BLOODBORNE PATHOGENS

1.0 INTRODUCTION

Bloodborne pathogens are pathogenic microorganisms present in human blood and in other potentially infectious materials that can be transmitted from one person to another and cause disease, including:

- Hepatitis B (HBV), the causative agent of **hepatitis,** a serious liver disease
- Human immunodeficiency virus (HIV), the causative agent of acquired immunodeficiency syndrome or **AIDS**.

As part of field work, exposure to blood and bloodborne pathogens may occur in a number of situations. For example, personnel may come in contact with potentially infectious material during an accident or injury, from the handling of contaminated waste, or during an inspection of a laboratory facility where blood products are used. Since infection can occur from a single exposure incident, personnel working in the field must take precautions to protect themselves from possible disease transmission.

Learning Objectives

At the end of this module, you will be able to:

- List examples of potentially infectious materials
- Explain how infections occur and identify the most significant modes of transmission
- Identify the measures for controlling exposure to bloodborne pathogens
- Identify the proper decontamination and handling of waste/material contaminated with blood or other potentially infectious materials
- Explain the process of immunization against hepatitis B and the medical evaluation that should follow any exposure incident.

2.0 HOW INFECTIONS OCCUR/MODES OF TRANSMISSION

For a disease to be transmitted from one person to another, the pathogen must be present in a high enough concentration, the person must be susceptible to the pathogen, and the pathogen must pass through the correct entry site. If any of these conditions does not exist, an infection cannot occur. The following sections discuss the elements involved in the transmission of bloodborne diseases.

2.1 Potentially Infectious Material

Bloodborne pathogens can be present in blood or certain body fluids of an infected person. Body fluids which personnel should consider infectious include:

- semen

- vaginal secretions
- cerebrospinal fluid
- synovial fluid
- pleural fluid
- pericardial fluid
- peritoneal fluid
- amniotic fluid
- saliva in dental procedures
- any body fluid that is visibly contaminated with blood
- unfixed human tissue or organ (other than intact skin)
- HIV-containing cell, tissue or organ cultures
- HIV/HBV-containing culture media or other solutions.

In addition, **in situations where it is difficult or impossible to determine whether the body fluid contains blood or to differentiate between body fluids, personnel should consider the body fluid as infectious.**

Bloodborne pathogens can not be transmitted by casual contact, such as shaking hands or sharing a glass. They can be transmitted only through direct contact with the blood or bodily fluids of an infected person.

2.2 Routes of Entry

As mentioned above, for disease transmission to occur, the pathogen must have a way to enter the bloodstream of an uninfected person. In the work place and in the field, the most common routes that pathogens enter the body include the following:

- Needlestick injuries
  This route of exposure is most significant for healthcare and laboratory workers handling hypodermic needles, IV sets, and other equipment that may have penetrated the skin of an infected person. However, field personnel may be at risk of needlestick injuries when handling wastes.

- Breaks in the skin
  Infectious fluids can enter the bloodstream through breaks in the skin such as an open wound, scratches, insect bites, rashes, burns and shaving nicks.

- Mucous membranes
  Bloodborne pathogens can be transmitted through the mucous membranes of the eyes, nose, or mouth.

- Contaminated objects
  Handling contaminated objects and then rubbing your eyes, nose or an open skin wound creates an entry route for bloodborne pathogens.

3.0 BLOODBORNE DISEASES OF CONCERN

Two of the more serious bloodborne diseases that can affect workers and field personnel are hepatitis B and acquired immunodeficiency syndrome (AIDS). Some important information regarding the transmission, symptoms and consequences of these viral infections are discussed in the sections below.

3.1 Hepatitis B

Hepatitis B is a severe liver infection caused by the hepatitis B virus (HBV). In addition to the blood-to-blood contacts discussed in Section 2.2, HBV has been found in saliva and can be injected into another person from a bite that breaks the skin. Although the virus can survive on surfaces at room temperature for up to 7 days, it cannot be transmitted from casual contact and cannot pass through the skin unless the skin is non-intact (i.e., an open wound).

