq) is the SI unit of activity (of radionuclide).

Traditionally, the unit called the Curie is used to describe activity. The same prefixes for multiples are applied to units of activity. 1 Curie (1Ci) is fairly large, while 1 µCi is very small, and 1 MCi (mega or 1,000,000) is extremely large.

Using the table above you can see that 1 Curie is equal to $3.7 \times 10^{10}$ Becquerel.

Activity is also measured in units of "disintegrations per minute" (dpm). Many common survey meters will be marked in "counts per minute" (cpm).

Do not mistake cpm (counts per minute) readings for dpm (disintegrations per minute) readings, they can have very different significance.

Dose: A general term for the quantity of radiation or energy absorbed.

Dose rate: The dose delivered per unit of time. It is usually expressed as rads per hour or in multiples or submultiples of this unit such as millirads per
hour. The dose rate is commonly used to indicate the level of hazard from a radioactive source.

**Rad:** A common unit term used to measure the amount of absorbed radiation.

In the United States, radiation absorbed dose (Rad), dose equivalent man (Rem) and exposure are often measured and stated in the older units called rad, rem, or roentgen (R).

Smaller fractions of these measured quantities often have a prefix, such as, milli (m) means 1/1000. For example, 1 rad = 1,000 mrad. Micro (m) means 1/1,000,000. So, 1,000,000 mrad = 1 rad, or 10 mR = 0.000010 R.

With radiation counting systems, radioactive transformation events can be measured in units of "disintegrations per minute" (dpm) and because instruments are not 100% efficient, "counts per minute" (cpm). Background radiation levels are typically less than 10 µR per hour, but due to differences in detector size and efficiency, the cpm reading on a fixed monitors and various hand-held survey meters will vary considerably.

**Radioactive Contamination.**

Radioactive contamination is simply a radioactive material in a place where you do not want it. Being exposed to radiation does not mean a person or object is contaminated or dirty. Exposure and contamination are two completely different problems:

- **Exposure.** Means that the human body has been subjected to radiation emitted from a radioactive source. Being exposed to radiation may have no lasting effect or it may cause illness or even death depending on the type of radiation and the duration of exposure.

- **Contamination.** Means that the actual radioactive material has come in direct contact with someone’s body or clothing. As long as the material remains in contact with your body or clothing, you are contaminated and constantly exposed. Decontamination is the process used to remove contamination.

There are three types of radioactive contamination - fixed, removable, and airborne.

1. **Fixed Contamination** cannot be removed easily from surfaces. It cannot be removed by casual contact, but it may be released when the surface is disturbed (e.g., grinding or using liquids for cleaning).
2. **Removable Contamination** can easily be removed from surfaces. Any object that comes into contact with it may become contaminated. For example, wiping, brushing, or washing may transfer it. Air movement across removable contamination could cause it to become airborne.

3. **Airborne Contamination** is simply contamination suspended in the air.

**Mechanisms of Damage**

Injury to living tissue results from the transfer of energy to atoms and molecules in the cellular structure. Ionizing radiation causes atoms and molecules to become ionized or excited. These excitations and ionizations can:

- Produce free radicals.
- Break chemical bonds.
- Produce new chemical bonds and cross-linkage between macromolecules.
- Damage molecules that regulate vital cell processes (e.g. DNA, RNA, proteins).

The cell can repair certain levels of cell damage. At low doses, such as that received every day from background radiation, cellular damage is rapidly repaired.

At higher levels, cell death results. At extremely high doses, cells cannot be replaced quickly enough, and tissues fail to function.

**Tissue Sensitivity**

In general, the radiation sensitivity of a tissue is:

- proportional to the rate of proliferation of its cells
- inversely proportional to the degree of cell differentiation

For example, the following tissues and organs are listed from most radiosensitive to least radiosensitive:

1. Most Sensitive: Blood-forming organs
2. Reproductive organs
3. Skin
4. Bone and teeth
5. Muscle
6. Least sensitive: Nervous system
This also means that a developing embryo is most sensitive to radiation during the early stages of differentiation, and an embryo/fetus is more sensitive to radiation exposure in the first trimester than in later trimesters.

**Prompt Effects**

High doses delivered to the whole body of healthy adults within short periods of time can produce effects such as blood component changes, fatigue, diarrhea, nausea and death. These effects will develop within hours, days or weeks, depending on the size of the dose. The larger the dose, the sooner a given effect will occur.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood count changes</td>
<td>50 rem</td>
</tr>
<tr>
<td>Vomiting (threshold)</td>
<td>100 rem</td>
</tr>
<tr>
<td>Mortality (threshold)</td>
<td>150 rem</td>
</tr>
<tr>
<td>LD$_{50/60}$ * (with minimal supportive care)</td>
<td>320 - 360 rem</td>
</tr>
<tr>
<td>LD$_{50/60}$ (with supportive medical treatment)</td>
<td>480 - 540 rem</td>
</tr>
<tr>
<td>100% mortality (with best available treatment)</td>
<td>800 rem</td>
</tr>
</tbody>
</table>

(Adapted from NCRP Report No. 98 "Guidance on Radiation Received in Space Activities, NCRP, Bethesda, MD (1989))

* The LD$_{50/60}$ is that dose at which 50% of the exposed population will die within 60 days.

**Federal Guidelines for Radiation Exposure**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LD$_{50/60}$</td>
<td>400 - 500 rem (approx.)</td>
</tr>
<tr>
<td>Federal Whole Body Dose Limit</td>
<td>5 rem per year</td>
</tr>
<tr>
<td>University Investigational Level (for whole body doses)</td>
<td>0.1 rem</td>
</tr>
<tr>
<td></td>
<td>See Note 1</td>
</tr>
<tr>
<td></td>
<td>See Note 2</td>
</tr>
<tr>
<td></td>
<td>See Note 3</td>
</tr>
</tbody>
</table>

**Note 1:** LD$_{50/60}$ is the dose which, when delivered in a very short period of time (typically seconds to minutes), will cause the death of 50% of a population within 60 days.

**Note 2:** The Nuclear Regulatory Commission's Whole Body Dose Limit applies to radiation exposures which result in the irradiation of deeper radiation-sensitive structures in the body, especially blood-forming tissues.

**Note 3:** The investigational level for whole body doses applies to radiation exposures which result in the irradiation of deeper radiation-sensitive structures in the body, especially blood-forming tissues.
Protective Action Guidelines Adopted By Ohio

The protective actions listed below as it relates to radiation exposure have been reviewed and put together by experts in the field of radiation. These are intended to be a voluntary consensus guide and are in no way construed as mandatory.

Dose Limits and Dose Alarms
This is the dose limit and dose alarm the electronic personal dosimeter (EPD) is recommended be set at. The dose is the total amount of radiation received over a given time. The limit is the preset amount in the EPD to recognize and give an alarm when it has been reached.

<table>
<thead>
<tr>
<th>Emergency Activity</th>
<th>Initial Limits without On-Scene HP Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life saving, protecting large populations, or protecting major property</td>
<td>1,000 mR or 1 Rem</td>
</tr>
</tbody>
</table>

Recommended Dose Rate Alarms
This is the dose rate alarm for an electronic personal dosimeter. The dose rate is the amount of radiation that is being detected per hour. The rate will determine the initial isolation point and the turn back point. The initial isolation point is the location that the police, fire or other responder have taken a reading and are receiving not more than 2mR/hr. This is the zone where police and fire will set up the perimeter. The turn back is the point where all emergency rescue operations should stop and turn back to the area of lesser radiation. The turn back is recommended to be 1000 mR/hr (1R/hr).

If Background = ~10 µR/hr
Investigate = 100 µR/hr (10× background) per alarming dosimeter
Isolate = 2 mR/hr (2,000 µR/hr)

<table>
<thead>
<tr>
<th>Emergency Activity</th>
<th>Initial Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial scene isolation by Police and refined hot zone by Fire &amp; HAZMAT</td>
<td>&gt; 2 mR/hr (and free of contamination)</td>
</tr>
<tr>
<td>Turn Back Limit</td>
<td>&gt; 1000 mR/hr</td>
</tr>
</tbody>
</table>
NOTE: Both tables are based on radiological emergency response health and Safety Manual, DOE/NV/11718-440 May 2001

**Hot Zone Boundary**
Establish Hot Zone boundary when either of the following is determined:

- > 2 mR/hr OR contamination (> 2× background) found

**Turn back limit:** This is the “limit” of n exposure level read on the dosimeter when the responder should leave the radiation area.

