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Title:	**Blood Borne Pathogens Guidelines**		
Document Type:	Procedure	Document #:	UHT0001970
Program:	Research	Effective Date:	January 1, 2015
Executive Sponsor:	Vice President, Research and Innovation	Last Reviewed:	January 1, 2019
Owner/Lead:	Director Research Facilities, Research Biosafety Officer Research Facilities	Last Revised:	February 27, 2023
Approval Body:	Director Research Facilities	Review Cycle:	3 year
Applicable Sites:	☐ **Unity Health** ☐ **Providence** ☐ **St. Joseph's** ☒ **St. Michael's**		
Keyword(s):	Blood borne pathogens, blood, body fluid, BBP, OPIMs		

1.0 PURPOSE

Many Blood Borne Pathogens (BBP) are known to cause disease in humans; however, most of these pathogens are uncommon, and you are unlikely to come into contact with them at work. A few, however, are common, and if you work with potentially contaminated materials, such as human blood, are of concern.

2.0 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)
- Body fluid that is visibly contaminated with blood
- Body fluid of unknown origin

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 (good laboratory 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

Good personal hygiene practices must be practiced irrespective of the type of body fluid being handled.

Transmission of Blood borne Pathogens

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

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

Common BBPs

1. *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. HIV infection leads to Acquired Immunodeficiency Syndrome (AIDS) and, ultimately, death.

HIV-infected persons may have no symptoms or 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, no cure has been found. Protocols have been developed that, when administered to workers that have been exposed, decrease the likelihood of HIV infection.

After a possible exposure, PEP (post-exposure prophylaxis) should be used only in emergencies and must be started within 72 hours.

2. *Hepatitis B Virus (HBV)*

HBV Hepatitis B virus (HBV) 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 severe 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 in the United States, each year become infected with HBV, with approximately 10% of these people becoming carriers of the virus. Therefore, there are far more people infected with HBV than HIV, making it more likely that blood or OPIM would be infected with HBV (~100 times greater).

An effective vaccine exists for HBV and is mandatory for all workers that manipulate human blood or OPIM.

3. *Hepatitis C Virus (HCV)*

The Hepatitis C virus (HCV), formerly known as "non-A-non B," has been found worldwide. The virus is 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, an 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 occurring through needle-stick injuries, cuts from equipment, and splashes to the eyes involving blood or OPIM.

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

4. Other examples of bloodborne pathogen diseases- Malaria, Syphilis, Brucellosis, Leptospirosis, Arboviral infections, Creutzfeldt–Jakob disease.

Prevention and control of Exposure

The use of human or animal blood samples with unknown health status or blood samples with known bloodborne pathogens is of particular concern in open-concept laboratory spaces and shared facilities. This procedure will outline the appropriate use and handling of blood samples to ensure that shared equipment is used appropriately and downstream users are not at risk. The following precautions are necessary for all human and xenogeneic blood samples of known biohazardous risk (e.g., animals injected with a virus). These precautions are not required 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 permit.
- All workers must have a confirmed titer/ immunized against Hepatitis B. Vaccinations can be arranged through Workplace Health, Safety and Wellness.
- 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 (RCF) 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 RCF and any equipment owned by principal investigators.

The following precautions are unnecessary for murine blood samples known NOT to have any biohazardous risk (e.g., un-modified C57 or BALB/c blood). The practices apply to any human blood samples known to be biohazardous or with unknown health status and xenogeneic samples known to be altered to render them biohazardous (i.e., murine blood infected with lentivirus, etc.).

- Verify that all the materials and equipment required for the experiment 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 samples presents a risk of spill or aerosolization (e.g., opening vacutainers, microfuge tubes, etc.), the samples must be used in a biosafety cabinet.
- If samples are spilled, the area must be treated with Virox to disinfect the surface before proceeding with the experiment.
- Labs working with blood samples should always have access to freshly prepared virox.

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 Risk Group 2.
- Before drawing or processing blood samples, all samples must be capped or covered and inspected for chips, cracks, or other imperfections.
- 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, they must be placed in rotors or cups covered by rotor lids.
- If samples with infectious agents are being centrifuged, the centrifuge must be labeled in case breakage occurs in the absence of the operator.
- Always ensure the load is properly balanced, using blank tubes filled with water when needed and arranging the samples symmetrically.
- Centrifuge blood samples in sealed buckets only.
- Centrifuges must always be operated with rotor lids in place and must be closed during the entire period of operation. If the centrifuge cannot contain aerosols, it is unsuitable 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 it until it has come to a complete stop. The appropriate procedure for spills and broken tubes is outlined below, depending on whether the samples are in a sealed bucket or not.
- Always carefully inspect tubes for cracks or breakage following centrifugation, particularly after ultracentrifugation.