The incubation period of HBV infections is long and the virus can stay in the body for up to six months before symptoms appear. Symptoms of hepatitis B include:

- Fever
- Rash
- Nausea/loss of appetite
- Jaundice (yellowing of the skin and eyes)
- Other flu-like symptoms.

In most cases, the illness will run its course in 8-10 weeks. However, in some people the virus can continue to be active and may cause cirrhosis or cancer of the liver and, eventually, death. Blood tests are available to detect antibodies for HBV in an infected person, and vaccines are available to prevent the disease.

3.2 HIV/AIDS

AIDS is an incurable disease caused by the human immunodeficiency virus (HIV). As with HBV, HIV cannot be transmitted from casual contact. In addition, there is no evidence that the virus is transmitted in saliva, feces, urine, sweat, tears or vomit unless these fluids are visibly contaminated with blood.

HIV attacks white blood cells and destroys the body’s ability to fight infection. People infected with HIV may not feel or look sick and may not show outward signs of the AIDS disease for many years. Symptoms may include:

- Severe tiredness
- Fever
- Night sweats
- Unexplained weight loss
- Shortness of breath

- Swollen lymph nodes
- Chronic diarrhea
- Skin lesions.

In its later stages, AIDS can lead to pneumonia, partial paralysis, mental disorders, and eventually death. Currently, there is no vaccine to protect against this disease and no cure.

4.0 PROTECTION FROM BLOODBORNE PATHOGENS

Preventing infectious disease and minimizing exposure to bloodborne pathogens requires planning and preparation, as well as an understanding of essential safe work practices and workplace controls. Some of these controls are discussed below.

4.1 Exposure Control Plan

Employers whose workers may be exposed to bloodborne pathogens are required by the Occupational Safety and Health Administration (OSHA) to develop a written Exposure Control Plan. This plan must serve to protect personnel from the health hazards associated with bloodborne pathogens, and contain a schedule and methods of implementation for each element of the OSHA regulation (29 CFR 1910.1030), including the following:

- Universal precautions
- Engineering and work practice controls
- Personal protective equipment
- Methods of decontamination (housekeeping)
- Biohazard communication (signs and labels)
- Employee information and training
- Record keeping.

An effective infection control plan must:

- Provide affected personnel with guidelines and procedures that address each of the above elements
- Include an exposure determination, which identifies all the job classifications and job tasks in which employees have occupational exposure
- Describe the procedures for hepatitis B immunization and the medical evaluation and follow-up should an exposure incident occur.

Field personnel should familiarize themselves with any site policies and procedures related to bloodborne pathogens prior to beginning work that may involve potential exposure to blood or other infectious materials.

4.2 Universal Precautions

Universal precautions is a strategy that stresses that **all blood and certain body fluids should be handled as if they are infectious for HIV and other bloodborne pathogens.** In other words, personnel should follow proper safe work practices and use the appropriate personal protective clothing regardless of the perceived status of the source individual.

4.3 Engineering Controls/Work Practice Controls

Engineering controls include any controls that either remove the pathogen or isolate the worker from the pathogen. When used in conjunction with safe work practices, these controls are expected to be the primary means of protecting personnel from occupationally-acquired infections and illnesses.

Examples of engineering controls may include:

- Sharps containers to store potentially contaminated needles and other sharp objects
- Mechanical needle recapping devices
- Local exhaust ventilation when handling blood or blood products.

Work practice controls may include the following:

- Use of adequate hand washing facilities/materials
- Proper handling and storage of contaminated needles and other sharps
- Prohibition of eating, drinking, smoking, etc., in areas where there is potential for exposure to blood or other potentially infectious materials
- Cleaning and disinfection of all equipment and work surfaces that may be contaminated
- Proper packaging of blood and other potentially infectious materials, including regulated waste, for shipping and transport.

