

MEASURES FOR DEALING WITH BIOTERRORISM

Section 1 : Bioterrorism

Bioterrorism is an act of terrorism where terrorists use biological agents as weapons. The term biological agent is defined as any micro-organism capable of causing disease, death, or other biological malfunction when it enters organisms including humans, animals, or plants or any substance capable of producing toxin. (Biological Weapons Convention).

Fire fighting and rescue activities in the event of a disaster caused by bioterrorism largely depend on how the disaster occurs. Since it is difficult to detect the presence of biological agents and a certain amount of time will have already passed before symptoms appear, fire fighting and rescue activities tend to be delayed compared to the response to other chemical terrorism.

However, we need to keep in mind that fire fighting and rescue activities are not responsible for dealing with all bioterrorism. For example, when white powder suspected of being anthrax is found, the fire service is supposed to be sent out only when there are victims. However, our responsibilities in such circumstances need to be determined on a case by case basis.

This chapter describes points of concern when conducting fire fighting and rescue activities in the event of a bioterrorism attack.

1-1 Types and features of biological agents

(1) Types of biological agents

The biological agents include bacterium, virus, rickettsia, or toxin produced by microorganisms.

A. Bacterium

Bacteria are unicellular organisms with a rigid cell wall. They have chromosomes and are prokaryotes without a nuclear membrane, and can be cultured in a medium. Their size ranges from approximately 0.7 to a few μm ($1\mu\text{m} = 1/1000\text{ mm}$) and they do not pass through a cell filter.

They are classified by their shapes (cocci, rod, and spiral bacterium) and also classified by their reaction to the gram stain test (gram-positive bacteria and gram-negative bacterium). This category includes anthrax, cholera and plague.

B. Virus

Viruses can be as small as 0.02-0.3 μm , which are the smallest pathogenic microorganisms currently known. They can pass through tiny pores that other bacteria can not pass through. They vary in shape, including round, cylinder, and regular dodecahedron shapes. They consist of a nucleocapsid protein coat containing nucleic acid. The virus cannot be cultivated in synthetic nutritive solutions (solution to culture microorganisms) but requires living cells in order to multiply. This group includes smallpox.

C. Rickettsia

Rickettsia is a microorganism with a similar structure to gram-negative bacteria that multiplies by binary fission. It is pleomorphic and a rod-shaped rickettsia is 0.6 x 0.3 μm in size. It does not grow in an acellular medium but grows only inside host cells. It infects via hosts such as lice, ticks, or mites. This group includes Q fever rickettsia.

D. Toxin

Toxins are defined as any toxic substances produced by any organism. They are capable of causing disease, death, or other biological malfunction when they are introduced into the human body, an animal, or a plant. Toxins are chemicals and do not grow or propagate once they are released. Their energy source is various organisms including plants, bacteria, shells, sponge, or coral. Toxins produced from these bio-sources may be directly used or the toxin-producing bacteria may be used for the terrorism activities. This group includes botulinum toxins produced by the bacillus *Clostridium botulinum*. In addition, enterohemorrhagic *Escherichia coli*, O-157 that produces verotoxin belongs to this group.

Table of Biological Agents with Potential Risk as Biological Weapons (From US Government Public Literature)

