CHAPTER 6

BIOHAZARDS

INTRODUCTION

Over the last three decades of the 20th Century, it became increasingly evident that, in addition to those hazards and risks typically faced by emergency response personnel, much more concentrated attention had to be given to the hazards and risks posed by the continually expanding profusion of industrial and commercial chemicals. While this concern will likely remain unabated well into the next century, it also became evident by the mid 1980s that biological agents of disease had also become of cardinal importance—not only with respect to the health of the general public, but, more specifically, to those who, by the nature of their occupation, experience routine exposure to blood and other body fluids.

Of immediate concern at that time, of course, was the abruptly devastating emergence onto the world scene of HIV (Human Immunodeficiency Virus), the viral agent that may lead to fully developed AIDS (Acquired Immune Deficiency Syndrome) in HIV-infected persons. In the United States, the growing recognition of AIDS as being communicable through exposure to the blood and certain body fluids of infected persons prompted federal enactment of the Health Omnibus Programs extension Act of 1988, Title II ("Aids Amendments of 1988") as a means of giving specific guidance to health workers, public safety workers, and emergency responders.

Even in the absence of precise understanding of the etiology of HIV, the U.S. Department of Health and Human Services (Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health) moved quickly (February, 1989) to issue specific guidelines to reduce workplace risk with regard to not only HIV, but also hepatitis B virus (HBV). The insightful inclusion of HBV along with HIV in these guidelines (U.S. Department of Health and Human Services, 1989: Guidelines for Prevention of Transmission of Human Immunodeficiency Virus and Hepatitis B Virus

to Health-Care and Public-Safety Workers) was based on the following assumptions:

1. Modes of transmission for HBV are similar to those of HIV,
2. Potential for HBV transmission in the workplace is greater than for HIV,
3. There is much greater experience with controlling workplace transmission of HBV, and
4. Practices to prevent the transmission of HBV will also minimize the risk of transmission of HIV.

In keeping with this approach to providing practical guidance for minimizing the risk of infection by a number of diverse pathogens that nonetheless demonstrate similarities in modes of transmission , the U.S. Occupational Safety and Health Administration (OSHA) implemented its own "Bloodborne Pathogen Standard" (29 CFR 1910.1030) for American industry in 1992.

While the recognition of bloodborne pathogens as an occupational risk to any personnel having contact with blood and body fluids of infected persons is now firmly established, bloodborne pathogens do not exhaust the range of biohazards that may present health risks to emergency responders.

With the rapidly growing mobility and population density of persons in an increasingly cosmopolitan global village, with the-ever developing industrial and commercial use of biotechnology and, as a consequence of the misuse of previous pharmaceutical technology, the general public continues to be at highly significant risk due to a host of pathogenic and parasitic organisms, with yearly deaths from infectious and parasitic organisms exceeding, worldwide, the deaths due to all other causes (Fig. 6.1) and accounting for one-third of all deaths. Of growing world-wide concern are the following.

1. Pathogenic Organisms That (a) Have Been Long Existent but Equally Long Isolated in Remote Areas of World, or (b) Are Newly Evolved through Genetic Mutations of Existing Pathogens

Diseases caused by these pathogens, including at least 30 new disease agents identified over the past 20 years, are referred to as *emerging diseases* (Table 6.1).

As even the most remote areas of the world become more accessible to world travelers, so does the world itself become more accessible to these pathogens. While it might be assumed that emergency response personnel are at no greater risk than the general public, it must be emphasized that it is becoming increasingly likely that a major catastrophe (e.g., earthquake,

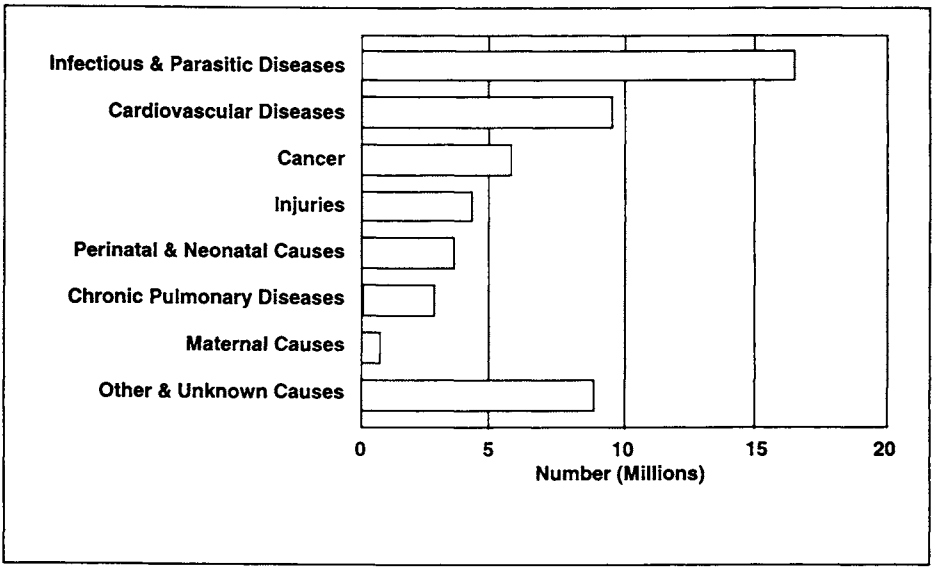

FIGURE 6.1 Worldwide deaths by cause, 1993 (adapted from Centers for Disease Control [CDC], Electronic Reference Library).

high-rise building collapse), wherever it occurs, will elicit the response of specialized emergency teams from throughout the world.

