QUEENSLAND MUSEUM

Biological Specimen Preparation Tool Kit

Background

In early 2019, two Queensland Museum workers contracted Q Fever. Following this, the Queensland Museum signed an enforceable undertaking agreement, making a commitment to resolve the risks and assist the community and museum industry. The risk of contracting Q Fever from cattle is well understood by industry; however, the risk of contracting Q Fever from native Australian animals has not always been fully understood. With this Tool Kit the Queensland Museum are sharing these learnings to benefit industry.

Scope

This Tool Kit has been developed as a source of information for taxidermists and museums that prepare vertebrate specimens for collection. This package contains a series of information sheets and methods that can be used to safely prepare biological specimens. Biological specimens can present a zoonotic risk for those collecting and preparing the specimen and others that are nearby. This toolkit focuses on the safe preparation of mammal and bird specimens however other specimen types can also pose a zoonotic risk.

Summary

This tool kit was developed in consultation with industry stakeholders, Work Health and Safety (WHS) specialists, and representatives from the Queensland Museum.

This tool kit does not address the requirements for authority or permits to collect specimens. These requirements are managed and enforced by government agencies depending on the location and origin of the specimen and the agency collecting the specimens.

1	**Zoonotic Risks**	Identify the zoonotic risks associated with biological specimen types being collected.
2	**Process Risks**	Identify the risks arising from the work being performed.
3	**Assess the Risks**	Assess the severity of the risks associated with the work being performed to prepare a biological mammal or bird specimen.
4	**Vaccination**	The vaccination requirements and processes for those handling mammal or bird specimens.
5	**Specimen collection steps**	Provide clear instructions to workers and volunteers regarding the handling of biological specimens that have been donated or collected.
6	**Storage containers**	List the different plastics and glass types that are suitable for the storage of biological specimens.
7	**Decontamination**	Identifies chemicals used to decontaminate surfaces and equipment. Provides guidance on how decontaminate equipment and what methods to use.
8	**Laboratory Requirements**	Review the preparation and storage areas for safety, capacity, and function.
9	**Laboratory Checklist**	Provides a list of requirements to assess compliance of biological specimen preparation laboratory facilities and practices.
10	**Communication and Information**	Inform workers, visitors, and members of the public about biological specimen risks and how to keep themselves and others safe.
11	**Laboratory equipment**	Provides a list of equipment and personal protective equipment and suppliers that were used to outfit a Biological Specimen Preparation (BSP) laboratory.
12	**Laboratory services**	Outlines the services required to support the operation of a BSP laboratory

Attachment A - Example Zoonoses Management procedure - How the organisation will manage the risks.
Attachment B - Example Laboratory Operations Manual - Governs the Operation of Laboratories.
Attachment C - Example Standard Operating Procedure (SOP) and Training Excel Tool – risk assessment, provision of clear instruction for complex tasks and record training.
Attachment D – Example Fridge Freezer Inventory.

1. Zoonotic Risks

Animal	Zoonotic diseases	Collection Requirements	Notes
Bats	Zoonotic diseases: • Lyssavirus (ABLV) • Hendra Virus • Nipah virus • Histoplasmosis in bat faeces. • Leptospirosis • Salmonella Parasitic diseases: • Toxoplasmosis	• Rabies virus vaccination • Dampen potentially contaminated soil to minimise dust exposure • Cover all cuts, grazes, and abrasions with waterproof dressings • Use a respirator with a HEPA filter. • Wear dry, full-cover boots or shoes, aprons and long sleeve shirts when handling animals or soil that is contaminated • Wear thick protective gloves as well as rubber or plastic gloves • Wash hands thoroughly on a regular basis, and shower after work	The prevalence of ABLV in bats is rare in healthy bats, and more common in sick, injured or orphaned bats.
Birds	Zoonotic diseases: • Avian influenza (Bird Flu) • Avian paramyxovirus • Campylobacteriosis • Psittacosis • Salmonella enteritidis Parasitic diseases: • Toxoplasmosis	• Control dust when working in areas contaminated with bird faeces and discharges • Use rubber or plastic gloves • Wear P2 respiratory masks • Ensure thorough cleaning and disinfection of clothes, self, and equipment. • Wash hands after handling birds, especially parrots • Wash hands regularly with soap and running water or apply an alcohol-based hand rub, and avoid touching the eyes, nose and mouth	Birds infected with avian influenza can shed the virus in their saliva, nasal secretions or faeces. Avian influenza is a notifiable disease.
Stock animals - horses, cattle, sheep, goats	Zoonotic diseases: • Anthrax • Brucellosis • Melioidosis • Leptospirosis • Salmonella • Tetanus • Q Fever Parasitic diseases: • Toxoplasmosis	• Q Fever vaccination or the use of a P2 respiratory mask • Tetanus vaccination • Cover all cuts and abrasions with waterproof dressings • Immediately and thoroughly clean any abrasions, cuts, and burns that have been contaminated with soil or surface water • Avoid exposure to water and soil in periods of high rainfall, particularly in tropical areas • Wear boots • Use rubber or plastic gloves • Wash hands with soap and water after handling. • Remove PPE and contaminated clothing at the site, bag them and wash them on site	People usually catch Q-Fever by breathing in droplets or dust contaminated by birth fluids, faeces, or urine from infected animals. Q-Fever is a notifiable disease.