Biological Warfare Agents		Human to human transmission	Incubation Period	Lethality (when untreated)	Signs and Symptoms	Treatment	Prophylaxis
Bacteria	Anthrax	No	1-6 days	Cutaneous form:25%, Inhalational, and gastrointestinal forms: almost 100%	Fever, cough and mild chest discomfort is followed by severe respiratory distress with cyanosis. Shock and death occurs within 24-36 hours after onset of severe symptoms	Control therapy, Administration of antibiotics	Vaccination is effective, Preventive administration of antibiotics
	Brucellosis	No	5-60 days, usually 1-2 months	5%	Irregular fever, headache, fatigue, chills, arthralgias, myalgias and psychotic manifestations such as depression	Administration of antibiotics	No vaccination available
	Cholera	Rare	4 hours - 5 days, usually 2-3 days	50% (Can be reduced by treatment)	Fever, vomiting, voluminous diarrhea, dehydration, and shock.	Fluid and electrolyte replacement, Administration of antibiotics	Killed vaccine, Attenuated vaccine
	Glanders, Melioidosis	Low	10-14 days	More than 50%	Fever, rigors, sweats, myalgia, headache, pleuritic chest pain, cervical adenopathy, splenomegaly, and generalized papular/pustular eruptions	Administration of antibiotics	Preventive administration of antibiotics
	Plague • Pneumonic Plague	High	2-3 days	100%	High fever, chills, progressing rapidly to cyanosis. Death from respiratory failure, circulatory collapse, and a bleeding diathesis.	Administration of antibiotics, Control therapy	Killed vaccine is not effective
	• Bubonic Plague	Transmit via flea	2-10 days	50%	Malaise and high fever; may progress spontaneously to the septicemic form, with spread to the CNS, lungs, etc.	Administration of antibiotics, Control therapy	Killed vaccine is effective
	Tularemia • Ulceroglandular type	No	1-21 days, usually 3-5 days	Moderate	A local ulcer and regional lymphadenopathy, fever, chills, headache and malaise.	Administration of antibiotics	Attenuated vaccine (on trial), Preventive administration of antibiotics
	• Typhoidal tularemia	No	1-21 days, usually 3-5 days	35%	Fever, headache, malaise, sublethal discomfort, prostration, weight loss and a non-productive cough.	Administration of antibiotics	Attenuated vaccine (on trial), Preventive administration of antibiotics
Rickettsia	Q Fever Rickettsia	Rare	2-14 days, usually 7 days	Very Low	Fever, cough, and pleuritic chest pain	Administration of antibiotics	Q fever vaccine inoculation, Preventive administration of antibiotics
Virus	Smallpox	High	Usually 12 days	High - Moderate	Start with acute malaise and fever. 2-3 days later lesions appear which progress to pustular vesicles. They are more abundant on the extremities and face	Control therapy	Smallpox inoculation, revaccination and administration of vaccinia immune globulin
	Equine Encephalitis • Venezuelan Equine Encephalitis etc.	Low	1-5 days	Less than 1%	Generalized malaise, remittent fevers, severe headache, photophobia, myalgias, nausea, vomiting, cough, and diarrhea.	Fluid and electrolyte replacement. Administration of antibiotics	Killed vaccine, Attenuated vaccine
	Viral Hemorrhagic Fevers • Ebola Hemorrhagic Fever • Marburg Disease • Yellow Fever • Lassa fever etc	Moderate	4-21 days	More than 5-20%, 50-90% for Ebola Hemorrhagic Fever	Easy bleeding, petechiae, hypotension and even shock, flushing of the face and chest, and edema. Constitutional symptoms such as malaise, myalgias, headache, vomiting, and diarrhea	Intensive control therapy, Administration of antibiotics, Convalescent plasma may be effective in Argentine hemorrhagic fever	Yellow fever vaccine, Administration of antibiotics for Lassa fever
Toxin	Botulism	No	1-5 days	High (Less than 5% with ventilatory assistance)	Ptosis and generalized weakness followed by symmetrical descending flaccid paralysis and development of respiratory failure.	Intubation and ventilatory assistance	Antitoxin
	Staph Enterotoxin B	No	3-12 hours	Less than 1%	Fever, chills, headache, myalgia, and nonproductive cough.	Control therapy	No
	Ricin	No	18-24 hours	High (Depends on the amount of toxin or the type of exposure)	Inhalation exposure: Fever, cough and pulmonary edema followed by severe respiratory failure. Oral exposure: Severe gastrointestinal symptom and gastrointestinal bleeding	Control therapy	No

[Adapted from]

Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response Centers for Disease Control and Prevention (CDC), 2000
 Medical Management of Biological Casualties Handbook: U.S. Army Medical Research Institute of Infectious Disease (USAMRIID), 1988)
 Jane Chemical Biology Handbook 4th Edition. Frederick R. Seidel, 1899

(2) Features of biological agents

The features of biological agents are as follows.