2. Pathogenic Organisms Cultured in Medical Research and Other Facilities, Including Facilities in Which Genetically Engineered Organisms Are Produced

There have long been laboratories and specialized storage depots housing pathogenic organisms used for research purposes. Emergency responders must therefore be prepared to deal with biohazard risks associated with such facilities. In addition, a growing number of laboratories and commercial industries involve genetic engineering of potential pathogens—a situation that greatly increases the probability of such facilities becoming involved in catastrophic emergencies. Thus, the following considerations become of paramount concern to emergency response planning:

- Given the rapid growth and development of contemporary societies, many facilities in which pathogens are cultured and stored (and/or genetically manipulated) are located in very dense population areas,

TABLE 6.1 Examples of Emergent Infectious Diseases Recognized Since 1973 (Adapted from CISET, 1997: Global Microbial Threats in the 1990s [National Center for Infectious Diseases Electronic Reference Library])

Year	Microbe	Type	Disease
1973	Rotavirus	Virus	Major cause of infantile diarrhea
1975	Parvovirus B19	Virus	Aplastic crisis in chronic hemolytic anemia
1976	*Cryptosporidium parvum*	Parasite	Acute and chronic diarrhea
1977	Ebola virus	Virus	Ebola hemorrhagic fever
1977	*Legionella pneumophila*	Bacterium	Legionnaires' disease
1977	Hantaan virus	Virus	Hemorrhagic fever with renal syndrome
1977	*Campylobacter jejuni*	Bacterium	Enterric pathogen
1980	HTLV-1	Virus	T-cell lymphoma-leukemia
1981	Toxic *Staphylococcus aureus*	Bacterium	Toxic shock syndrome
1982	*Escherichia coli* (0157:H7)	Bacterium	Homorrhagic colitis; hemolytic uremic syndrome
1982	HTLV-II	Virus	Hairy cell leukemia
1982	*Borrelia burgdorferi*	Bacterium	Lyme disease
1983	HIV	Virus	AIDS
1983	*Helicobacter pylori*	Bacterium	Peptic ulcer disease
1985	*Enterocytozoon bieneusi*	Parasite	Persistent diarrhea
1986	*Cyclospora cayatanensis*	Parasite	Persistent diarrhea
1988	Human herpesvirus-6	Virus	Roseola subitum
1988	Hepatitis E	Virus	Enterically transmitted non-A, non-B hepatitis
1989	*Ehrlichia chafeensis*	Bacterium	Human ehdlichiosis
1989	Hepatitis C	Virus	Parenterally transmitted non-A,non-B hepatitis
1991	Guanarito virus	Virus	Venezuelan hemorrhagic fever
1991	*Encephalitozoon hellem*	Parasite	Conjunctivitis, disseminated disease
1991	New species of Babesia	Parasite	Atypical babesiosis
1992	*Vibrio cholerae* 0139	Bacterium	New strain associated with epidemic cholera
1992	*Bartonella henselae*	Bacterium	Cat-scratch disease; bacillary angiomatosis
1993	Sin nombre virus	Virus	Adult respiratory distress syndrome
1993	Encephalitozoon cuniculi	Parasite	Disseminated disease
1994	Sabia virus	Virus	Brazilian hemorrhagic fever
1995	HHV-8	Virus	Associated with Kaposi sarcoma in AIDS patients

- Given recent advances in biotechnology as well as the ready availability of that technology, it is highly unlikely that any legal authority knows precisely what is actually being done anywhere regarding the production or genetic manipulation of pathogens—except in those specific cases where legal sanction or financial support is sought by those doing the work, and
- Given recent experience with both current technology and external (so-called "foreign") and internal (so-called "domestic") terrorism, it is not unimaginable that a pathogen may well become the weapon of choice for any knowledgeable sociopath.

In light of these considerations, it is suggested to be only prudent for emergency response planning to take careful account of the real possibility that the occupational risks associated with bloodborne pathogens do not define the full range of risks attendant to biohazards.

3. Well-Known Pathogens That, Due to Society's Overuse of Antibiotics, Have Evolved into Strains Now Resistant to Those Antibiotics

Diseases caused by well-known pathogens that were once controlled but which have become either resistant to antibiotics or are, for other reasons (e.g., changes in human behavior, development of natural resources, changes in public policy), ascendant are referred to as *reemerging diseases* (Table 6.2).

Again, microbial resistance to antibiotics is a risk presented to the general public, with seemingly no special relevance to the emergency responder. However, during emergency response activities involving close personal contact with victims, it is only prudent (as in the case of HIV) that emergency response personnel take appropriate measures to protect themselves from any infection.

BLOODBORNE PATHOGENS

Bloodborne pathogens are those pathogenic organisms that may be found in certain body fluids of infected persons. They may be transmitted to noninfected persons through their contact with contaminated body fluids, including:

- human blood, blood components, and products made from human blood
- semen (male reproductive secretion)
- vaginal secretions (female reproductive secretions)
- cerebrospinal fluid (associated with brain and spinal cord)
- synovial fluid (associated with membranes in bone joints)
- pleural fluid (associated with lung)
- pericardial fluid (associated with chest cavity)
- peritoneal fluid (associated with abdominal cavity)
- amniotic fluid (associated with membranous sack covering fetus)
- saliva (only in dental procedures where there is a high probability of blood becoming mixed with saliva)
- any other body fluid that is visibly contaminated with blood
- all body fluids in situations where it is difficult to differentiate between body fluids

The two bloodborne pathogens of primary concern are the hepatitis virus (HV), specifically types B and C (HBV and HCV, respectively), and the so-called AIDS virus (HIV), which is really a number of distinctly different genetic strains of the same virus.