Animal	Zoonotic diseases	Collection Requirements	Notes
Pigs	Zoonotic diseases: • Anthrax • Brucellosis • Leptospirosis • Salmonella • Tetanus Parasitic diseases: • Toxoplasmosis	• Tetanus vaccination • Cover all cuts and abrasions with waterproof dressings • Wear boots • Use plastic or rubber gloves • Wash hands with soap and water after handling • Immediately and thoroughly clean any abrasions, cuts, and burns that have been contaminated with soil or surface water	Anthrax may form spores that contaminate soil for 50 years. The most common source of human Brucellosis infection in Qld is feral pigs.
Dogs and cats and rodents	Zoonotic diseases: • Hydatid (dogs) • Brucellosis • Leptospirosis • Salmonellosis • Tetanus Parasitic diseases: • Toxocariasis • Toxoplasmosis	• Tetanus vaccination • Avoid contact with animal faeces • Cover cuts and abrasions with waterproof dressings • Use rubber or plastic gloves • Wash hands after handling animals, before handling and eating food, and before smoking • Immediately and thoroughly clean any abrasions, cuts, and burns that have been contaminated with soil or surface water	
Reptiles and Snakes	Zoonotic diseases: • Tetanus	• Tetanus vaccination • Cover cuts and abrasions with waterproof dressings • Use rubber or plastic gloves • Wash hands after handling animals, before handling and eating food, and before smoking • Immediately and thoroughly clean any abrasions, cuts, and burns that have been contaminated with soil or surface water	Snakes that are alive must not be received and may only be handled by licensed snake handlers.
Marsupials	Zoonotic diseases: • Q Fever Parasitic diseases: • Toxoplasmosis	• Q Fever vaccination or wearing a P2 respiratory mask if handling kangaroos. • Use rubber or plastic gloves • Wash hands after handling animals, before handling and eating food, and before smoking	Kangaroo carcass and faeces present the risk of Q-Fever.
Turtles	Zoonotic Disease: • Campylobacteriosis • Salmonellosis Parasitic diseases: • Toxoplasmosis	• Use rubber or plastic gloves • Wash hands after handling animals, before handling and eating food, and before smoking	

Animal	Zoonotic diseases	Collection Requirements	Notes
Fish, Jellyfish, and amphibians	Zoonotic disease: • Mycobacteriosis • Nocardiosis Parasitic diseases: • Anisakis nematodes	• Use thick protective gloves • Double glove when receiving jellyfish • Wear thick boots when wading	Box jellyfish presents a serious risk if handled.
Shellfish	Infections: • Vibrio Vulnificus	• Cover cuts and abrasions with waterproof dressings • Use rubber or plastic gloves • Wash hands after handling animals, before handling and eating food, and before smoking • Immediately and thoroughly clean any abrasions, cuts, and burns that have been contaminated with soil or surface water • Wear thick boots when wading	In FY 2010-11, there were 16 hospitalisations associated with *Vibrio vulnificus* infections in Queensland.
Ticks	Zoonotic diseases: • Q Fever	• Q Fever vaccination or wearing P2 respiratory mask if handling ticks • Use rubber or plastic gloves • Wash hands after handling with soap and running water or use an alcohol-based hand rub and avoid touching one's eyes, nose and mouth	
Plants and mushrooms	Stinging plants: • Gympie-Gympie stinging tree • Nettle family Poisonous mushrooms: • Green-spored parasol	• Use rubber or plastic gloves • Wash hands after handling, before handling and eating food, and before smoking	Soil contamination may also present a risk of illness.
Artifacts	Orthopoxviruses: • Smallpox • Variola virus	• Wear gloves, gown, eye protection, and a fitted respirator • Inspect artifacts for contamination by skin lesions (human, cats, rodents, camels, cattle, sheep). These might include scabs contained within envelopes, clothing, blankets, medical memorabilia (e.g., vaccination kits), or zoological specimens (e.g., hides and mounted animals)	

2. Process Risks

Risk	Control measure	Explanation	Evidence of Compliance
Biological material entering site	Approved specimen receipt process	All items being received must be double bagged and collected by qualified personnel.	Records of collection and procedures for collection
Biological material in freezer or storage	Approved specimen storage process	All items inside the freezer must be entered in an inventory, and all items in the collection are preserved and registered.	An inventory of items located in the freezer, including details of what, when collected, who owns the item and where it came from, and risks present.
	Identify biological risk within freezer	Ensure only specimens are stored in the freezer and post clinical risk image on the outside surface of freezer and refrigeration units.	
Airbourne material contaminated with zoonotic organisms	Restrict laboratory access	All personnel entering the laboratory must show a business need to be there and proof of immunity or wear a P2 protective mask.	Register of training for employees and visitor instruction.
	Prohibit drilling or mechanical cutting	Avoid any activities that would aerosol biological material.	Prohibit drilling or mechanical cutting.
	Mechanical Ventilation producing negative pressure	The input of air through mechanical ventilation or air conditioning must result in a negative air pressure with less air input than output.	Design specifications show air exchange rate for input and extraction. Regular maintenance.
	Local exhaust ventilation	Movable ventilation systems that can be positioned over the working surface.	Inspection and testing by qualified provider every 6 months.
	Fume Cupboard	Enclosed space that provides fume extraction and splash protection.	
	Fume hood	Air extraction hood often located above specific machinery or sinks.	
Biological contamination of equipment inside the laboratory	Restrict personal equipment from high-risk areas	Provide enclosed cabinets for workers and visitors to the laboratory to store personal items.	Laboratory Access and Egress SOP.
	Decontaminate all equipment being removed from high-risk area	Procure decontamination chemicals, develop a process for decontamination and implement with development of SOP with training.	Record of decontamination. Decontamination SOP
Biological contamination of surfaces within the laboratory	Implement regular cleaning of laboratory surfaces	Use appropriate chemicals to decontaminate floors, doors, walls, benches, and fixed equipment within the laboratory.	Records of cleaning and decontamination.
	Impervious floors and walls	The floors and walls of the laboratory are designed for regular exposure to water and decontamination chemicals.	Design specifications of floors and walls. Inspection of floors and walls.
	High-quality stainless-steel benches	All benches are fabricated with 316 grade stainless steel to withstand regular use of VirkonS.	Design specifications of benches.