**Do not remain in area >1 R/hr (>1,000 mR/hr) unless involved in saving lives.**

### Recommended Radiation Detection Equipment and Rates

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>RECOMMENDED EQUIPMENT</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Awareness</strong></td>
<td>Alarming, Electronic Personal Dosimeter (EPD) Gamma only Rate range: 0 µR/hr – 10,000 R/hr Dosimeter range: 0 µR – 999 R</td>
<td>Initial Rate Alarm Setting: &gt;100 µ/ hr RATE - investigate Initial Hot Zone boundary: &gt;2.0 mR/hr RATE – isolate Awareness Level Dose Limit: 1 R. DOSE – dose limit (assuming no respiratory protection) NOTE: normal background is ~10 µR/hr (0.01 mR/hr)</td>
</tr>
<tr>
<td></td>
<td>Alarming, Personal Radiation Detector (PRD) Gamma only Rate Range: 0 µR/hr – 5 mR/hr</td>
<td>Covert detection of illicit trafficking of radioactive material. Detects minute increases above background. Vibrate and audible alarm selectable.</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td>Contamination detection meter 44-9 alpha/beta/gamma contamination detector Internal detector up to 2 R./hr for rapid victim search &amp; rescue</td>
<td>Refine Hot Zone boundary: &gt;2 mR/hr gamma and/or &gt;2× bkgd contamination on ground - isolate area Warm Zone operations: &gt;2× bkgd contamination on person – decontaminate Warm Zone Operations Level Dose Limit: 5 R. DOSE – dose limit (with respiratory protection) Hot Zone Operations Level Dose Rate turn-back limit (for other than lifesaving): 1 R./hr DOSE RATE (with respiratory protection) Hot Zone Operations Level Dose Limit for rapid victim search &amp; rescue: 25 R. DOSE – dose limit (with respiratory protection)</td>
</tr>
<tr>
<td></td>
<td>Contamination detection pedestrian portal monitor (vehicle monitor option available) Gamma only</td>
<td>Warm Zone operation: Large population screening for contamination. Detects minute increases above background. Throughput: ~1 person/second.</td>
</tr>
</tbody>
</table>
**Emergency Worker Dose Limits:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>With Respiratory Protection</th>
<th>Dose Limit¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations-level administrative limit for general functions</td>
<td>NO</td>
<td>1,000 mR</td>
</tr>
<tr>
<td>Operations-level administrative limit for general functions</td>
<td>YES</td>
<td>5,000 mR</td>
</tr>
<tr>
<td>Operations-level administrative limit for saving valuable community property</td>
<td>NO</td>
<td>2,000 mR</td>
</tr>
<tr>
<td>Operations-level administrative limit for saving valuable community property</td>
<td>YES</td>
<td>10,000 mR</td>
</tr>
<tr>
<td>Operations-level administrative limit for saving lives</td>
<td>NO</td>
<td>5,000 mR</td>
</tr>
<tr>
<td>Operations-level administrative limit for saving lives</td>
<td>YES</td>
<td>25,000 mR</td>
</tr>
</tbody>
</table>

Footnotes:

1 – Source of limits: USEPA-400-R-92-001 May 1992 Emergency Worker Dose Limits, Table 2-2

2 – There is no lifesaving limit if the responder is trained, aware of risks, and volunteers.

3 – If Health Physician (radiation protection specialist) support is not available, it is recommended emergency responders do not exceed 1 R exposure on their own cognizance.
Hazmat/WMD First Responder Operations
Radiological Agents
Module 2 – Unit 7 – Review Quiz

1) Radioactive materials are unstable and emit energy in an attempt to become stable, and while doing so they emit harmful ionizing radiation.
   a. True
   b. False

2) Which radioactive particles are highly ionizing, have low penetrating ability, can only travel a few centimeters in air and which mainly pose an threat if they get inside the body?
   a. Alpha
   b. Beta
   c. Gamma
   d. X-Ray

3) Which type of radiation is a ray, which poses an external threat, can travel greater distances and requires heavy shielding to stop?
   a. Alpha
   b. Beta
   c. Gamma
   d. Polymer

4) A conventional explosive used to scatter radioactive material to produce widespread contamination is known as a ___________?
   a. Chemical bomb
   b. High Order Explosive
   c. Nuclear Detonation
   d. Dirty Bomb

5) A small pocket sized device used to monitor radiation exposure levels of personnel is called a:
   a. Geiger Counter
   b. Dosimeter
   c. Nuclear Meter
   d. Analog Micrometer
Module 2
Unit 8
Scope of Module 2, Unit 8

This unit provides a more complex understanding about explosive materials as well as devices designed with use of explosive materials. The goal of this unit is to give performance – defensive (operations) level personnel a general understanding on the fundamentals of explosive dynamics so responders can perform protective measures as well as identify potential explosive devices.

Learning Objective

The student will Describe the types of explosives and explosive devices used in the commission of terrorist actions.

Student Performance Objectives

- Describe what an incendiary device is
- Describe explosive characteristics
- Describe the 5 insults to stimulate explosives
- Describe the difference between low and high explosives
- Describe how clandestine drug labs and clandestine homemade explosive labs differ
- Describe the difference between primary and secondary high explosives
- Describe what the acronym IED stands for
- Describe what the acronym VBIED stands for
- Describe the major components of an IED
- Describe the types of switches used to detonate an IED

Resource List

- Student Manual (Module 2)
Incendiary Devices

Incendiary devices may look a lot like explosives at first glance. Their form and visual composition may be similar. However, there are many that do not look like an incendiary device. An example would be a hijacked 757 airplane, such as those used against the World Trade Center on September 11, 2001. Items used to make an incendiary device may include:

- Road flares
- Gasoline and motor oil
- Light bulbs
- Common electrical components
- Matches
- Household chemicals
- Fireworks
- Propane and butane cylinders
- Plastic pipes, bottles and cans
- Glass bottles of fuel (Molotov cocktail)

A classic example of an incendiary device is the Molotov cocktail. The name "Molotov cocktail" is derived from Vyacheslav Mikhailovich Molotov, a Russian communist who was the Foreign Minister and Secretary of War of the Soviet Union during World War II. A Molotov cocktail (or petroleum bomb) is a very simple incendiary weapon consisting of a breakable container filled with flammable liquid. The flammable liquid is typically gasoline or alcohol (methanol or ethanol). The mechanism for ignition is a rag stuffed in the mouth of the bottle that is lit on fire. The cocktail is then thrown at
the desired target shattering the breakable container and releasing the fuel inside. The burning rag ignites the fuel thus making it an incendiary device.

In some cases tar, palm oil or other thickening agents are added to the cocktail in order to make the burning fluid stick to the target rather than run off. Sometimes acid is added to the mix to increase the damaging potential of the liquid, and to increase the chances for it to penetrate fire-resistant surfaces. These devices are easy to make and are typical weapons used in guerrilla warfare and violent rioters.

**Explosive Characteristics**

Explosives are chemicals made into a compound or mixture for which, upon the application of heat or shock, decomposes or rearranges with extreme rapidity, yielding much gas and heat.

For a chemical to be an explosive, it must exhibit all of the following characteristics:

**Formation of gases** - Gases. The principal gaseous products of the more common explosives are carbon dioxide, carbon monoxide, water vapor, nitrogen, nitrogen oxides, hydrogen, methane, and hydrogen cyanide. Some of these gases are suffocating; some are actively poisonous. The gases from low explosives are rarely dangerous, since they usually escape at once into the open and are dissipated and diluted with air. Generally speaking, the commonly used high explosives produce a large proportion of noxious gases, which are particularly dangerous, since under normal conditions of use these gases do not dissipate rapidly. Projectiles filled with high explosives often burst after penetration into confined spaces from which the gases are not easily evacuated.

**Evolution of heat** - An explosive reaction is always accompanied by the rapid liberation of heat. The amount of heat represents the energy of the explosive and hence its potentiality for doing work. It may be supposed that the quantity of heat given off by an explosive reaction is large, but this is not necessarily the case. A pound of coal, for example, yields five times
as much heat as a pound of nitroglycerine. However, coal cannot be used as an explosive, because it fails to liberate heat with sufficient rapidity.

**Rapidity of reaction** - Velocity. An explosive reaction differs from ordinary combustion in the velocity of the reaction. This is also the basis for differentiation between high and low explosives. The velocity of combustion of explosives may vary within rather wide limits, depending upon the kind of explosive substance and upon its physical state. The burning rate of colloidal cellulose nitrate powders used as propellants in modern guns is in the order of 24 centimeters per second at average gun pressures, whereas the velocity of reaction of high explosives ranges from about 2,000 to 8,500 meters per second.