4.4 Personal Protective Equipment (PPE)

If occupational exposure to bloodborne pathogens still exists after institution of engineering and work practice controls, then personal protective equipment must also be used. PPE will be considered appropriate only if it does not permit blood or other potentially infectious materials to pass through or reach the employees' clothing, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time used.

Appropriate PPE may include:

- Disposable gloves to prevent skin contact
- Utility gloves for handling sharp objects (e.g., broken glass)
- Gowns or lab coats to prevent contamination of street clothes

- Face shields, masks and eye protection to protect against splashes, spray, etc., that might reach the mucous membranes
- Disposable resuscitation masks or microshields for use during artificial respiration.

PPE should be used when handling, transporting, decontaminating, or disposing of materials potentially contaminated with bloodborne pathogens.

All personnel should ensure that they have access to the appropriate personal protective equipment and have been trained in the proper use and disposal of this equipment.

5.0 DECONTAMINATION AND REGULATED WASTE

All equipment and environmental surfaces must be decontaminated after contact with blood or other potentially infectious materials and at the end of a procedure or work shift if contamination may have occurred.

Personnel should use the following clean-up and decontamination procedures and should refer to section 5.5 for disposal guidelines.

5.1 General Guidelines

- Always put on the appropriate personal protective equipment prior to beginning decontamination procedure
- Always pick up contaminated glass or sharps using mechanical means; never use the hands
- Remove PPE when decontamination is complete. Remember to remove gloves last to prevent contamination of skin, and wash hands as soon as possible after removing the gloves. Place contaminated disposable PPE in a property labeled leak-proof bag for disposal
- Remove garments that have been penetrated/contaminated as soon as possible. If possible, dispose of these garments as waste in a properly labeled leak-proof bag
- Wash and dry work uniforms according to the manufacturer's instructions, and brush-scrub boots and leather goods with soap and hot water to remove contamination.

5.2 Spills of Blood or Other Body Fluids

- Put on appropriate protective equipment. [Note: personnel should consider the use of impermeable aprons/garments and boot covers if the amount of contamination is significant (e.g., large pools of blood)]
- Clean up and remove all visible material first with disposable towels or other means that prevents direct skin contact with the blood
- Place soiled towels immediately in a leak-proof bag to prevent contamination with other surfaces
- Decontaminate the entire area with clean towels and a 1:10 solution of common household bleach and water.

- When decontamination is complete, collect contaminated items and place in a labeled leak-proof bag for disposal.

5.3 Equipment

- Put on the appropriate protective equipment [Note: in most cases this will only include disposable gloves]
- Wash equipment thoroughly with a 1:10 solution of common bleach and water
- Collect contaminated towels and waste and place in a leak-proof bag for disposal.

5.4 Bins, Pails, Cans

All bins, pails, cans, and similar receptacles intended for reuse which have a reasonable likelihood for becoming contaminated with blood or other potentially infectious materials must be inspected and decontaminated on a regularly scheduled basis. They should be cleaned and decontaminated immediately, or as soon as possible, upon visible contamination.

5.5 Regulated Waste

In addition to proper decontamination procedures, proper handling of regulated waste is essential in effective exposure control. OSHA defines regulated waste to include the following:

- Liquid or semi-liquid blood or other potentially infectious materials
- Contaminated items that, if compressed, would release blood or other potentially infectious materials in a liquid or semi-liquid state
- Items caked with dried blood or other potentially infectious materials that are capable of releasing these materials during handling
- Contaminated sharps
- Pathological and microbiological waste containing blood or other potentially infectious materials.

All regulated waste must be placed in containers that are:

- Closable
- Constructed to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping
- Color coded or labeled with the universal biohazard symbol, which is readily visible from all angles.

Sharps containers must also be puncture resistant and leak proof on the sides and bottoms.

All regulated waste containers must be closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping. Disposal of all

regulated waste shall be in accordance with applicable federal, state, and local regulations. However, depending on the quantity of waste generated the following disposal options may be applicable:

- Disposal of waste may be coordinated with the site/host medical facility
- Disposal may be contracted with a qualified commercial medical waste disposal firm.