Risk	Control measure	Explanation	Evidence of Compliance
	Stainless-steel or metal storage cabinets and equipment	Benches, shelving, storage cupboards, and equipment are designed for regular decontamination.	Design specifications of cabinets and equipment.
Entrapment in restricted space such as freezer	Area designed for easy escape and alarm	Functional door release mechanism and bell to alert nearby workers of entrapment.	Inspection records of door release mechanism and bell.
	Avoid work alone in freezer	Develop work schedule restrictions to ensure workers can call for assistance and others know of their presence in the restricted space.	Walk in Freezer SOP and training records.
Fridge and Freezer icing over	Airflow around specimens in freezer	Promote airflow within the freezer with shelving and raised surfaces to allow air to move around specimens.	Inventory records.
	Freezer inspection process	Inspect freezer for ice build-up, freezer seal integrity, and storage protocols.	Inspection records.
Biological contamination of clothing and footwear	Implement laboratory coat requirements	Issue laboratory coats to workers, restrict their use, and arrange laundering by an appropriately qualified provider.	Laundering records, training records.
	Protect footwear	Ensure workers wear enclosed shoes, provide boot covers and implement a shoe decontamination process.	Laboratory Access and Egress SOP.
Disposal of contaminated waste	Clinical waste disposal	Organise for all waste that is biologically contaminated to be secured and then collected for disposal by an appropriate qualified provider.	Clinical waste disposal SOP and training records.
	Sharps waste disposal	Organise for all sharps waste to be separated from other waste and collected in appropriate sharps containers and collected for disposal by an appropriately qualified provider.	Sharps use and disposal SOP and training records.
Exposure to biological risk during activities	High risk activities conducted by qualified personnel	All workers that conduct high risk activities have appropriate laboratory qualification and/ or experience, a business need to be in attendance, and immunity to the biological risk/s.	Induction records and access restrictions.
		Install signage on the entry door when high risk tasks are underway.	Signage, SOP for high-risk work.
Contractor and visitor access	Restrict High risk activities	Identify the different High-risk activities. Ensure that high risk activities do not occur when contractors or visitor are scheduled to visit the laboratory.	SOP for contractor entry.
	Log all access into the laboratory	Keep a register of all visitors, contractors, and other access into the laboratory. Implement a check to ensure that access is approved and for business purposes, and not public access or sight-seeing.	Induction and approval of laboratory entry. Visitor Access SOP.
Emergency Response	Access into lab by Emergency personnel	Ensure emergency service officers wear appropriate protection should they need to clear the area of personnel in the event of an emergency.	Emergency Access SOP.
	Biological spill or exposure response	Ensure biological materials can be cleaned up and decontaminated following a spill.	Biological Exposure SOP.

3. Risk Assessment

The risks levels for activities involved in preparing mammals and birds for museum collection or taxidermy. Activities that present higher risks should be avoided if sufficient control measures such as immunisation, laboratory facilities and processes are implemented.

Extremely High Risk	High Risk	Medium Risk	Low Risk
Risk of contracting infectious disease is likely	The risk of contracting an infectious disease is significant	The risk is present but manageable	The risk of biological infection is extremely low

Risk level	Situation	Example
High Risk	Biological specimen outside of the organisation, prior to collection.	A kangaroo that has died naturally in a wildlife sanctuary and has been offered for collection.
High Risk	Transporting a biological specimen to the laboratory	Placing the specimen inside two layers of plastic and a container for transport.
High Risk	Storage of a specimen in a cold room, fridge or freezer	Specimens are collected and kept in cold or frozen storage to await processing and preparation.
Extremely High Risk	Dissection of a biological specimen	Removing parts of a biological specimen, using scalpels and tools to prepare the specimen for preservation.
Extremely High Risk	Skinning Specimens	Removing the skin of a specimen using scalpels and tools.
Extremely High Risk	Skeletonising specimens	Removing remaining flesh from bones using boiling or insects
High Risk	Waste disposal	Disposing of or double bagging biologically contaminated equipment or sharps.
High Risk	Laundering lab coats	Placing contaminated laboratory coats into a washing machine
High Risk	Chemically treating a specimen to preserve it	Applying chemical to a specimen to destroy any biologically active bacteria or viruses
High Risk	Cleaning the laboratory	Removing blood and material and treatment with anti-viral and anti-bacterial chemicals.
Medium Risk	Moving contained or double bagged biological material	Moving biological waste that is double bagged in a waste receptacle for collection by qualified contractor.
Low Risk	Transporting or working with preserved specimens	Moving specimens that have been chemically preserved and analysing the biological material that is treated
Low risk	Contractors performing equipment maintenance	Contractor entering a clean laboratory to maintain equipment such as a plumber or electrician.
Low Risk	Emergency response	Wardens entering the laboratory in an emergency to ensure all personnel are clear of the workplace
Medium Risk	Visit by auditors or other inspection	External auditor or inspector entering the laboratory to conduct inspection and assurance activities

4. Vaccination

Vaccination is the first consideration for the management of Zoonotic illness in the workplace.

Q Fever

The number of people diagnosed with Q Fever is increasing in Queensland. Q Fever exposure is a higher risk than previously anticipated, particularly for anyone who works with animals, animal remains or in areas where animals have been.

Australian Immunisation register

Funded by the Meatworks industry, the Australian Q Fever register was developed in 2002 to securely register the names of people who have received the Q Fever Vaccination or a positive skin test and have agreed to entry on the register. Employers with Q Fever risks use the register to identify workers who have immunity or vaccination against Q Fever. The Q Fever register has been moved to the Australian Immunisation Register.

Process of Vaccination:

- People who have already contracted Q Fever and have antibodies should not be vaccinated. The employer should contact an appropriate medical centre and schedule two (2) doctor's visits, seven (7) days apart.
- A skin test is conducted to determine if the person has been exposed to Q Fever and has antibodies. A small amount of vaccine is injected just under the skin, which allows the immune system response to be assessed visually. Additionally, blood is drawn and sent for serology analysis to determine if Q Fever antibodies are present. The combination of the serology results and a skin test is used to identify if the person has already been exposed to Q Fever.
- Seven (7) days after a skin test, a follow up visit to the doctor will review the site of the skin test to determine if the skin is red or raised or there is any indication that the body has reacted.
    - If a negative skin test is observed the person should be vaccinated against Q Fever. The worker should not be exposed to Q Fever risks until two (2) weeks following vaccination
    - If a positive skin test is observed, the person should not be vaccinated and can be registered with the Q Fever National Register.
    - Occasionally, a person can receive a mild reaction, not a strong positive nor a clear negative. In these instances, a half dose of vaccination can be provided a week apart to ensure that the person does not have a severe reaction to the vaccination but is still protected.
    - Confirmation of entry to the Q Fever register is sent to the worker, this includes the vaccination register number. This number is used to link the worker to the employer.

Lyssavirus / Hendra Virus

Some Australian bats carry Australian bat lyssavirus (ABLV), which can be caught by humans (only three (3) recorded cases since 1996). Rabies vaccination is used to protect people that are exposed to Lyssavirus or Hendra Virus or animals that are likely to carry a risk of Lyssavirus or Hendra virus. Although rabies is not considered a serious threat in Australia the Lyssavirus or Hendra Virus is similar to the rabies virus.