TABLE 6.2 Some Factors Leading to the Ongoing Reemergence of Infectious Diseases

Disease or Agent	Factors in Re-emergence
	Viral Infections
Rabies	Breakdown in public health measures; changes in land use; travel
Dengue/ dengue hemorrhagic fever	Transportation, travel and migration, urbanization
Yellow Fever	Favorable conditions for mosquito vector
	Parasitic Infections
Malaria	Drug and insecticide resistance; civil strife; lack of economic resources
Shistosomiasis	Dam construction, improved irrigation, and ecological changes favoring the snail host
Neurocysticercosis	Immigration
Acanthamebiasis	Introduction of soft contact lenses
Visceral leishmaniasis	War, population displacement, immigration, habitat changes favorable to the insect vector and increase in immunocompromised human hosts
Toxoplasmosis	Increase in immunocompromised human hosts
Giardiasis	Increased use of child-care facilities
Echinococcosis	Ecological changes that affect the habitats of the intermediate (animal) hosts
	Bacterial Infections
Group A Streptococcus	Uncertain
Trench fever	Breakdown in public health measures
Plague	Economic development; land use
Diphtheria	Interruption of immunization program due to political changes
Tuberculosis	Human demographics and behavior; industry and technology; international commerce and travel; breakdown of public health measures; microbial adaptation
Pertussis	Refusal to vaccinate in some parts of the world because of the belief that injections or vaccines are not safe
Salmonella	Industry and technology; human demographics and behavior; microbial adaptation; food changes
Pneumococcus	Human demographics; microbial adaptation; international travel and commerce; misuse and overuse of antibiotics
Cholera	Travel; new strain; reduced water chlorination

Fact Sheet	***Hepatitis B***
Clinical Features	Jaundice, fatigue, abdominal pain, loss of appetite, intermittent nausea, vomiting
Etiologic Agent	Hepatitis B virus
Incidence	140,000 - 320,000 infections/year in United States
Sequellae	Of symptomatic infections, 8,400 - 19,000 hospitalizations/year and 140 - 320 deaths/year Of all infections, 8,000 - 32,000 chronic infections/year, and 5,000 - 6,000 deaths/year from chronic liver disease including primary liver cancer
Prevalence	Estimated 1 - 1.25 million chronically infected Americans
Costs	Estimated $ 700 million (1991 dollars)/years (medical and work loss)
Transmission	Bloodborne; sexual; perinatal
Risk Groups	✚ Injection drug user ✚ Sexually active heterosexuals ✚ Homosexual men ✚ Infants/children of immigrants from disease-endemic areas ✚ Low socioeconomic level ✚ Sexual/household contacts of infected persons ✚ Infants born of infected mothers ✚ Health care workers ✚ Hemodialysis patients
Trends	Incident increased though 1985 and then declined 55% through 1993 because of wider use of vaccine among adults, modification of high-risk behaviors, and possibly a decrease in the number of susceptible persons. Since 1993, increases observed among the three major risk groups: sexually active heterosexual, homosexual men, and injection drug users.
Prevention	✚ Hepatitis B vaccine available since 1982 ✚ Screening pregnant women and treatment of infants born to infected women ✚ Routine vaccination of infants and 11-12 year olds ✚ Catch-up vaccination of high-risk groups of all ages ✚ Screening of blood or tissue donors

FIGURE 6.2 Basic facts about Hepatitis B (adapted from information from National Center for Infectious Disease [NCID], Electronic Reference Library).

HBV (Fig. 6.2) is of particular concern as an occupational hazard not only because it causes a long-term disabling liver disease possibly leading to cirrhosis and even liver cancer, but also because of its efficient transmission from one person to anther following contact with infected blood and body

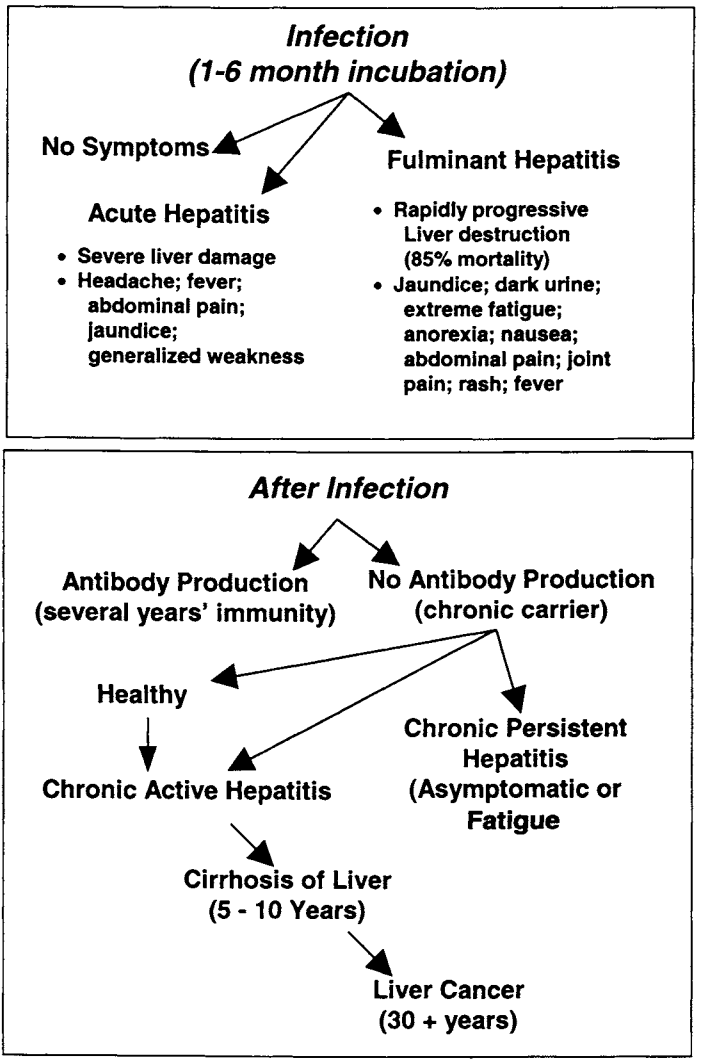

FIGURE 6.3 Alternative pathways of infection and postinfection development of HBV.

fluids. HBV has caused (and continues to cause) more cases of occupationally linked infectious disease than any other bloodborne pathogen. In fact, the probability of infection by HBV is on the order of 100,000 times greater than the probability of infection by HIV.