Proper decontamination and waste disposal

- After working with the blood samples, BSC surfaces and all equipment that has been in contact with the samples (rotor buckets, etc.) must be thoroughly disinfected with accelerated Hydrogen Peroxide (Virox).

- All biological sharps waste must be placed in an appropriate container for waste that may puncture. Yellow receptacles should never be too full -- request a new receptacle when it is two-thirds full.
- If you have liquid blood waste, it must be treated with 1:10 diluted bleach for at least 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 it in the yellow biohazard bag.

Transport of Biohazardous Material

- Before transporting any sample, ensure that you are familiar with any hazards associated with the samples and the biohazardous spill response and reporting procedure.
- Use a primary (water & leakproof) container (i.e., a test tube) labeled with contents. The primary container should be secured in a holder or rack. Use a Secondary container (e.g., plastic sample bag or Styrofoam box) lined with absorbent material (e.g., paper towels).
- If the samples are transported from the hospital to the labs at LKSKI/KRCBS, use a zippered blood transport bag.
- Label with a brief description and emergency contact information.
- Decontaminate the exterior of the secondary container.
- Remove gloves when transporting the samples.
- 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 the destination without stops or delays.
- Never leave specimens unattended.

Spill response

- Alert the area occupants and evacuate the immediate area for 30 minutes until all aerosols have settled before returning to clean the spill. Secure the area to avoid traffic.
- Before entering the affected area, don appropriate PPE (gloves, lab coat, goggles/face shield, N95 respirator).
- Remove any sharps using forceps or scoop and place them in a biohazard sharps container.
- Place paper towels or absorbent material around the spill. Allow the liquid to be absorbed. Place towels or absorbent material into a biohazard container. Repeat as necessary.

- When most of the spill has been absorbed, soak the area in a disinfectant (e.g., 1:10 Bleach or accelerated Hydrogen Peroxide (Virox). Leave for 30 min. Absorb onto a 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 the centrifuge. Leave the centrifuge closed for 30 minutes to allow aerosols to settle. If you must leave the room during this time, clearly label the centrifuge as "AEROSOLIZED BIOHAZARD DO NOT OPEN" with your name and contact information.
- Put on all appropriate PPE before opening. Open the lid slowly. Remove the sealed swinging-buckets with spilled/broken samples and place them in the BSC.
- Remove unbroken capped samples and wipe the exterior with accelerated hydrogen peroxide (Virox). These can subsequently be processed as initially intended.
- Autoclave broken sample tubes. If buckets are autoclavable, autoclave it. If buckets are not autoclavable, thoroughly disinfect them with accelerated hydrogen peroxide (Virox). Afterward, dispose of sharps in yellow receptacle/sharps container.
- The inside of the centrifuge and the rotor itself should be decontaminated with accelerated hydrogen peroxide (Virox).
- Clean the BSC afterward as outlined in the BSC Guidelines.

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

- Turn off the centrifuge. Leave the centrifuge closed for 30 minutes to allow aerosols to settle. If you must leave the room during this time, clearly label the centrifuge as "AEROSOLIZED BIOHAZARD DO NOT OPEN" with your name and contact information.
- Open the lid slowly, wearing thick rubber gloves, an N95 respirator, and goggles. Remove the centrifuge rotor with ALL buckets, and place it in the BSC.
- Remove unbroken capped samples and wipe the exterior with accelerated hydrogen peroxide (Virox). These can subsequently be processed as initially intended.

- Autoclave broken sample tubes. If buckets and rotor are autoclavable, autoclave them. If buckets and rotor are not autoclavable, thoroughly disinfect with accelerated hydrogen peroxide (Virox). Afterward, dispose of 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 Guidelines.

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 a 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 Workplace Health, Safety, and Wellness for follow-up.
- Report the incident to your supervisor and fill out the online incident report.
- If an emergency or medical attention is required, report to the Emergency Room.

3.0 DEFINITIONS

Term/Acronym	Definition
BSC	Biosafety cabinet
BBP	Blood borne pathogens
OPIM	Other Potentially Infectious Materials

4.0 REFERENCES

Public Health Agency of Canada (PHAC), Canadian Biosafety Standards and Guidelines, 2nd Ed., 2015

Biological Safety Cabinet Guidelines.

OSHA Blood borne Pathogen Standards

Version	Approval/Sub-approval body	Approval date
01	Research Biosafety Committee	January 1, 2015
02	Research Biosafety Committee	November 13, 2018
03	Research Biosafety Committee (reviewed)	January 1, 2019
04	Director Research Facilities; Research Biosafety Officer	February 27, 2023