Process of vaccination:

Two (2) rabies vaccines are available in Australia. Each one requires three (3) intramuscular doses - an initial dose, a second dose after seven (7) days, and a third at 21 or 28 days. It takes one month to administer the vaccine over three (3) spread out doses.

5. Biological Specimen Collection Steps

1. Planning
    - Identify the specimen type and the biological and other risks involved.
    - Determine the need to collect through consultation.
    - Provide instruction to those with the specimen to isolate the specimen.
    - Identify the size and complexity of the task.
    - Select the appropriate equipment and personnel for the task.
    - Ensure that personnel are trained and vaccinated.
2. Receipt
    - The process of picking up or receiving biological specimens from the field or from the public.
    - Understand the location of the specimen and the risks of travel to the site.
    - Confirm the information provided on the size, type, and condition of the specimen.
3. Isolation
    - The process of securing the specimen in preparation for disposal or transport.
    - Wrap or contain the specimen to prevent leakage or unwanted odour.
4. Transport
    - The process of moving the biological specimen from where it was found to a safe location.
5. Storage
    - How to safely store biological specimens in anticipation of taxidermy, research, or collection.
6. Preparation Processes
    - Preparing a specimen for research
        (a) Chemicals to be used
        (b) Preserving methods
    - Preparing a specimen for collection
    - Preparing a specimen for taxidermy
7. Decontamination
    - Areas, vehicles, equipment, and tools that have been used on or exposed to biological material from the specimen collection need to be cleaned and made ready for reuse or occupancy.
8. Disposal
    - The process of safe destruction or disposal of biological specimens, avoiding legacy exposure to biological and other risks.

6. Storage Containers

Biological specimens are stored in ethanol or formalin solution within glass and plastic containers. There are different grades of glass and plastic, and many specimens can be stored in solution, within the container for over 50 years. The appropriate storage container must be selected, a container that is resistant to the preserving chemical, along with the temperature, UV light, and potential impact damage. The following table shows the different types of storage container and the considerations for long term storage.

The size of the containers must correlate with the storage facility, in terms of weight and size. Some plastic containers contain a bund or port that would allow a tap to be added. These containers can be manufactured with the port already installed or have the port drilled in. Avoid purchasing and replace any containers with drilled ports because the glue used to secure the plug is prone to failure, leading to leakage of the storage solution.

Container type	Discussion	Potential unsuitability
Glass	Able to see the specimen inside the container	
Laboratory glass	Additional resistance to extreme temperatures	
 Grade 1 Polymer Polyethylene Terephthalate (PET)	Clear tough plastic.	
 Grade 2 Polymer High-Density Polyethylene (HDPE)	Common white or coloured plastic. Strong, chemical-resistant.	▪ Ethyl Alcohol ▪ Naphthalene
 Grade 3 Polymer Polyvinyl Chloride (PVC) Chlorinated Polyvinyl Chloride (CPVC)	Hard rigid clear plastic	▪ Naphthalene ▪ Bleach (NaOCl) – variable resistance
 Grade 4 Polymer Low Density Polyethylene (LDPE) Linear Low-Density Polyethylene (LLDPE)	Soft flexible plastic used in squeezable wash bottles	▪ Ethyl Alcohol ▪ Naphthalene (70˚C)
 Grade 5 Polymer Polypropylene (PP)	Hard but flexible plastic. Resists harsh chemicals, often used to make containers like beakers, tubes, and vials that will hold strong chemicals.	▪ Naphthalene ▪ Bleach (NaOCl) - variable resistance (140˚C)
 Grade 6 Polymer Polystyrene (PS)	Rigid, brittle plastic. Petri dishes, but not appropriate for use with strong chemicals.	
 Grade 7 Polymer All other resins and Multi materials	Cross Linked Polyethylene (XLPE)	▪ Naphthalene ▪ Bleach (NaOCl) – variable resistance
	Polycarbonate (PC): Tough plastic resisting impact and high temperatures.	
	Polytetrafluoroethylene (PTFE): Used for specific lab equipment (stir bars and tubing).	
	Polymethyl pentene (PMP): Clear plastic that resists chemicals, especially organic ones. Alternative to glass specimen containers.	
	Polyester	▪ 100% Ethyl Alcohol ▪ Borax ▪ Bleach (NaOCl) ▪ Detergents
	Vinyl Ester	▪ Borax ▪ Detergents

7. Decontamination Methods and Chemicals

Biological specimens contaminate surfaces and equipment in the area where they are prepared and processed. All surfaces within the preparation area need to be decontaminated, this includes walls, floors, doors, bench surfaces, sinks, fridges and freezers, trolleys, cutting tools, microscopes, computers, footwear, and hands.

The use of chemicals to perform decontamination is essential; however, these chemicals must effectively control the biological risks present. Some chemicals present serious risks to workers, are unpleasant to use, and can also damage the equipment and surfaces they are being used on.

Workers may take personal equipment, such as mobile phones, into the operational areas; however, they will need to be decontaminated. Computers and laptops should not enter the laboratory, unless there is no intention to remove the computer, as decontamination processes are likely to destroy them.

Chemical	Use	Effectiveness	Risks / Comments
VirkonS	VirkonS is a pink powder that is diluted in water usually at 1:100 for normal use. Virkon sachets can be purchased for use in biological spill kits.	▪ When left for 10 minutes it is effective anti-viral and anti-bacterial. ▪ Virkon solution is pink when effective and will change to clear when effectiveness has dissipated.	▪ VirkonS powder is hazardous and should not be breathed in. ▪ Virkon solution has a pleasant mild smell that is not hazardous and will not affect clothing or specimens.
Ethanol 70%	Ethanol solution is used to sterilise surfaces and equipment and can be purchased in different forms such as wipes and hand sanitizer.	▪ Effective anti-viral ▪ Effective anti-bacterial.	▪ Ethanol is classified as a dangerous good and a hazardous chemical. ▪ Ethanol presents serious risk of fire, particularly near electrical equipment. ▪ Regular use will cause skin irritation. ▪ Ethanol can deform glue and rubber seals on equipment and shoes.
Anti-viral hand wash	Decontaminate hands and skin	▪ Effectiveness dependent on brand and type.	▪ Select product designed for Veterinarian use.
Detergent or hand soap	Detergent is used to clean blood and dirt and grease from floors and equipment.	▪ Not effective. ▪ Detergent removes visible traces of biological matter but does not effectively sterilise surfaces.	▪ Detergent must be followed by a sterilising process and the introduces manual handling risks. ▪ Detergent is often slippery and introduces slip risks.
Bleach (sodium hypochlorite solution)	Bleach is used to sterilise surfaces after the use of detergent.	▪ Bleach degrades into salt water and becomes 20 percent less effective with each year of storage. ▪ Bleach solutions are not as effective after being mixed with water for over 24 hours. ▪ Organic material tends to neutralise bleach.	▪ Bleach is a highly alkaline and will destroy retina cells within seconds of eye exposure. ▪ Bleach must be used in an area with good ventilation. ▪ Bleach is corrosive and metal surfaces need to be wiped down with water or ethanol after treating them with bleach. Avoid using bleach on delicate metal instruments.

