

## Chapter 3: Health Effects

---

# Chapter 3

## Health Effects

## Chapter 3: Health Effects

---

# Chapter 3: Health Effects

---

## Objectives

After completing this chapter, participants should be able to:

1. Describe at least three types of safety and health personnel.
2. Explain medical screening and surveillance for infectious diseases.
3. Describe at least two symptoms or signs of exposure that are related to infectious diseases.
4. List at least five types of information that workers should know about pathogens that are known or suspected to be present on a worksite.
5. Explain the importance of occupational health plans when working around infectious diseases, and list at least four categories of information they normally contain.
6. Describe the health effects of chemical disinfectants used in infectious disease cleanup operations.
7. Describe the health effects of heat stress in an infectious disease work environment.
8. Explain at least three safe work practices for preventing heat stress.

## Chapter 3: Health Effects

### Introduction

In Chapter 2, you learned about the different types of hazards that you may encounter on an infectious disease worksite. In this chapter, you will learn more about the types of effects that these hazards may have on your health. This information includes recognizing signs and symptoms of exposures to biological agents, chemical exposures, and different types of heat stress, as well as information about occupational health plans, and what to do if you are exposed to hazards.

d

**NIOSH:** *National Institute for Occupational Safety and Health*

**CDC:** *Centers for Disease Control and Prevention*

Numerous agencies in the United States work to provide up-to-date information about a number of infectious agents, including the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), and the Centers for Disease Control and Prevention (CDC).

These agencies provide information about the health effects, routes of exposure, signs and symptoms of exposure, and what types of vaccines and/or treatments are available for a number of different diseases. Occupational exposure risk assessments and occupational health plans can help address these topics for work environments where infectious agents are known or suspected to be present.

Employers are responsible for providing you a safe and healthy workplace. You are responsible for following all safety and health rules, regulations, and best practices. More detailed information about relevant standards and regulations is covered in *Chapter 4: Standards and Guidelines*.

# Chapter 3: Health Effects

---

## Health Effects

### HEALTH AND SAFETY PERSONNEL

Various professionals within the occupational health field help to keep you and your coworkers safe and healthy. They include the following:

#### Industrial Hygienist

Industrial hygienists are scientists and engineers committed to protecting the health and safety of people in the workplace and the community. The goal of the industrial hygienist is to keep workers, their families, and the community healthy and safe. They play a vital part in ensuring that federal, state, and local laws and regulations are followed in the work environment. Typical roles of an industrial hygienist include:

- Investigating and examining the workplace for hazards and potential dangers;
- Making recommendations on improving the safety of workers and the surrounding community;
- Conducting scientific research to provide data on possible harmful conditions in the workplace;
- Developing techniques to anticipate and control potentially dangerous situations in the workplace and the community;
- Training and educating the community about job-related risks;
- Advising government officials and participating in the development of regulations to ensure the health and safety of workers and their families; and
- Ensuring that workers are properly following health and safety procedures.

#### Safety Professional

According to the American Society of Safety Engineers, safety professionals are individuals who are engaged in the prevention of events that harm people, property, or the environment. Occupational safety professionals help organizations prevent injuries, illnesses, and property damage. These professionals must acquire knowledge of safety sciences through education

## Chapter 3: Health Effects

---

and experience so that others can rely on their judgment and recommendations. Safety professionals evaluate hazards and risks on jobsites, as well as identify, recommend, and help implement controls.

### Occupational and Environmental Physician

The American College of Occupational and Environmental Medicine (OEM) defines the major role of the occupational and environmental physician as evaluating the interaction between work and health. Occupational and environmental physicians often provide first-level medical care on site. They also provide medical surveillance when it is applicable or required by OSHA or other standards. OEM doctors must possess knowledge of worksite operations and hazards, determine workers' fitness for work, and diagnose and treat occupational and environmental diseases.

### Occupational Health Nurse

Occupational and environmental health nursing is the specialty practice that provides for and delivers health and safety programs and services to workers, worker populations and community groups. The practice focuses on promotion and restoration of health, prevention of illness and injury, and protection from work-related and environmental hazards.

### Infectious Disease Specialist

An infectious disease specialist is a doctor who has received special training to diagnose and treat infectious diseases. According to the Infectious Diseases Society of America, a worker might be referred to an infectious disease specialist if an infection is difficult to diagnose, is accompanied by a high fever, or if the patient does not respond to treatment.

### Infection Control Practitioners

Infection control practitioners work in healthcare settings to help prevent, investigate, monitor, and report the spread of infectious diseases in the workplace. Their position requires training in both epidemiology and public health. These practitioners create infection control plans and are also responsible for training both medical staff and patients in infection control protocols.

# Chapter 3: Health Effects

## MEDICAL SCREENING AND SURVEILLANCE

Medical screening and medical surveillance are two fundamental strategies for optimizing employee health. Although the terms are often used interchangeably, they are quite distinct concepts. Medical screening is, in essence, only one component of a comprehensive medical surveillance program. The fundamental purpose of screening is early diagnosis and treatment of the individual and thus has a clinical focus. The fundamental purpose of surveillance is to detect and eliminate the underlying causes such as hazards or exposures of any discovered trends and thus has a prevention focus. Both can contribute significantly to the success of worksite health and safety programs.

OSHA “medical surveillance” requirements are generally clinically focused (e.g., medical and work histories, physical assessment, biological testing) with information obtained from the clinical processes used in the monitoring and analysis elements of medical surveillance. Medical screening and surveillance related to working in areas with certain infectious diseases are addressed in two OSHA General Industry standards. One is the Bloodborne Pathogens Standard (29 CFR 1910.1030), and the other is the HAZWOPER Standard (29 CFR 1910.120).

The Bloodborne Pathogens Standard does not require a pre-placement exam but requires that the employer offer the hepatitis B vaccine (unless the worker is already immune or the vaccine is contraindicated). If a worker suspects an exposure to hepatitis B, additional post-exposure testing is required, and the worker must follow U.S. Public Health Service post-exposure protocols.