**Initiation of reaction.** The initiation of the reaction is usually regarded as the sensitivity of the explosive

Primary Explosives are a sensitive explosive which nearly always detonates by single ignition from such means as spark, flame, impact and other primary heat sources of appropriate magnitude. Primary explosives can detonate by the action of a relatively weak mechanical shock or by a spark. If used in the form of blasting caps (detonator), they initiate the main explosive. They are also filled in percussion caps mixed with friction agents and other components. An initiating explosive must be highly brisant and must have a high triggering velocity. The most important primary explosives are mercury fulminate, lead azide, lead trinitroresorcinate, silver azide, diazodinitrophenol, and tetrazene, which is used as an additive in primers. Initiating charges must be transported only if they are already pressed into capsules. The latter are usually made of aluminum, and sometimes of copper, white plastic capsules are used for special purposes.

It can basically be stated that energetic materials release their energy in three forms:

- Heat
- Light
- Sound.
Categories of Explosives

Pyrotechnics
Pyrotechnics are produced to create smoke, light, heat, and sound. The pyrotechnics most people are familiar with are those used for entertainment such as fireworks. There are other pyrotechnics that have specific job functions such as road flares, smoke grenades, thermites and airbag inflaters.

The typical airbag may have 50g to 200g of sodium azide depending on the size and function of the airbag. Airbags are inflated by burning sodium azide which is the same stuff used in detonators and other explosive applications. Some airbags have potassium nitrate, which is commonly called saltpeter and is a key component in “blackpowder.”

Propellants
Propellants are designed to provide a controlled release of gas that can be used to perform useful work. This gas can be used to push something, i.e., a bullet from a gun. The key to safe and effective use of propellants is to control the release of the gas created when it is detonated. If the detonation exceeds the container or direction control of the release, an uncontrolled explosion could occur.

Explosives
Explosives are designed to yield a near instantaneous release of energy. The event of harnessing the instantaneous release of explosives is most often performed for destructive purposes. The destructive forces are produced when the instantaneous release overpowers the container harnessing the explosive. This overpowering of the container produces an explosion and debris from the container and surrounding items propelled by the release. A bomb designed to cause maximum dispersion of shrapnel is intended to kill and cause property destruction.
**Explosive Stimuli**

The term used to describe the energy put into an explosive material is called an “insult.” Insults come in five forms - heat, friction, impact, electrostatic discharge, and shock. Depending on the sensitivity of the explosive material any one of these insults could create an initiation of the explosive.

The sensitivity of an explosive refers to the ease with which it can be ignited or detonated, i.e., the amount and intensity of shock, friction, or heat that is required. Care must be taken to clarify what kind of sensitivity that explosive is subject to when the term sensitivity is used.

Descriptions of the five insults are:

**Impact** - Insult sensitivity is expressed in terms of the distance through which a standard weight must be dropped to cause the material to explode.

**Friction** - Insult sensitivity is expressed in terms of what occurs when a weighted pendulum scrapes across the material (snaps, crackles, ignites, and/or explodes).

**Heat** - Insult sensitivity is expressed in terms of the temperature at which flashing or explosion of the material occurs.

**Electrostatic** - Insult sensitivity is expressed in terms of the amount of static electric discharge necessary for detonation of the explosive. Black powder is **VERY** susceptible to electrostatic discharge.

**Shock** - Insult sensitivity is expressed in terms of a detonation of an explosive by means of another explosive in close proximity.

These insults or sensitivities are most generally the culprits for accidental detonation of explosives. The accidental detonations are a result of the insult being introduced during routine handling of the explosives.

**Two Classifications of Explosives**

Explosives are classified as **low** or **high** explosives according to their rates of decomposition. Low explosives burn rapidly (or deflagrate). High explosives ordinarily detonate. There is no sharp line of demarcation between low and high explosives. The chemical decomposition of an explosive may take years, days, hours, or a fraction of a second. The slower forms of decomposition take place in storage and are of interest only from a stability standpoint. Of more interest are the two rapid forms of decomposition, burning and detonation. The term "detonation" is used to describe an explosive phenomenon of almost
instantaneous decomposition. The properties of the explosive indicate the class into which it falls. In some cases explosives may be made to fall into either class by the conditions under which they are initiated.

Low Explosives

Low explosives burn rapidly rather than detonate. The most common type of low explosive is gunpowder. It serves as a propellant to shoot ammunition from guns and other weapons. Fireworks are also low explosives. Low explosives are normally employed as propellants. They undergo auto-combustion at rates that vary from a few inches per second up to 3,300 feet per second.

Examples of low explosives

Black Powder – Black powder is one of the most dangerous explosives known to man. It is very sensitive to friction, heat, impact, electric and nonelectric sparks. Black powder does not deteriorate with age or exposure. If black powder was to be submerged in water and dried it would have the same explosive properties as if never wetted at all. Black powder is composed of potassium nitrate or sodium nitrate and sulfur and charcoal. The granules are usually black and irregular in size. Commercially black powder is found in sizes Fg, FFg, FFFg, FFFFg,. Black powder is sold and specified using two parameters, its weight and the size of the granules. Black powder weight is measured in different units. Modern shells have the weight listed in Drams. Powder sold in cans is measured in ounces or lbs., and recommended black powder loads are measured in grains (a unit of volume).

Safety Fuse – It has a black powder core that burns at a predetermined rate. At the end of the safety fuse it transmits a spit of flame to the primary explosive material, usually a nonelectric detonator.

Photoflash Powder - The main ingredient in flash powder is potassium perchlorate. The potassium perchlorate is mixed with aluminum or sulfur. Flash powder is extremely sensitive to heat and sparks and burns rapidly causing a flash of light. Flash powder is usually gray/silver in color due to the use of aluminum in
the mixture. It is very common to find flash powder at sites where illegal explosive devices are being made.

Pyrodex

Smokeless Powder

**High Explosives**

These are normally employed in warheads. They undergo detonation at rates of 3,300 to 28,500 feet per second. High explosives are conventionally subdivided into two classes and differentiated by sensitivity:

The two main categorizations of high explosives are primary and secondary.

**Primary** - extremely sensitive to shock, friction, and heat. They will burn rapidly or detonate if ignited.

**Secondary** - relatively insensitive to shock, friction, and heat. They may burn when ignited in small, unconfined quantities; detonation occurs otherwise.

**Primary Explosives** should be handled in small quantities. They are very sensitive to heat, and even a spark of static electricity can cause them to explode. A few primary explosives include lead azide, lead styphnate, and mercury fulminate. They are usually used in detonators to set off other explosives.

High Explosives can be mixed with substances called Electric Blasting cap shown here, as with most blasting caps, use a small amount of primary explosive to detonate the base charge.

**High Explosives** detonate with greater power than primary explosives but are less sensitive. They usually require a detonator to set them off. Common types of high explosives include nitroglycerin; RDX; TNT; PETN; and pentolite, a combination of TNT and PETN. Most high explosives are used commercially for blasting and excavating, but they also are used by the military in grenades, bombs, and artillery shells. High explosives can be mixed with substances called
plasticizers to produce plastic explosives. Plasticizers, like such as oil and wax, make it easy to shape explosives into various forms. Plastic explosives have been used mostly by terrorists because of the ease of concealment but it has been used in bombs and by the armed forces in land mines.

**Blasting Agents (tertiary)** are the safest and least expensive explosives used in industry. They are usually used to blast away rock in excavating and mining operations. Common blasting agents include dynamite and mixtures of ammonium nitrate and fuel oil (ANFO).

### Examples of high explosives

**Primary Explosives**

- **Lead Azide**  
  VOD: 16,745 ft/sec

- **Lead Styphnate**  
  VOD: 17,000 ft/sec

- **Mercury Fulminate**  
  VOD: 14,780 ft/sec

**Other Primary Initiating Explosives**

There are many other types of primary initiating explosives. They generally will not be found in a "raw" form due to the sensitivity of the product. They will generally be found as components in blasting caps (detonators)

Examples include:

- **Lead Salts of Picric Acid**
- **Nitrogen Sulfide**
- **Copper Fulminate**
- **Chlorates with Red Phosphorus**
- **Tetrazene**
- **DDNP (Diazodinitrophenol)**
Secondary Explosives

Nitroglycerin (NG)
VOD: 25,000 ft/sec

Dynamite
VOD: 8,000 to 22,000 ft/sec.

Ammonium Nitrate
VOD: 12,000 - 15,000 ft/sec.

PETN (Pentaerythrite Tetranitrate)
VOD 27,200 ft/sec.

RDX (Cyclotrimethylene trinitramine, Cyclonite)
VOD 27,394 ft/sec.

HMX
VOD 29,000 ft/sec.

SEMTEX
VOD 22,464 ft/sec.

Pentolite
VOD 24,600 ft/sec.

Slurries/Water Gels
VOD 15,750 ft/sec.

Binary Explosives (ANFO)
VOD: 14,000 ft/sec.

Boosters
VOD: 16,000 - 24,000 ft/sec.

