Exposure Monitoring and Health Surveillance

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AUSTRALIAN ANIMAL HEALTH LABORATORY
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Medical Surveillance Criteria

- The purpose of medical surveillance is for the early identification of conditions, if any, that could present an increased risk of adverse health effects related to the task being performed.
- Based on the type of work being performed, including consideration of factors such as the duration of the task, the materials being used, and the potential for exposure, medical surveillance is either recommended or required for the job.

Medical Surveillance Criteria

- In the US the Occupational Safety and Health Administration (OSHA) have specific requirements. These include;
  - Exposure to noise levels exceeding 85 dBA in a 8 hour TWA
  - Wear a respirator
  - Handle any of 13 regulated carcinogens
  - Handle a list of chemicals (including formaldehyde)
  - Handle radioactive chemicals
  - Exposure to asbestos
- *Various advisory groups (e.g. Biosafety Committee) … may recommend/require medical exams, biological monitoring, immunizations, or titers based on the nature of the work activity*

Exposure Monitoring

- Medical Advice and contingency planning
- Medical Surveillance
- Baseline serum
- Immunization
-

Medical Advice & Planning

- Institutions should seek medical advice when establishing their Health Surveillance and Medical Monitoring programs
  - AAHL Medical Advisory Committee
- Medically informed post-exposure response planning should be undertaken to establish;
  - Immediate post exposure-specific response
  - Potential post-exposure prophylaxis options,
  - Recommended diagnostic tests,
  - Sources of expert medical evaluation
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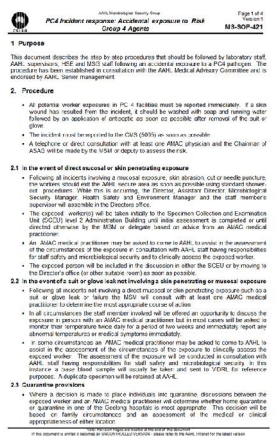


PC4 Incident response: Accidental exposure to Risk Group 4 Agents
MS-SOP-421

1 Purpose

This document describes the step by step procedures that should be followed by laboratory staff, AAHL supervisors, HSE and MSS staff following an accidental exposure to a PC4 pathogen. The procedure has been established in consultation with the AAHL Medical Advisory Committee and is endorsed by AAHL Senior management.

2. Procedure

- All potential worker exposures in PC 4 facilities must be reported immediately. If a skin wound has resulted from this incident, it should be washed with soap and running water followed by an application of antiseptic as soon as possible after removal of the suit or glove.
- The incident must be reported to the CMS (5005) as soon as possible.
- A telephone or direct consultation with at least one AMAC physician and the Chairman of ASAG will be made by the NSM or deputy to assess the risk.

2.1 In the event of direct mucosal or skin penetrating exposure

- Following all incidents involving a mucosal exposure, skin abrasion cut or needle puncture, the workers should exit the AAHL secure area as soon as possible using standard shower-out procedures. While this is occurring, the Director, Assistant Director, Microbiological Security Manager, Health Safety and Environment Manager and the staff member's supervisor will assemble in the Directors office.
- The exposed worker(s) will be taken initially to the Specimen Collection and Examination Unit (CCU) level 2 Administration Building until risk assessment is completed or until directed otherwise by the MSM or delegate based on advice from an AMAC medical practitioner.
- An AMAC medical practitioner may be asked to come to AAHL to assist in the assessment of the circumstances of the exposure in consultation with AAHL staff having responsibilities for staff safety and microbiological security and to clinically assess the exposed worker.
- The exposed person will be included in the discussion in either the SCEU or by moving to the Director's office (or other suitable room) as soon as possible.

2.2 In the event of a suit or glove leak not involving a skin penetrating or mucosal exposure

- Following all incidents not involving a direct mucosal or skin penetrating exposure such as a suit or glove leak or failure the NSM will consult with at least one AMAC medical practitioner to determine the most appropriate course of action.
- In all circumstances the staff member involved will be offered an opportunity to discuss the exposure in person with an AMAC medical practitioner but in most cases will be asked to monitor their temperature twice daily for a period of two weeks and immediately report any abnormal temperatures or medical symptoms immediately.
- In some circumstances an AMAC medical practitioner may be asked to come to AAHL to assist in the assessment of the circumstances of the exposure to clinically assess the exposed worker. The assessment of the exposure will be conducted in consultation with AAHL staff having responsibilities for staff safety and microbiological security. In this instance a base blood sample will usually be taken and sent to VIDRL for reference purposes. A duplicate specimen will be retained at AAHL.

2.3 Quarantine provisions

- Where a decision is made to place individuals into quarantine, discussions between the exposed worker and an AMAC medical practitioner will determine whether home quarantine or quarantine in one of the Geelong hospitals is most appropriate. This decision will be based on family circumstances and an assessment of the medical or clinical appropriateness of either location.

PC4 Emergency Procedures: Accidental exposure to Risk Group 4 Agents
MS-SOP-421

RESPONSE FLOW CHART FOLLOWING PC4 EXPOSURE EVENT

Potential or actual exposure requires an immediate response, a skin wound is washed with soap or disinfectant as soon as suit or glove is removed.

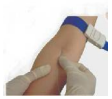
Details of the incident are reported to the CMS (5005) immediately

Details of the incident are reported to the MSM by CMS

Most Serious	OR	Less Serious
Mucosal exposure or skin penetrating injury		Suit or glove failure but no direct mucosal exposure or skin penetrating injury
Exposed lab worker should exit the area using normal procedures and report to the SCEU		Exposed lab worker can continue to work unless advised otherwise by MSM.
While the exposed staff member is leaving the secure area, the Director Assistant Director MSO, HSE Manager and the staff member's supervisor will meet to consider necessary actions.		The staff member involved will be offered an opportunity to discuss the exposure in person with an AMAC medical practitioner.
The exposed staff member will be medically assessed by an AMAC medical practitioner and will be included in the discussions as to whether quarantine is appropriate soon as possible.		An AMAC member will be consulted to assist in the assessment of risk. ASAG Chairman will be advised.
If a decision is made to place individuals into quarantine, discussions between the exposed worker and an AMAC medical practitioner will determine		In most cases of low risk exposure staff will be asked to monitor their temperature twice daily for an appropriate period and immediately report any abnormal temperatures or medical symptoms.
For more significant exposures, advice will be sought from additional AMAC members. Consideration may be given to transfer the exposed person to Royal Melbourne Hospital		If a decision is made to place individuals into quarantine, discussions between the exposed worker and an AMAC medical practitioner will determine whether home quarantine or quarantine in one of the Geelong hospitals is most appropriate.
A report of the incident and subsequent discussions will be conveyed immediately to the Victorian CVO, the Victorian Chief Health Officer and the Chief, CSIRO Livestock Industries and the Chair of ASAG		Where quarantine is recommended a report of the incident and subsequent discussions will be conveyed immediately to the Victorian CVO, the Victorian Chief Health Officer and the Chief, CSIRO Livestock Industries and the Chair of ASAG.

Baseline serum

- Traditionally baseline serum samples are collected from 'at-risk' personnel, to be stored for future reference
- If samples are collected, it should be with informed consent & documentation defining;
  - who owns the serum
  - how it is stored
  - who can access it for testing
  - who may order tests and access the results
- Serum should be disposed of once the individual leaves the



Baseline serum

- Some organizations do not collect baseline serum samples for staff—depending on occupational exposure risks
- Instead serum collected immediately after a recognized exposure event and then two weeks after
- Look for a serum antibody rise against specific pathogen
- With many human pathogens it is difficult to establish whether the 'infection / seroconversion' was a result of lifestyle or occupational expos etcure. Eg

Medical Surveillance

- All personnel advised of the risk of occupational exposure to microorganisms
- A serum sample should be collected (with informed consent) as soon as practicable following an occupational exposure.
- Staff encouraged to seek medical evaluation for symptoms that they suspect may be related to infectious agents in their work area (PUOs)
- May consider health surveillance cards to provide attending medical staff with phone number to obtain expert & informed

Illness Surveillance Card for Staff

CSIRO

TO THE EMPLOYEE

Keep this card in your possession. In case of an unexplained febrile illness inform your supervisor. If you seek medical attention present this card to your Medical Practitioner

ILLNESS SURVEILLANCE CARD

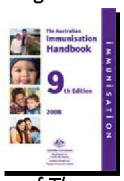
CSIRO

TO THE MEDICAL PRACTITIONER

The bearer of this card works in an area of the CSIRO Australian Animal Health Laboratory where endemic and exotic pathogenic microorganisms are handled. In the event of an unexplained febrile illness further information about these microorganisms can be obtained by contacting the Microbiological Security Manager on (03) 5227 5300.