The HAZWOPER Standard does require a pre-placement medical exam as well as emergency/exposure examinations or tests. Work and medical history is also considered with an emphasis on symptoms related to handling hazardous substances and health hazards, fitness for duty, and the ability to wear PPE such as respirators.

In addition to the HAZWOPER Standard, the Respiratory Protection Standard (29 CFR 1910.134) requires workers to fill out a respirator medical evaluation questionnaire or complete a medical exam that answers the same questions as those in the questionnaire, and may require re-evaluation of workers who exhibit signs of symptoms related to issues with respirator use.



29 CFR 1910.1030  
OSHA Bloodborne Pathogens  
Standard

29 CFR 1910.120  
OSHA HAZWOPER Standard



**contraindicated:** Not  
recommended or not  
appropriate.



29 CFR 1910.134  
OSHA Respiratory Protection  
Standard



## Chapter 3: Health Effects

If workers are exposed, or suspect exposure to an infectious agent, they should seek medical assistance immediately, depending on the type of pathogen, and the type of exposure.

### Medical Screening

Medical screening is a method for detecting disease or body dysfunction before an individual would normally seek medical care. Screening tests are usually administered to individuals without current symptoms, but who may be at high risk for certain adverse health outcomes.

### Medical Surveillance

Medical surveillance is the analysis of health information to look for problems that may be occurring in the workplace that require targeted prevention. Thus, surveillance serves as a feedback loop to the employer. Surveillance may be based on a single case or sentinel event, but more typically uses screening results from the group of employees being evaluated to look for abnormal trends in health status. Surveillance can also be conducted on a single employee over time. Review of group results helps to identify potential problem areas and the effectiveness of existing worksite preventive strategies.

NIOSH studies trends in worker injuries and illnesses. Their surveillance studies make a difference in worker safety and health by:

- tracking diseases, injuries and workplace exposures for further study;
- identifying new and emerging problems in the workplace;
- providing evidence used to direct intervention and prevention activities; and
- monitoring the overall impact of occupational health research.

Federal, state, and private industry partners regularly collect and provides NIOSH with the data that are used in surveillance studies. These data provide current information about injuries and illnesses occurring among workers in different jobs and industries. With these data, NIOSH is able to monitor recent trends in work-related injuries, illnesses, hazards, deaths, and exposures.



*Medical surveillance studies can help NIOSH to monitor trends in exposures to biological hazards.*

d

**sentinel event:** Any unanticipated event in a healthcare setting resulting in death or serious injury to a patient, not related to the natural course of the patient's illness.

# Chapter 3: Health Effects

---

## HEALTH EFFECTS OF BIOLOGICAL HAZARDS

Exposure to biological hazards may occur on a number of different worksites, from healthcare settings to airports where passengers infected with a Category A priority pathogen may have been present, to other places where infected persons may have gone, including their own homes or workplaces.

The health effects of biological hazards depend on the agent and can range from mild skin irritation to life-threatening viral or bacterial diseases. Two of the most common symptoms associated with biological hazards are intestinal upset and skin irritation or infection. Other highly infectious diseases, such as viral hemorrhagic fevers (VHF), however, can include fever, fatigue, dizziness, muscle aches, loss of strength, and exhaustion. Severe cases of VHFs often show signs of bleeding under the skin, in internal organs, or from body openings such as the mouth, eyes, and ears.

### Pathogen Exposure Awareness

It is crucial for workers to be aware of the type of pathogen(s) known or suspected to be present on a specific worksite. This information includes:

- routes of transmission for the infectious agent (airborne, contact, droplet);
- how virulent the pathogen is (the severity or harmfulness of the pathogen);
- what types of signs or symptoms are commonly associated with the pathogen;
- what the incubation period is for the pathogen; in other words, how long the pathogen may live in the body before the worker exhibits any signs or symptoms;
- whether or not a vaccine is available for the pathogen and when it should be administered;
- whether pre-work medical testing is recommended or required before potential exposure to the pathogen on the worksite;
- what types of treatments are available if exposure does occur;
- what type of medical monitoring is recommended or required throughout the job; and
- what the protocol is for reporting any suspected exposure to the pathogen.

## Chapter 3: Health Effects

Certain infectious diseases may have multiple routes of transmission. Control measures on worksites should take into account routes of exposure as part of the risk assessment plan.

Engineering and administrative controls, and proper use of appropriate PPE are generally sufficient for removing the vast majority of risk presented by infectious agents. However, despite these measures, there is the possibility that some risk may still exist on a worksite; therefore, Standard Precautions should be used by all employees.

*Table 1* provides information about a select list of infectious diseases. Being informed and reporting symptoms as they occur is important not only to individual workers, but in cases of highly infectious diseases that are easily transmissible in a work setting, this can also be important for protecting those around you from accidental exposure. Always consult your employer’s occupational healthcare provider if you suspect that you may have been exposed to an infectious substance.