Method	Discussion
Mopping and scrubbing	Method used to apply cleaning chemicals to remove blood and debris from floors, walls, and surfaces. Mopping and scrubbing equipment must never leave the laboratory
Spray	Sterilisation chemicals are mechanically sprayed across floors and surfaces to provide adequate coverage. Spraying is not appropriate for Ethanol.
Foot Bath	Sterilization chemicals in a tray to decontaminate footwear as a person leaves the laboratory.

8. Biological Laboratory Requirements

The areas where biological specimens are processed need to be designed and maintained as a laboratory, with separate ventilation and air handling systems, a fume cupboard to manage chemical fumes, and impervious walls and floor surfaces, restricted access, and security.

A. Access

Access to the laboratory is restricted to those who are trained in the Laboratory entry requirements and protected with appropriate vaccination for their work.

An atrium or separate clean area is identified at the entry point into the laboratory where those entering the laboratory don and doff PPE and keep their personal effects, away from the operational areas and separated from biological contamination. A separate hand-washing sink and footwear cleaning equipment or material are located within the clean area.

B. Air Handling

Negative pressure is maintained within the laboratory to prevent airborne material from escaping the laboratory. All high-risk work areas have adequate ventilation. A fume cupboard is available where formalin is used, and local exhaust ventilation is available where high risk tasks are performed.

C. Cold rooms, fridge, and Freezers

Biological Specimens are usually stored at extremely low temperatures until they can be processed and preserved. Each fridge and freezer that is used to store biological specimens must have an inventory for its contents and a biological risk sign attached.

Only commercial fridges and freezers should be purchased for the storage of biological specimens because domestic appliances are not designed for exposure to decontamination chemicals or the nature of laboratory use. A freezer that operates at -18 degrees is recommended. A walk-in freezer or refrigerator must have a mechanism to release the door and a bell to call for assistance.

Fridges and freezers that are being used to store biological specimens should also be connected to a power supply that has generator back up. Extended power loss must be anticipated, and the risks from biological specimens become unmanaged if the fridge or freezer is not supplied with power.

Fridges and freezers that are being used to store biological specimens should be monitored to ensure the temperature remains within specification, to ensure that action can be taken should a fault occur.

Emergency procedures should identify response to power loss or freezer failure and the steps to take to store the biological specimens an alternative freezer or organise for a mobile freezer to be supplied.

D. Equipment

All equipment that enters the operational areas of the laboratory must be of a commercial type and able to be decontaminated. Do not manufacture any items or procure equipment with wooden or porous surfaces. Any computer keyboard or mouse should be covered to allow for regular cleaning, and all equipment leaving operational areas, including contractor equipment, should be decontaminated.

Chemical cabinets will be required if significant hazardous chemicals such as flammable liquids (ethanol) or corrosive chemicals (Borax) are stored. Refer to Section 11 for further information on Laboratory equipment.

E. Cleaning processes and chemicals

Normal cleaners engaged to clean the building should not clean the laboratory or empty rubbish bins where biological specimens are prepared. Additionally, the cleaners should be informed about the risks and must not be able to access a laboratory that prepares biological specimens.

Laboratory workers are responsible for cleaning the laboratory and should clean benches and equipment after use. Surfaces are cleaned with appropriate antiviral and anti-bacterial cleaning chemicals and using a method described in a Standard Operating Procedure for cleaning activities.

F. Laboratory Coats and Linens

Laboratory workers who are processing specimens must wear a laboratory coat to prevent their clothes from becoming contaminated with biological material. Laboratory coats are put on before entry to operational areas and worn during all laboratory activities. Laboratory coats are removed when exiting the operational area. Laboratories often need to use towels or other linen, and these will also be contaminated with biological material.

The laboratory coats and linen must not be taken home for laundering. Domestic laundering equipment cannot remove Q Fever or Australian Bat Lyssavirus contaminants. A commercial laundering service that specialises in clinical risk should be engaged to ensure that commercial equipment, chemicals, and hot temperatures are used to sterilise laboratory coats and linen. Refer to Section 12 Laboratory Services of the BSP Tool Kit for further details.

G. Waste disposal

Biological matter and waste that is generated from biological specimen processing and preparation is often contaminated and must be disposed of as hazardous biological waste or clinical waste. This includes the used PPE such as gloves and masks.

H. Emergency

Fire Extinguishers must be installed and serviced, and an Emergency Eyewash and Emergency Shower must be installed if chemicals are used.

9. Biological Laboratory Inspection Checklist

Element	Compliance requirement	**Result** (compliant, partially compliant, non-compliant)
Immunity	All personnel that perform high-risk tasks or routinely enter the laboratory are protected from contracting Q Fever or Australian Bat Lyssavirus (ABLV) through proof of immunity.	
	Personnel that occasionally enter the laboratory for short term and low-risk tasks or contractors either wear a P2 mask or show proof of immunity.	
	Proof of immunity is through the provision of a registration number for the Q Fever register or documentation from a doctor.	
Outside Laboratory	Signage outside the door identifies the biological risk within the laboratory and the need to wear a P2 mask or provide proof of immunity prior to entry.	
	P2 masks are provided outside the entry door to the laboratory.	
	Access through the door of the laboratory is restricted with a key or access card to control unauthorised access.	
Entry	Entry door closes automatically, and locks.	
	Separate handwashing sink is provided at entry, with antibacterial handwashing soap.	
	An atrium is identified as a clean area for donning and doffing PPE and is separated from the operational area.	
	Atrium contains clean laboratory coats and PPE that are protected from splashes and spills.	
	Atrium contains a storage cabinet for personal items to remain outside of operational areas.	
	No food is permitted insider laboratory and drinks are available only in the clean area.	
	The clean zone and operational areas are clearly marked.	
Personal Protective Equipment (PPE)	Disposable laboratory coats or cotton laboratory coats that are laundered in a commercial laundry designed to decontaminate the coat, are provided in the clean area.	
	Gloves in a range of sizes to allow a good fit are provided in the clean area and throughout the laboratory.	
	Safety glasses and/or face shield are provided within the clean area. Prescription safety glasses should be made available to workers who regularly need to wear safety glasses.	
	Aprons are provided for high-risk work that would heavily contaminate laboratory coats and clothing underneath.	
	Thermo-insulated gloves and coats are provided for work within a walk-in freezer (if applicable).	
	Foot covers are available to protect shoes from biological material	
Surfaces	Floor surface is made from water impervious material that is resistant to chemicals.	
	Walls are covered with an impervious material, resistant to water and chemicals.	
	All equipment and surfaces are metal or chemical resistant plastic	
	Surfaces are clean with no residual biological matter.	