- 1) Relatively easy to produce and inexpensive
- 2) A certain incubation period is required between the first contact and the onset of the disease (time from first contact to the pathogen to observation of symptoms of the disease in question, 1-6 days for pulmonary anthrax and usually 12 days for smallpox)
- 3) Difficult to recognize its presence
- 4) Can cause psychological shock without actually being used

Once the biological agents are released, the group exposed to the biological agent is infected and a number of people will show symptoms after a certain incubation period has passed. As a covert weapon, the biological agent is spread through the community. Since the infected people move around during the incubation period, a terrible disaster may have resulted by the time we realize that the biological agent was released.

The biological agents are likely to be released into the air in aerosol form (*), as this method is effective and easy to handle. In addition, a terrible disaster may be anticipated when food and drink are contaminated. Mailing the biological agent is another method of release, as seen in the anthrax threat in the United States.

Possible biological agents suitable for bioterrorism are summarized in the table. In future, more powerful biological agents such as highly toxic or drug resistant agents may be developed by taking advantage of genetic engineering technologies.

*** AEROSOL**

A state of liquid or fine solid particles suspended in gas. The effect on the human body depends on the size of the particles. Particles that are too large do not reach the deeper parts of the lungs such as the alveoli and particles that are too small are exhaled, not reaching the alveoli when breathing. The anthrax spore is approximately 1-5 μm , an ideal size to deposit on the alveoli. The size of its pollen and spray are 10-100 μm and over 100 μm , respectively.

1-2 Features of disasters caused by bioterrorism

Due to the types of terrorist activities and the characteristics of the biological agents, disasters caused by bioterrorism have the following features.

(1) Direct release of the biological agent by terrorists in a public place

A large number of people who happen to be there may become infected when the agent is dispersed by wind or air-conditioning inside buildings. Unlike chemical agents, as the symptoms appear after a certain incubation period has elapsed, people will not immediately develop symptoms at the site of the exposure. However, the people may be psychologically shocked and feel sick.

In addition, when the exposed people move around without being decontaminated or receiving treatment, a large number of people may become sick simultaneously over large areas after the incubation period has passed.

(2) Covert release

By the time we realize that the biological agent has been released and the infected people have moved around, a terrible disaster may ensue as the infected people spread over large areas. In addition, an outbreak may occur simultaneously over large areas and produce many victims if the release of the biological agent is not realized immediately.

(3) Release by post

As seen in the incidents in the US, a situation similar to the case of (1) may arise when the biological agent is released via post.

In addition, if the mail is opened before the presence of the biological agent is detected, many people may become sick simultaneously, as in the case of (2).

When mail suspected of containing the biological agent is discovered, measures must be taken to deal with the infection and subsequent psychological shock.

Features of Diseases Caused by Bioterrorism

- A rapidly increasing incidence of disease (e.g. within hours or days) in a normally healthy population.
- The number of patients increases and decreases over a short period.
- An unusual increase in the number of people seeking care, especially with fever, respiratory, or gastrointestinal complaints.
- An endemic disease rapidly emerging at an uncharacteristic time or in an unusual pattern.
- Lower attack rates among people who had been indoors, especially in areas with filtered air or closed ventilation systems, compared with people who had been outdoors.
- Clusters of patients arriving from a single locale.
- Large numbers of cases rapidly becoming serious and potentially fatal.
- Any patient presenting with a disease that is relatively uncommon that may have been caused by bioterrorism (e.g., pulmonary anthrax, tularemia, or plague)

Section 2 : Points of concerns in conducting fire fighting and rescue activities

2-1 Points of concern in conducting fire fighting and rescue activities

The rescue workers should keep close contact with the relevant authorities to identify the extent of the disaster and assess the risk. At the same time, they must prevent the damage from spreading and secure the safety of the local residents as a top priority. At the same time they must secure their own safety, therefore the following points of concern must be taken into account.