**Table 1: Sample Infectious Disease Information**

| <b>Bordetella pertussis (causes pertussis or whooping cough)</b>  |   |   |  |
|---|---|---|--|
| <b>Routes of Transmission</b>   | Spread from person to person, by coughing or sneezing or when spending a lot of time near one another where you share breathing space.  |   |  |
| <b>Symptoms</b>   | <table border="0"> <tr> <td style="vertical-align: top;"> <p><b>Early symptoms</b></p> <ul style="list-style-type: none"> <li>• runny nose</li> <li>• low-grade fever (generally minimal throughout the course of the disease)</li> <li>• mild, occasional cough</li> </ul> </td> <td style="vertical-align: top; padding-left: 20px;"> <p><b>Later symptoms</b></p> <ul style="list-style-type: none"> <li>• fits of many, rapid coughs followed by a high-pitched “whoop”</li> <li>• vomiting during or after coughing fits</li> <li>• exhaustion after coughing fits</li> </ul> </td> </tr> </table> | <p><b>Early symptoms</b></p> <ul style="list-style-type: none"> <li>• runny nose</li> <li>• low-grade fever (generally minimal throughout the course of the disease)</li> <li>• mild, occasional cough</li> </ul> | <p><b>Later symptoms</b></p> <ul style="list-style-type: none"> <li>• fits of many, rapid coughs followed by a high-pitched “whoop”</li> <li>• vomiting during or after coughing fits</li> <li>• exhaustion after coughing fits</li> </ul> |
| <p><b>Early symptoms</b></p> <ul style="list-style-type: none"> <li>• runny nose</li> <li>• low-grade fever (generally minimal throughout the course of the disease)</li> <li>• mild, occasional cough</li> </ul> | <p><b>Later symptoms</b></p> <ul style="list-style-type: none"> <li>• fits of many, rapid coughs followed by a high-pitched “whoop”</li> <li>• vomiting during or after coughing fits</li> <li>• exhaustion after coughing fits</li> </ul>  |   |  |
| <b>Vaccines</b>   | Pertussis vaccines are available but are not currently approved or recommended for use in persons over six years of age.  |   |  |
| <b>Post-Exposure Treatments</b>   | Antibiotics   |   |  |

# Chapter 3: Health Effects

| Ebola virus disease (EVD)       |   |
|---------------------------------|---|
| <b>Routes of Transmission</b>   | <p>The virus can be spread to others through direct contact (through broken skin or mucous membranes in, for example, the eyes, nose, or mouth) with</p> <ul style="list-style-type: none"> <li>• blood or body fluids of a person who is sick with or has died from Ebola,</li> <li>• objects (like needles and syringes) that have been contaminated with body fluids from a person who is sick with Ebola or the body of a person who has died from Ebola</li> </ul> |
| <b>Symptoms</b>                 | <ul style="list-style-type: none"> <li>• fever</li> <li>• severe headache</li> <li>• muscle pain</li> <li>• weakness</li> <li>• fatigue</li> <li>• diarrhea</li> <li>• vomiting</li> <li>• abdominal (stomach) pain</li> <li>• unexplained hemorrhage (bleeding or bruising)</li> </ul>   |
| <b>Vaccines</b>                 | <p>None</p> <p>Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully test-ed for safety or effectiveness.</p>  |
| <b>Post-Exposure Treatments</b> | <p>Symptoms are treated as they appear. The following basic interventions, when used early, can significantly improve the chances of survival:</p> <ul style="list-style-type: none"> <li>• Providing intravenous fluids (IV) and balancing electrolytes (body salts).</li> <li>• Maintaining oxygen status and blood pressure.</li> <li>• Treating other infections if they occur.</li> </ul>  |

| Hepatitis A                   |   |
|-------------------------------|---|
| <b>Routes of Transmission</b> | <p>Contact with objects, food, or drinks contaminated by the feces (or stool) of an infected person</p>   |
| <b>Symptoms</b>               | <p>Some people with hepatitis A do not have any symptoms. If you do have symptoms, they may include the following:</p> <ul style="list-style-type: none"> <li>• fever</li> <li>• fatigue</li> <li>• loss of appetite</li> <li>• nausea</li> <li>• vomiting</li> <li>• abdominal pain</li> <li>• dark urine</li> <li>• clay-colored bowel movements</li> <li>• joint pain</li> <li>• jaundice (a yellowing of the skin or eyes)</li> </ul> |

## Chapter 3: Health Effects

| Hepatitis A              |  |
|--------------------------|--|
| Vaccines                 | Yes  |
| Post-Exposure Treatments | Doctors usually recommend rest, adequate nutrition, and fluids |

| Hepatitis B              |   |
|--------------------------|---|
| Routes of Transmission   | <p>Contact with infectious blood or body fluids (e.g., semen, saliva), including</p> <ul style="list-style-type: none"> <li>sex with an infected partner;</li> <li>contact with blood or open sores of an infected person;</li> <li>needle sticks or sharp instrument exposures; and</li> <li>sharing items such as razors or toothbrushes with an infected person.</li> </ul> <p>HBV is not spread through food or water, sharing eating utensils, breastfeeding, hugging, kissing, hand holding, coughing, or sneezing.</p> |
| Symptoms                 | <p>Some people with hepatitis A do not have any symptoms. If you do have symptoms, they may include the following:</p> <ul style="list-style-type: none"> <li>fever</li> <li>fatigue</li> <li>loss of appetite</li> <li>nausea</li> <li>vomiting</li> <li>abdominal pain</li> <li>dark urine</li> <li>clay-colored bowel movements</li> <li>joint pain</li> <li>jaundice (a yellowing of the skin or eyes)</li> </ul>   |
| Vaccines                 | Yes   |
| Post-Exposure Treatments | <p>For acute infections, no medication is available; treatment is supportive.</p> <p>For chronic infections, there are several antiviral medications for persons with chronic infection</p>   |

| Influenza virus (Flu)  |  |
|------------------------|--|
| Routes of Transmission | <p>Contact or inhalation of droplets from coughing, sneezing, or talking</p> <p>Touching a surface or object that has flu virus on it and then touching one's own mouth or nose.</p> |

# Chapter 3: Health Effects

| Influenza virus (Flu)    |  |
|--------------------------|--|
| Symptoms                 | <ul style="list-style-type: none"> <li>• fever or feeling feverish/chills</li> <li>• cough</li> <li>• sore throat</li> <li>• runny or stuffy nose</li> <li>• muscle or body aches</li> <li>• headaches</li> <li>• fatigue (tiredness)</li> </ul> |
| Vaccines                 | Flu vaccine  |
| Post-Exposure Treatments | Antiviral drugs  |

| MRSA (Methicillin-Resistant Staphylococcus aureus) |  |
|--|--|
| Routes of Transmission                             | Direct or indirect contact   |
| Symptoms   | <p>Appears as a bump or infected area on the skin that might be:</p> <ul style="list-style-type: none"> <li>• red, swollen</li> <li>• painful</li> <li>• warm to the touch</li> <li>• full of pus or other drainage</li> <li>• accompanied by a fever</li> </ul> |
| Vaccines   | None   |
| Post-Exposure Treatments                           | <p>Antibiotics</p> <p>Some patients with MRSA abscesses may need surgery to drain the infection.</p>   |

| Shiga toxin-producing E. coli (STEC) |  |
|--------------------------------------|--|
| Routes of Transmission               | Ingestion of contaminated food or liquids.   |
| Symptoms                             | <ul style="list-style-type: none"> <li>• severe stomach cramps</li> <li>• diarrhea (often bloody)</li> <li>• vomiting</li> <li>• low-grade fever (for some)</li> </ul> |
| Vaccines                             | None (possibly in development).  |
| Post-Exposure Treatments             | Non-specific supportive therapy, including hydration.  |