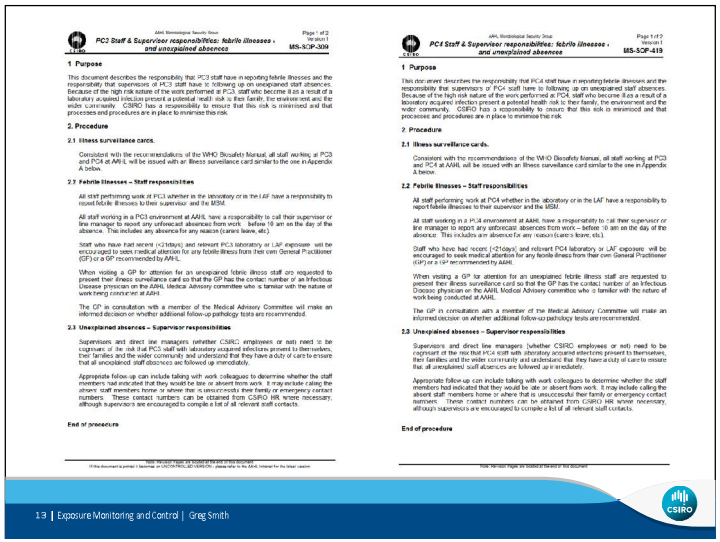
Immunisation

- Immunisation should be offered to all staff working with agents infectious for humans based on medical advice
- Immunisation should be kept current—need system
- Consideration should be considered to immunising support staff
- In Australia guidance is available from the latest editions of *The Australian Immunisation Handbook*
- Immunisation usually doesn't prevent infection, just symptoms
-



Work at BSL4

- When working with Risk Group 4 viruses, a system shall be set up for;
  - reporting accidents and exposures to microorganisms
  - monitoring employee absenteeism
  - the medical surveillance of illnesses that are potentially laboratory associated
- Annual medical assessment to determine fitness for work in encapsulated suit
- Compulsory First Aid training tailored to resuscitation in a PC4 environment



PC3 Staff & Supervisor responsibilities: febrile illnesses and unexplained absences

MS-SOP-309

1 Purpose

This document describes the responsibility that PC3 staff have in reporting febrile illnesses and the responsibility that supervisors of PC3 staff have to following up on unexplained staff absences. Because of the high risk nature of the work performed at PC3, staff who become ill as a result of a laboratory acquired infection present a potential health risk to their family, the environment and the wider community. CSIRO has a responsibility to ensure that this risk is minimised and that processes and procedures are in place to minimise this risk.

2. Procedure

2.1 Illness surveillance cards.

Consistent with the recommendations of the WHO Biosafety Manual, all staff working at PC3 and PC4 at AAHL will be issued with an illness surveillance card similar to the one in Appendix A below.

2.2 Febrile Illnesses – Staff responsibilities

All staff performing work at PC3 whether in the laboratory or in the LAF have a responsibility to report febrile illnesses to their supervisor and the MSM.

All staff working in a PC3 environment at AAHL have a responsibility to call their supervisor or line manager to report any unforecast absences from work – before 10 am on the day of the absence. This includes any absence for any reason (carers leave, etc.)

Staff who have had recent (<21days) and relevant PC3 laboratory or LAF exposure will be encouraged to seek medical attention for any febrile illness from their own General Practitioner (GP) or a GP recommended by AAHL.

When visiting a GP for attention for an unexplained febrile illness staff are requested to present their illness surveillance card so that the GP has the contact number of an Infectious Disease physician on the AAHL Medical Advisory committee who is familiar with the nature of work being conducted at AAHL.

The GP in consultation with a member of the Medical Advisory Committee will make an informed decision on whether additional follow-up pathology tests are recommended.

2.3 Unexplained absences – Supervisor responsibilities

Supervisors and direct line managers (whether CSIRO employees or not) need to be cognisant of the risk that PC3 staff with laboratory acquired infections present to themselves, their families and the wider community and understand that they have a duty of care to ensure that all unexplained staff absences are followed up immediately.

Appropriate follow up can include talking with work colleagues to determine whether the staff members had indicated that they would be late or absent from work. It may include calling the absent staff members home or where that is unsuccessful their family or emergency contact numbers. These contact numbers can be obtained from CSIRO HR where necessary, although supervisors are encouraged to compile a list of all relevant staff contacts.

End of procedure

PC4 Staff & Supervisor responsibilities: febrile illnesses and unexplained absences

MS-SOP-419

1 Purpose

2. Procedure

2.1 Illness surveillance cards.

2.2 Febrile Illnesses – Staff responsibilities

2.3 Unexplained absences – Supervisor responsibilities

End of procedure

Medical Surveillance

- Staff advised to report any PUO and seek medical advice
- Staff must report to supervisor when absent from work
- Supervisors have an obligation to establish contact with any subordinate staff that does not report for work or call in

Any Questions?

Thank you

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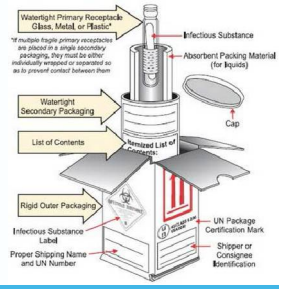

Intra- and Inter-laboratory transport

Greg Smith| Microbiological Security Manager
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Intra-laboratory transport - background

- The United Nations issues the "UN Recommendations on the Transport of Dangerous Goods".
- These form the basis of most national and international
  - **International Civil Aviation Organization**
  - **International Maritime Organization**
- These regulations cover all forms of dangerous goods, chemical,

Intra-laboratory transport - background

- The UN *Guidance on regulations for the Transport of Infectious Substances, 2013–2014**
- The Technical Instructions for the Safe Transport of Dangerous Goods by Air published by the International Civil Aviation Organization (ICAO) are the legally binding international regulations
- The ICAO rules apply on all international flights.
- Within country national legislation applies. This is normally based on the ICAO provisions.
- The International Air Transport Association or IATA produce the IATA Dangerous Goods

*The UN *Guidance on regulations for the Transport of Infectious Substances, 2013–2014* is included on your USB

Intra-laboratory transport

Infectious substances are defined as; *substances which are known or are reasonably expected to contain pathogens;*

- **Cultures;** *the result of a process by which pathogens are intentionally propagated*
- **Patient specimens;** *collected directly from humans or animals, including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluid swabs*
- **Biological products;** *used either for prevention, treatment, or diagnosis of disease in humans or animals*, (eg vaccines)
- **Genetically Modified Organisms;** *Genetically modified microorganisms not meeting the definition of infectious*

Category A Dangerous Goods

An infectious substance which is …. capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.

- **UN2814: INFECTIOUS SUBSTANCE, AFFECTING HUMANS (*cause disease in humans or both in humans and animals)***
- **UN2900: INFECTIOUS SUBSTANCE, AFFECTING ANIMALS (*cause disease only in animals)***

Assignment based on … professional judgement concerning individual circumstances of the source human or animal

Category B Dangerous Goods

An infectious substance which does not meet the criteria for inclusion in Category

- **UN3373: "BIOLOGICAL SUBSTANCE, CATEGORY B"**

Dangerous goods - Exemptions

- *Substances that do not contain infectious substances or that are unlikely to cause disease in humans or animals*
- *Substances containing microorganisms that are non-pathogenic to humans or animals* (RG-1)
- *Substances in a form that any present pathogens have been neutralized or inactivated such that they no longer pose a health risk*

….. unless they meet the criteria for inclusion in another class

Depending on quantity fixatives many be classed as hazardous

Packing Instructions

Different packing instructions depending upon class;

- **Class A infectious substances** (UN2814 /UN 2900)
  - Packing Instructions 620
- **Class B infectious substances** (UN3373)
  - Packing Instructions 650

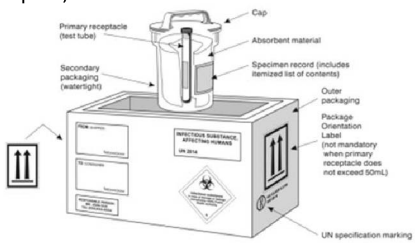
Packing Instructions 620

Packaging must meet UN Class 6.2 specifications;

The primary receptacle or the secondary packaging shall be capable of withstanding a pressure differential of not less than 95 kPa*

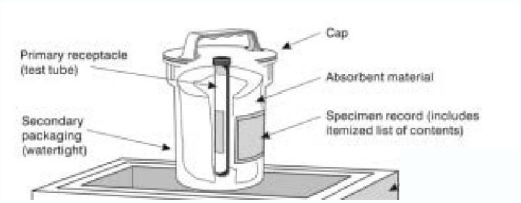
Combined packaging must pass;

- 9-metre drop test,
- puncture test,
- pressure test and
- [illegible]



Packing Instructions 620

- Primary container (withstand pressure diff of >95 kPa)
- Wrapped in absorbent material (sufficient for packaged contents)
- Packed in watertight secondary container which includes label with itemised list of contents

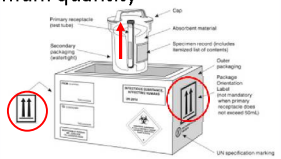


Packing Instructions 620

- For surface transport there is no maximum quantity per package
- For Air transport;

  50 mL /50 g for passenger aircraft

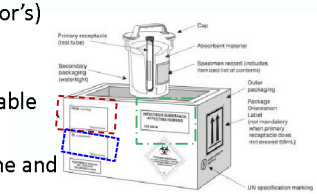
  4 litres/4 kg for cargo aircraft



- If any receptacle with a capacity for more than 50 mL shall be orientated in the outer packaging so that the closures are upward.
- Orientation labels ("UP") shall be fitted to two opposite sides of out packaging.