Element	Compliance requirement	**Result** (compliant, partially compliant, non-compliant)
Equipment	All fume cupboards, fume hoods, and local exhaust ventilation equipment have been inspected and tested within the previous 6-months.	
	All equipment in the laboratory is designed for laboratory use, with no domestic appliances permitted.	
	Equipment used in complex tasks have Standard Operating Procedure (SOP) developed.	
	No processes that would aerosol biological matter are used within the laboratory, i.e. no drilling or powered cutting equipment.	
	Vacuum cleaner type “H” is used for laboratory purposes, and a vacuum cleaner is not used for surface cleaning.	
	Compressed air is not used for cleaning activities.	
	All computer and/or laptop keyboard and mouse are covered and protected from splashes, reducing contamination and facilitating cleaning processes.	
Refrigerator and Freezer	Fridges and freezers have biological hazard signage.	
	Walk-in freezer has an operational emergency escape bolt.	
	Walk-in freezer has an operational alert bell.	
	Workers do not enter the walk-in freezer without another person in the laboratory or without informing a person nearby with a timeframe to note their return.	
	Back-up power is available for fridges and freezers that store items that have zoonotic risk.	
	Warning systems are installed on cold storage equipment to monitor freezer temperature levels.	
	All fridges and freezers have an inventory identifying the contents of the fridge or freezer, when it was collected, and who owns it.	
	Walk in freezer is well organised with shelving and sufficient airflow to avoid icing over.	
	Fridge and freezers are well maintained with good seals and low levels of icing.	
Chemicals	All chemicals are assessed to determine which meet the classification of “hazardous.”	
	All hazardous chemicals have a Safety Data Sheet (SDS) that was issued less than 5-years ago.	
	Each hazardous chemical has a risk assessment for the use of the chemical completed within the previous 5-years.	
	All hazardous chemicals are labelled if not entirely used during the shift.	
	All liquid hazardous chemicals are stored within a bunded container sufficient to capture container contents.	
	All chemicals are stored according to segregation requirements. Flammable liquids are kept separated from incompatible chemicals.	
	Significant quantities of flammable chemicals or corrosive chemicals are stored within the appropriate chemical cabinet.	
Cleaning	Chemicals used for cleaning and decontamination are appropriate and will kill the zoonotic organisms present in the laboratory.	

Element	Compliance requirement	**Result** (compliant, partially compliant, non-compliant)
	Cleaning equipment including mops, buckets, squeegees, wet brushes are identified with colour or other label as identifying its use in the laboratory only and are kept within the laboratory.	
	A decontamination process and chemicals are provided for all equipment that is removed from the laboratory.	
	A foot bath or shoe cleaning process is implemented for all personnel leaving the operational area.	
	A cleaning schedule has been determined and monitored for completion, identifying the cleaning dates and responsible person.	
	Laboratory personnel clean the laboratory, external or contract cleaners do not enter or clean the laboratory area.	
Waste	Clinical waste receptacles are provided for all biologically contaminated waste, and the bins are identified with appropriate signage.	
	Clinical waste is double bagged and kept frozen and secured until pick up.	
	Sharps waste receptacles are provided for all used needles, scalpels and other sharps, with appropriate signage.	
	General waste receptacles are provided in the clean zone and do not contain contaminated waste or sharps.	
	Accredited and licensed waste collection contractors collect chemical waste, clinical waste and sharps waste.	
Induction and Training	Appropriately qualified personnel provide detailed training for personnel performing complex or high-risk tasks within the laboratory.	
	All personnel entering the laboratory receive training in entry restrictions and PPE requirements.	
	All visitor and contractor entry is approved as a business need and is provided with induction.	
	Induction and training records are available for review.	
Emergency	An evacuation diagram is installed within the laboratory.	
	Laboratory workers are instructed to respond to an alert tone by putting away specimens, securing clinical waste and cleaning.	
	Fire extinguisher/s are positioned in the laboratory as per fire safety requirements, with a clearance zone of 1 metre.	
	Fire extinguishers are tested every 6-months, by a qualified provider and records of testing are kept.	
	An emergency shower and eyewash station are installed at a central point, with a clearance zone of 1m.	
	The emergency shower and eyewash station is tested every 6-months by a qualified provider, and records of testing are kept.	
	Spill kits are kept for chemical and biological spills.	
	First aid kit/s are provided, and signage is installed identifying the location of the first aid kit.	
	First aid kits are resupplied regularly, so that there are no out-of-date or used up items.	
	Emergency isolation button is installed to electronically isolate key general purpose outlets (GPOs) or electrical equipment.	

10. Communication and Information

The risk posed from biological specimens needs to be communicated with all people who may be exposed to the risk. This includes workers and anyone visiting the museum. The method and information contained in the communication needs to align with the needs of the audience.

A. Biological Specimen Preparation Workers

Museum activities need to be assessed to identify the activities that would expose the person to biological risk and the information that needs to be communicated.

Workers that prepare biological specimens must receive detailed training and instruction on how specimens are handled safely. The details are developed with a risk assessment to identify the workflow, hazards to be aware of, and chemicals and equipment to use. The training and competency assessment is supported with the development of standard operating procedures (SOPs).