## Chapter 3: Health Effects

| Tuberculosis (TB)               |  |
|---------------------------------|--|
| <b>Routes of Transmission</b>   | <p>TB bacteria are spread through the air from one person to another. The TB bacteria are put into the air when a person with TB disease of the lungs or throat coughs, speaks, or sings. People nearby may breathe in these bacteria and become infected.</p>   |
| <b>Symptoms</b>                 | <p>TB disease in the lungs may cause symptoms such as</p> <ul style="list-style-type: none"> <li>• a bad cough that lasts 3 weeks or longer</li> <li>• coughing up blood or sputum (phlegm from deep inside the lungs)</li> <li>• pain in the chest</li> </ul> <p>Other symptoms of TB disease are</p> <ul style="list-style-type: none"> <li>• weakness or fatigue</li> <li>• chills</li> <li>• weight loss</li> <li>• fever</li> <li>• no appetite</li> <li>• sweating at night</li> </ul> |
| <b>Vaccines</b>                 | <p>Bacille Calmette-Guérin (BCG) is a vaccine for TB. This vaccine is not widely used in the U.S., but it is often given to infants and small children in other countries where TB is common. BCG does not always protect people from getting TB.</p>  |
| <b>Post-Exposure Treatments</b> | <p>There are 10 drugs currently approved by the U.S. FDA for treating TB. Of the approved drugs, the first-line anti-TB agents that form the core of treatment regimens are:</p> <ul style="list-style-type: none"> <li>• isoniazid (INH)</li> <li>• rifampin (RIF)</li> <li>• ethambutol (EMB)</li> <li>• pyrazinamide (PZA)</li> </ul>   |

### OCCUPATIONAL HEALTH PLANNING

Employers must conduct and provide advance planning for medical care to workers potentially infected with highly infectious agents, which is a fundamental component of an occupational health program for a worksite where Category A priority pathogens are known or suspected to be present.

Workers should be fully informed and trained about available medical support services and encouraged to utilize them.

# Chapter 3: Health Effects

---

Risk assessments should define potential hazards and exposures by job responsibility and provide methods for controlling exposure to workers and the general public. For example, OSHA's Bloodborne Pathogens Standard (29 CFR 1910.1030) provides easy-to-follow methods for controlling BBPs. Similarly, OSHA's Respiratory Protection (29 CFR 1910.134) and HAZWOPER (29 CFR 1910.120) Standards provide methods for controlling related hazards.

Prevention is the most effective approach to managing biohazards. Workers must be educated about the biohazards to which they may be occupationally exposed, the types of exposures that place their health at risk, the nature and significance of such risks, as well as the appropriate first aid and follow-up for potential exposures. That information should be reinforced annually, at the time of any significant change in job responsibility, and following recognized and suspected exposures.

Occupational Health Plans for an infectious disease worksite may cover the following types of topics:

- control methods (engineering/administrative);
- PPE;
- pre-placement medical evaluations;
- pre-/post-exposure prophylaxis and vaccines;
- periodic medical evaluations; and
- post-injury or post-exposure reporting.

## **PRE-PLACEMENT MEDICAL EVALUATIONS**

Depending on the type of pathogen(s) to which workers may be exposed and the types of tasks workers may engage in, a pre-placement medical evaluation may be required. This includes any work that is covered under the Respiratory Protection Standard or HAZWOPER Standard, among others. More detailed information about OSHA standards as they relate to infectious diseases is covered in *Chapter 4: Standards, Guidelines, and Workers' Rights*.

In occupational health plans that require pre-placement medical evaluations, healthcare providers should be aware of potential hazards encountered by the worker. A description of the requirements for the position and an understanding of the potential health hazards present in the work environment, provided by the worker's supervisor, should guide the evaluation.



## Chapter 3: Health Effects

The healthcare provider should review the worker's previous and ongoing medical problems, current medications, allergies, and prior immunizations. With that information, the healthcare provider decides what medical services are needed to permit the individual to safely assume the duties of the position.

Medical information should include the current health status and a medical evaluation. It should also address all of the medical information that is required by the appropriate OSHA standards.

- The medical evaluation should follow Occupational Safety and Health Administration (OSHA) standards if appropriate. For instance, if the worker is required to handle hazardous material, then the examination should adhere to the OSHA HAZWOPER standard.
- If respirator use is required due to the type of pathogen(s) present, the examination should adhere to the OSHA Respiratory Protection standard.

### Current Health Status

Topics about the worker's current health status that should be covered in a pre-placement medical examination include:

- Pre-existing medical and mental health conditions (degree of medical control).
- Relevant lifestyle factors (e.g., tobacco use [smoking or chewing], exercise habits).
- Symptoms currently experienced.
- Medications, medication side effects (for example, medicines that increase or block sweating), and other issues related to medications (for example, storage needs such as refrigeration).
- Other specific risk factors (will depend on job, e.g., use of personal protective equipment, exposures).
- Immunization status: routine adult and any special risk (e.g., worker in healthcare facilities).
- Pregnancy status (female workers).

# Chapter 3: Health Effects

## Medical Evaluation

A medical evaluation should include the worker's history, a physical examination, and any medical testing needed for pre-placement counseling.