Packing Instruction 620 - Labelling

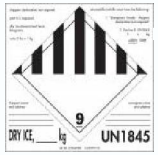
1. the shipper's (sender's, consignor's) name and address
2. **the telephone number** of a responsible person, knowledgeable about the shipment
3. the receiver's (consignee's) name and address
4. the United Nations number followed by the proper shipping name (UN 2814 "INFECTIOUS SUBSTANCE, AFFECTING HUMANS" or UN 2900 "INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only", as appropriate)

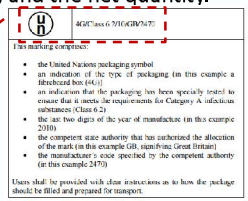


Technical names need not be shown on the

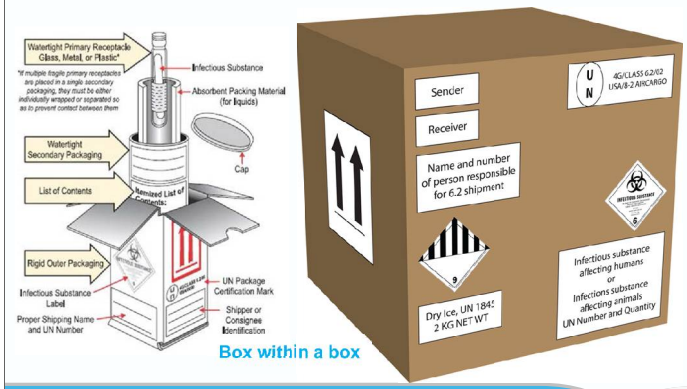
Packing Instruction 620 - Labelling

- The outer packaging shall bear the UN packaging specification marking which indicates that the packaging has passed the performance tests to the satisfaction of the competent authority.
- temperature storage requirements (optional)
- when dry ice or liquid nitrogen is used: the technical name of the refrigerant, the appropriate UN number, and the net quantity.





Packing Instruction 620

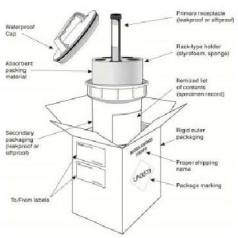


Shippers Declaration

- Virtually the same information that is included on outer packaging is included in declaration
- For the purposes of documentation, the proper shipping name shall be supplemented with the technical name.
- Must designate if it is suitable for cargo and passenger as well as whether the material is radioactive

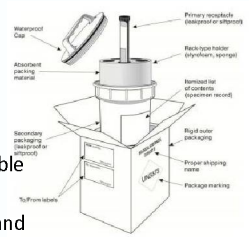
Packing Instruction 650

- Triple packaging still applies
- For surface transport there is no maximum quantity per package
- For air transport:
  - no primary receptacle shall exceed 1 litre
  - outer packaging must not contain >4 litres(for liquids)
  - except for packages containing body parts, organs or whole bodies, the outer packaging must not contain more than 4



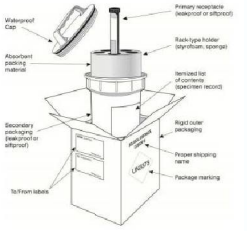
Packing Instruction 650 – labelling

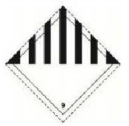
- Each package shall display the following information:
- for air: the shipper's (sender's, consignor's) name, address and telephone number
- for air: the telephone number of a responsible person, knowledgeable about the shipment
- the receiver's (consignee's) name, address and telephone number
- the proper shipping name ("BIOLOGICAL SUBSTANCE, CATEGORY B") adjacent to the diamond-shaped mark
- temperature



Packing Instruction 650 – labelling

- when dry ice or cryogenic liquids are used as refrigerant then appropriate label affixed
- Dangerous goods documentation (including a shipper's declaration) is not required
- International shipments require:
  - a packing list/proforma invoice that includes the shipper's and the receiver's address, the number of packages, detail of contents, weight, value (eg no commercial value)
  - an import and/or export permit and/or





Intra-laboratory transport

Labelled, leak-proof and impact resistant secondary containers should be used to move infectious material between containment zones in the same building to prevent a spill or leak if a container is dropped.

- Within laboratory between BSC and incubator
- Between BSC or incubator to inverted microscope
- Between rooms within a containment zone
- Within a facility between containment zones



Intra-laboratory transport

Many companies sell them "specimen transport containers" or










Secondary containers don't have to be expensive


Questions

Thank you

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Standard precautions and sharps safety

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April 2015

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Standard Precautions

Standard precautions

- Concept of *Universal Precautions* was introduced in mid 1980's as the medical community grappled with the emergence of AIDs and rising incidence of Hepatitis in medical personnel.
- Essentially, they were good hygiene habits, such as hand washing and the use of gloves and other PPE, correct handling of hypodermic needles and scalpels, and aseptic techniques.
- Bodily fluids (and patients) were to be treated as though they

http://www.samaritimes.com/wp-content/uploads/2014/09/HIV-

"Precautions to protect against exposure must be taken when there is any potential for exposure to bodily fluids. It is assumed that all bodily fluids have the potential to transmit disease"

The Universal Precaution Rule:

Treat all ~~human~~ blood, bodily fluids and other potentially infectious materials

Standard precautions

- Although it is a medical term and a 'medical approach' the principals are equally applicable to work involving animals
- Just because you don't know that it is infected doesn't mean it isn't
  - Hendra
  - Nipah
  - Rabies
  - Leptospirosis
  - Ebola
  - SARS
  - Japanese Encephalitis
  - MERS
  - Marburg
  - Hantavirus

Personal protective equipment (PPE)

ASSESS THE RISK of exposure to infectious material or contaminated surfaces BEFORE any laboratory, animal or field-based activity.

Select PPE based on the assessment of risk:

- Clean non-sterile gloves
- Clean, non-sterile gown (front covering, long sleeved)
- Mask and eye protection or a face shield

Make this a routine!

Personal protective equipment (PPE)

- Whenever you may be exposed to infectious materials you must wear the appropriate PPE.
- PPE places a barrier between you and potentially infectious

Here are some basic rules to follow:

- Always wear PPE in exposure situations - wear a lab gown, gloves and eye protection whenever splashing is a possibility
- Remove and replace PPE that loses its ability to function as a barrier to potentially infectious materials
- Remove PPE before leaving the work area
- Dispose of contaminated PPE properly-

PPE - Gloves

- Wear when working in the laboratory, in the field or dealing with animals.
- Change between tasks and procedures after contact with potentially infectious material.
- Remove after use, before touching non-contaminated items and surfaces.
- Perform hand hygiene immediately after removal

More later in PPE training session!

Facial Protection (eyes, nose and mouth)

During activities that are likely to generate splashes or sprays of infectious or potentially infectious material (or chemicals).

Wear either;

(1) a surgical or procedure mask and eye protection (eye visor, safety glasses or goggles)

or

(2) a face shield to protect mucous membranes of the eyes, nose, and mouth

More later in PPE and respiratory protection training sessions!

Gown

- Wear to protect skin and prevent contamination of clothing during activities that are likely to generate splashes or sprays of infectious or potentially infectious material
- Remove soiled gown before leaving laboratory, and perform hand hygiene.

More later in PPE training session!

Hand hygiene: When ?

- Before and after any direct contact with animals or infectious or potentially infectious material, whether or not gloves are worn.
- Immediately after gloves are removed.
- After touching blood, body fluids, secretions, excretions and contaminated items, even if gloves are worn.
- After contact with inanimate objects in the

Hand Hygiene

Summary technique:

- Hand washing (40–60 sec): wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single use towel; use towel to turn off faucet.
- Hand rubbing (20–30 sec): apply enough product to cover all

Hand Hygiene: Hand wash

World Health Organization

Hand Hygiene: Hand wash

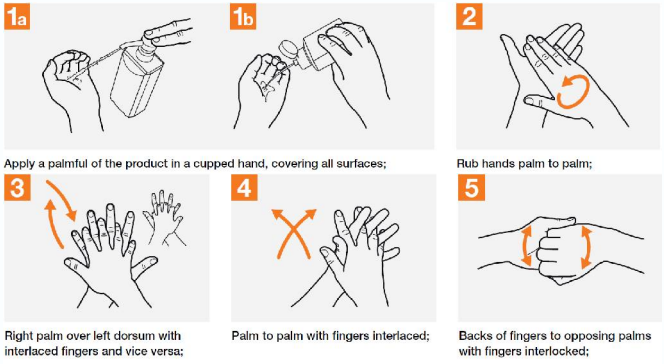
WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the handwash (steps 2-7): 15-20 seconds

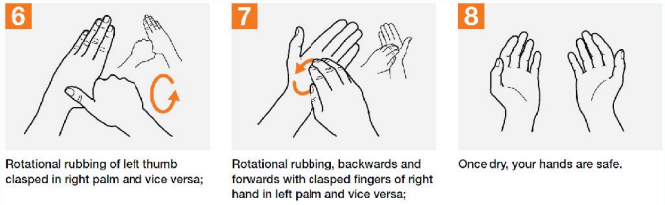
Duration of the entire procedure: 40-60 seconds

It is a requirement in Australia for all soap dispensers and handwash basins to be hands-

Hand Hygiene: Hand rub



Hand Hygiene: Hand rub

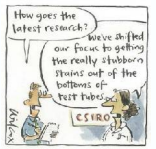


Duration of the entire procedure: 20-30 seconds

It is a requirement in Australia for all hand rub dispensers to be hands-

Laboratory cleaning

- Use adequate procedures for the routine cleaning and disinfection of laboratory work areas including benches, shelves and equipment.
- Work areas should be decontaminated at conclusion of work, when going for a break and at the end of the day
- The area should be left safe – remember the support staff and



Waste disposal

- Ensure safe waste management.
- Don't overfill waste receptacles
- Place in appropriate waste containers (ie autoclave bags)
- Place sharps in sharps container not in autoclave bags
- Not everything can be autoclaved (batteries, light bulbs, aerosol cans)
- Discard single use items

Sharps Safety

The problem

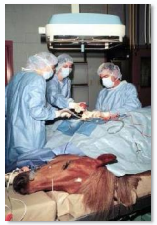
- In the US[1] there are approximately 385,000 needle sticks and other sharps-related injuries among healthcare personnel annually. 46% incurred by nurses.
- WHO[2] estimates there are;
  - 16,000 HCV infections and 142 deaths each year due directly to sharp injuries among healthcare workers
  - 66,000 HBV infections and 261 deaths annually
  - 1000 HIV infections leading to 735 deaths over the next