Detonating Cord
VOD: 22,000 - 27,000 ft/sec. or about 4 miles/sec.

TNT
VOD: 22,637 ft/sec.

TNT is the standard velocity of deflagration (VOD) that all other explosives are based on. An example would be that C4 is 102% of the explosive power of TNT.
Composition C4
VOD: 26,377 ft/sec.

Explosive Families
Explosives are divided into like families based on their chemical composition. There are four families of explosives:

- Nitro Compounds
- Nitrate Esters
- Nitrmines
- Acid Salts

Homemade Explosive Mixtures
Homemade explosives are more present now than ever because of the restrictions on high explosives. Most of the homemade explosives are manufactured in the home they are referred to as home labs. These home labs are especially dangerous because the person, or cook, making the explosive mixture usually do not have very much knowledge of chemistry. The Cooks typically find a recipe in one of the numerous websites that give instructions on how to use the precursor chemicals to make an explosive mixture. In most cases the methods by which to extrapolate the precursors necessary are ad-hoc at best, the cooks detonate their product in the manufacture process.

One tell tale item that can be watched for in a home lab discovery where suspected explosives are being manufactured is the use of hydrogen peroxide.

In many cases the home lab producing explosives will look very similar to a home lab for methamphetamine. In either case the responder that has found the suspected home lab should be very careful not to disturb the lab. Both methamphetamine and explosive home labs need to be investigated and mitigated by experienced hazardous material technicians.

Some of the homemade explosives that you may come across may be:

- TATP (Triacetone Triperoxide)
- HMTD (Hexamine Peroxide)
- ANFO (Ammonium Nitrate and Fuel Oil)
List of Explosives from ATF

A
Acetylides of heavy metals.
Aluminum containing polymeric propellant.
Aluminum ophorite explosive.
Amatex.
Amatol.
Ammonal.
Ammonium nitrate explosive mixtures (cap sensitive).
*Ammonium nitrate explosive mixtures (non-cap sensitive).
Ammonium perchlorate composite propellant.
Ammonium perchlorate explosive mixtures.
Ammonium picrate [picrate of ammonia, Explosive D].
Ammonium salt lattice with isomorphously substituted inorganic salts.
*ANFO [ammonium nitrate-fuel oil].
Aromatic nitro-compound explosive mixtures.
Azide explosives.

B
Baranol.
Baratol.
BEAF [1, 2-bis (2, 2-difluoro-2-nitroacetoxyethane)].
Black powder.
Black powder based explosive mixtures.
*Blasting agents, nitro-carbo-nitrates, including non-cap sensitive slurry and water gel explosives.
Blasting caps.
Blasting gelatin.
Blasting powder.
BTNEC [bis (trinitroethyl) carbonate].
BTNEN [bis (trinitroethyl) nitrime].
BTTN [1,2,4 butanetriol trinitrate].
Bulk salutes.
Butyl tetryl.

C
Calcium nitrate explosive mixture.
Cellulose hexanitrate explosive mixture.
Chlorate explosive mixtures.
Composition A and variations.
Composition B and variations.
Composition C and variations.
Copper acetylide.

Cyanuric triazide.
Cyclonite [RDX].
Cyclotetramethylenetetranitramine [HMX].
Cyclotol.
Cyclotrimethylenetrinitramine [RDX].

D
DATB [diaminotrimethoxylbenzene].
DDNP [diazodinitrophenol].
DEGDN [diethylene glycol dinitrate].
Detonating cord.
Detonators.
Dimethylol dimethyl methane dinitrate composition.
Dinitroethylenurea.
Dinitroglycerine [glycerol dinitrate].
Dinitrophenol.
Dinitrophenolates.
Dinitrophynyl hydrazine.
Dinitroresorcinol.
Dinitrotoluene-sodium nitrage explosive mixtures.
DIPAM [dipicramide; diaminohexanitrobi phenyl].
Dipicryl sulfone.
Dipicrylamine.
Display fireworks.
DNPA [2,2-dinitropentyl acrylate].
DNPD [dinitropentano nitrile].
Dynamite.

E
EDDN [ethylene diamine dinitrate].
EDNA [ethylenedinitramine].
Ednatol.
EDNP [ethyl 4,4-dinitropentanoate].
EGDN [ethylene glycol dinitrate].
Erythritol tetranitrate explosives.
Esters of nitro-substituted alcohols.
Ethyl-tetryl.
Explosive conitrates.
Explosive gelatins.
Explosive liquids.
Explosive mixtures containing oxygen-releasing inorganic salts and hydrocarbons.
Explosive mixtures containing oxygen-releasing inorganic salts and nitro bodies.
Explosive mixtures containing oxygen-releasing inorganic salts and water insoluble fuels.
Explosive mixtures containing oxygen-releasing inorganic salts and water soluble fuels.
Explosive mixtures containing sensitized nitromethane.
Explosive mixtures containing tetranitromethane (nitroform).
Explosive nitro compounds of aromatic hydrocarbons.
Explosive organic nitrate mixtures.
Explosive powders.

F

Flash powder.
Fulminate of mercury.
Fulminate of silver.
Fulminating gold.
Fulminating mercury.
Fulminating platinum.
Fulminating silver.

G

Gelatinized nitrocellulose.
Gem-dinitro aliphatic explosive mixtures.
Guanyl nitrosamino guanyl tetrazene.
Guanyl nitrosamino guanylidene hydrazine.
Guncotton.

H

Heavy metal azides.
Hexanite.
Hexanitrodiphenylamine.
Hexanitrostilbene.
Hexogen [RDX].
Hexogene or octogene and a nitrated N-methylaniline.
Hexolites.
HMTD [hexamethylenetriperoxidediamine].
HMX [cyclo-1,3,5,7-tetramethylene 2,4,6,8-tetranitramine; Octogen].
Hydrazinium nitrate/hydrazine/aluminum explosive system.
Hydrazoic acid.

I

Igniter cord.
Igniters.
Initiating tube systems.

K

KDNBF [potassium dinitrobenzo-furoxane].

L

Lead azide.
Lead mannite.
Lead mononitroresorcinate.
Lead picrate.
Lead salts, explosive.
Lead stypnate [stypnate of lead, lead trinitroresorcinate].
Liquid nitrated polyol and trimethylolethane.
Liquid oxygen explosives.

M

Magnesium ophorite explosives.
Mannitol hexanitrate.
MDNP [methyl 4,4-dinitropentanoate].
MEAN [monoethanolamine nitrate].
Mercuric fulminate.
Mercury oxalate.
Mercury tartrate.
Metriol trinitrate.
Minol-2 [40% TNT, 40% ammonium nitrate, 20% aluminum].
MMAN [monomethylamine nitrate]; methylamine nitrate.
Mononitrotoluene-nitroglycerin mixture.
Monopropellants.

N

NIBTN [nitroisobutametriol trinitrate].
Nitrate explosive mixtures.
Nitrate sensitized with gelled nitroparaffin.
Nitrated carbohydrate explosive.
Nitrated glucoside explosive.
Nitratopolyhydric alcohol explosives.
Nitric acid and a nitro aromatic compound explosive.
Nitric acid and carboxylic fuel explosive.
Nitric acid explosive mixtures.
Nitro aromatic explosive mixtures.
Nitro compounds of furane explosive mixtures.
Nitrocellulose explosive.
Nitroderivative of urea explosive mixture.
Nitrogelatin explosive.
Nitrogen trichloride.
Nitrogen tri-iodide.
Nitroglycerine [NG, RNG, nitro, glyceryl trinitrate, trinitroglycerine].
Nitroglycide.
Nitroglycol [ethylene glycol dinitrate, EGDN].
Nitroguanidine explosives.
Nitroparaffins Explosive Grade and ammonium nitrate mixtures.
Nitrostarch.
Nitro-substituted carboxylic acids.
Nitrourea.

O

Octogen [HMX].
Octol [75 percent HMX, 25 percent TNT].
Organic amine nitrates.
Organic nitramines.

P

PBX [plastic bonded explosives].
Pellet powder.
Pentolite.
Perchlorate explosive mixtures.
Peroxide based explosive mixtures.
PETN [nitropentaerythrite, pentaerythrite tetranitrate, pentaerythritol tetranitrate].
Picric acid and its salts.
Picramide.
Picrate explosives.
Picrate of potassium explosive mixtures.
Picratol.
Picric acid (manufactured as an explosive).
Picryl chloride.
Picryl fluoride.
PLX [95% nitromethane, 5% ethylenediamine].
Polynitro aliphatic compounds.
Polyolpolynitrate-nitrocellulose explosive gels.
Potassium chlorate and lead sulfocyanate explosive.
Potassium nitrate explosive mixtures.
Potassium nitroaminotetrazole.
Pyrotechnic compositions.
PYX [2,6-bis(picrylamino)]-3,5-dinitropyridine.