History should be directed at identifying specific work-related hazards. For instance, the pre-placement medical evaluation could identify medical and physiological conditions that make adjustment to hot environments more difficult, increasing the need for primary prevention.



*A medical evaluation can help identify conditions that may make adjustment to hot environments more difficult.*

- The goal is to enhance awareness, improve worker training, and engage employers in appropriate primary preventive measures.
- Risk factors that can be identified through medical screening include obesity, hypertension, diabetes, heart disease, viral infections, gastroenteritis, anxiety or depression, pregnancy and use of antihistamines, diuretics, and beta blockers, among others.

## Additional Medical Evaluation Information Needs

Some workers may need more extensive evaluation because of working in hazardous conditions, working with hazards that are covered by specific OSHA standards, or pre-existing medical conditions. Mental health is important. The most common cause of problems with respirator use is claustrophobia.

The specific content should be determined by the following factors:

- Report of or concern about pre-existing illness, conditions, or symptoms that may be adversely affected during the placement.
- Use of respirators or exposure to hazards that are regulated by OSHA standards.
- Anticipated tasks, working conditions, locations, or exposures that are known to be hazardous or have specific exposures that may warrant medical monitoring.

*d*

**claustrophobia:** Fear of confined places.

## Chapter 3: Health Effects

This additional evaluation may result in:

- Advice to the worker of risk posed by their medical conditions and recommended duty limitations.
- Recommendation for further medical evaluation.
- Recommendation for specific training prior to placement.

### PRE-/POST-EXPOSURE PROPHYLAXIS AND VACCINES

d

**prophylaxis:**  
*Prevention of disease.*

Prophylaxis is a medical term that refers to the prevention of disease. In terms of working around infectious diseases, pre-exposure prophylaxis usually refers to being vaccinated, if a vaccine exists for that particular pathogen. The OSHA Bloodborne Pathogens Standard, for example, requires that the hepatitis B vaccine be offered after a worker has received the required bloodborne pathogens training, and within 10 days of initial assignment to a job with occupational exposure. An annual influenza virus vaccine may be recommended in certain work situations to prevent the development of the flu.

Post-exposure prophylaxis involves offering a treatment that may help prevent certain pathogens from developing into an infection. For example, workers who have been exposed to anthrax spores in an anthrax remediation worksite may be given antibiotics to prevent the anthrax spores from developing their deadly toxins. Workers who may have been exposed to the human immunodeficiency virus (HIV) from a needlestick or contaminated sharps may be recommended to take antiretroviral medicines (ART) within 72 hours of exposure to prevent infection.

Protocols should be developed in advance that clearly identify the situations in which pre- and post-exposure treatment are to be considered, the appropriate treatment, and the source of products and expert consultation. Determining the accurate level of risk associated with all exposures is not possible, and the decision to administer post-exposure treatment may have to be made quickly and in the absence of confirmatory laboratory testing.

### PERIODIC MEDICAL EVALUATIONS

Routine, periodic medical evaluations generally are not recommended; however, limited periodic medical evaluations or medical clearances targeted to job requirements may

# Chapter 3: Health Effects

---

exist. For example, the OSHA HAZWOPER Standard (29 CFR 1910.120) requires a physical exam annually, or at the discretion of the physician. Periodic examinations are dependent upon specific factors cited in the standard such as airborne concentrations of a hazardous substance and/or years of exposure, biological indices, age of employee, amount of time exposed per year. In addition, some standards require periodic exams to be conducted at varying time intervals.

The OSHA Respiratory Protection Standard (29 CFR 1910.134) dictates that even after workers have been medically cleared to use a respirator on the job there will be times when they will have to be reevaluated by a physician or licensed healthcare professional. You must be reevaluated when:

- You report medical signs or symptoms that are related to your ability to use a respirator, such as a heart condition, lung disease, or claustrophobia.
- A physician or licensed healthcare professional, your supervisor, or the respirator program administrator informs your employer that you need to be reevaluated.
- Information from the respiratory protection program, including observations made during fit-testing and program evaluation, indicates a need for you to be reevaluated.
- A change occurs in workplace conditions that increase the burden on you while using the respirator; for example your job becomes more physically demanding, or you must wear additional protective clothing, or you must work in extreme temperatures.

## **POST-INJURY AND POST-EXPOSURE REPORTING**

All occupational injuries and illnesses, including exposures to human pathogens, should be reported to your employer and your employer's safety and health personnel. Strategies for responding to biohazard exposures should be formulated in advance. Proper post-exposure response is facilitated by exposure-specific protocols that define appropriate first aid, potential post-exposure treatment options, recommended diagnostic tests, and sources of expert medical evaluation.

The adequacy and timeliness of wound cleansing or other response after an exposure occurs may be the most critical determinant in preventing infection. When appropriate,


## Chapter 3: Health Effects

first aid should be defined, specific to the disease (e.g., for bloodborne pathogens always use Standard/Universal Precautions) widely explained to workers and supervisors, and immediately available to an injured worker. Standard protocols should include a printed summary of the recommended medical response to specific exposures that can guide immediate response in the workplace and that the injured worker can provide to the treating facility. The medical provider's description of the injury should include:

- The potential infectious agent.
- The mechanism and route of exposure (splash to mucous membranes or skin, aerosol, etc.).
- Time and place of the incident.
- PPE used at the time of the injury.
- Prior first aid provided (e.g., nature and duration of cleaning and other aid, time that lapsed from exposure to treatment).
- Information about the worker's personal medical history relevant to risk of infection or complications of treatment.

First aid should be repeated if the initial adequacy is in question. Healthcare providers must use appropriate barrier and other universal precautions to avoid exposure to infectious agents and toxins.

### HEALTH EFFECTS OF CHEMICAL HAZARDS

  
*toxin = poison*

A chemical is considered a toxin (poison) when it causes harmful effects or interferes with the way your body works. When a chemical is toxic to humans, it means the substance is poisonous to humans. Disinfectants used in the cleanup operations where infectious diseases are present can have different health effects if not used properly, or if proper work controls are not followed. (Information on controls for chemical hazards was provided in *Chapter 2: Hazards and Controls*.)