HBV infection may require an extended period of incubation and become manifest in highly diverse symptoms (Fig. 6.3), with many infected

persons becoming long-term carriers and therefore potential sources of new infection.

In the United States, it has been estimated that on the order of 300,000 persons, including 9,000 health care workers, become infected with HBV every year. Worldwide, about 300 million persons are chronic carriers of HBV. In southeast Asia and tropical Africa, chronic carriers represent at least 10% of the population; in North America and most of western Europe, this group is less than 1%.

Historically, primary attention was given to HBV as the primary occupationally linked hepatitis virus, while HCV (a non-A, non-B strain), which is also transmitted through blood and other body fluids, was considered to present relatively little risk in the workplace. However, HCB has now been demonstrated to present potentially significant workplace risk, with upward of 40% of hepatitis infections previously attributed to HBV now possibly attributable to HCV.

HIV contravenes the body's capacity to resist a variety of life-threatening infections. HIV infection may also lead to severe weight loss, fatigue, neurological disorders, and certain cancers, including cancer of the skin or other connective tissue (sarcoma) and cancer of the lymph nodes or lymph tissues (lymphoma).

First discovered in 1979, AIDS (Fig. 6.4) quickly attained the status of a global epidemic, with estimates of actual cases worldwide approaching 600,000 in less than a decade. However, a distinction must be made between "HIV infection" and the development of AIDS.

HIV infection is indicated by the presence of (a) the HIV agent in the body (e.g., by means of a positive HIV-antigen test) and/or (b) HIV antibodies produced by the infected body (e.g., by means of a positive HIV-antibody test). AIDS is a complex of symptoms indicating significant destruction of the HIV-infected body's immune response capability. While it is assumed that HIV infection can result in the development of AIDS, the disease can progress quite differently in different persons, in both symptomatology and chronology.

While most HIV-infected persons do appear to develop antibodies to HIV within 6 to 12 weeks of exposure to HIV, some may show neither outward symptoms nor an analytically detectable antibody response (e.g., by means of an HIV screening test) for even longer periods. Finally, even before the full-blown development of AIDS, which is indicated by essentially the collapse of the immune system and the subsequent development of opportunistic diseases (e.g., pneumonia, fungal diseases of the throat and lung, Kaposi's sarcoma, and tuberculosis), an HIV-infected person may develop other symptoms, including severe, involuntary weight loss, chronic diarrhea, constant or intermittent weakness, and extended periods of fever—conditions that may themselves result in death.

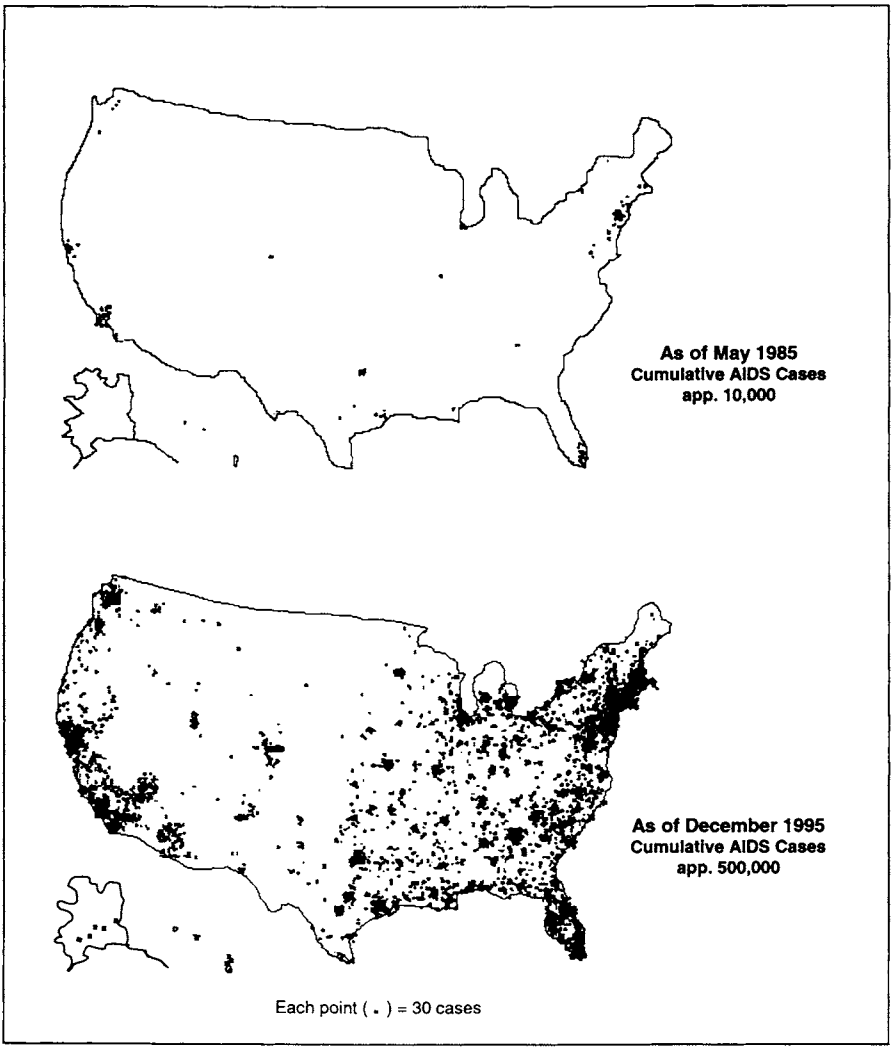

FIGURE 6.4 Cumulative AIDS cases (1985, 1995) in United States (adapted from U.S. Centers for Disease Control [CDC], CDC Electronic Reference Library).