R

RDX [cyclonite, hexogen, T4, cyclo-1,3,5-trimethylene-2,4,6-trinitramine; hexahydro-1,3,5-trinitro-S-triazine].

S

Safety fuse.
Salts of organic amino sulfonic acid explosive mixture.
Salutes (bulk).
Silver acetylide.
Silver azide.
Silver fulminate.
Silver oxalate explosive mixtures.
Silver styphnate.
Silver tartrate explosive mixtures.
Silver tetrazene.
Slurried explosive mixtures of water, inorganic oxidizing salt, gelling agent, fuel, and sensitizer (cap sensitive).
Smokeless powder.
Sodatol.
Sodium amatol.
Sodium azide explosive mixture.
Sodium dinitro-ortho-cresolate.
Sodium nitrate explosive mixtures.
Sodium nitrate-potassium nitrate explosive mixture.
Sodium picramate.
Special fireworks.
Squibs.
Styphnic acid explosives.

T

Tacot [tetranitro-2,3,5,6-dibenzo- 1,3a,4,6a tetrazapentalene].
TATB [triaminotrinitrobenzene].
TATP [triacetonetriperoxide].
TEGDN [triethylene glycol dinitrate].
Tetranitrocobazole.
Tetrazene [tetracene, tetrazine, 1(5-tetrazolyl)-4-guanyl tetrazene hydrate].
Tetryl [2,4,6 tetranitro-N-methylaniline].
Tetrytol.
Thickened inorganic oxidizer salt slurried explosive mixture.
TMETN [trimethylolmethane trinitrate].
TNEF [trinitroethyl formal].
TNEOC [trinitroethylorthocarbonate].
TNEOF [trinitroethylorthoformate].
TNT [trinitrotoluene, trotyl, trilite, triton].
Torpex.
Tridite.
Trimethylol ethyl methane trinitrate composition.
Trimethylolthane trinitrate-nitrocellulose.
Trimonite.
Trinitroanisole.
Trinitrobenzene.
Trinitrobenzoic acid.
Trinitrocresol.
Trinitro-meta-cresol.
Trinitronaphthalene.
Trinitrophenetol.
Trinitrophloroglucinol.
Trinitroresorcinol.
Tritonal.

**U**
Urea nitrate.

**W**
Water-bearing explosives having salts of oxidizing acids and nitrogen bases, sulfates, or sulfamates (cap sensitive).

Water-in-oil emulsion explosive compositions.

**X**
Xanthomonas hydrophilic colloid explosive mixture.

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**Initiation**

An explosive is detonated by the initiation of either heat and fire or shock. In most cases the initiators are a little less stable than the desired explosive to be detonated. This less stable initiator is kept to small quantities to make the transport and setup of the initiation more safe. The small quantity of primary explosive used to start the desired explosive may not be enough to start the detonation process of the intended explosive so there must be an increasing chin of explosives called the explosive train. The explosive train is a series of explosions arranged to produce the most effective detonation or explosion of a particular explosive. The simplest explosive train requires only two steps, while more complex trains of military munitions may require four or more separate steps to achieve detonation. Explosive trains are classified into either low or high. This classification is determined by the classification of the last material in the charge to be detonated.

**Low Explosive Train**

As we have discussed the low explosive train is classified as such because of the target material or the final material in the charge to be detonated. An example of a low explosive train would be a firearm round. The firing pin of the weapon is the mechanical initiator of the explosive train. The impact of the firing pin on the primer causes a flame that ignites the propellant charge. The gases produced during the explosion push the bullet through the barrel of the weapon.

A pipe bomb where the final material for detonation is smokeless powder requires only a two-step explosive train because the explosive material only needs fire to ignite.
High Explosive Train

The high explosive train is classified because of the material used in the final stage of the charge is a high explosive. The most common high explosives used in the final stage of a high explosive is a secondary high explosive. Secondary high explosives are primarily used because of their insensitivity to heat, shock, friction or flame. This insensitivity also translates over into detonation of that secondary explosive and therefore requires an increased explosive shock wave to detonate. The increased shock wave to detonate the secondary high explosive in the final stage is created by using a primary explosive in the explosive train.

As was stated earlier, a primary explosive is an explosive that is sensitive to flame, friction, shock and heat. Because of safety, primary explosives are primarily used in very small quantities while the more stable secondary high explosives are used in the bulk of the explosion.

Some tertiary explosive such as ammonium nitrate and fuel oil (ANFO) are more insensitive to flame, friction, heat and shock and will not be set off by a simple two stage train previous discussed. The increased need for an increased shock will determine what increase in stages of the explosive train must be necessary to deliver a shock for proper detonation.

Typical Three Step Explosive Train

- Detonation of a small amount of a sensitive primary explosive. (Detonator)
- Shock travels to a slightly larger amount of less sensitive secondary high explosive (Booster).
- The shock from the booster is passed to the large amount of the lesser sensitive secondary explosive which is the main charge.

Improvised Explosive Devices (IED)

As you learned in the HAZMAT / WMD Awareness course explosive devices can be anything. The only limit to the device is the limit of the person making the device.
The term improvised explosive device is defined as devices that are:

- Fabricated in an improvised manner incorporating explosives or destructive, lethal, noxious, pyrotechnic or incendiary chemicals
- Designed to destroy, disfigure, distract or harass
- Placed or delivered to a target

Vehicles can be used because of their size and mobility. Pipe bombs are the most common type of bombs today because of their simplicity. They are usually associated with metal or plastic and a fuse. Satchel devices are backpacks with a portable concealed container with explosives. Improvised devices can be any device that produces a fragmentation, thermal or blast pressure of desired proportion.

In the awareness training you learned that explosive devices are the weapon of choice for terrorists and have been for quite some time. Current statistics show that about 86% of all terrorist incidents involve the use of explosives. Explosives can be improvised to deliver an assortment of harm or destruction or as a vehicle for chemical, biological, incendiary and nuclear agents. Recent trends worldwide can tell us that the use of explosive devices is on the increase. Places such as Iraq are possibly proving grounds for assessment on how effective different IED or VBIED (vehicle borne improvised explosive device) can be in relation to security and terrorist actions.

Also discussed in the awareness course was the recognition of suspicious items suspect of harboring explosives. The protection measures described were basically preventive in nature. Anything that is suspicious should be treated with the utmost respect. Outward warning signs that there might be an explosive could include:

- Abandoned containers
- Incidents preceded by a written or verbal threat
- Trip wires / booby traps
- Suspicious mailings
- Strong chemical odors
- Devices containing unknown items
- Multiple explosions

**Why use explosives and explosive devices?**

Explosives and Improvised Explosive Devices (IED) or Vehicle Born Improvised Explosive Devices (VBIED) are easily acquired, made and moved into place for deployment. The ease by which anyone can make an IED or VBIED is very
humbling. Some of the reasons Terrorists and Criminals like explosives & IED's are:

- Dramatic, low risk, draws a lot of attention
- Few skills needed
- Can execute attack remotely
- Components readily available
- Government sponsors difficult to identify
- Forensic evidence difficult to identify, collect and assemble

Another reason there is such popularity for explosive use by terrorists is the dramatic statement. A successful or even partial successful explosive attack would receive a plethora of media attention. This attention gives the responsible group attention and usually serves the interest and objectives of that group.

**Major Components of an IED**

An IED is typically comprised of four basic components, power supply, initiator, explosive and switch. A common way to remember these basic components is to use the acronym **PIES**.

- **P** - Power supply
- **I** - Initiator
- **E** - Explosives
- **S** - Switch

**Power Supply** - The most common power supply will be in the form of a battery. This makes the device portable and reliable. Since batteries can be manufactured in all kinds of shapes and sizes it makes the detection of the power source difficult sometimes. Other power sources might be mechanical in nature. A compressed spring can yield enough energy to set off a non-electric detonator.

**Initiator** - Most final stage explosives are insensitive to shock and therefore need to be set off by a more powerful initiation. Common types of initiators are:

- detonators
- flash bulbs
- primers
- safety fuse / hobby fuse
• firecracker
• Improvised Initiators (mouse trap & primer)
• Improvised blasting cap (fuse & small container with gun powder)

It should be noted that there are many more configurations for an initiator and responders should be watchful of highly creative perpetrators.

Another less common means of initiating explosives is the mixing hypergolic chemicals. The main key to a hypergolic device is to keep the two chemicals separate until the device can be safely placed. These type of devices are extremely hazardous because they are so unpredictable. Sometimes you might hear the term Macgyver Bomb with hypergolic devices. The name is based on the TV character that was popular in the mid 1980’s.