B. Other Workers

Workers that have visitor facing roles need to be aware of the risks in the biological specimen preparation. The workers that interact with museum visitors need to know what areas of the museum to avoid and why. Additionally, museum visitors can bring biological specimens into the museum, and the public facing workers need to know how to manage this situation.

Other workers in the museum need to understand what areas are restricted and why, with clear information advising that the preserved biological specimens no longer present a biological risk.

C. Museum Visitors

Museums engage in educating and teaching the public. When displaying biological specimens, the public should be prevented from interacting with specimens that would expose them to biological risk.

The public are often inspired by what they observe on display and may want to donate biological specimens. This should be discouraged with information on the museum's website and instructions regarding donations. The Queensland Museum instructs visitors to take a photograph of any item that might be considered appropriate for donation or collection, and then Queensland Museum personnel safely conduct the collection activities.

D. Laboratory Visitors

Laboratory equipment needs to be maintained, and laboratories can host visitors to inspect the area or ensure the area is cleared during an emergency evacuation. Visitors need to understand the risks before they enter, and appropriate signage is required, identifying the biological risk hazard and mandatory precautions needed before entry.

Before a visit is scheduled laboratory the activities within the laboratory should be suspended, with biological specimens made safe and the surface areas cleaned.

Provide all visitors to the biological specimen laboratory with clear instruction on the hazards present, what they are permitted to do within the laboratory, and the precautions that are needed to keep them safe. This instruction should include how to properly wear, don, and doff the face mask or other personal protective equipment. A register of all visitors that have been authorised to enter the laboratory is required.

E. Security

Laboratories that contain significant biological hazards must remain secure. Authority to enter must be documented along a defined authorisation process to ensure that the information and instruction is recorded, and entry is justified.

11. Laboratory Equipment

The equipment used to fit out a biological specimen preparation (BSP) laboratory requires equipment designed to be cleaned and sanitised, and purpose-built for a commercial environment. Appliances designed for use in a domestic environment are not suitable for use in a workplace or commercial area. The following equipment was supplied with the recent fit-out of the Queensland Museum BSP laboratory.

Note: The following equipment costs represent purchases made in 2023 and 2024 and should not be taken as a quoted price. Costs do not include packing or delivery.

Equipment description	Supplier	Net cost	Total cost
Custom-size soak tank (890 x 1100 x 1020 mm)	Soak Tank Australia	$12,000.00	$13,200.00
Large veterinary table (height adjustable)	Shotton Parmed	$14,320.00	$15,752.00
Custom stainless-steel drying racks x 4	T&H Sheetmetal	$10,572.00	$11,629.20
Custom stainless-steel cupboards x 2	T&H Sheetmetal	$8,160.00	$8,976.00
Custom stainless-steel benches x 2	T&H Sheetmetal	$9,570.00	$10,527.00
Stainless-steel instrument trolley M1541 (6 drawers & 2 shelves with rails)	MHA Products	$2,755.00	$3,030.50
Stainless-steel instrument trolley M1532 (2 drawers)	MHA Products	$855.00	$940.50
Stainless-steel instrument trolley M1541 (6 drawers)	MHA Products	$2,755.00	$3,030.50
1910 series cage trolley with mesh shelves	MHA Products	$1,170.00	$1,287.00
Q series procedure cart	Alpha Lifecare	$3,171.90	$3,171.90
Manual scissor-lift trolley (150 kg)	Adaptalift	$372.73	$410.00
Steelco sliding steel door cabinets	Zenith Corporation Aust.	$2,716.89	$2,988.57
Flammable liquid cabinet 250 L (A50250)	Seton Australia	$2,252.00	$2,477.20
Corrosive substance cabinet 250 L (A50238)	Seton Australia	$2,705.00	$2,976.16
Commercial stainless-steel fridge and freezer	Advanced Air Con.	$7,036.22	$7,739.84
SZ61 microscope & LG-LSLED LED light	Evident Australia	$4,292.07	$4,721.28
LED bench/desk magnifying lamp ML201LE	Redbank Group	$654.00	$719.40
DMA 35 EX portable density meter	Anton Paar	$6,040.00	$6,644.00
Stainless platform scales (150 kg) S3228	MHA Products	$1,813.00	$1,994.30
Stainless waterproof scales (30 kg) S3224	MHA Products	$492.00	$541.20
Ergonomic drafting chair x 4	Empire Office Furniture	$1,821.20	$2,003.32
One-step safety step (Gorilla) A40287	Seton Australia	$104.05	$114.46
Two-step safety step (Gorilla) A48295	Seton Australia	$170.00	$187.00
Sanitising footbath (800 x 1000 mm)	Seton Australia	$277.52	$305.27
Large butcher knives and knife sharpener	CQ Butchers & Catering Supplies	$830.00	$913.00
IT411FO-BLS foot-operated double linen skip	Newfound Distributors	$896.00	$985.60
Green wheelie bin 660 L	Materials Handling	$1,205.00	$1,325.50
MHP06 Backsaver midi (bin spring lift) 400 x 700 mm	Materials Handling	$890.00	$978.00
Clinical waste bin with foot pedal	Alpha Medical Solutions	$168.18	$185.00
SETESTKIT Pratt shower and eyewash test kit	Rowe Scientific	$308.15	$338.97

When purchasing equipment, an assessment that identifies the needs of the work and workers is key to managing and minimising the risk of injury in the laboratory. For example:

- The large stainless-steel veterinary table allows users to easily adjust the height of the working surface with a powered, rechargeable lifting mechanism. The table is mobile, with large wheels that can be locked for stability and unlocked to allow the table to be moved to the soak tank to transfer with minimal manual handling risks.
- The stainless-steel soak tank contains a hydraulic lifting and lowering mechanism, which allows workers to place the prepared specimen directly onto a raised surface which slowly lowers and raises into and out of the liquid with minimal risk of splashing or manual handling issues.
- The large laundry bin (green wheelie bin 660 L) was fitted with a spring lift device (MHP06 Backsaver midi) that lowers as laundry bags are put into the bin and then lifts as the laundry bags are recovered and the weight reduces. This eliminates the problem of workers needing to reach into the bottom of the bin to recover laundry bags, reducing the risk of injury.
- Clinical waste bins, the general waste bin, and laundry bins are all supplied with foot pedals or sensory lid lifting devices to avoid the need to lift the lid and reduce handling and contamination risks.

The following table identifies the consumables and personal protective equipment supplied with the fit-out of the refurbished BSP laboratory at Queensland Museum.