1. http://www.cdc.gov/niosh/stopsticks/sharpsinjuries.html
2. Pruss-Ustun, A Rapiti, E and Hutin, Y. Sharps Injuries: Global burden of disease from sharps injuries t health

The problem

- Survey of Australian Veterinarians[1] indicated that 75.3 % suffered a sharps injury in previous 12 mths and 58.9% reported at least 1 contaminated sharps exposure (n=664).
- Of those reporting a sharps injury;
  - Syringes 63.7% of respondents
  - Suture needles 50.6% of respondents
  - Scalpel blades

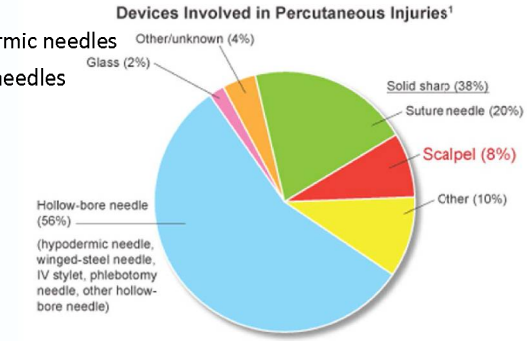
41%



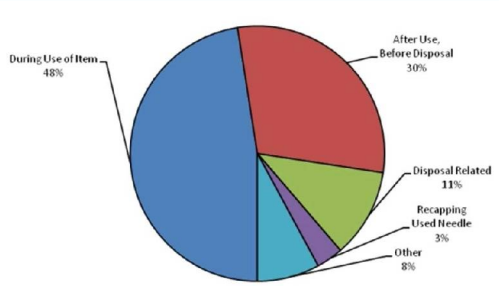
1. Leggat PA, Smith DR and Speare R. (2009) Exposure rate of needlestick and sharps injuries among Australian Veterinarians.

Sharps injuries

- 56% hypodermic needles
- 20% Suture needles
- 8% Scalpels
-



Hypodermic injuries



Reduce Hypodermic injuries

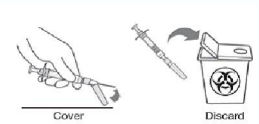
- Minimise handling of sharps
- Do not remove or recap needles
- Use guards or safety devices
- Wear puncture resistant gloves
- Ensure animal is properly restrained or sedated

Reduce Hypodermic injuries

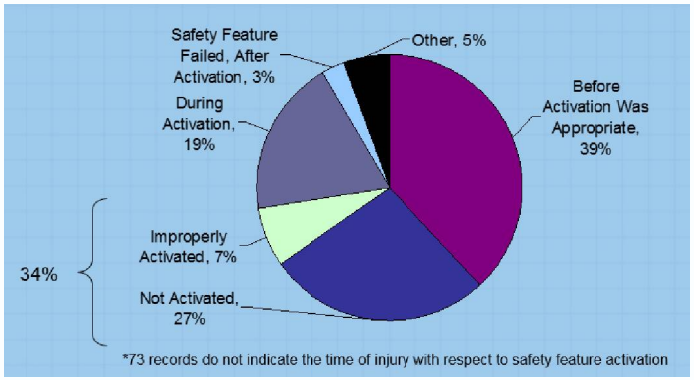
- Avoid using unless necessary or substitute where possible
- Dispose of syringe and needle as a unit
- Use appropriate sharps containers for discard
- Use Devices with Engineered Sharps Protection
- Do not overfill container

Safety Devices: Key Features

- Are integrated into the device
- Provide immediate protection after use and throughout disposal
- Few devices provide protection during use
- Keep the worker's hands from having to move to the point of risk



Engineered Sharps protection isn't a panacea



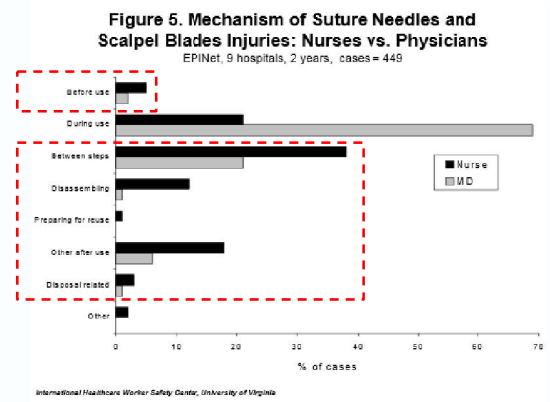
Scalpels

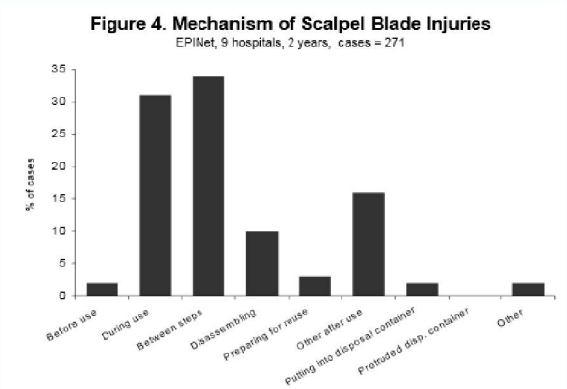
Scalpel blade injuries 2000-2001

- 78% of injured was not the one holding the scalpel
- 41% occurred between uses (handing, disposal etc)
- 10% during disassembly of scalpel blades from reusable handles
- 68% reusable 32 % disposables
- 94% Hands (right 56%, Left 38%)
- 3% Arms
- 2 % Feet

Perry J, Parker, G, Jagger,J (2003) Scalpel Blades Reducing Injury Risk. *Advances in Exposure Prevention* 6:4 37-

Nurses were much more likely to be injured before



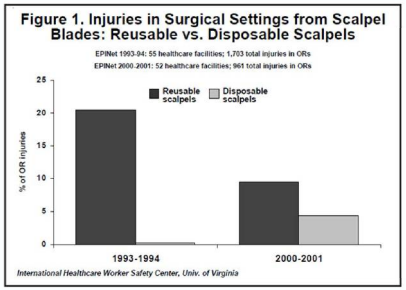


How to reduce chances of injury with scalpel

- Hands-free transfer –never hand or receive a scalpel by hand
- Place it down on a tray and allow others to pick it up
- [illegible]

How to reduce chances of injury with scalpel

- Disposable vs reusable
- [illegible]



How to reduce chances of injury with scalpel

- Use one hand blade removal devices if not disposable
- Use puncture resistant glove – not cut resistant or
- [illegible]

How to reduce chances of injury with scalpel

- Use cut resistant gloves – Kevlar
- [illegible]

Scissors

How many of you have used scissors in the field or the laboratory?

[illegible]

Scissors – what's in a name?

Sharp - Sharp

Sharp - Blunt

Blunt -

Which is safest?

Glass pipettes are dangerous

use plastic instead

Some traps

Questions

Thank you

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PPE

Andrew Hill | Biocontainment Microbiologist
April 2015

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What is PPE?

What is PPE?

What is PPE?

Personal protective equipment (PPE) is anything used or worn by a person to minimise risk to the person's health or safety and includes a wide range of clothing and safety equipment. PPE includes boots, face masks, hard hats, ear plugs, respirators, gloves, safety harnesses, high visibility clothing etc.

-

PPE for risk mitigation

- E - eliminate
- R - reduce
- I - isolate
- C - control
- P **personal protective equipment**
- D - discipline

Why almost last?

- Only protects the wearer
- User dependant
- Often not made to measure
- Ergonomically less than ideal
- Various reasons for failure in protection
  - Poor fit
  - Improper implementation
  - Casual use
  - Not used
  - Poor maintenance
  - Wrong product

We use PPE .....

- when there are no other practical control measures available (as a last resort)
- as an interim measure until a more effective way of controlling the risk can be used, or
- to supplement higher level control measures (as a back-up).

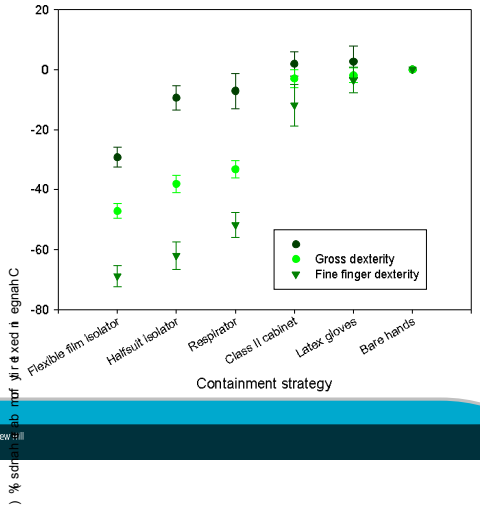
Implementing PPE

- Appropriate
- Compliance with standards
- Ergonomic
- Fit test
- Training
- If used together – compatible
- Demonstrable benefit
- Monitoring of use
- Storage
- Maintenance
- Change of process = re-evaluate PPE

Limitations

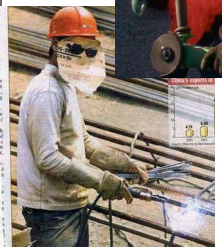
- Know the limitations
  - Laboratory clothing exercise
- Decontamination or Disposal
  - Discussion of various RPE options
- Application and Removal
  - Donning and doffing of gown and gloves
- Protection *vs* Challenge

Dexterity and Containment Systems



Spot the obvious mistake

Perfect!



Thank you

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Primary containment and BSCs

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April 2015

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What is Primary Containment?

The first barrier between the pathogen and the operator or environment

Specific boxes, containers or vials

Something which isolates the pathogen to a defined space

A BSC

A maximum containment suited laboratory

What <u>don't</u> we mean?