Regardless of the progress of specific symptoms, and regardless of the length of time over which infected persons may remain asymptomatic, all HIV-infected persons must be considered capable of transmitting HIV to others. However, it is important to emphasize that *HIV transmission requires intimate contact with contaminated blood and other body fluids.*

There is no documented evidence of HIV transmission simply through casual and even close physical contact with infected persons.

In addition to HBV, HCV, and HIV, bloodborne pathogens include a variety of highly infectious agents that pose significant risks to workers in various parts of the world. These pathogens (Fig. 6.5) include bacterial, protozoan, and viral species that, through a variety of disease vectors (e.g., mosquitoes, ticks, lice), ultimately contaminate human blood and other body fluids.

Any effort to minimize the risk of infection by bloodborne diseases must be predicated by the following three considerations:

1. Exposure to the blood and body fluids of infected persons always presents a real risk of contracting the disease.
2. Analytical tests devised to detect the presence of infection have inherent limits. In some instances, such limits become manifest in *false negatives,* which are analytical results that indicate a disease is not present when it actually is present. For example, a person who is infected with HIV may nonetheless be completely asymptomatic, with blood showing no detectable levels of HIV antibody for weeks and even months after infection. Negative analytical results are therefore false; they do not prove that infection is absent—nor do they demonstrate that a person is incapable of transmitting the disease to others.
3. Given the range in variation of human response to infection (from grossly symptomatic to completely asymptomatic response), given different periods of latency typically associated with the signs and symptoms of bloodborne diseases, and given the inherent limits of analytical procedures performed to detect disease (e.g., false negative, outright laboratory error), no person can safely assume that any human blood or related body fluid is safely free of contamination with infectious agents.

It is particularly important that these considerations be specifically integrated with job-task analyses (Chapter 5) so that individual job-tasks that might involve exposure of emergency response personnel to blood or body fluids can be identified and proper protective equipment (Table 6.3) issued to responsible personnel.

UNIVERSAL PRECAUTIONS

Universal precautions are procedures specifically designed to control the risk of infection by bloodborne pathogens in a wide range of different work-related circumstances. These precautions involve (a) vaccination, (b) engineering controls, (c) work practice controls, and (d) the use of personal protective equipment.

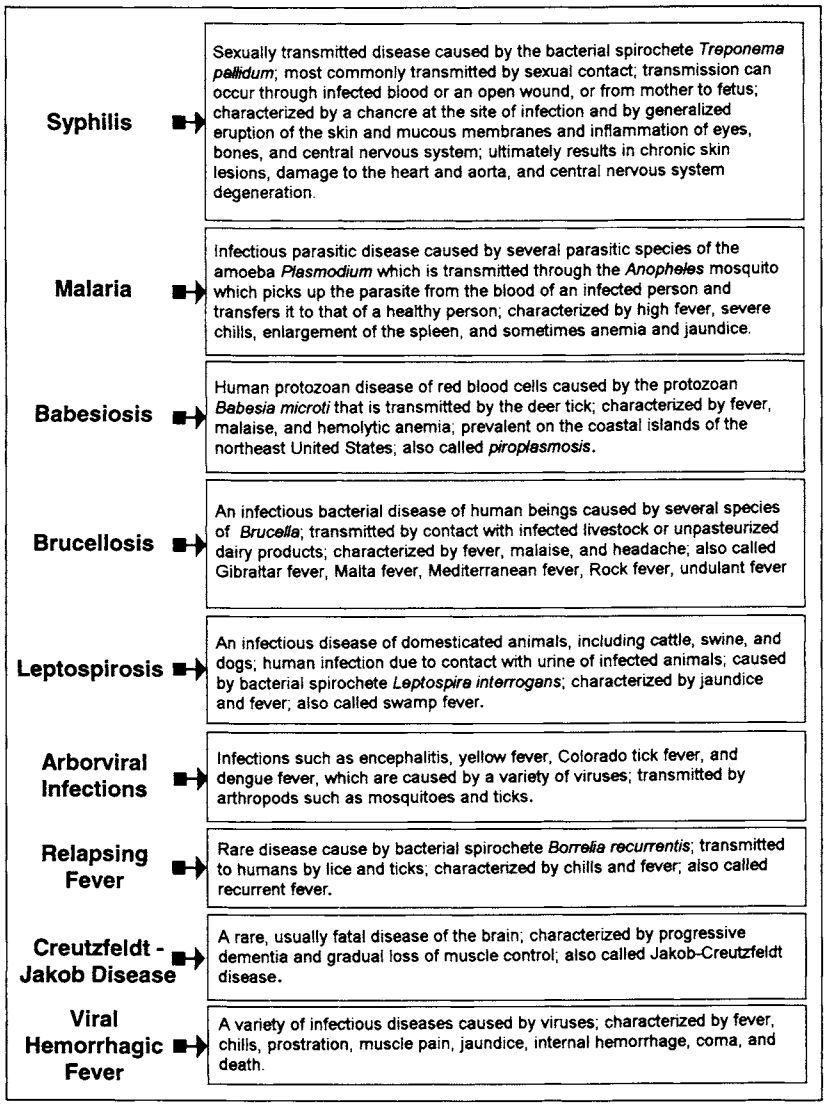

FIGURE 6.5 Additional infectious diseases that may be transmitted among humans through contaminated body fluids.