*Disinfectants can have different health effects if proper work controls are not followed.*

# Chapter 3: Health Effects

Chemical exposures can happen in many different ways, including the following:

- Inhaling contaminants in the form of vapors, gases, dusts, fumes, or mists.
- Swallowing contaminants (dangerous materials).
- Absorbing contaminants through the skin or eyes.

The degree of the chemical hazard depends on the dose of a substance. Dose is defined by the amount or concentration of a substance received over time. It is the most important factor in determining if you will get ill from a chemical exposure.

Dose is determined by the following:

- The length of exposure: how long you are exposed: 1 hour, 1 day, 1 month, 1 year, 10 years, etc.
- The concentration: the amount inhaled, ingested, and/or absorbed through your skin.

The longer you are working at a particular job and the higher the concentration of a chemical, the greater your potential dose becomes. In general, higher doses of chemicals will have a greater effect on your body. This connection between the amount and the effect is known as the “dose-response relationship” (See *Figure 1*).

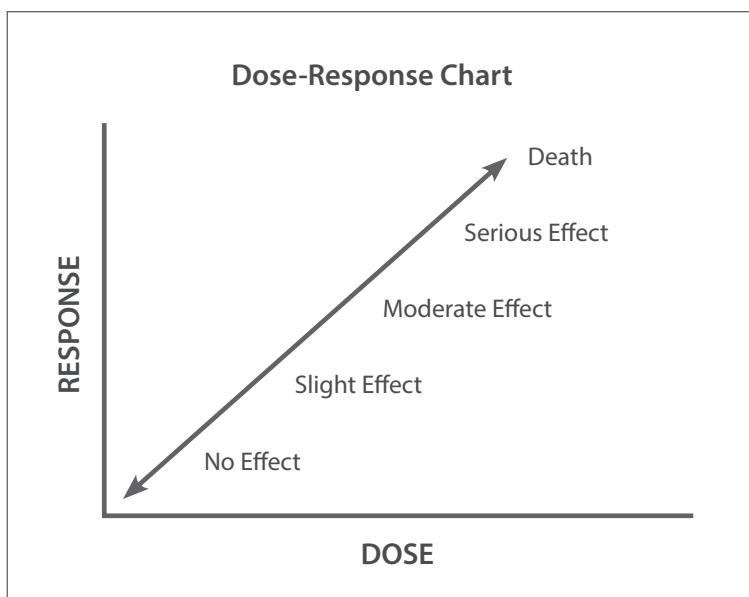


Figure 1: Dose-Response Chart

## Chapter 3: Health Effects

---

### Chemical Reactions

A chemical reaction occurs when chemicals combine to produce a new substance and/or a release of energy. When a chemical reacts with another chemical, both chemicals may become more dangerous to your health. The new substance may also act differently than either of the original chemicals and be more hazardous. For example, when household bleach and drain cleaner (lye) are mixed together, they react to form two very dangerous substances – chlorine gas and hydrochloric acid.

### Types of Chemical Exposure

A chemical exposure can be either acute or chronic.

**Acute Exposure:** An acute exposure is a single short exposure or a few short exposures to a relatively large concentration of a chemical. An acute exposure may have both prompt (immediate) and delayed effects on your body. For example, ammonia immediately irritates your eyes and nose, but if the dose is large enough, ammonia may cause severe respiratory distress (such as fluid in the lungs) up to 6 hours after your exposure.

**Chronic Exposure:** A chronic exposure is a repeated exposure to a chemical that occurs over months and/or years. The chemicals are usually at relatively low concentrations. Chronic exposures are hazardous because some chemicals may accumulate in your body over time. Sometimes your body does not have enough time between exposures to repair itself. Your body has several organs that attempt to change chemicals into a less toxic form and eliminate them from your body. The liver and the kidney are two examples. If the rate of exposure to a chemical is greater than the rate at which the chemical is eliminated, chemicals may build up and accumulate in your body.

Examples are as follows:

- Ammonia does not accumulate in the body at all.
- Lead may be stored in the body for years.
- Asbestos remains in the body forever.

# Chapter 3: Health Effects

---

## Physical Warning Signs of Acute Exposure

Physical warning signs of an acute chemical exposure are as follows:

- Breathing difficulties – faster or deeper breaths, soreness, a lump in your throat.
- Dizziness, drowsiness, disorientation, and difficulty concentrating.
- Burning sensation in your eyes or on your skin.
- Weakness, fatigue, and lack of energy.
- Chills and upset stomach.
- Odors and/or a strange taste in your mouth.

It is important to remember to remove yourself from the work area if you experience any warning signs of an acute chemical exposure. Always refer to the product-warning label and safety information for guidance on what you should do if you suffer an acute exposure due to inhalation, ingestion, or absorption of a chemical disinfectant.

## HEALTH EFFECTS OF PHYSICAL HAZARDS

### Heat Stress

Heat stress is a potential physical hazard on an infectious disease worksite and can occur without warning. Many times this is because of certain PPE that is required and/or due to working in a hot environment. It can cause mild problems such as heat rash and muscle cramps, and severe problems such as heat exhaustion and heat stroke. Several factors contribute to heat stress:

- environmental conditions;
- personal protective equipment (PPE)/clothing;
- workload;
- your susceptibility; and
- acclimatization (lack of).



## Chapter 3: Health Effects



*NIOSH provides a wealth of resources for heat stress at: [www.cdc.gov/niosh/topics/heatstress](http://www.cdc.gov/niosh/topics/heatstress).*

In addition to these factors, you and your coworkers may be at a higher risk for heat stress if you are in the following conditions:

- Dehydrated from diarrhea or fever caused by infections.
- Physically unfit or have not worked in a hot environment in the past week (not acclimated).
- Inflicted with a chronic disease, such as heart disease or diabetes.
- Dehydrated from drinking too much alcohol or using drugs.
- Overweight.
- Regularly taking certain medications for depression, nervous conditions, high blood pressure, diabetes or heart disease.