- Suits
- PPE
- Other tubes \ containers without biological seals
  - Standard Eppendorf tubes
  - Universal bottles without 'O'ring
  - Sandwich boxes
- Disinfection

Primary Containment - Control at Source

- Where practicable maintain a physical barrier
- In the absence of a physical barrier other methods such as air movement.
- Filters can form part of the primary barrier
- Control in this way minimises and defines the potentially contaminated area

Problems with primary containment

- You can't put everything in a box
- Limited equipment available
- Expensive to implement
- Limits dexterity of operator

Biological Safety Cabinets

Various equipment described as :

- BSCs
- MSCs
- (Virus) Hood
- Laminar flow
- Clean Workstation
- Clean Bench

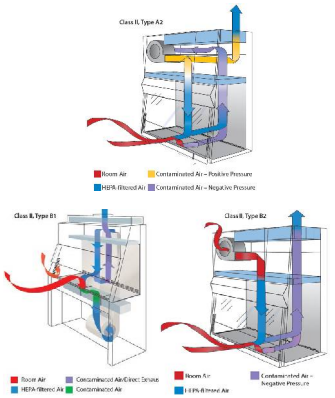
Equipment described using these terms may not be appropriate for infectious work.

Biological Safety Cabinets cont'd.

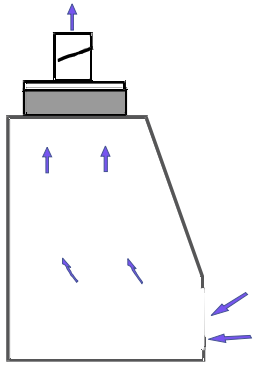
(Micro)biological Safety Cabinets come in three types Class I, II & III
However:

- Class II has international subtypes including A1, **A2**, B1, B2
- Class II type Cytotoxic
- Class I / III hybrid
- Class III +/- Passbox
- All sorts of duct configurations

Microbiological agent Hazard / Risk Group *vs* Cabinet Class: Misconception over Class of BSC and hazard group of organism



Biological Safety Cabinets - Class I



- Purpose: Operator Protection
- Inward air flow with total exhaust
- Aperture velocity 0.5 – 1 ms^{-1}
  - Standards differ by country
- Operator Protection Factor >10^5

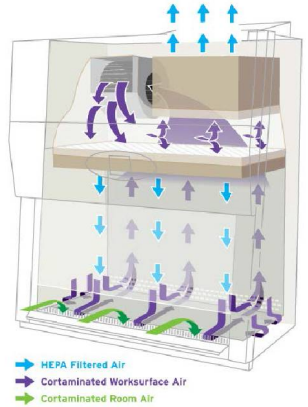
Class I - Basic function

Class I - Operator Interaction

Class I – Equipment Considerations

Biological Safety Cabinets - Class II

- Purpose: Product & Operator Protection
- Recirculation and Inward air flow with partial exhaust
  - Most common 70% exhaust
- Recirculated air provides laminar air curtain
- Operator Protection Factor 10^5



Biological Safety Cabinets - Class II

Origin and Standard	Designation	Inflow	Exhaust options	Recirculate air from work area?
EU/UK BS 5726 BS EN 12469		≥0.4m/s	Recirc. to lab Canopy Hard Duct*	Yes
USA NSF49	A1 (A)	>0.38m/s	Canopy	Yes
USA NSF49	A2 (B3)	>0.51m/s	Canopy	Yes
USA NSF49	B1	>0.51m/s	Hard Duct	Yes
USA NSF49	B2	>0.51m/s	Hard Duct	No
Australia AS 1807.22		>0.4m/s <0.45m/s	Recirc. To lab Canopy	Yes

Standards will often default the performance specifications to 'Manufacturers Stated Values'. This does not mean they are effective.

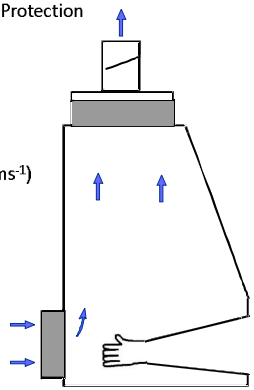
- *With anti blow back protection

Class II – Basic function

Class II – Operator interaction

Biological Safety Cabinets - Class III

- Purpose: Operator Protection, Inherent Product Protection
- Sealed envelope
  - Gauntlet (glove) port access
  - With or without pass-box
- HEPA Filtered inward air flow with total exhaust
- Operator Protection Factor >10^6
- Aperture velocity at glove breach >0.7ms^{-1} (~ 6 ms^{-1})



Class III – Smoke clearance

Laminar flow – Clean workstations etc.

- PCR Hoods

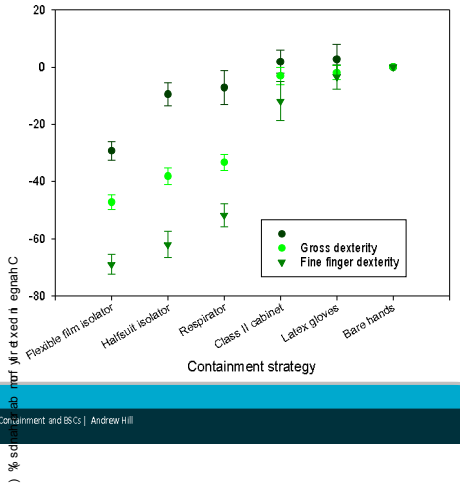
- Cleanroom benches

Fume hoods/cupboards/powder stations

Incidents and failures - BSCs

- Whatever happens - Don't panic!
- **Spills**
  - Clean up small ones as you go
  - Large spills require thought - stop work
- **Failure of BSC or power to BSC**
  - Learn 'normal operation' cycle of cabinet
  - Minimise aerosol production
  - Make safe as best as possible and stop work
  - Withdraw from cabinet and remove PPE

Dexterity and Containment Systems



Laboratory equipment - Centrifuge

Laboratory equipment - Incubators

- CO_2 etc.
- Tissue culture
- Solid media
- Liquid media
- Eggs

Laboratory equipment – Cold Storage

- Maintenance of the barrier
  - Failure & dropping
- Appropriate vessels
  - Flasks
  - Tubes
  - Secondary containment?
  - Sample integrity vs LN safety
    – Inside or outside threads

Thank you

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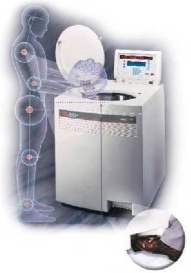

Safe Centrifuge Operation

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Overview

Introduction to centrifuges

Hazards

Rotor care

Safe centrifuge operation

Rotor failure

Incidents and spills

Introduction

Three general classes of centrifuge:

- Low speed (< 6000 rpm)
- High speed (max. 30,000 rpm)
- [illegible]

Hazards – OHS/HSE considerations

- Sample leaks (aerosols, contamination)
- Sample imbalance
- Stress failure of component parts
- Contact with rotating parts
- Mechanical failure of rotating parts
- [illegible]

Hazards – OHS/HSE considerations

Operating centrifuges can expose users to several dangers:

Physical

- Rotors can be HEAVY – lift and fit with care.
- Contact with rotating parts

Biological

- [illegible]

Centrifugation is a high risk activity

- Centrifugation of pathogens carries a very high risk of infectious aerosol production and release!
- Aerosols are created when fluid escapes from the sample container, rotor or centrifuge while the centrifuge is in operation.
- This may occur when spinning uncapped samples, or when a leak, spill, or breakage of the tube occurs.
- Spills can occur during loading/unloading and sample [illegible]

Hazards – Rotor stress

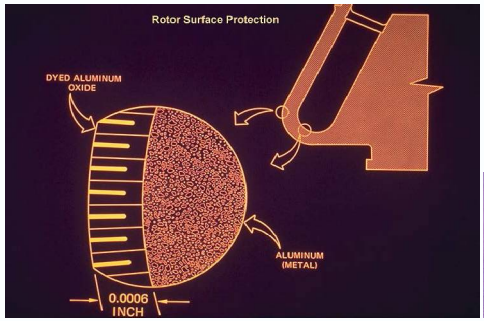
Parameters that Determine Rotor Stresses

- Rotor Speed
- Rotor Geometry
- Rotor Weight
- Sample Weight
- Stress Density

EVEN LOW SPEED ROTORS CAN BE HIGHLY STRESSED

Hazards – Rotor stress: Corrosion

Anodizing is corrosion resistant, not corrosion proof



Hazards – Rotor stress: Corrosion

Aluminium reacts with a corrosive

Cumulative effect of tensile load and a corrosive environment can result in a significantly reduced service life of the metal.

Rotor care

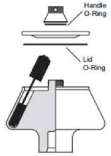
Wash rotors and buckets

- Do not allow corrosive materials to dry on rotor.
  - ✓ Wash rotor and components immediately if salts or other corrosive agents are used or if a spill has occurred.
  - ✓ Wash with approved detergent ('Solution 555*'), warm water and nylon brush when necessary.