TABLE 6.3 Guidelines for Use of Protective Clothing and Equipment to Manage Risk of Infection Due to Contaminated Body Fluids (Adapted from U.S. Fire Administration, 1992: Guide to Developing and Managing an Emergency Service Infection Control Program [FA-112])

Task or Activity	Disposable Gloves	Gown	Mask	Protective Eyewear
Bleeding Control (with spurting blood)	Yes	Yes	Yes	Yes
Bleeding Control (with minimal bleeding)	Yes	No	No	No
Emergency Childbirth	Yes	Yes	Yes	Yes
Blood Drawing	Yes	No	No	No
Starting an Intravenous (IV) Line	Yes	Yes	Yes	Yes
Endotracheal Intubation, Esophageal Obturator Use	Yes	No	No	No
Oral/Nasal Suctioning (manual cleaning airway)	Yes	No	No	No
Handling & Cleaning Contaminated Instruments	Yes	No	No	No
Measuring Blood Pressure	No	No	No	No
Measuring Temperature	No	No	No	No
Giving an Injection	No	No	No	No

Vaccination

The only bloodborne disease for which there is a proven vaccine is HBV. In the United States, personnel who might become exposed to HBV in the performance of their work must be offered immunization against HBV. According to 29 CFR 1910.1030, vaccination must be offered to at-risk personnel within 10 working days of initial job assignment and at no cost to the employee. Other provisions of the OSHA regulations include:

- The vaccination is to be offered at a reasonable time and place and under the supervision of a licensed physician or a health care professional licensed to give HBV vaccinations
- An employee is not required to have a vaccination if (a) the employee has previously received the complete HBV vaccination series, or (b) tests show the employee is immune to HBV, or (c) the vaccine is contraindicated for medical reasons

- An employee is not required to participate in a prescreening program as a prerequisite to receiving the HBV vaccination
- An employee may refuse to receive the HBV vaccination or, having initially refused, may subsequently decide to receive it.

Work Practice Controls

Work practice controls are those policies and procedures designed to minimize the risk of infection during the performance of routine tasks. Four basic types of work practices are relevant in any situation (including emergency response) where exposure to bloodborne pathogens is possible.

1. General Work Practices (Apply across the range of work-related tasks; See "Job-Task analysis" [Chapter 5])

- Eating, drinking, smoking, applying cosmetics or lip balm, and wearing contact lenses should be prohibited.
- Food and beverages should not be stored in cabinets, refrigerators, freezers, or on counters except where such facilities are specifically designated and restricted to the storing or handling of food and beverages.
- Any procedure involving blood, body fluids, body parts, or potentially infectious materials should be performed to minimize splashing, spraying, or the formation of droplets.
- Any specimen containing blood, body fluids, or potentially infectious materials should be kept in clearly labeled, leakproof, closed containers during collection, storage, handling, processing, shipping, and transport.
- No blood , body fluid, or body part should ever be touched or cleaned up without the use of proper protective clothing and equipment.

2. The Use of "Sharps" (Practices regarding the use and disposal of needles, blades, and other items that may cut or puncture the skin)

- Needles or other sharps contaminated with human blood or other body fluids should not be bent, broken, sheared, recapped, or removed from their holders.
- Disposable sharps should be deposited in containers that are puncture-resistant, leakproof, and color-coded or labeled "Biohazard."
- Nondisposable sharps should be decontaminated according to written directions.

3. Accidental Contact (Procedures to be followed after accidental contact with human blood, tissue, or body fluids)

- Immediately flush eyes with water or wash skin with soap and water.
- Remove any contaminated clothing immediately and wash any areas of skin that may have been contaminated by fluids soaking through.
- Obtain medical consultation after contact to determine necessity of follow-up medical treatment or prophylaxis.

4. Housekeeping (Procedures governing the clean-up of spills of blood, body fluids, and body parts, as well as general housekeeping tasks)

- All blood-soaked rags, papers, and other materials should be placed in biohazard bags, sealed, and disposed of through a biohazard-certified (medical waste) facility.
- Trash receptacles in areas where contamination is likely should be cleaned and decontaminated as soon as possible after contamination.
- All areas contaminated by blood, body fluids, or body parts should be decontaminated.

5. Personal Protective Clothing and Equipment

- Disposable vinyl or latex gloves should be used wherever hand contact with bloodborne pathogens may occur.
- An emergency packet should be immediately available to emergency responder and other personnel who may become exposed to bloodborne pathogens and should contain (a) disposable vinyl or latex gloves, (b) appropriate disinfectant solution, (c) a supply of absorbent containment material and scoop, (d) biohazard bags, and (e) disposable towels (for stanching copious flows of blood without exposing responders to blood splash).
- Disposable gloves must not be cleaned or washed for reuse. However, they should be cleaned prior to removal and disinfected following removal or discarded into biohazard bags.
- No petroleum products (e.g., hand creams) should be used in conjunction with latex gloves because such materials may degrade latex.
- In no circumstances should mouth-to-mouth resuscitation be performed without the use of protective mouthpieces or ambu gags to prevent contact with potentially blood-contaminated saliva.

- Additional protective clothing should be provided as circumstances may require, including fluid-proof aprons, goggles, shoe covers, and face shields.

EXPOSURE CONTROL PLAN

Under the provision of 29 CFR 1910.1030, an employer must develop a written exposure control plan. The specific objectives of this plan are (a) to designate job-related tasks that present the risk of exposure to bloodborne pathogens, (b) to define the schedule and means for implementing exposure controls, and (c) to establish procedures for the evaluation of exposure incidents, personnel training, and record-keeping.

The regulations provide specific guidance regarding those world-related activities that may result in exposure to bloodborne pathogens. Emergency response operations potentially include all of these activities.

1. Activities that result in direct exposure of all personnel to bloodborne pathogens (e.g., emergency medical service personnel)
2. Activities that result in direct exposure of some personnel to bloodborne pathogens (e.g., rescue personnel)
3. Individual tasks and procedures or groups of closely related tasks and procedures in which some or all employees may experience exposure to bloodborne pathogens (note: fire brigade)

Among the various procedures to be implemented regarding the control of exposure to bloodborne pathogens, particular attention must be given to oversight and enforcement. It cannot be overemphasized that the protection of emergency responders who might become exposed to bloodborne pathogens and other body fluids means protection from infections that can easily spread to responders' families and the community at large. This broad social responsibility for the control of disease means that compliance with workplace policies and procedures designed to control severely disabling and even life-threatening disease must be rigorously enforced without exception throughout the emergency response team.

