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Effective Date:	January 01,2015	**Author**	Steven Hayes
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Introduction

Currently, there are many Blood Borne Pathogens (BBP) known to cause disease in humans, however, most of these organisms are exotic and you are unlikely to come into contact with them at work. A few, however, are common and if you work with potential contaminated materials, such as human blood, are of concern.

Associated Procedure

Blood and Other Potentially Infectious Materials (OPIMs)

Common BBP may be found not only in human blood, but also in Other Potentially Infectious Materials (OPIM) including the following body fluids:

- Blood products (such as plasma or serum)
- Semen
- Vaginal secretions
- Cerebrospinal fluid
- Pleural fluid (or lung fluid)
- Synovial fluid (or fluid from your joints)
- Amniotic fluid (or uterine fluid)
- Peritoneal fluid (or fluid that fills your body cavity)
- Saliva in dental settings (possibility of blood)
- Any body fluid that is visibly contaminated with blood
- Any body fluid that you can't tell what it is

Other items found in the clinical or laboratory setting are also considered to be OPIM and they

include:

- Any unfixed tissue or organ, other than intact skin, from a living or dead person
- Cell or tissue cultures that may contain blood borne pathogens
- Organ cultures and culture medium or other solutions that may contain BBP
- Blood from experimental animals infected with BBP
- HBV, HIV or other BBPs.

It is a required to use routine practices when handling these body fluids and materials. The following body fluids are not expected to be infectious sources of blood borne pathogens unless they are visibly contaminated with blood:

- Urine
- Feces
- Vomit
- Tears
- Sweat
- Sputum
- Nasal secretions

Although these body fluids do not currently require universal precautions, good personal hygiene practices are highly recommended when handling these materials.

Transmission of Blood borne Pathogens

Blood borne pathogens can be transmitted when infectious blood or OPIM is introduced into the bloodstream of a person. Transmission of blood borne pathogens in the workplace can occur through the following routes of transmission:

- Parenteral exposure - this means that the infected blood or OPIM is introduced directly into your body through a break in the skin. Examples include: a needle-stick injury or a cut with a piece of contaminated glass.
- Mucous membrane exposure - this means that the infected blood or OPIM enters your body through contact with a mucous membrane found in your eye, nose or mouth.

Common BBPs

Human Immunodeficiency Virus (HIV)

HIV is a retrovirus (lentivirus) that gradually weakens the immune system of an infected person, leaving that person unable to fight off opportunistic infections. This leads to Acquired Immunodeficiency Syndrome (AIDS) and ultimately, death.

HIV-infected persons may have no symptoms or may experience symptoms such as swollen lymph nodes, fatigue, weight loss, diarrhea, persistent dry cough and fever.

Despite recent medical advances, where drugs have been found to slow the replication of the virus, but no cure has been found. Protocols have been developed which, when administered to workers that have been exposed, decrease the likelihood of HIV infection

Hepatitis B Virus (HBV)

HBV Hepatitis B virus (HBV) is a virus that causes an infection of the liver potentially leading to liver disease, liver cancer and possibly death.

Symptoms of HBV infection may range from no symptoms, to brief flu-like symptoms, to jaundice and serious illness. If symptoms do occur, they may not be evident until 2 to 6 months after the person is infected. However, studies have shown that an infected person can be infectious to others several weeks before the onset of symptoms.

It is estimated that between 140000 to 320000 people each year in the United States become infected with HBV, with approximately 10% of these people becoming carriers of the virus (able to infect others, whilst showing no symptoms themselves). This is of importance because there are far more people infected with HBV that HIV, making it a higher likelihood that blood or OPIM would be infected with HBV (~100 times greater).An effect vaccine exists and is mandatory for all workers that manipulate human blood or OPIM.

Hepatitis C Virus (HCV)

The Hepatitis C virus (HCV), formerly known as "non A-non B", has been found in all parts of the world. The virus appears to be transmitted most efficiently through parenteral exposure to blood from an infected individual. Common examples of transmission events are receiving a blood transfusion from an infected source or sharing intravenous drug needles with an infected individual.

As with HBV, a HCV infection can have a wide range of symptoms (including death) and a carrier state (which can cause liver disease).

The risk of transmission is thought to be between that of HIV and HBV, with most infections in healthcare workers occur through needlestick injuries, cuts from equipment and splashes to the eyes involving blood or OPIM.

Since no effective treatment exists, preventing exposure through the use of routine practices and safe laboratory practices is the best way to reduce transmission of HCV.