Rotor care

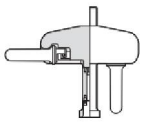
Wash rotors and buckets

- Use plastic or wooden tools to remove O-rings or gaskets for cleaning—do not use metal tools that could scratch anodized surfaces.
- Use a mild detergent such as Beckman Solution 555 diluted 10 to 1 with water, and a soft brush to wash rotors and rotor components and accessories (*Most laboratory detergents are too harsh for aluminium rotors and components*)
- Rinse thoroughly with water
- Air-dry the body or buckets upside down



Rotor care – cleaning and storage

- Do not wash rotor components or accessories in a dishwasher. Do not soak in detergent solution for long periods, such as overnight.
- Do not immerse or spray a swinging-bucket rotor body with water because liquid can become trapped in the hanger mechanism and lead to



Rotor care – cleaning and storage

- Keep rotors clean and dry.
- Store fixed-angle rotors upside down with lids and inserts removed.
- Store swing-

• Do not expose aluminium rotors to:

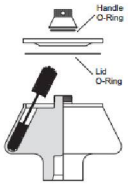
- Strong acids or bases
- Alkaline detergents
- Salts of heavy metals

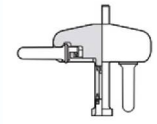
Rotor care – maintenance

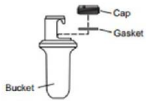
Examine rotor, lid and O-rings

Wipe clean the O-rings or gaskets regularly (lubricate after cleaning).

- Replace them about twice a year or as required







Preparing to perform a centrifuge run

Only trained persons should operate a centrifuge.

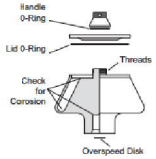
Wear appropriate PPE:

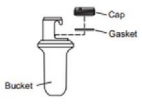
- GOWN
- GLOVES
- SAFETY GLASSES
-

Safe centrifuge operation

Examine rotor, lid and O-rings (each run)

- Check and lubricate O-rings with silicon vacuum grease (Beckman). Ensure they are attached properly.
- Lubricate threads with Spincote (Beckman) if required.
- Inspect rotor and lid for rough spots, scratches and signs of

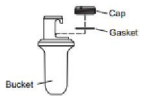




Safe centrifuge operation

Examine rotor, lid and O-rings

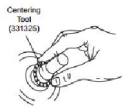
- Frequently clean all surfaces that contact O-rings.
- Regularly clean the threads of the rotor (lid, handle, buckets, cavities, and so on) with a nonmetal brush and a small amount of concentrated detergent, then rinse, and dry thoroughly.
- Lubricate the threads (*Spincote for Beckman*



Safe centrifuge operation

Pre-run Safety Check

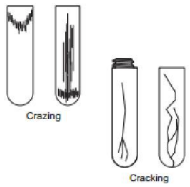
- Make sure the ultra- rotor is equipped with overspeed disc
- If disk is missing replace it
- Check the chemical compatibilities of all materials used
- Verify that tubes, bottles, and accessories being used are



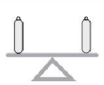
Safe centrifuge operation

Examine tubes

- Discard any tubes that are discoloured, crazed or cracked
- Crazing —is the result of stress relaxation. If a crack approaches the outer wall of the tube or bottle, discard it
- Properly stored have an indefinite shelf life if.
- Store in a dark, cool, dry place away from ozone, chemical fumes, and



Safe centrifuge operation - Balancing



Ensure that the load is balanced

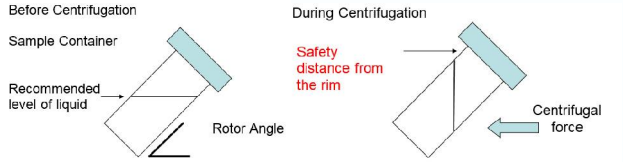
- A difference of 0.5 grams at 500,000 x g is equivalent to a 250 kg difference.

1. Balance tubes by eye, seal lid, decontaminate and dry outer surface. Remove from BSC
2. Measure difference in weight on balance
3. Return to BSC and add require volume to adjust balance (ie 1 gm=1mL)
4. [illegible]

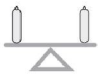
Safe centrifuge operation

Fill levels

- Do not overfill tube – fill levels depend on the angle of the fixed angle rotor.
- Check manufactures recommendations for maximum fill

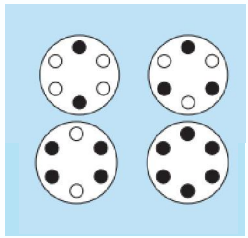


Safe centrifuge operation - Balancing

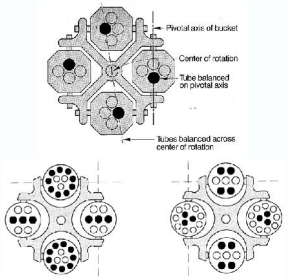


Ensure that the load is balanced

Balancing a fixed angle rotor for 2, 3, 4 or 6 sample containers



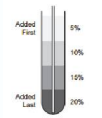
Balancing a swing out rotor

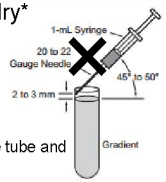


Safe centrifuge operation - Balancing

Isopynic gradient

1. Accurately balance gradients (sucrose or other) on the bench without sample.
2. Transfer to BSC and layer equal amounts (volume) of sample on top. Seal, decontaminate and dry* surfaces.
3. [illegible]





*It is essential that all traces of disinfectant are removed from the tube and the tubes are dry before loading into rotor buckets.

Moisture can result in: 1) Collapse of tube or 2) difficulty in removing tube

Safe centrifuge operation - Balancing

Swinging Bucket - ultracentrifugation

- Match numbered caps with numbered buckets.
  - Screw the caps into the bucket until there is metal-to-metal contact.
  - Tighten flat caps with a screwdriver.
- Attach all buckets, loaded or empty, to the rotor in corresponding numbered location.
  - Loaded buckets must be arranged symmetrically
  - Opposing tubes must be filled to the same level with liquid of the

Safe centrifuge operation - Balancing

Swinging Bucket - ultracentrifugation

- Ensure buckets are attached securely on rotor (2 hooks)
- Buckets should hang straight
- Carefully lift rotor straight with both hands when loading centrifuge
-

Safe centrifuge operation

- Never fill centrifuge tubes above the maximum recommended by the manufacturer.
- Never exceed safe rotor speed (this is often located on the rotor lid).
- If using CsCL or other dense material then maximum rotor speed is reduced
-

Safe centrifuge operation

- Use correctly fitting tubes.
- Check compatibility of tube material to solvent medium
- Make sure rotor is correctly balanced and loaded
- Confirm centrifuge has achieved run speed prior to exiting the room
- Stop centrifuge immediately if an unusual condition (noise or vibration) begins.
-
- **REPORT** any faults or damage to responsible staff member or supervisor.

Preparing to perform a centrifuge run

Fill in machine log books.

Make sure to include what infectious agent

Log books inform staff what hazards may exist in the event of an accident

Usually separate Log books for each ultracentrifuge rotor- important for tracking usage for the purposes of derating rotors

They provide a contact name if something goes wrong

BECKMAN AVANTI J-30I

CENTRIFUGE LOG SHEET

DATE	Time	Rotor type	Rotor serial number	RPM	Run length	Temp	Operator	Remarks

Example only

Safe centrifuge operation

IF EVER IN DOUBT OVER USING A CENTRIFUGE, CHECK WITH YOUR SUPERVISOR OR OTHER TRAINED STAFF MEMBER BEFORE PROCEEDING.

Rotor failure – when things go wrong. . . .

USER ERROR IS THE BIGGEST CAUSE OF CENTRIFUGE MALFUNCTION.

Failure to place lid on rotor

Failure to secure rotor lid

Failure to secure rotor to drive

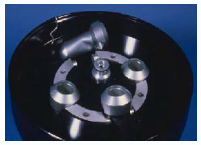
Overload of rotor's max. mass

Running swing-out rotor with missing buckets

Swing-out buckets hooked incorrectly

Improper balance of tubes

Use of tubes not rated for high speeds



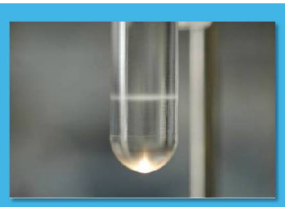
Rotor decontamination & sterilisation

- Labware contaminated with radioactive or pathogenic solutions should be decontaminated or disposed of following appropriate safety guidelines and/or regulations.
- Select a disinfectant that will not damage the tube or bottle material.
- Most ultracentrifuge bottles and rotors are resistant to;

  70% Alcohol allow >1 hour

  Autoclaving at 121°

Questions



Thank you

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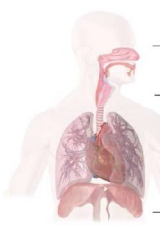


Percent of Particles Deposited in Region (particle size in µm)

	0.1 µm	1.0 µm	10 µm	100 µm
Head airway region	2	28	81	50
Tracheo-bronchiole region	3	3	1	0
Alveolar region	14	12	2	0

Aerosols, respiratory protection and fit testing

Greg Smith| Microbiological Security Manager

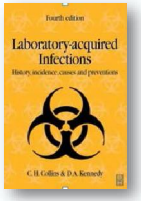
AUSTRALIAN ANIMAL HEALTH LABORATORY
www.csiro.au

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Laboratory Acquired infections

Source	Clinically apparent cases 1849 to 1974
Accident	702
Animal or ectoparasite	659
Clinical Specimen	286
Discarded glassware	47
Human autopsy	74
Intentional infection	19
Aerosol	522
Work with Agent	827
Other	16
Unknown	769
TOTAL	**3921**

(31 LAIs/ year)



R.M. Pike, *Laboratory-associated infections* incidence, fatalities, causes, and prevention. Ann Rev Microbiol 33 (1979), pp. 41–66

Importance of Aerosols

82% of laboratory infections were not due to a known accident such as inoculations, ingestion, splashing, wound injuries. (Pike 1976)

Most LAIs are presumed to be caused by aerosols.

*This may be an over estimate!

Aerosols

The probability of producing infectious aerosols increases with the titre of the material being handled.

Aerosols can also originate from dry material such as animal bedding, dried spilt material, bacterial cultures on a plate,

Where do aerosols come from?