Explosives - The explosives are the component in the IED that causes most of the damage. When the explosives are ignited it goes through a rapid chemical change called decomposition. This process of decomposition causes a rapid violent release of gas and thermal energy.

Switches- Switches are the mechanism by which the device is activated. Since improvised explosive devices are There may be more than one switch on a device to allow the person setting the device to escape.

There are a number of different types of switches.

Clockwork timers such as wind up clocks, watches, pocket watch can be used for a determined detonation time. The clock timers usually will be effective for a 12 hour time frame for detonation due to the movement of the hands in the clockwork device. Digital wrist watches can be utilized as a
more sophisticated type of detonation timer. The battery in the LED time device may not be enough to set off the device and therefore might be run through some type of amplifier for ignition.

Pressure release switches are spring loaded push or contact switches that can be improvised or commercially purchased. They function by applying pressure or by removing pressure causing a spring loaded striker to strike a primer or close two electrical contacts to activate the circuit.

Pull release switches can be as simple as a clothespin that has wire wrapped on both sides with a piece of non-conductive material between. When the non-conducting material is pulled out from between the clothespin the circuit is completed and initiates the explosion or sets the timer in motion.

Magnetic switches, also called reed switches, are primarily used in security systems for doors and windows. The two parts of the switch contain a magnet and a reed switch in the other. When the magnetic field is in close proximity to the reed switch the circuit will either be open or closed depending on the specific design of the switch. The removal of the magnetic field is the activation for the reed switch to activate the initiation.
Vibration switches are switches that close an electronic circuit upon vibration of a spring extended through a conductive material. When the spring is vibrated it shakes and touches the conductive material thereby initiating the device.

Mercury switches are typically used as an anti tampering mechanism on a device. The movement of the mercury completes or removes the circuit causing the initiation of the device.

Alarm sensors used in commercial alarm systems can be used for the initiation of improvised explosive devices. Any motion detection, infrared detection, microwave, sound or ultrasonic sensors can be used to initiate an IED.

Photocells that are used to detect the presence or absence of light can be used on an IED.

Remote control devices such as a remote for a radio controlled toy could be used to initiate an IED. This is
particularly dangerous since it allows the perpetrator to be an operable distance away from the device when initiated.

**Common Types of IED**

As we have stated, there are many different types of IED's that can be used. The most common type of low explosive device is the **pipe bomb**.

The pipe bomb is typically a two-step firing train. It is usually made of either metal or plastic pipe. The bomb maker typically puts hobby fuse in the end of the pipe and uses a match to light the hobby fuse. The fuse will burn at an estimated rate indicated by the manufacturer. This will allow the perpetrator time to escape the deadly explosion of the pipe bomb. The fuse will burn transmitting the flame to the interior of the pipe where the low explosives are. When the low explosives are ignited the confined gases produced by the ignition expand tearing the pipe apart resulting in a blast and fragmentation.

IED's must be contained so they produce an explosion and must be concealed so they are not easily recognized as an explosive device. The packaging and concealment is only limited to the imagination of the maker.

**Other common IED's that might be seen are:**

- Briefcase
- Box
- Suitcase
- Postal Mail
- Toys
- Cellular Phone
- Pagers
- Computers
- Lights
- Furniture
- CO2 Gas Cartridges
- Fire Extinguishers
- Flashlights
- Bottles & Jars
- Automobiles & Trucks
- Packages & Presents
- Plaster Figures
- Butane, gasoline, propane tanks

Cellular phone used on a failed IED displaying one missed call.
Source: unknown
**Letter & package bombs** can be mailed or shipped by regular authentic carriers or can be dropped off at the location for the intended detonation. These packages can be of any shape or size. They can be disguised as letters, books, packages, presents or anything the perpetrator wants to use. It is important to recognize indicators of possible suspicious packages to alert you of a possible package IED. Some of the indicators to look for are:

- No return address
- Rigid or bulky
- Restrictive markings
- Mailed from a foreign country
- Excessive postage
- Addressed to title only
- Misspelled words
- Badly typed or written

**Vehicle bombs** are also called Vehicle Born Improvised Explosive Devices (VBIED). These VBIED are just as elusive to detect as the regular IED. Responders should be alert to abandoned or out of place vehicles at the scene of an incident or in proximity to a high profile event or structure. The important thing to remember when dealing with the VBIED devices are the enormous destructive power they have. As a comparison, a large American car can hold approximately 1500 pounds of ANFO. 1200 pounds of ANFO was used in the world trade center bombing in 1993.

A small bed pickup truck will hold approximately 3000 pounds of ANFO if the bed is filled to the edge of the top of the cargo bed. This would be a devastating explosion. The explosion that caused the destruction at the Murrah Federal Building in Oklahoma City was approximately 4800 pounds of ANFO.
REMEMBER – It is not the purpose of this unit to teach you how to mitigate a suspicious package by understanding the mechanisms of injury but rather to help you as a responder identify a threat if you come across one. IT IS THE RESPONSIBILITY OF THE EXPLOSIVE ORDNANCE DISPOSAL TECHNICIANS TO RENDER THESE ITEMS SAFE !!!
Hazmat/WMD First Responder Operations
Explosives and Incendiary Devices
Module 2 – Unit 8 – Review Quiz

1) The primary purpose of an incendiary device is to cause:
   a. Radiological Contamination
   b. Fire
   c. Explosion
   d. Chemical Dispersion

2) The most commonly used terrorist weapon for WMD is:
   a. Radiological
   b. Biological
   c. Chemical
   d. Explosives

3) A lab for homemade explosives is sometimes mistaken for a:
   a. Pressure Cooker
   b. Methamphetamine Lab
   c. Photo Processing Lab
   d. Chemistry Lab

4) A common ingredient in many homemade explosives is:
   a. Radiological Materials
   b. Hydrogen Peroxide
   c. Nitric Acid
   d. Propane

5) Vehicle Borne Improvised Explosive Devices are popular with terrorists because they are:
   a. able to transport large amounts of explosive
   b. able to easily conceal the explosives
   c. mobile and can be placed without suspicion
   d. all of the above
6) Which of the following is NOT one of the four major components of an IED?
   a. Power
   b. Isolator
   c. Explosive
   d. Switch

7) Which of the following is NOT a type of switch used in an IED?
   a. Photocell
   b. Remote control
   c. Chemical switch
   d. Motion sensor
Module 2
WMD Scenario
**Scope of Module 2 Scenario**

At the conclusion of module 2 the students should be able to perform a scenario that encompasses all occupational domains. This scenario is used to evaluate the effective student retention of the instruction in this module. The scenario may be utilized as a table top or actual participation exercise.

**Learning Objective**

The student will be able to respond and perform necessary defensive actions based on their occupational domain for which they are coming from.

**Student Performance Objectives**

- Recognize the threat.
- Identify the threat.
- Isolate the hazard.
- Notify more resources and other responders.
- Evaluate the control practices.
- Terminate the incident after it has been controlled.

**Resource List**

- Student manual (Module 2)
- List of available resources
- Map of area (either real or fabricated)
- If table top flip charts, or marker boards
- If hands-on a suitable location for scenario
- Props as described in scenario
- Equipment and personnel to fill roles.
Date: (Today’s date)

Time: (Local)

Weather Conditions: (As observed)

Location: (Multi unit apartment complex, 4 units per building)

Two Police units are dispatched to Apartment #3 Shady Lane on a reported domestic.

The caller is a neighbor who does not wish to be identified.

The caller advises that there is a lot of yelling coming from inside the apartment.

Officers arrive on the scene and knock on the door. The door is answered by a female holding a young child in her arms. The woman and the child both are crying and the woman has red marks on her face and arms.