The chance of developing heat stress increases with increased humidity, hot environments, and the use of PPE. Since heat stress is one of the most common and serious illnesses at infectious disease sites, regular monitoring and other precautions are the best way to stay safe.

Your body maintains a normal temperature (98.6°F/37°C) in a hot environment by sending more blood to the skin through flushing and sweating. At first, your body cools itself by sending more blood to the skin where heat is released. The amount of blood available to other parts of your body decreases as the blood vessels dilate (open up) to allow more blood to go to your skin. This includes your brain and muscles. When you work in a hot environment, you may feel tired sooner and be less mentally alert. Both of these factors, plus the burden of wearing PPE, can contribute to an increased number of accidents in a hot workplace.

As the air temperature increases, your body also starts to sweat. Heat is carried away as the sweat evaporates from your skin. If the humidity in the air increases, or if the sweat cannot evaporate because of PPE, your body has a harder time keeping a safe temperature.

When you are severely stressed by the heat, you may stop sweating. This lack of sweating is a sign that your body's temperature regulator is not working properly. This can cause the most severe form of heat stress – heat stroke.

Drinking large amounts of replacement fluids, frequent self-monitoring, and adequate rest breaks are essential for preventing heat stress.

# Chapter 3: Health Effects

## Monitoring for Heat Stress

You can reduce the risk of heat stress by monitoring your pulse, body temperature, and weight loss.

- Check your heart rate (pulse) during rest breaks. If it is greater than 110 beats per minute, your work time should be reduced and your rest time increased.
- Check your temperature at the end of the work period. If it is higher than 99.6°F (37.6°C), your work time should be reduced and your rest time increased. If it's higher than 100.6°F (38.1°C), your PPE needs to be removed.
- Check your weight before and at the end of the work shift. If your weight loss is greater than 1.5 percent of your total weight, you need to drink more fluids before and during work.

### To calculate 1.5% of weight:

Normal: 200 lb

1.5% = .015

$200 \text{ lb} \times .015 = 3 \text{ lb}$

Drink more fluids if weight loss is greater than 3 pounds from the start of the work shift to the end of the work shift.



*Monitoring your pulse is one way to reduce the risk of heat stress.*

## FORMS OF HEAT STRESS

There are four forms of heat stress that result from exposure to high temperatures. They are:

- heat rash;
- heat cramps;
- heat exhaustion; and
- heat stroke.

## Chapter 3: Health Effects

---

### Heat Rash

Heat rash is the mildest form of heat stress. It is caused by heavy sweating where sweat cannot easily be removed by skin evaporation.

Heat rash looks like a red cluster of pimples or small blisters. It appears most often on the neck and upper chest, in the groin area, under the breasts, and in elbow creases.

If heat rash occurs, you should move to a cooler and less humid environment when possible. Keep the affected area dry. Talcum or other powders may be used to increase comfort.

### Heat Cramps

Heat cramps usually affect workers who sweat a lot during strenuous activity. Sweating depletes the body's electrolyte and moisture levels. Low electrolyte levels in muscles can cause them to cramp painfully. Heat cramps can also be a symptom of heat stroke.

Signs and symptoms include muscle spasms, usually in the arms and legs, after heavy exertion.

If heat cramps occur, the affected person must stop all activity and sit in a cool place. They should drink clear juice or a sports beverage. They should not return to strenuous work for a few hours after the cramps subside because further exertion may lead to heat exhaustion or heat stroke. Seek medical attention if any of the following apply: the worker has heart problems, the worker is on a low-sodium diet, or the cramps do not subside within one hour.

### Heat Exhaustion

Heat exhaustion is the body's response to an excessive loss of water and salt, usually through excessive sweating. Workers most prone to heat exhaustion are those that are elderly or have high blood pressure, and those who work in hot environments. Signs and symptoms include:

- heavy sweating;
- extreme weakness or fatigue;
- dizziness, confusion, and nausea;
- clammy, moist skin;

# Chapter 3: Health Effects

- pale or flushed complexion;
- muscle cramps;
- slightly elevated body temperature; and
- fast and shallow breathing.



Workers may need to assist a buddy who is suffering from heat exhaustion.

Heat exhaustion resembles shock. It may occur before or after heat cramps. There is no increase in body temperature. If heat exhaustion occurs, the worker should rest in a cool, shaded, or air-conditioned area. Have them drink plenty of water or other cool, nonalcoholic beverages. Wet them down with cool water, or provide them with access to a cool bath or shower.

## Heat Stroke

Heat stroke (sometimes known as sun stroke) is the most serious form of heat stress. It results from the body's inability to regulate its temperature. It can be fatal if not recognized and treated at the scene immediately, followed up by advanced medical care and rapid transport to a hospital. Signs and symptoms include:

- hot, dry skin (no sweating);
- hallucinations;
- chills;
- throbbing headache;
- high body temperature;
- confusion and dizziness; and
- slurred speech.

The onset of heat stroke can be gradual, with mental excitement and dryness of the mouth and skin, or it can be sudden, with delirium, altered level of consciousness (the victim seems



*heat stroke = sun stroke*

## Chapter 3: Health Effects



*Heat stroke has a death rate of 30% to 50%!*

to be “out of it”), or coma. Heat stroke is always life threatening! This condition has a death rate of 30% to 50%!

If you or a coworker experience any of the symptoms of heat stroke, get out of the heat and take action to cool off immediately, such as wetting the body with cool (not ice cold) water and fanning. If conscious, the victim may sip cool water. Call or send someone to call 911 or your workplace emergency number immediately. The victim must receive advanced medical care, usually including hydration through intravenous (I.V.) methods as the victim usually will vomit liquids taken by mouth or the stomach will not absorb liquids fast enough to save a person’s life.

It is extremely important to check yourself and your coworkers for signs and symptoms of heat stress and to seek treatment if needed. *Table 2* lists the signs and symptoms for each form of heat stress.