Prevention and control of Exposure

The use of human or animal blood samples with unknown health status or blood samples with known bloodborne pathogens are of particular concern in open-concept laboratory spaces as well as shared facilities. This procedure will outline appropriate use and handling of blood samples to ensure that shared equipment is used appropriately and downstream users are not put at risk. The following precautions are necessary for all human blood samples and

xenogenic blood samples of known biohazardous risk (e.g. animals that have been injected with virus). These precautions are not necessary for murine blood samples that are known not to have any biohazardous risk (e.g. un-modified C57 or BALB/c blood). In addition, laboratory equipment specifically belonging to an individual lab will also need to adhere to these procedures to prevent exposure of laboratory personnel to blood-borne pathogens, as centrifuged blood products can be easily aerosolized, putting both the user and nearby individuals at risk.

Human blood and OPIM are classified as Risk Group 2 pathogens and require a Containment level 2 laboratory to carry out any work safely.

Before any work begins, the following must be completed:

- A current Research Biosafety Committee permit.
- All workers must be have a confirmed titer/ immunized against Hepatitis B. Vaccinations can be arrange through CHSS
- Biosafety training and WHMIS must be completed/up to date
- Centrifuge users must be properly trained in the operation of the equipment, either by the Research Core Equipment (RCEF) Coordinator or the lab's PI or designate

Personal Protective Equipment (PPE)

- Gloves
- Lab coat with purple collar
- Lab appropriate clothing, including closed-toed shoes

Proper personal protective equipment must be worn at all times. Gloves should always be worn when handling cells, tubes, rotors, etc.

Work practices

These work practices apply to the shared equipment in the RCEF and any equipment owned by principal investigators that are set up in their own laboratory space

The following precautions are not necessary for murine blood samples that are known NOT to have any biohazardous risk (e.g. un-modified C57 or BALB/c blood) and apply to any human blood samples known to be biohazardous or with an unknown health status as well as xenogenic samples known to be altered in a manner that renders them biohazardous (i.e. murine blood infected with lentivirus, etc.).

- Verify that all the materials and equipment you are working with are in the lab and easily accessible
- When samples are prepared, make sure that the centrifuge tubes are not filled to the rim to avoid liquid from being trapped between threads of screw tops or stoppers
- Make sure all tubes are properly capped or covered
- Use rubber cushions in carriers when centrifuging glass containers
- When handling of samples presents a risk of spill or aerosolization (e.g. opening vacutainers, Eppendorf tubes, etc.) the samples must be used in a BSC or fume hood.
- If samples are spilled, the area must be treated with Virox to disinfect the surface prior to proceeding with the experiment

Centrifugation work practices

- Users must wear appropriate personal protective equipment (PPE). When working with samples that may result in aerosols, assume at all times that the blood samples you are using are biohazard level 2
- All samples must be capped or covered and inspected for chips, cracks or other imperfections prior to drawing or processing blood samples
- Ensure that all tubes are properly capped or covered. Only tubes with tops or stoppers are to be used in the centrifuge. If open tubes must be used, it must be placed in rotors or cups that are covered by rotor lids
- If samples with infectious agents are being centrifuged, the centrifuge must be labelled in case breakage occurs in the absence of the operator
- Always ensure that the load is properly balanced, using blank tubes filled with water when needed and arranging the samples in a symmetrical manner
- Balancing and loading of the rotor must be done in a BSC if you are using the centrifuge in the RCEF to ensure that equipment does not get contaminated with blood products
- Put samples in the centrifuges with sealed buckets or a rubber seal on the lid of the rotor. Centrifuges must always be operated with rotor lids in place and must be closed during the full period of operation. If the centrifuge is unable to contain aerosols, it is not suitable for the centrifugation of blood samples with blood-borne pathogens
- Set the appropriate time, speed, and brake settings. Close and lock the centrifuge and begin the centrifugation program. Only operate the centrifuge when the rotor lids are in place to prevent aerosol dispersion
- If the centrifuge has excessive vibration, turn off the centrifuge (do not apply brake) and do not open the centrifuge until it has come to a complete stop. The appropriate procedure for spills and broken tubes are outlined below, depending on whether the samples are in a sealed bucket or not
- Always carefully inspect tubes for cracks or breakage following centrifugation, in particular following ultracentrifugation

Proper decontamination and waste disposal

- After working with the blood samples, all BSC surface must be thoroughly disinfected with accelerated Hydrogen Peroxide (Virox) as well as all equipment used that has been in contact with the samples (rotor buckets, etc)
- All biological sharps waste must be placed in an appropriate container for waste that may puncture. Yellow receptacles should never be too full -- request for a new receptacle when it is two-thirds full
- If you have liquid blood waste (less than 300 mL), it must be treated with 1:10 diluted bleach for a minimum of 20 minutes. Pour the mixture down the drain with plenty of water. Glass tubes go into the biological sharps container and plastic tubes go into the yellow biohazard bags. Alternatively, seal the sample tube so it does not leak and place in the yellow biohazard bag