She states when she arrived home from work her live in boy friend was cooking something on the stove and when she questioned him about it he became very irritated, began yelling at her and pushed her out of the kitchen. When she tried to take the baby and leave he again became very agitated and refused to allow her to leave. When he saw the police arrive he ran into the bedroom and locked the door. She states there are no weapons in the house and that he is not normally like this.
HAZARDOUS MATERIALS TRAINING FOR FIRST RESPONDER OPERATIONS

1.) Because of strict regulations by EPA, most household chemicals will not react with each other and are relatively non-toxic.
   a.) True
   b.) False

2.) Which of the following is true concerning Decontamination?
   a.) All personnel, clothing and equipment leaving the Hot Zone must be decontaminated or left for disposal in the Warm Zone.
   b.) A decontamination area must be set up prior to personnel entering an area where the potential for exposure to hazardous substances exists.
   c.) Decontamination may take place by physically removing the contaminant, disinfecting biologic hazards, or a combination of physical and chemical needs.
   d.) All of the above
   e.) None of the above

3.) Proper decontamination begins with removal of SCBA, then gloves and other hand protection, followed by heavily contaminated outer gear and less contaminated inner gear.
   a.) True
   b.) False

4.) An individual is exposed when a chemical, infectious material, radioactive substance or other agent enters, or is in direct contact with, the body.
   a.) True
   b.) False

5.) An asphyxiant is any substance that:
   a.) Burns in the presence of oxygen
   b.) Is absorbed through the respiratory system
   c.) Is heavier than air
   d.) Deprives the body of oxygen

6.) SCBA and SFPC can shield you from the primary exposure hazard of most alpha and beta radiation.
   a.) True
   b.) False
7.) Carbon dioxide, helium, hydrogen, and nitrogen are all examples of ______________ asphyxiants, which displace oxygen from the environment.
   a.) Chemical  
   b.) High  
   c.) Low  
   d.) Simple

8.) The maximum concentration that a responder or worker could escape without suffering irreversible harm as a consequence of a 30-minute exposure should his/her respirator equipment fail, is known as:
   a.) TLV-C  
   b.) IDLH  
   c.) TLV-TWA  
   d.) STEL

9.) Which of the following is true concerning routes of exposure to chemicals?
   a.) The digestive system is more delicate than the lungs and generally less capable of disposing of hazardous materials.
   b.) Short-term exposure to a high concentration is always more toxic than a long-term exposure to a low concentration.
   c.) The scalp, underarm, genital and jaw areas allow greater absorption than do other parts of the body.
   d.) None of the above

10.) Class 5 materials, such as ammonium nitrate fertilizer, include which of the following groups of materials?
    a.) Oxidizers  
    b.) Organic peroxides  
    c.) Poisonous gases  
    d.) a & b are correct  
    e.) none of the above

11.) A placard with the Hazard Class number 8 at the bottom of the placard indicates a(n):
     a.) Organic peroxide  
     b.) Poison  
     c.) Flammable solid  
     d.) Corrosive
12.) The highway cargo tank pictured here is a:
   a.) Non-pressure MC 306/DOT 406
   b.) Low-pressure MC 307/DOT 407
   c.) Corrosive liquid MC 312/DOT 412
   d.) Pressure MC 331

13.) The highway cargo tank pictured here is a:
   a.) Non-pressure MC 306/DOT 406
   b.) Low-pressure MC 307/DOT 407
   c.) Corrosive liquid MC 312/DOT 412
   d.) Pressure MC 331

14.) The highway cargo tank pictured here is a:
   a.) Non-pressure MC 306/DOT 406
   b.) Low-pressure MC 307/DOT 407
   c.) Corrosive liquid MC 312/DOT 412
   d.) Pressure MC 331

15.) The highway cargo tank pictured here is a:
   a.) Non-pressure MC 306/DOT 406
   c.) Low-pressure MC 307/DOT 407
   c.) Corrosive liquid MC 312/DOT 412
   d.) Pressure MC 331

16.) The highway cargo tank pictured here is a:
   a.) Cryogenic liquid MC 338
   b.) Tube trailer
   c.) Dry bulk commodity carrier
   d.) DOT Spec. 51

17.) The highway cargo tank pictured here is a:
   a.) Cryogenic liquid MC 338
   b.) Tube trailer
   c.) Dry bulk commodity carrier
   d.) DOT Spec. 51

18.) The railroad tank car pictured here is a:
   a.) Non-pressure
   b.) Pressure
   c.) Corrosive liquid
   d.) Cryogenic liquid
19.) The railroad tank car pictured here is a:
   a.) Non-pressure
   b.) Pressure
   c.) Corrosive liquid
   d.) Cryogenic liquid

20.) One of the most common materials transported in a ton container is:
   a.) MTBS
   b.) Vinyl chloride monomer
   c.) MTBE
   d.) Chlorine

21.) __________ is a measure of the ability of a liquid to evaporate, that is, to change from a liquid to a gas.
   a.) Flash point
   b.) Vapor pressure
   c.) Boiling point
   d.) Melting point

22.) Gases or vapors with a vapor density less than 1 will:
   a.) Sink in air
   b.) Rise in air
   c.) Mix easily with air
   d.) Evaporate quickly

23.) A chemical with a pH less than 7 is alkaline; a chemical with a pH greater than 7 is acidic.
   a.) True
   b.) False

24.) A readily available resource for dealing with an incident involving poisonous gas and specific recommendations for evacuation distances, is the:
   a.) North American Emergency Response Guidebook
   b.) MSDS
   c.) Hazardous Materials Database
   d.) NIOSH Pocket Guide
25.) You are the First Responder at an incident where an unknown material has been released into a pond. You have confirmed that the specific gravity of the product is greater than 1. Therefore, the product will tend to float on top of the water.

   a.) True
   b.) False

26.) Leaking propane tanks that are not on fire are hazardous situations because propane vapors:

   a.) Sink to low areas and move downwind from the release
   b.) Are asphyxiants and can displace air
   c.) May cause frostbite with direct skin contact
   d.) Are flammable with low LELs
   e.) All of the above

27.) Which of the following positions must be established at all hazardous materials incidents?

   a.) Incident Commander
   b.) Safety Officer
   c.) a & b are correct
   d.) None of the above

28.) Which of the following are considered to be defensive control operations?

   a.) Extinguishment
   b.) Diking and damming
   c.) Vapor suppression
   d.) All of the above

29.) Emergency Centers such as ___________________ are important resources providing immediate technical assistance to an emergency responder.

   a.) CHEMTEK
   b.) NFPA
   c.) CHEMCO
   d.) CHEMTREC

30.) The Warm Zone is the area where emergency personnel can operate beyond the range of contamination.

   a.) True
   b.) False

31.) First Responders are qualified to neutralize most hazardous materials spills.

   a.) True
   b.) False
32.) The area in which decontamination takes place is the:
   a.) Hot Zone
   b.) Warm Zone
   c.) Cold Zone

33.) The area which serves as the staging area for the backup team which is also beyond the range of potential contamination is the:
   a.) Hot Zone
   b.) Warm Zone
   c.) Cold Zone
Module 2
Appendix A
Scope of Module 2, Appendix A

Operations Security (OPSEC) is an analytic process used to deny an adversary information - generally unclassified - concerning our intentions and capabilities by identifying, controlling, and protecting indicators associated with our planning processes or operations. OPSEC does not replace other security disciplines - it supplements them.

Learning Objective

At the conclusion of this appendix you will have a better understanding of how operational security works and will be able to identify methods for gathering intelligence to improve the overall security of your operation.

Student Performance Objectives

- Define the term Operations Security (OPSEC).
- Explain two reasons why law enforcement and public safety agencies need Operations Security.
- List six basic situations where Operations Security can be of value to law enforcement and public safety agencies.
- Define the terms Threat and Adversary.
- List seven major groupings of Adversaries and explain how these groups may pose a threat to Operations Security.
- List six basic methods Adversaries use to collect intelligence against law enforcement and public safety agencies.
- List the five steps of the Operations Security Process.
- List the two components of analyzing a Threat and explain how to determine if an Adversary is a credible Threat.
- List five sources of information for developing a Threat Analysis.
- Describe six basic communications methods that are vulnerable to compromising a law enforcement mission.
- Describe the Risk Assessment process as it relates to Operations

Resources Needed

- Student Manual (Module 2)
Appendix A
Operational Security

Introduction

Operations Security (OPSEC) is an analytic process used to deny an adversary information - generally unclassified - concerning our intentions and capabilities by identifying, controlling, and protecting indicators associated with our planning processes or operations. OPSEC does not replace other security disciplines - it supplements them.

OPSEC is guarding the information we do know, because little bits of information combined with other little bits of information can provide a large picture for someone (or a group) that would like nothing more than to harm responders at home or abroad.

Overview of Operational Security (OPSEC)

OPSEC is the protection of information from the bad guys concerning the capabilities and plans of responders. This protection of operations does not allow the adversary to use our tactics against us during a response.

Operational Security is made up of three basic fundamentals:

1. Understanding the threat - If you don't know the threat, how do you know what to protect?
2. Identifying what information is to be protected - If you don't know what to protect, how do you know you are protecting it?
3. Protecting information from exploitation - If you are not protecting it, the adversary (dragon) wins!

OPSEC is then formulated to understand the threat so a response and interdiction effort can be devised for prevention. After the threat is narrowed and identified, the next thing to do is identify what it is the adversary wants. (i.e., information, money, drugs, etc.) The final law of the OPSEC program is to protect the target assets from the reasonably assumed threat that you have identified.
**Origin of OPSEC**

There is nothing new about the principles underlying OPSEC. In fact, we can trace OPSEC practices back to the colonial days and the Revolutionary War. George Washington, our first president, was a known OPSEC practitioner. General Washington was quoted as saying, "Even minutiae should have a place in our collection, for things of a seemingly trifling nature, when enjoined with others of a more serious cast, may lead to valuable conclusion."