Consumables and PPE	Supplier	Net cost	Total cost
Avagard™ Antiseptic Hand and Body Wash 1.5 L x 5	Joya Medical Australia	$195.50	$215.05
Virkon® disinfectant 10 kg	Oveds Horse & Pet Store	$457.86	$503.65
A21694 Sharps container 2 L	Seton Australia	$93.9	$103.29
3M P2 respirator masks A41040 – box of 10 x 2	Seton Australia	$155.22	$170.74
A41254 Nullarbor safety glasses with clear anti-fog lens x 12	Seton Australia	$235.80	$259.38
Clinical waste bags 60 L – 50 pack x 2	Alpha Medical Solutions	$48.18	$53.00
Heavy-duty aprons – blue PVC	CQ Butchers & Catering Supplies	$413.64	$455.00
Face shields x 200	Joya Medical Australia	$260.00	$286.00
Medline® disposable blue polyethylene isolation gowns x 15	Joya Medical Australia	$56.00	$61.60
Shoe covers (CPE) x 50	Joya Medical Australia	$6.00	$6.60

12. Laboratory Services

A. Prescription safety glasses

Safety glasses are supplied to all people entering the biological specimen preparation (BSP) laboratory. The safety glasses available on the market range in price and quality. The selection criteria for safety glasses include:

- compliance with Australian Standard 1337 Eye Protectors for Industrial Applications.
- functional fit for any workers in the laboratory who have a smaller face frame.
- resistance to fogging up during use of heated water.
- comfort.

Workers reported vision difficulties when using safety glasses in addition to prescription glasses. Workers were observed to remove the safety glasses when completing fine detail work, such as using sharps, labelling specimens, or cutting and skinning.

To avoid injury and improve safety, Queensland Museum trialled supplying prescription safety glasses for 6 months from July to December 2024. The trial was restricted to workers at the Kurilpa site who perform tasks with a mandatory requirement to wear safety glasses. At the conclusion of the trial, the following factors were analysed:

- cost of supply of prescription vs non-prescription safety glasses.
- improved compliance with the requirement to wear protective glasses.
- feedback from workers regarding the comfort.

Twenty (20) pairs of safety glasses were consumed in three (3) months of normal BSP laboratory operation at a cost of $432. The cost to supply prescription safety glasses totalled $600. The prescription safety glasses were issued individually and kept with workers' personal effects.

Workers reported great satisfaction at being able to select the frames of their safety glasses to suit their face and have the lenses meet their vision requirements. The use of the prescription safety glasses avoided workers needing to wear their normal prescription glasses underneath large and uncomfortable safety glasses. In addition to improved worker satisfaction the following benefits were noted:

- Workers who wear prescription safety glasses were observed to wear them continuously while in the BSP laboratory. There were no instances where workers were observed in the operational area without their prescription eye protection.
- Significantly fewer pairs of safety glasses were consumed during the trial period than the previous 6-month period.
- While previously the laboratory supply of safety glasses often depleted faster than anticipated, workers now spent less time locating unopened boxes of safety glasses, resulting in reduced frustration.

At the conclusion of the trial, the use of prescription safety glasses was extended to all Queensland Museum sites.

B. Supply of laboratory coats and linen

Workers are provided with laboratory coats to prevent hazardous material (e.g. chemicals or biological matter) from being transferred to clothing, which can result in this material leaving the laboratory. Laboratory coats are put on before entry to operational areas and worn during all laboratory activities. Laboratory coats are removed when exiting the operational area.

There are two main types of laboratory coat: those that fasten at the back; and those that fasten in front with domes or buttons. Back-fastening laboratory coats minimise the incidence of biological mater being deposited on clothing, but feedback from workers who have used the back-fastening coats was that they experienced discomfort at the neck and wrists from the tight-closing collar and cuffs. Front-fastening coats can gape at the domes or buttons, increasing the transfer risk for hazardous material, but the issue of gaping was resolved by supplying robust aprons to wear over the front-fastening coat.

Coats need to be available in a variety of sizes to accommodate the different workers, and their comfort and preference. Workers should be supplied with sample sizes and asked to select the size that would best fit and be

most comfortable. Sufficient coats must be available for each worker during everyday use. Three coats are required per person: one for current use, one as back-up in the cupboard, and one that is being laundered.

To minimise the cost of absorbent material, a BSP laboratory can use cotton or linen towels in operational areas. Large cotton towels and small linen towels can dry surfaces and absorb spills, as well as provide a stable base underneath cutting boards and as a landing point for knives and sharps.

C. Laundering

Coats and towels become contaminated with biological matter and must be laundered by a sterilising laundry process, which is available only through professional laundering services. These services launder at temperatures and with chemicals sufficient to sterilise laboratory coats and towels used by BSP workers.

Professional laundering services also provide a linen hire service, allowing clients to specify the quantity and type of coats and linen required per week. These services collect dirty linen when clean linen is supplied.

The dirty linen can be heavily contaminated and drip biological matter through the cotton laundry bag. If laundry is heavily contaminated with biological matter, it will need to be contained to prevent drips and spills. Laundry bags that hold heavily soiled linen should be lined with a dissolvable plastic liner, supplied by the commercial laundry service. The professional laundering service supplies dissolvable plastic liners that are suitable for use within their equipment and dissolve when exposed to the heat and chemicals used to clean and sterilise.

Dirty linen is collected in laundry bags and moved from the laboratories to a secure bin at the loading dock, where it is collected by the laundering service. Workers use a trolley to move the dirty linen to the holding point to avoid manual handling strain.

A 600-litre bin is sufficient to hold dirty linen from multiple laboratories. When the spring-loaded base is fitted to the bottom of the bin it lifts the heavy laundry bags to the top of the bin and workers avoid having to reach to the bottom of the bin to retrieve the last bag.

Clean linen is delivered to the loading dock within clean laundry bags and laboratory coats on hangers. To avoid contamination, a separate clothes rack should be used to receive clean linen.

D. Clinical Waste Collection

The BSP laboratory generates general waste and clinical waste. Clinical waste includes biological matter and consumables that are contaminated with potentially infectious biological matter. These consumables include disposable gloves, sharps containers, and equipment that cannot be decontaminated.

Professional clinical waste collection services collect clinical waste from the site and transport it to a facility for incineration.