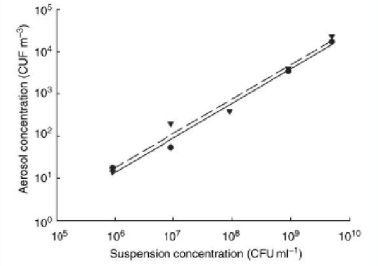


Figure 2 Aerosol generated from centrifuge accident (●, Andersen: $y = x^{0.82}/5828$, $r^2 = 0.989$; ▼, Cyclone: $y = x^{0.81}/4169$, $r^2 = 0.975$).

A direct relationship was found between titre and aerosol concentration. The lower the titre the less likely is that significant aerosol exposure will occur

Bennett A, Parks S (2006). *Microbial aerosol generation during laboratory accidents and subsequent risk assessment.* J Appl Microbiol 100(4):658-

Where do aerosols come from?

Accident (10^9 spore/ml suspension)	Aerosol Generated (cfu/m³)	CONTROL
Centrifuge Rotor Leak*	2.30×10^4	SEALED ROTOR
Flask Breaks in Shaking Incubator*	1.15×10^3	USE PLASTICWARE
Dropping Large 2l Bottle*	1.37×10^4	USE PLASTICWARE
15ml Spill from 1m*	2.07×10^3	WORK IN CABINET

A direct relationship was found between titre and aerosol concentration. The lower the titre the less likely is that significant aerosol exposure will occur

Bennett A, Parks S (2006). *Microbial aerosol generation during laboratory accidents and subsequent risk assessment.* J Appl Microbiol 100(4):658-

Aerosols from Laboratory accidents

Accident	Casella CFU m^{-3}	Anderson CFU m^{-3}	Cyclone CFU m^{-3}
Dropping Flask (250mL 0.75 m)	173	643	1.03 x10^{3}
Syringe filter (10 mL)	3.7 x 10^{3}	493	2.07x10^{3}
Fungal Plate (4x plates dropped) *	>3.3 x 10^{3}	1.34 x 10^{3}	>1.56 x10^{5}
Centrifuge bucket (unsealed)	150	64	142
Bacterial Plate (4x 3d old plates) *	26.7	3.6	8.2
15 mL spill from 900mm	387	493	2.07 x 10^{3}

Tracer Suspension 2 x 10^{9} *B. atrophaeus* spores/mL-

** Doesn't have to be a liquid to create aerosol*

Bennett A, Parks S (2006). *Microbial aerosol generation during laboratory accidents and subsequent risk assessment.* J Appl Microbiol 100(4):658-

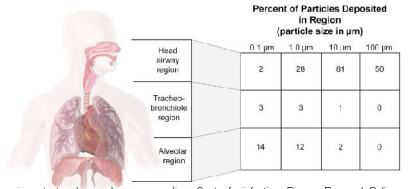
How long do particles stay in the air?

Particle Size (µm)	Time aloft
20	1.5 min
10	8.3 min
5	35.7 min
2	2.8 hrs
1	12.0 hrs
0.5	41.7 hrs

Particle	Size (µm)
Pollen	20
Clostridium sp	5.0
Bacillus anthracis	1.118
Brucella sp.	0.566
Coxiella burnetii	0.283
Hantavirus	0.096
Ebola	0.088
Parvovirus	0.022

Aerosols

- Particles can deposit in the nose, mouth, pharynx and larynx (the head airways region), deeper within the respiratory tract (from the trachea to the terminal bronchioles), or in the alveolar region.
- Where aerosol particles within the respiratory system strongly determines the health effects of exposure to such aerosols



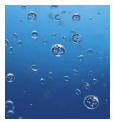
Jones RM, Brosseau LM. Ebola virus transmission via contact and aerosol—a new paradigm. Centre for infectious Disease Research Policy. http://www.cidrap.umn.edu/news-perspective/2014/11/commentary-ebola-virus-transmission-contact-and-aerosol-new-

Aerosols

Droplets >0.1 mm (>100 µm
--- they contaminate surfaces

Droplets 0.005 - 0.1 mm (5–100 µm
--- evaporate in 0.4 -1.7 seconds and
infectious aerosols may remain airborne

Particles change size - lose 50% in 1 second due to evaporation

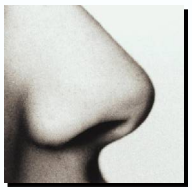


THE AEROSOL SOCIETY
the science of airborne particles

Aerosols 50-100 µm (Trapped in nasal mucosa)

Low energy input yields larger droplets >50 µm.

- Pipettes with no visible spill
- Careful pouring
- Opening lyophilised cultures
- Opening containers
- Centrifugation
- Infected animals

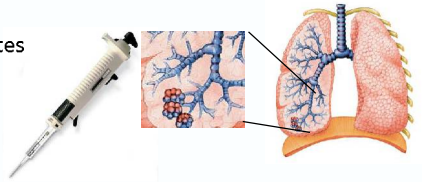


Laboratory acquired infections. 4th edition Collins and Kennedy (1999), information adapted from Kenny and Sable (1968) and Stern *et al*

Aerosols < 5 µm penetrate the alveoli

High energy input yields smaller droplets <10 µm

- Vortex
- Automatic pipettors
- Harvesting or dropping infected eggs
- Shaking machines
- Dropping culture plates
- Pipette spills
- Infected animals

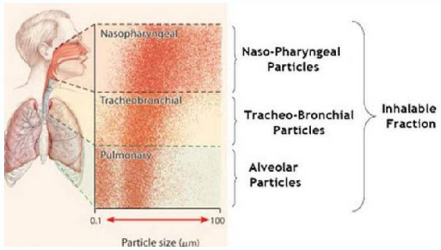


Laboratory Acquired Infections. 4th Edition Collins and Kennedy (1999), information adapted from Kenny and Sable (1968) and Stern *et al*

Droplet vs Airborne

Short vs Long (1-2 metres vs >2 metres)

Surgical mask vs N95 Masks



Droplet transmission

- A form of contact transmission in which respiratory droplets carrying infectious pathogens transmit infection when they travel directly from the respiratory tract of the infectious individual to susceptible mucosal surfaces (nasal mucosa, conjunctivae, and less frequently, the mouth) of a recipient;

"generally over short distances, necessitating facial protection"

- 1 metre rule (social distancing) now extended to 2 metres
- Influenza is considered to be droplet spread
- Surgical mask recommended

SARS, Influenza, Rubella, meningococcal

Aerosol transmission

- The dissemination of either airborne droplet nuclei or small particles in the respirable size range containing infectious agents that remain infective over time and distance.
- May be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with the infectious individual
- **N95 (P2) mask or higher is recommended**

N95 has passed US test

We don't know what we don't know

- The association of droplet exposure with infection is confounded by inhalation exposure
- Close contact with infectious people permits droplet exposure but also maximizes inhalation exposure.
- It is incorrect to conclude that because long-range transmission of infection is not observed, a pathogen is transmitted only by the droplet route.
- Given a choice, particularly when dealing with unknowns I would

We don't know what we don't know

COMMENTARY: Ebola virus transmission via contact and aerosol — a new paradigm

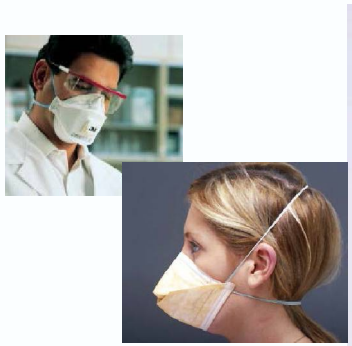
Filed Under: Ebola; Healthcare-Associated Infections; VHF

Rachael M Jones, PhD, and Lisa M Brosseau, ScD | Nov 16, 2014 Share Tweet LinkedIn Email Print & PDF

Editor's note: *Today's commentary was submitted to CIDRAP by the authors, who are national experts on respiratory protection and infectious disease transmission. In September they published a commentary on optimal respiratory protection for Ebola. and in May they published a similar*

- Influenza and rhinovirus and gastrointestinal viruses (norovirus and rotavirus) may be transmitted by small-particle aerosols, despite their primary classification as droplet- and contact-

Respiratory protection - face masks



How many have used respiratory protection?

How many have experienced issues fitting?

Which respirator?

P1: Mechanically generated particles

P2: Mechanically & thermally generated particles (RG2 & RG3 agents)

P3: For all particulates - top level protection(RG2 & RG3 agents

Which respirator?