However, OPSEC, as a methodology, originated during the Vietnam conflict when a small group of individuals were assigned the mission of finding out how the enemy was obtaining advance information on certain combat operations in Southeast Asia. This team was established by the Commander-in-Chief, Pacific, and given the code name "PURPLE DRAGON."

It became apparent to the team that although traditional security and intelligence countermeasures programs existed, reliance solely upon them was insufficient to deny critical information to the enemy--especially information and indicators relating to intentions and capabilities. The group conceived and developed the methodology of analyzing U.S. operations from an adversarial viewpoint to find out how the information was obtained.

The team then recommended corrective actions to local commanders. They were successful in what they did, and to name what they had done, they coined the term "operations security."

**The Intelligence Puzzle**

Intelligence collection and analysis is very much like assembling a picture puzzle. Intelligence collectors are fully aware of the importance of obtaining small bits of information (or "pieces" of a puzzle) from many sources and assembling them to form the overall picture.

Intelligence collectors use numerous methods and sources to develop pieces of the intelligence puzzle . . . their collection methods range from sophisticated surveillance using highly technical electronic methods to simple visual observation of activities (these activities are referred to as "indicators").

Information may be collected by monitoring radio and telephone conversations, analyzing telephone directories, financial or purchasing documents, position or "job" announcements, travel documents, blueprints or drawings, distribution lists, shipping and receiving documents, even personal information or items found in the unclassified trash.
The Premise of OPSEC

The premise of OPSEC is that the accumulation of one or more elements of sensitive/unclassified information or data could damage operational security by revealing classified information.

The Goal of OPSEC

The goal of OPSEC, as a "countermeasures" program, is to deny an adversary pieces of the intelligence puzzle.

OPSEC Process (5 Steps)

Identification of Critical Information - Basic to the OPSEC process is determining what information, if available to one or more adversaries, would harm an organization's ability to effectively carry out the operation or activity. This critical information constitutes the "core secrets" of the organization, i.e., the few nuggets of information that are central to the organization's mission or the specific activity. Critical information usually is, or should be, classified or least protected as sensitive unclassified information.

Analysis of Threats - Knowing who the adversaries are and what information they require to meet their objectives is essential in determining what information is truly critical to an organization's mission effectiveness. In any given situation, there is likely to be more than one adversary and each may be interested in different types of information. The adversary's ability to collect, process, analyze, and use information, i.e., the threat, must also be determined.

Analysis of the Vulnerabilities - Determining the organization's vulnerabilities involves systems analysis of how the operation or activity is actually conducted by the organization. The organization and the activity must be viewed as the adversaries will view it, thereby providing the basis for understanding how the organization really operates and what are the true, rather than the hypothetical, vulnerabilities.

Assessment of Risks - Vulnerabilities and specific threats must be matched. Where the vulnerabilities are great and the adversary threat is evident, the risk of adversary exploitation is expected. Therefore, a high priority for protection needs to be assigned and corrective action taken. Where the vulnerability is slight and the adversary has a marginal collection capability, the priority should be low.
Application of the Countermeasures - Countermeasures need to be developed that eliminate the vulnerabilities, threats, or utility of the information to the adversaries. The possible countermeasures should include alternatives that may vary in effectiveness, feasibility, and cost. Countermeasures may include anything that is likely to work in a particular situation. The decision of whether to implement countermeasures must be based on cost/benefit analysis and an evaluation of the overall program objectives.

- What is OPSEC?
- Is there a need for it?
- What will OPSEC do?

OPSEC Laws

The First Law of OPSEC - If you don't know the threat, how do you know what to protect? Although specific threats may vary from site to site or program to program. Employees must be aware of the actual and postulated threats. In any given situation, there is likely to be more than one adversary, although each may be interested in different information.

The Second Law of OPSEC - If you don't know what to protect, how do you know you are protecting it? The "what" is the critical and sensitive, or target, information that adversaries require to meet their objectives.

The Third Law of OPSEC - If you are not protecting it (the critical and sensitive information), the adversary wins! OPSEC vulnerability assessments, (referred to as "OPSEC assessments" - OA's - or sometimes as "Surveys") are conducted to determine whether or not critical information is vulnerable to exploitation. An OA is a critical analysis of "what we do" and "how we do it" from the perspective of an adversary. Internal procedures and information sources are also reviewed to determine whether there is an inadvertent release of sensitive information.

You’ve used OPSEC before.

You have probably been practicing OPSEC in your personal life without knowing it! When you are getting ready to go on a trip have you ever:

- Stopped the delivery of the newspaper so that they would not pile up outside and send a signal that you are not home?
• Asked your neighbor to pick up your mail so the mailbox would not fill up, also indicating that you are away?

• Connected your porch lights and inside lights to a timer so they would go on at preset times to make it look like someone is home?

• Left a vehicle parked in the driveway?

• Connected a radio to a timer so that it comes on at various times to make it sound like that someone is inside?

Well, guess what? You did! You practiced OPSEC!

The critical information here is obvious - we do not want anyone to know the house is unoccupied. None of the actions (countermeasures) listed above directly conceal the fact that your residence is unoccupied. A newspaper on the lawn or driveway does not necessarily mean no one is at home. Newspapers in the yard or driveway are only an indicator to the adversary. That indicator, combined with other indicators, (no internal lights at night, mail stuffed in the mailbox, etc.) will provide the adversary with the information needed to reach a conclusion with an acceptable level of confidence. In this case, the more indicators that the adversary is able to observe, the greater the level of confidence in his/her conclusion. When you eliminate these indicators, you have a much better chance of ensuring that your home is not burglarized while you are away.

The same holds true at your place of work. We must protect our critical information and eliminate indicators available to the adversary.

(Defend America, Editor, Linda Kozaryn)

What or Who is the Dragon?

The dragon is the threat as we have discussed previously in this unit. A threat is any individual, organization, or country that has the intent and technical capability to attack us by using our weaknesses discovered during their intelligence gathering. This threat can be against people, property, or to the critical information for ensuring a safe and successful mission. Anyone that is a threat to your operations should be considered an adversary.

WHO IS A THREAT?

A threat is anyone that has identified vulnerabilities and makes a plan to cause harm thought those vulnerabilities. The THREAT could be against almost
anything with any value. It can be people, property, or the critical information we need to ensure the safety and success of our mission. Those persons or groups who represent a threat to our operational or personal safety should be regarded as an **ADVERSARY**.

**WHO IS AN ADVERSARY?**

An adversary is anyone who may be collecting information about us and our organization and intends to use this information to either defeat our operations or plan an attack against us.

It should be noted that if we know who the adversary is and their intended actions we can then formulate a probability of attack by the adversary and execute prevention to reduce or eliminate the highly probable threat to personal safety or operations of a mission or task. This is usually accomplished by using proper threat assessments.

**Adversaries of Operational Security**

The different types of adversaries have different goals, objectives, motivations, and capabilities. Examples of such adversaries may include:

- **International Terrorist Groups**
- **Criminals** (Burglars, Thieves, etc.)
- **Organized Crime**
- **Drug Trafficking**
- **Extremists**
- **Domestic Militias**
- **Foreign Intelligence**
- **Hackers & Crackers**
- **Other “wolves”**

**How an Adversary will collect Intelligence**

**Communications** - Communications or Signal Intelligence is intelligence techniques that monitor radio, landline telephone, cellular telephone, FAX, and e-mail transmissions using a variety of electronic eavesdropping methods. A simple technique is the use of a police scanner radio to monitor unsecured police and fire department radio communications.

**People** - Human intelligence is reliant on operators (people) to watch, listen, and document specific operations.
Open Source. This is a widely used information gathering technique that uses legal information gathering methods from publicly accessible sources. Some examples are:

- Web pages
- Chatrooms
- Online lists
- Online forums
- Email

Photography / Videos. The use of photography is also called Imagery Intelligence. It uses still and video photography to collect information that can be used to put together information about your operations and organization. This method of information gathering may be used for the identification of targets within the community. Photographs can be studied repeatedly by using increased size and detail for scene reconstruction.

Trash. Trash is an element that may reveal a great deal about an operation. Anyone who has access to your office trashcan or your building’s dumpster can get a plethora of information about your operations.

False Alarms. A false alarm would be a very beneficial method for a group to collect evidence. The purpose is to create a false alarm and watch how the responders handle the incident. The adversary then has the element most wanted to guard against and that is the vulnerability. It is very important to keep changing the response and be watchful of those persons who are seemingly personally interested in the incident scene.
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