6.0 HEPATITIS B IMMUNIZATION

As discussed above, a vaccine is available to protect personnel against infection with hepatitis B. In fact, OSHA requires that employers make this vaccine available to all personnel with potential occupational exposure to blood and/or body fluids -- at no cost. Vaccination programs must be administered in accordance with the recommendations of the U.S. Public Health Service and under the supervision of a licensed physician or health care professional.

The vaccine is usually administered as three injections in the arm over a six month time period, and will provide over 90% protection against hepatitis B for 7 or more years. To ensure adequate immunity, it is important for workers to receive all three injections.

Recently OSHA has added special considerations for employees who provide first aid for incidents occurring in the workplace. Because these employees do not routinely administer first aid, the risk of exposure for these personnel is considered to be low. According to OSHA, these responders need only be offered the hepatitis B vaccine within 24 hours of exposure to blood or other potentially infectious material. This exemption applies only to employees whose routine work assignments do not include the administration of first aid. In addition, the employer must meet other provisions of the OSHA standard.
In both cases, personnel may decline the hepatitis B vaccination, and may request to be vaccinated at a later date. However, employees who choose not to receive the vaccine must sign a mandatory declination statement.

7.0 POST-EXPOSURE EVALUATION AND FOLLOW-UP PROCEDURES

An *exposure incident* is a specific eye, mouth, mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials. **Immediately** following an exposure incident, personnel are required to receive confidential post-exposure medical evaluation and follow-up.

The medical evaluation will be provided to the affected personnel at no cost and at a reasonable time and place. All testing and evaluation will be conducted under the supervision of a licensed physician and in accordance with the current recommendations of the U.S. Public Health Service.

The medical evaluation and follow-up will involve:

- Evaluation of the incident, including documentation of the following:
  - Route of exposure
  - HBV and HIV status of the source patient, if known
  - Circumstances under which the exposure occurred

- Collection and testing of exposed employee's blood for determination of HIV and HBV status

- Collection and testing of source individual's blood if HIV and HBV status is not already known

- Informing employee of results of all testing

- Counseling

- Post-exposure prophylaxis (e.g., administration of hepatitis B immune globulin) when medically indicated

- Evaluation of any reported illness related to exposure incident

- Additional HIV testing shall be offered to the affected employee six weeks post-exposure and periodically thereafter.

8.0 SUMMARY

Field personnel may face on-the-job exposure to blood and other potentially infectious materials, which can lead to infections such as HIV and hepatitis. This hazard can be reduced or removed by using a combination of the following:

- Proper planning and training
- Universal precautions
- Engineering controls
- Work practice controls
- Personal protective clothing and equipment
- Appropriate vaccinations.

In addition, to minimize the potential for accidental exposure, field personnel should be aware of the potential routes of exposure and should familiarize themselves with the proper procedures for handling regulated waste and decontaminating work areas and equipment.

Key concepts presented in this module are:

- Field personnel may face on-the-job exposure to blood and other potentially infectious materials, which can lead to infections such as HIV and hepatitis.

- Infectious disease transmission requires that the pathogen be in a high enough concentration, the person must be susceptible to the pathogen, and the pathogen must pass through the correct entry site.

- Bloodborne pathogens can be present on blood or certain body fluids of an infected person.

- Situations where it is difficult or impossible to determine whether the body fluids contain blood or to differentiate between body fluids personnel should consider the body fluids as infections.

- Routes of exposure include needlesticks, breaks in the skin, mucous membranes and contaminated objects.

- Bloodborne diseases of concern include Hepatitis B, HIV/AIDS.

- Universal precautions: all blood and certain body fluids should be handled as if they are infectious.

- Engineering controls/work practice controls are the primary means of protecting personnel from occupationally-acquired infections and illnesses.

- Effective PPE does not permit blood or potentially infectious materials to pass through or reach the employees' clothing, skin, eyes, mouth or other mucous membranes under normal conditions.