- (1) Handle appropriately the relevant authorities such as law enforcement officials, self-defense forces, medical institutions, prefectural governments, local municipalities (including a sanitation bureau, a health department and health institutions etc.)
- (2) Collect information and investigate the source of the infection where possible for risk assessment
- (3) Prevent the rescue workers from becoming infected (Secure the safety of the rescue workers)
- (4) Prevent spreading the infection through the rescue workers or infected people
- (5) Prevent spreading the infection through emergency vehicles such as ambulances and medical equipment
- (6) Treat infected people appropriately

2-2 On receipt of a 119 call

- (1) When a disaster and victims of exposure to a biological agent are notified via a 119 call, assemble troops, prepare equipment, gather information about climatic conditions, request additional troops, and report to the relevant authorities appropriately.
- (2) When the suspicious materials are found, a call operator should instruct an informer not to leave or touch the suspicious materials, to protect his respiratory organs by covering with a towel, to protect the exposed body parts, to wash or change clothing items when a part of the body touches the suspicious materials.

2-3 Points of concern for each disaster scenario

Matters that must be considered in each disaster scenario are described below as a reference in conducting fire fighting and rescue activities at each fire department or in developing rescue action plans in future.

2-3-1 Points of concern in conducting fire fighting and rescue activities when the biological agent is released in a public place

(1) Rescue suit during activities

- A. To prevent the infection of their respiratory organs such as the nose, mouth, or skin, the rescue workers who investigate the biological agent and who rescue victims should wear an air respirator system and a chemical protective suit that covers the exposed area of their bodies. In particular, a positive pressure type chemical protective suit (level A equivalent protection) should be worn until the released biological agent is identified. Where the positive pressure type chemical protective suit is not available, the opening of a non-sealed chemical protective suit should be covered with packing tape for protection.
- B. When rescue workers who do not have a chemical protective suit need to conduct rescue activities on site, they should take such measures as wearing gloves, a cap, a simple protective suit, fireproof suit or poncho, an air respirator system, gas mask or mask (N-95), and anti-dust goggles to minimize the exposed body parts. In addition, they must fully comply with the Standard Precautions that the CDC stipulates for medical institutions. Extra precautions are required for protecting injured and damaged skin.

*** Compliance with Standard Precautions**

(1) Handwashing

Hands must be washed after touching blood, body fluids, excretions, secretions, or items contaminated with such body fluids, whether or not gloves are worn. Hands must be washed immediately after gloves are removed, between patient contacts, and as appropriate to avoid the transfer of microorganisms to other patients and the environment. Either plain or antimicrobial-containing soaps may be used according to the facility policy.

(2) Gloves

Clean, non-sterile gloves must be worn when touching blood, excretions, secretions, or items contaminated with such body fluids. Clean gloves are put on just before touching mucous membranes and injured or skin. Gloves must be changed between tasks and between procedures on the same patient if contact with contaminated material occurs. Hands must be washed promptly after removing gloves and before leaving a patient treatment area.

(3) Mask/Eye Protection or Face Shields

A mask and eye protection (face shield) must be worn to protect the mucous membranes of the eyes, nose, and mouth while performing procedures and patient treatments that may cause splashes of blood, body fluids, excretions, or secretions.

(4) Gowns

A gown is worn to protect the skin and prevent soiling clothing during procedures and patient treatments that are likely to generate splashes or sprays of blood, body fluids, excretions, or secretions. The gowns and gown materials selected should be suitable for the activity and the amount of body fluid likely to be encountered. Soiled gowns must be removed promptly and hands washed to avoid transfer of microorganisms to other patients and the environment.

(2) Determining the most suitable treatment site

- A. As for a disaster caused by chemical terrorism, the most suitable treatment site is determined by considering the wind direction, wind speed, land features, building conditions, access for responders arriving later, and route for transferring rescue workers.
- B. As a rule, victims should be placed on the windward side or parallel to the wind direction. In addition, avoid placing them near an air vent when the disaster occurs inside a building.

(3) Estimation of the extent of the disaster

To prevent spreading the damage further, the rescue workers should gather all possible information through close contact with relevant authorities and estimate the risk according to the data obtained from the detector, other measuring instruments (including the data from other institutions) and the condition of the victims.

(4) Preventing the spread of contamination

If necessary, after considering the wind direction, wind speed, land features, and building conditions and discussing with local law enforcement officials, the following points need to be considered.

- 1) Limit entrance to the area except for rescue workers in full protective suits
- 2) Decontaminate completely the rescue workers and the victims when entering and exiting the area
- 3) Minimize unnecessary transfer of the victims in the area

In addition, when the disaster occurs indoors, appropriate measures such as turning off an air conditioning system must be taken to prevent further contamination.