Special attention must also be given to those procedures regarding the evaluation of any incident of exposure, especially the methodical and detailed assessment of any related failures with regard to the identification of specific tasks and personnel at risk (e.g., responders involved in the extrication victims), the adequacy of work practice controls (e.g., personal protective clothing, disinfection of clothing and equipment), and the adequacy of personnel training. Each postexposure incident evaluation should include specific recommendations for revising the exposure control plan as well as

TABLE 6.4 Summary Information Regarding Nonbloodborne Infectious Diseases (Adapted from U.S. Fire Administration, 1992: Guide to Developing and Managing an Emergency Service Infection Control Program [FA-112])

Disease	Mode of Transmission	Availability of Vaccine	Signs and Symptoms
Chickenpox	Respiratory secretions and contact with moist blisters	No	Fever; rash; skin blisters
Diarrhea	Fecal/Oral contamination	No	Loose, watery stools
German Measles *(Rubella)*	Respiratory droplets and contact with respiratory secretions	Yes	Fever; rash
Hepatitis A *(Infectious Hepatitis)*	Fecal/Oral contamination	No	Fever; loss of appetite; jaundice; fatigue
Herpes Simplex *(Cold Sores)*	Contact of mucous membranes with moist lesions; fingers are at particular risk for becoming infected	No	Skin lesions located around the mount area
Other non-A, non-B Hepatitis	Several viruses with different modes of transmission	No	Fever; headache; fatigue; jaundice
Herpes Zoster *(Shingles)*	Contact with moist lesions	No	Skin lesions
Influenza	Airborne	Yes	Fever; fatigue; loss of appetite; nausea; headache
Lice	Close head-to-head contact; both body and pubic lice require intimate contact (usually sexual) or sharing of intimate clothing	No	Severe itching and scratching, often with secondary infection; scalp and hairy portions of body may be affected; eggs of head lice attach to hairs as small, round, gray lumps

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TABLE 6.4—*continued*

Disease	Mode of Transmission	Availability of Vaccine	Signs and Symptoms
Measles	Respiratory droplets and contact with nasal or throat secretions; highly communicable	Yes	Fever; rash; bronchitis
Meningitis			
• Meningococcal	Contact with respiratory secretions	No	Fever; severe headache; stiff neck; sore throat
• Haemophilus influenza (usually in very young children)	Contact with respiratory secretions	No	Same
• Viral Meningitis	Fecal/Oral contamination	No	Same
Mononucleosis	Contact with respiratory secretions or saliva, such as with mouth-to-mouth resuscitation	No	Fever; sore throat; fatigue
Mumps *(Infectious Parotitis)*	Respiratory droplets and contact with saliva	Yes	Fever; rash

continues

precise schedules for implementing those revisions and monitoring their effectiveness.

NONBLOODBORNE PATHOGENS

A large number of diseases may be transmitted to emergency response personnel through means other than contact with the blood or blood-related fluids of infected persons (Table 6.4). In addition to direct contact with the body and clothing of infected victims, such non-bloodborne diseases may be transmitted via contact with feces, nasal secretions, sputum, sweat, tears, urine, and vomitus. However, emergency responders

TABLE 6.4—*continued*

Disease	Mode of Transmission	Availability of Vaccine	Signs and Symptoms
Salmonellosis	Foodborne	No	Sudden onset of fever, abdominal pain, diarrhea, nausea, and frequent vomiting
Scabies	Close body contact	No	Itching; tiny linear burrows or "tracks"; blisters, particularly around finger, wrists, elbows, and skin folds
Tuberculosis *(Pulmonary)*	Airborne	No	Fever; night sweats; weight loss; cough
Whooping Cough *(Pertussis)*	Airborne; direct contact with oral secretions	Yes	Violent cough at night; whooping sound when cough subsides

need not have direct contact with a victim's body, secretions, or clothing to experience the risk of infection. For example, an underwater or swift water rescue effort may require submersion into lakes, ponds, and rivers that contain viable pathogenic organisms deposited there by sewage. Also, the debris of collapsed structures may become contaminated in the immediate area of victim entrapment. Rain and wind can also transfer contaminated body substances to response personnel who are otherwise removed from infected victims.

A basic strategy for minimizing the risk of disease transmission by contact with infected body substances is most commonly referred to as *body substance isolation* (BSI). While universal precautions are based on the assumption that all blood and certain body fluids should be considered potentially infectious for bloodborne pathogens, BSI is based on the assumption that *all body fluids and substances are potentially infectious* (Fig. 6.6). BSI therefore requires careful attention to proactive infection-preventive measures, including:

- Proper personal hygiene
- Immunization programs (where appropriate vaccines are available)