- Decontaminate all equipment and environmental surfaces if contact with blood or other potentially infectious material has occurred.

Measures you can take to prevent infection include:

- Understand the modes of transmission for the infectious agent of concern.
- Become familiar with the agency Exposure Control Plan.
- Use universal precautions whenever exposure to blood or body fluids is possible.
- Follow safe work practice controls.
- Wear PPE, gloves, gowns, face shields and/or masks as appropriate.
- Store potentially infectious waste in closable, leakproof labelled containers.
- If appropriate, receive Hepatitis B vaccination.

EXERCISE

1. Check the items on this list, which in addition to blood may pose the dangers of bloodborne pathogens.

   _____a. Hair and nails
   _____b. Cerebrospinal fluid
   _____c. Pericardial fluid
   _____d. Peritoneal fluid
   _____e. Perspiration
   _____f. Semen
   _____g. Any fluid that is contaminated with blood
   _____h. Tears

2. Areas of the body that are vulnerable to exposure to bloodborne pathogens include:

   _____a. Eyes
   _____b. Nose and mouth
   _____c. Intact skin
   _____d. The lungs
   _____e. Broken skin

3. For each of the statements in the chart below, indicate whether it is true of the hepatitis B virus (HBV), the human immunodeficiency virus (HIV) or both (use a check mark).

	HIV	HBV
a. Infection with this virus can be prevented with a vaccine	_____	_____
b. This virus attacks the white blood cells and weakens the immune system	_____	_____
c. This virus is unlike any other known virus, and currently is incurable	_____	_____
d. This virus causes severe liver disease and can lead to cancer of the liver	_____	_____
e. This virus has been found in saliva and can be injected into another person from a bite that breaks the skin	_____	_____
f. Patients with this virus are vulnerable to many diseases and infections.	_____	_____
g. This virus can survive at room temperature	_____	_____

4. Universal Precautions means: (Circle the best answer)

    a. All blood or other body fluids should be treated as though they were infectious.
    b. Personnel should be constantly alert for bloodborne pathogens and should follow safe work practices at all times.
    c. All blood should be tested for possible contamination with bloodborne pathogens.

5. Name three pieces of personal protective equipment that may be used when handling blood or potentially infectious body fluids.

    a.
    b.
    c.

6. Nedles, syringes, and blades have to be disposed of in puncture-resistant containers: (Circle one)

    True False

7. Waste containers for materials contaminated with bloodborne pathogens should be: (Circle all that apply)

    a. Closable
    b. Constructed to prevent leakage of fluids
    c. Easy to carry
    d. Only 2/3 filled
    e Color-coded or labeled with the universal biohazard symbol.

EXERCISE KEY

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_____***e.*** ***Broken skin***

3. For each of the statements in the chart below, indicate whether it is true of the hepatitis B virus (HBV), the human immunodeficiency virus (HIV) or both (use a check mark).

	HIV	HBV
a. Infection with this virus can be prevented with a vaccine	_____	__***X***__
b. This virus attacks the white blood cells and weakens the immune system	__***X***__	_____
c. This virus is unlike any other known virus, and currently is incurable	__***X***__	_____
d. This virus causes severe liver disease and can lead to cancer of the liver	_____	__***X***__
e. This virus has been found in saliva and can be injected into another person from a bite that breaks the skin	__***X***__	_____
f. Patients with this virus are vulnerable to many diseases and infections.	__***X***__	_____
g. This virus can survive at room temperature	_____	__***X***__

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   a. All blood or other body fluids should be treated as though they were infectious.
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   c. All blood should be tested for possible contamination with bloodborne pathogens.

5. Name three pieces of personal protective equipment that may be used when handling blood or potentially infectious body fluids.

   gloves, mask, safety glasses, labcoat, mouthpiece, etc.

6. Needles, syringes, and blades have to be disposed of in puncture-resistant containers: (Circle One)

   True False

7. Waste containers for materials contaminated with bloodborne pathogens should be: (Circle all that apply)

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