(5) Evacuation from the contaminated area

To evacuate the provisional area contaminated with the biological agent, appropriate measures such as the designation of the evacuation area must be taken through discussions with the relevant authorities. In these circumstances, decontamination in accordance with item (4) above must be taken into account to prevent further contamination. In addition, appropriate post-evacuation measures must be taken after discussions with the relevant authorities.

Furthermore, the people presenting in the provisional contaminated area should be listed in case they later develop the disease. This must be done in discussion with the relevant authorities and fully respecting privacy.

(6) Response when suspicious materials are found

Close collaboration with law enforcement officials is essential when dealing with suspicious materials. The law enforcement officials must be notified immediately if they have not yet arrived at the scene. The suspicious materials must be sealed in a plastic bag or a container to avoid touching and moving and they must be turned in to the law enforcement officials.

(7) Collaboration with relevant authorities

- A. An appropriate and collaborative response must be taken by the relevant authorities including the law enforcement officials on site, self-defense forces, medical doctors, prefectural governments, a local municipality (a sanitation bureau, a health department and health institutions etc.).
- B. If the relevant authorities necessary for the rescue work have not yet arrived on the scene, they must be contacted immediately.
- C. If medical doctors have not arrived on the scene, the rescue workers must share the information with the health department or medical institutions to obtain their instructions.

(8) Non-proliferation

- A. Rescue workers must carry out their activities near the disaster area or building where the biological agent is deposited with a minimal number of workers, and they should move as quietly as possible to avoid spreading the particles of the biological agent.
- B. The area where the biological agent is deposited should be covered with a vinyl sheet to prevent further dispersal. In this circumstance, extra care is necessary when removing the cover sheet so that the biological agent does not spread further.

(9) Decontamination

A. Decontamination of rescue workers

The rescue workers engaged in the disaster area and the rescue workers exposed to the biological agent should be decontaminated carefully by taking a shower or by being cleaned with a water hose. In this circumstance, appropriate measures should be taken in disposing of the water used for decontamination as well as protecting the rescue workers conducting the decontamination.

B. Decontamination of the victims

Appropriate measures should be taken for the management of the contaminated clothing items of suspected victims and the decontamination procedures described in the item A above should be carried out. (An extra precaution to use hot water is necessary in wintertime).

To prevent spreading or inhaling the biological agent attached to hair, a cap or hood should be worn to cover the head. In addition, spreading the biological agent attached to clothing should be avoided as much as possible when undressing. The discarded clothing items should be kept in sealed plastic bags or a container to prevent further spread of the biological agent. In addition, privacy should be protected when the victims are undressing and the provision of clean clothing items should be taken care of.

C. Decontamination of equipment used for the rescue activities

The equipment used in the contaminated or disaster area or the equipment contaminated with the biological agent should be decontaminated with disinfectant. In addition, if decontamination with disinfectant is not possible, the equipment should be sealed in a plastic bag or a container.

(10) Requests for Assistance

Assisting units should be promptly dispatched or mutual additional troops and greater area fire service troops should be requested when the disaster is too great for a local fire department to deal with alone.

(11) Patient Transport

- A. The patients should be transferred to the ambulance only after being decontaminated as much as possible.
- B. When loading patients onto the ambulance, they should be covered with a shield to prevent further spread of the contaminant.
- C. The patients must be transferred in a manner similar to that for the transfer of infected people.
- D. Transporting rescue workers should wear a protective suit, cap, gloves, anti-dust goggles, and mask (N-95) to prevent infections. If necessary, a chemical protective suit (or a poncho, if the suit is not available) and gas mask should be worn.
- E. After the transfer is completed, the inside of the ambulance and the equipment used for the transfer should be decontaminated to prevent spreading the infection via the ambulance.

2-3-2 When the biological agent is covertly released and victims present after the incubation period

(1) Gathering information and equipment preparation

- A. When a number of victims arise simultaneously over larger areas, the information should be collected from the relevant authorities and the equipment necessary for the rescue activities should be prepared.
- B. When the reports suggest the infection was caused by the biological agent, a chemical protective suit (or poncho if not available), mask (N-95), gloves, disinfectant, anti-dust goggles or gas mask should be brought to take all possible measures to prevent infections.