Transport of Biohazardous Material

- Before transporting any sample, ensure that you are familar with any hazards associated with the samples, as well as biohazardous spill response and reporting procedure
- Use a primary (water & leak proof) container (i.e. a test tube) label with Biohazard decal and contents. The primary container should. if, possible, be secured in a holder or rack. Use a Secondary container (e.g. plastic sample bag or stryofoam box) lined with absorbent material (e.g. paper towels)
- Label with brief description and emergency contact info
- Decontaminate exterior of secondary container
- Remove gloves when transporting
- Use a cart if transporting large and/or multiple specimens. Sufficient absorbent material must accompany the specimen
- Use the least crowded elevators to minimize the risk to the public and staff
- Take specimens directly to destination without stops or delays
- Never leave specimens unattended
  If a spill occurs during transport, contact the Biological Research Officer (BSO) (x77534)

Spill response

- Alert the area occupants and evacuate the immediate area for 30 minutes until all aerosols have settled before going back to clean the spill. Secure the area to avoid traffic
- Put on all appropriate PPE (gloves, lab coat, goggles/face shield, N95 respirator) before entering affected area
- Remove any sharps using forceps or scoop and place in a biohazard sharps container
- Place paper towels or absorbent material around the spill. Allow liquid to be absorbed. Place towels or absorbent material into biohazard container. Repeat as necessary.
- When majority of spill has been absorbed, soak area in a disinfectant (e.g. 10 % Bleach or accelerated Hydrogen Peroxide (Virox). Leave for 30 mins. Absorb onto paper towel or other absorbent material. Repeat as necessary. Thoroughly wipe the area until dry
- Discard remaining absorbent materials, N95 respirator and gloves in the yellow biohazard bag and tightly close the bag. Place the gown/lab coat in an autoclavable bag and autoclave. Goggles and other reusable items should be soaked in 10% Virox for 30 minutes and allowed to air dry
- Wash hands thoroughly

Spill response for spilled/broken centrifuge samples in a sealed bucket

- Turn off centrifuge. Leave the centrifuge closed for 30 minutes to allow aerosols to settle. During this time if you must leave the room, clearly label the centrifuge as “AERESOLIZED BIOHAZARD DO NOT OPEN” with your name and contact information
- Put on all appropriate PPE before opening. Open lid slowly. Remove the sealed swinging-buckets with spilled/broken sample and place it in the BSC
- Remove any unbroken capped samples and wipe the exterior with accelerated hydrogen peroxide (Virox). These can subsequently be processed as originally intended
- Autoclave broken sample tubes. If buckets are autoclavable, autoclave it. If buckets are not autoclavable, thoroughly disinfect with accelerated hydrogen peroxide (Virox). Afterwards, dispose sharps in yellow receptacle/sharps container
- The inside of the centrifuge as well as the rotor itself should be decontaminated with

accelerated hydrogen peroxide (Virox)
- Clean the BSC afterwards as outlined in the BSC Guideline

Spill response for spilled/broken centrifuge samples NOT in a sealed bucket

- Turn off centrifuge. Leave the centrifuge closed for 30 minutes to allow aerosols to settle. During this time if you must leave the room, clearly label the centrifuge as "AERESOLIZED BIOHAZARD DO NOT OPEN" with your name and contact information
- Open lid slowly, wearing thick rubber gloves, N95 respirator and goggles. Remove the rotor, with ALL buckets and place it in the BSC
- Remove any unbroken capped samples and wipe the exterior with accelerated hydrogen peroxide (Virox). These can subsequently be processed as originally intended
- Autoclave broken sample tubes. If buckets and rotor are autoclavable, autoclave it. If buckets and rotor are not autoclavable, thoroughly disinfect with accelerated hydrogen peroxide (Virox). Afterwards, dispose sharps in yellow receptacle/sharps container
- The inside of the centrifuge should be decontaminated with accelerated hydrogen peroxide (Virox)
- Clean the BSC afterwards as outlined in the BSC Guideline

If a spill occurs in the BSC, follow the BSC spill response found on the BSC Guidelines

First Aid

In case of accidental splash or inoculation/mucosal absorption of substance potentially contaminated with blood samples, immediately wash the area with soap and running water for a minimum of 15 minutes. If eyes get potentially contaminated, immediately flush the eyes at an eyewash station for a minimum of 15 minutes.

For accidental ingestion, please report to the Emergency Room.

Report to Corporate Health and Safety for follow-up.

Report the incident to your supervisor and fill out the online incident report (Event tracker on the Intranet).

If it is an emergency or if medical attention is required, report to the Emergency Room.

References

Public Health Agency of Canada (PHAC), Canadian Biosafety Standards and Guidelines, 1st Ed., 2014

Biological Safety Cabinet Guidelines 2015

Revision Number	Contact