**Table 2: Signs and Symptoms of Heat Stress**

| Type                   | Causes   | Signs/Symptoms   |
|------------------------|--|--|
| <b>Heat rash</b>       | <ul style="list-style-type: none"> <li>heavy sweating, sweat not removed by skin evaporation</li> </ul>  | <ul style="list-style-type: none"> <li>redness on skin</li> <li>blisters or a rash</li> </ul>  |
| <b>Heat cramps</b>     | <ul style="list-style-type: none"> <li>heavy sweating with inadequate electrolyte replacement</li> </ul>   | <ul style="list-style-type: none"> <li>muscle spasms</li> <li>pain in hands, feet, and abdomen.</li> </ul>   |
| <b>Heat exhaustion</b> | <ul style="list-style-type: none"> <li>increased stress on various body organs and the circulation system</li> <li>caused by the inability of the heart to work properly and/or dehydration</li> </ul> | <ul style="list-style-type: none"> <li>dizziness and nausea</li> <li>normal to low temperature</li> <li>heavy sweating</li> <li>pale, cool, and moist skin</li> <li>rapid pulse and breathing</li> <li>fainting</li> </ul> |

# Chapter 3: Health Effects

| Type               | Causes  | Signs/Symptoms  |
|--------------------|---|---|
| <b>Heat stroke</b> | <ul style="list-style-type: none"><li>• heat stroke is the most serious form of heat stress</li><li>• temperature regulation fails</li><li>• body temperature rises to critical levels, as high as 108°F to 112°F</li><li>• the body must be cooled before serious injury or death occurs</li><li>• competent medical help must be obtained</li></ul> | <ul style="list-style-type: none"><li>• dizziness, confusion, nausea, and high fever</li><li>• little or no sweating</li><li>• red, hot, and usually dry skin</li><li>• strong rapid pulse</li><li>• convulsions</li><li>• coma</li><li>• death</li></ul> |

## Preventing Heat Stress: Employers

Under OSHA law, employers are responsible for providing workplaces free of known safety hazards. This includes protecting workers from extreme heat. An employer with workers exposed to high temperatures should establish a complete heat illness prevention program.

- Provide workers with water, rest and shade.
- Allow new or returning workers to gradually increase workloads and take more frequent breaks as they acclimatize, or build a tolerance to working in the heat.
- Plan for emergencies and train workers on prevention.
- Monitor workers for signs of illness.

## Preventing Heat Stress: Workers

You and your coworkers can take the following actions to prevent heat stress:

- Drink 1.5 gallons (4–6 liters) of fluids (water or juices) during the day, even when you are not thirsty. Alcohol, coffee, soda, and tea are not good fluids to replace water loss.
- Maintain good physical fitness. Work cautiously until your body has adjusted to the heat (become acclimatized).

## Chapter 3: Health Effects

- Recognize the signs and symptoms of heat stress.
- Monitor your pulse, temperature, and weight.
- Check with your doctor if chronic health problems exist, or if medication is being taken.

If you experience any signs or symptoms of heat stress while working, you should stop work immediately and notify your supervisor, or another appropriate person. If a coworker or your buddy shows or complains of heat stress symptoms, notify the appropriate person immediately.



*Hydration is key to avoiding heat stress on the job.*

# Chapter 3: Health Effects

---

## Summary

Employers are responsible for providing you a safe and healthy workplace. You are responsible for following all safety and health rules, regulations, and best practices. There are various types of occupational health and safety professionals to keep you and your coworkers safe and healthy, including industrial hygienists, safety professionals, occupational and environmental physicians, occupational health nurse, infectious disease specialists, and infection control practitioners.

Medical screening and medical surveillance are two fundamental strategies for optimizing employee health. Medical screening, a method for detecting disease or body dysfunction, is only one component of a comprehensive medical surveillance program. The fundamental purpose of screening is early diagnosis and treatment of the individual (clinical focus). The fundamental purpose of surveillance, which is the analysis of health information to identify potential problems in the workplace, is to detect and eliminate the underlying causes of hazards or exposures (prevention focus).

Exposure to biological hazards can occur in healthcare settings, public locations, and in people's homes. The health effects of biological hazards depend on the infectious agent, and can range from mild skin irritation to life-threatening viral or bacterial diseases. It is crucial for workers to be aware of the type of pathogen(s) known or suspected to be present at a worksite. This includes the routes of transmission, the severity or harmfulness, the signs and symptoms, the incubation period, whether or not a vaccine is available, what types of treatments are available, and the protocol for reporting any suspected exposure. Control measures should take into account routes of exposure as part of the risk assessment plan, and standard precautions should always be used.

Employers must conduct and provide advance planning for medical care to workers potentially infected with highly infectious agents. Risk assessments should define potential hazards and exposures by job responsibility, and provide methods for controlling exposure. Prevention is the most effective approach to managing biohazards. Workers must be educated about the biohazards to which they may be exposed, the types of exposures that place their health at risk, and the appropriate first aid and follow-up for potential exposures.



## Chapter 3: Health Effects

---

Occupational health plans for an infectious disease worksite may cover such topics as control methods, medical evaluations and support, pre-/post-exposure prophylaxis and vaccines, PPE and incident reporting.

Disinfectants used in cleanup operations, if not used properly or if proper work controls are not followed, can have different health effects. Chemical exposures can occur by inhaling, swallowing, or absorbing contaminants. The degree of the chemical hazard depends on the dose of a substance, which is determined by the length of exposure and the concentration. The connection between the amount of the chemical and its effect on your body is known as the dose-response relationship. A chemical exposure can either be acute or chronic.

Heat stress is a potential physical hazard on a worksite, and can occur without warning. Factors that contribute to heat stress include environmental conditions, PPE, and workload. Since heat stress is one of the most common and serious illnesses at infectious disease sites, regular monitoring and other precautions are the best way to stay safe. Heat stress from exposure to high temperatures can result in heat rash, heat cramps, heat exhaustion, and heat stroke. You can reduce the risk of heat stress by monitoring your pulse, body temperature, and weight loss.

# Chapter 3: Health Effects

---