(2) Response on emergency site

- A. When it is suspected that patients are infected with the biological agent, they must be treated accordingly. The rescue workers must report to the relevant authorities such as law enforcement officials, prefectural governments, the sanitation bureau of a local municipality with a health department (a health department and health institutions etc.) for assistance.
- B. If directions are available from the relevant authorities such as medical doctors, prefectural governments, a sanitation bureau of a local municipality, the rescue workers must follow them.
- C. If necessary, they should request additional troops armed with protective equipment such as chemical protective suits and prevent spread of the contamination in accordance with the measure described in 3-1.
- D. Special arrangements for family members living with the victims should be discussed with the relevant authorities.

(3) Public announcement of the information

- A. As it is possible that the disaster area is not limited to a single fire department jurisdictional area, and a larger area may be affected, when suspected victims of a biological agent are discovered, the rescue workers must notify the local public health officials immediately and the local public health officials must report to the fire department.
- B. When they receive such a report, the local public health officials and the fire department should share the information with the local governments in the area and other relevant authorities. These authorities should give the fire department appropriate instructions.

(4) Others

Cooperation with the relevant authorities, requesting additional troops, decontamination during and after transfer procedures should be the same as described in 2-3-1.

2-3-3 When the biological agent is released via post

- (1) Similar measures to section 3-1 should be taken.
- (2) When an informer first notifies the fire department, instruct him not to leave the scene or touch the suspicious material, to protect the respiratory organs with a towel, to protect the exposed body parts, to wash or change clothing items when they come into contact with the suspicious material.
- (3) When the fire department is the first to respond, if necessary the materials in question need to be sealed in plastic bag or a container to submit to the law enforcement officers when they arrive.

2-4 Disinfection

(1) Protocol

The cleaning protocol may vary according to the type of biological agent, but the suggested concentrations are shown below.

A. Equipment

Wipe with gauze soaked with a 0. 5% sodium hypochlorite solution.

B. Skin

As a rule, plenty of soap and water should be used to clean completely.

(2) Points of concerns

- A. Disinfect blood, feces, urine, sputum, or pus as well.
- B. Disinfecting procedures should be conducted by taking full account of infection protection measures and disinfection and decontamination of the protective suits and other clothing items used for the procedures.

- C. Extra precaution is required when using sodium hypochlorite as chlorine gas may be produced when it contacts an acid cleaner. In addition, keep in mind that chemical damage may occur when the skin is exposed to high concentrations of sodium hypochlorite solution (higher than 1%).
- D. The products containing sodium hypochlorite available in the market are as follows.

Product Name	Concentration
Milton, Purifiante P	1% (10,000ppm)
Haitec, Bleach	Approximately 5% (Approximately 50,000ppm)
Texant, Purelox	6% (10,000ppm)
Hypolite	10% (10,000ppm)

Section 3 : Infected patient transport

According to the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections (New Infectious Diseases Control Law) (April, 1999), the transport of the patients who are diagnosed as infected with Category I infectious diseases, Category I quasi-infectious diseases, asymptomatic general infectious diseases, Category II infectious diseases, Category II quasi-infectious diseases (Cholera, Shigellosis, Typhoid fever, or Paratyphoid fever etc.) and who are required or suggested to be hospitalized by the prefectural governor, falls under the jurisdiction of the prefectural governor.

Section 4 : Media coverage regarding infected patients and suspected victims

Article 3 of the Law Concerning the Prevention of Infectious Diseases and Medical Care for Infectious Patients (Infectious Diseases Control Law) (1998 Law 114) ordains the protection of human rights for the infected people by national and local authorities. In addition, Article 16 ordains that the Minister of Health, Labor and Welfare and the prefectural governor investigate and analyze the information collected regarding the infectious disease and announce the information to prevent and control the spread of the infectious disease while protecting privacy.

In this matter, in responding to the disaster caused by the biological agent, extra consideration is required in dealing with the items ordained by law or in handling the private information when releasing information to the media or managing the information.