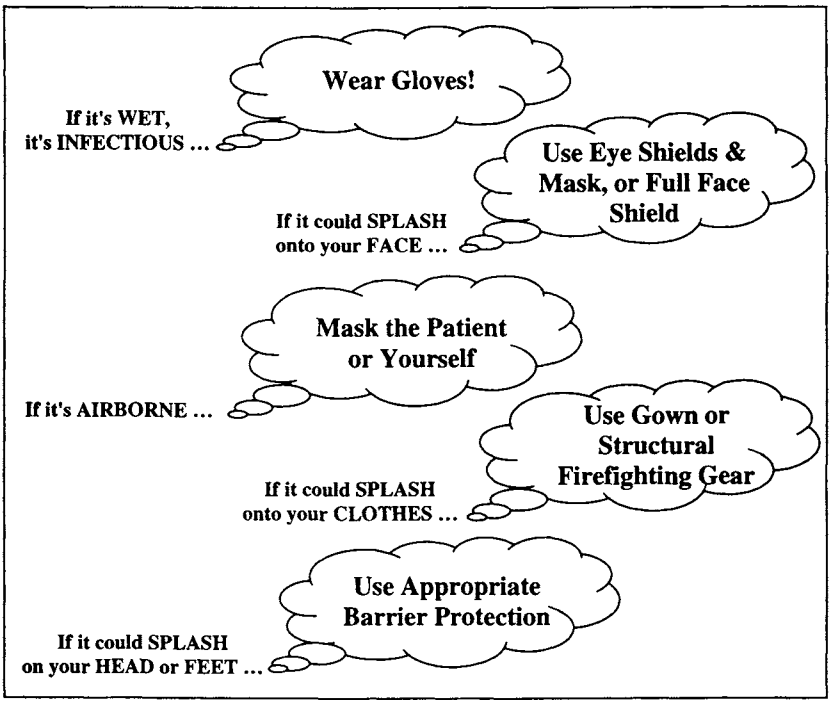

FIGURE 6.6 Basic rules for managing risks related to infectious diseases (adapted from U.S. Fire Administration, 1992: Guide to Developing and Managing an Emergency Service Infection Control Program [FA-112]).

- Decontamination procedures
- Proper procedures for the handling and disposal of waste

Written SOPs should be prepared (Fig. 6.7) for all procedures that implement these infection-preventive measures.

In many instances, emergency responders are volunteer personnel who respond to incidents by driving to the emergency site in their own vehicles. This is particularly common in community fire brigades in the United States, which respond not only to fires but also to vehicular accidents and other types of local emergencies. In such a situation, and despite the use of protective gloves and other clothing, special attention must be given to on-site procedures for personal cleaning and disinfection to minimize the possibility of individual volunteer responders carrying home (either on their own bodies or in their personal vehicles) infectious materials that can subsequently be transmitted to friends and families.

Infection Control Standard Operating Procedures

SOP # IC 5
Scene Operations

1. The blood, body fluids, and tissues of all patients are considered potentially infectious, and Universal Precautions/Body Substance Isolation procedures will be used for all patient contact.

2. The choice of personal protective equipment is specified in SOP # IC 4. Personnel will be encouraged to use maximal rather than minimal PPE for each situation.

3. While complete control of the emergency scene is not possible, scene operations as much as possible will attempt to limit splashing, spraying, or aerosolization of body fluids.

4. The minimum number of personnel required to complete the task safely will be used for all on-scene operations. Members not immediately needed will remain a safe distance from operations where communicable disease exposure is possible or anticipated.

5. Handwashing is the most important infection control procedure.

   Personnel WILL wash hands

   - After each patient contact
   - After handling potentially infectious materials
   - After cleaning or decontaminating equipment
   - After using the bathroom
   - Before eating
   - Before and after handling or preparing food

6. Handwashing with soap and water will be performed for 10 to 15 seconds. If soap and water are not available at the scene, a waterless handwash may be used, provided that a soap and water wash is performed immediately upon return to quarters or hospital.

7. Eating, drinking, smoking, handling contact lenses, or applying cosmetics or lip balm is prohibited at the scene of operations.

FIGURE 6.7 Example of standard operating procedure for performing tasks under universal and body substance precautions (adapted from U.S. Fire Administration, 1992: Guide to Developing and Managing an Emergency Service Infection Control Program [FA-112]).

SOP # IC 5
.....Continued

8. Used needles and other sharps shall be disposed of in approved sharps containers. Needles will not be recapped, resheathed, bent, broken, or separated from disposable syringes. *The most common occupational blood exposure occurs when needles are recapped.*

9. Sharps containers will be easily accessible on-scene.

10. Disposable resuscitation equipment will be used whenever possible. For CPR, the order of preference is:

    - Disposable bag-valve mask
    - Demand valve resuscitator with disposable mask
    - Disposable pocket mask with one-way valve
    - Mouth-to-mouth resuscitation

11. Mouth-to-mouth resuscitation will be performed only as last resort if no other equipment is available. All members will be issued pocket masks with one-way valves to minimize the need for mouth-to-mouth resuscitation. Disposable resuscitation equipment will be kept readily available during on-scene operations.

12. Patients with suspected airborne communicable diseases will be transported wearing a face mask or particulate respirator whenever possible. Ambulance windows will be open and the ventilation system turned on full whenever possible.

13. Personal protective equipment will be removed after leaving the work area, and as soon as possible if contaminated. After use, all PPE will be placed in leakproof bags, color coded and marked as a biohazard, and transported back to the station for proper disposal.

14. On-scene public relations will be handled by the Department Public Information Officer, if available; if not, the senior line office will assume this function. The public should be reassured that infection control PPE is used as matter of routine for the protection of all members and the victims that they treat. The use of PPE does not imply that a given victim may have a communicable disease.

15. No medical information will be released on-scene.

16. At conclusion of on-scene operations, all potentially contaminated patient care equipment will be removed for appropriate disposal or decontamination and reuse.

FIGURE 6.7—*continued*

Another aspect of emergency response that is often overlooked for its potential to spread infectious disease (including both bloodborne and other infectious agents) into the community is the use of private wreckers/recycling companies to transport and dispose of crash-vehicles and/or other types of structural debris (e.g., building materials) that may contain large amounts of infectious body substances. Because this task typically takes place at the termination of an incident response when site control reverts to nonemergency response personnel, there is real potential for (a) direct contamination of personnel involved in subsequent salvage and disposal operations involving contaminated vehicles and debris, and (b) contamination of ambient air, water, and soil during those operations, with subsequent risk to the public.