Protection factor (PF) = $\frac{\text{Conc. of hazards outside hood}}{\text{Conc. Of hazards inside hood}} = \frac{20}{2} = 10$

Minimum (or assigned) protection factor (MPF / APF)=
Level of protection a device is expected to deliver 95% of the time –

A device with an APF of 10 can be used where the conc. of Hazard is

Assigned Protection Factors

MPF*	Respirator type	Comment
10	Half-facepiece (P2 or N95)	Respirator needs to be fit tested to the individual
50	Powered air purifying respirator (PAPR) with half-facepiece	Devices covering half-face provide lower levels of protection
50	Full-facepiece respirator with P3 or HEPA filter	Respirator needs to be fit tested to the individual
100	PAPR with P3 or HEPA filter and head-covering hood	Considered to provide high protection. Fit testing to the individual not required
10 000	Self-contained breathing apparatus (SCBA) with positive pressure demand	Not practical for most microbiological applications

* Minimum protection factor that could be assigned to the respirator type

Respirator Rules

- Respirators should not be touched while being worn
- Respirators should be changed when they become moist
- Respirators should never be reapplied after they have been removed
- Respirators should not be left dangling around the neck
- Hand hygiene should be performed upon touching or disposing of a used respirator
- Respirators should be removed outside the contaminated area and disposed of in a closed receptacle.
- Fitting models not designed to my face

Factors that affect fit (and efficacy)

- Training
- Correct fitting procedure
- Dental work
- Repeated removal and refitting of mask
- Smiling and frowning
- Employee attitude
- Makeup on face
- Design of respirator - one make or size does not fit all!
- Facial hair, glasses, headwear

Factors affecting face seal

- Beard or facial hair
- Shape or size of face
- Long hair
- Earrings
- Glasses/spectacles
- Facial markings – scars or moles

- Any of these can potentially impair the performance of P2 masks

The problem with hair

- Beards, side burns, moustaches – even stubble
- Long hair

Should have a policy that staff are clean shaven at the start of their shift

Particle	Size (µm)
Pollen	20
Clostridium sp	5.0
Bacillus anthracis	1.118
Brucella sp.	0.566
Coxiella burnetii	0.283
Hantavirus	0.096
Ebola	0.088
Parvovirus	0.022

Human hair 150 µm

Donning the Mask – Kimberley-Clark N95

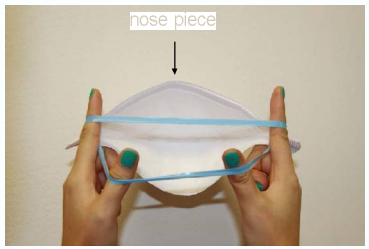
- Duckbill mask
-

Donning the Mask – Kimberley-Clark N95

- Separate the mask edges
- Put a small bend in the nose wire
- Hold upside down and gently shake the straps

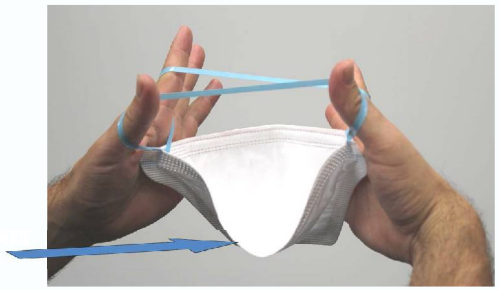
Donning the Mask – Kimberley-Clark N95

- Separate the 2 headbands
- Ensure the nose piece is at the top of mask
-



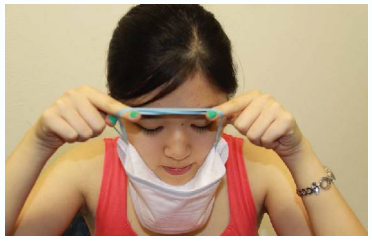
Donning the Mask – Kimberley-Clark N95

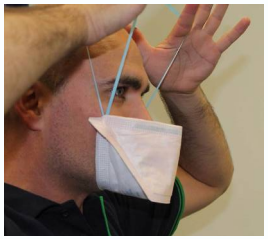
- Roll your thumbs up
-



Donning the Mask – Kimberley-Clark N95

- Place chin into “cup” of mask
- Pull headbands up and over your head





Donning the Mask – Kimberley-Clark N95

- Release lower headband
- Release lower band from thumbs position under your ears
- Position other headband at back of

Donning the Mask – Kimberley-Clark N95

- Ensure that mask is symmetrical on face and edges aren’t folded
- Conform nose piece to your nose and across cheek bones
- Adjust

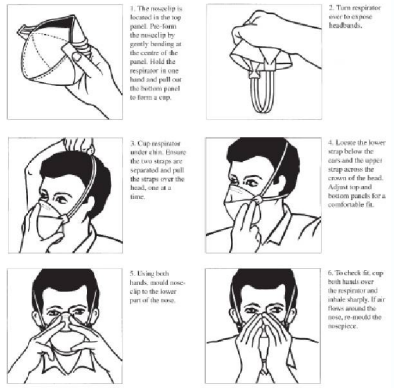
Donning the Mask – Kimberley-Clark N95

- Mask firmly positioned under chin
- Straps positioned at base of neck at back of

Fit Checking

- Inhale and exhale several times while wearing the mask
- Mask should collapse slightly on inhalation and expand slightly upon exhaling
- The wearer should not feel any air leaking around the mask with

3M™ 9320
Dust / Mist Respirator



Incorrect fit

Inappropriate fit may be identified by:

- Air leaking around mask
- Mask not expanding and collapsing
- Glasses or face shield/goggles fogging

Reposition mask

Repeat fit check

Vest-Pocket Respirator Guards Workers' Lungs

SMALL enough to be carried in a vest pocket, a one-ounce respirator protects industrial workers against dust with new convenience. The unbreakable, soft rubber device covers the nose alone, so that a wearer can talk, eat, smoke, and don glasses or goggles. While the user breathes naturally through his nose, an ingenious valve exhausts stale air and allows only filtered air to enter. Although the replaceable filter folds to wafer size, its effective area of nine square inches assures easy inhalation. Elastic ear loops hold the respirator.

Tiny nose nosis do not interfere with talking or eating

Popular Science

Doffing mask

- Never remove mask inside the contaminated environment
- Perform Hand hygiene
- Remove mask by the headbands only
- Perform Hand hygiene again

Fit or seal check and must dos

- A fit check must be performed every time a mask is applied
- Ensures that you have achieved a good seal
- Never re-use a mask.
- Wet or damaged masks must be replaced immediately
- Always perform hand hygiene before application and after

Who needs Fit Testing?

- New starters or those using a respirator for the first time
- Anyone changing respirator brand, size or type
- Fit testing is different to fit checking
- Guidance for fit testing contained in AS/NZ Standard 1715 or OSHA 29 CFR 1910.134 Appendix A
- Two types of fit testing
  - Qualitative
  - Quantitative

Comparison of qualitative and quantitative

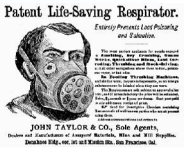
Qualitative	Quantitative
Inexpensive ($400 for 3M kit)	Expensive ($18K)
Relies on subjective response	Objective measurement
Simple to use	Allows quick determination
Particle test (not gas or vapour)	Generates particles or measures existing
Not suitable for high Factor devices PF>100	Can test PF>100
Some people don't respond to reagents	Maintenance and calibration required

Performing Qualitative fit test

- Fit test kit (hood, collar, sensitivity solutions, 2 nebulizers, instructions)
- Private area away from distractions
- Washing facilities and drinking water
- Stopwatch
- Allow 20-30 minutes per person
- FT-10 Saccharin
- FT-30 Bitrex
- May need several – time to wash down & dry units between test

Performing Qualitative fit test

Questions



Powered Air Purifying Respirator (PAPR)

Greg Smith| Microbiological Security Manager
Training Course April 2015

AUSTRALIAN ANIMAL HEALTH LABORATORY
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PAPR Training Overview

This training covers:

- The need for PAPR's
- Typical Situations for Use
- Advantages of PAPR's
- PAPR Components
- Pre Use Checklist
- System Verification & Calibration
- PAPR Operation
- Fitting Straight

This training is specifically focused on the 3M Jupiter PAPR

The Need for PAPR's

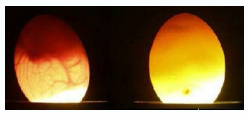
Powered Air Purifying Respirators are designed:

To provide respiratory protection for staff who may potentially be exposed to airborne microorganisms or toxic / noxious fumes and chemicals

Typical Use Situations

Typical use situations for PAPR's at AAHL include:

- Laboratory staff conducting activities outside of primary containment with respiratory pathogens
- Handling influenza infected eggs in a laboratory
- Investigating or cleaning up certain types of spills
-



PAPR's should be used anytime procedures demand so or when a risk assessment dictates use

Advantages of PAPR Use

Using PAPR's offers certain advantages including:

- No fit test required (one size fits all)
- Cooler to work in due to air movement
- Provides full face protection
- Glasses can be worn easily
- Suitable for men with beards /facial hair
- Has a higher protection factor than most other forms of

Advantages of PAPR Use

PAPR has a higher protection factor than most other forms of respiratory protection

MPF*	Respirator type	Comment
10	Half-facepiece (P2 or N95)	Respirator needs to be fit tested to the individual
50	Powered air purifying respirator (PAPR) with half-facepiece	Devices covering half-face provide lower levels of protection
50	Full-facepiece respirator with P3 or HEPA filter	Respirator needs to be fit tested to the individual
100	PAPR with P3 or HEPA filter and head-covering hood	Considered to provide high protection. Fit testing to the individual not required
10 000	Self-contained breathing apparatus (SCBA) with positive pressure demand	Not practical for most microbiological applications

* Minimum protection factor that could be assigned to the respirator type

Table from AS/NZ 2243.3 Safety in laboratories: Part 3 Microbiological Safety and Containment

PAPR Components

The following components make up the full PAPR unit:

- Battery & Battery Charger

- Calibration Tube (Black Ball)
- Air Flow Tube (White Ball)

PAPR Components (continued)

- Backpack and Belt

- Filters

- Air Hose & Head Piece / Hood

PAPR Filters

- Filters

No P3 – No Use
Both filters of same type
Both Filters changed at same time

Replace after 3

Replace after 12 months

Remember to remove seal before use

Pre Use Checklist

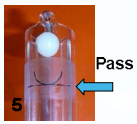
Prior to using a PAPR the following must be carried out:

- Check unit is complete & no visible faults including hood
- Inspect the hose / head piece / hood for damage
- Check filters replace if out of date or not sure
- Insert charged battery
- Undertake system verification check to ensure sufficient airflow

Pre Use Checklist - System Verification Check

To ensure sufficient airflow:

- Attach the filters
- Disconnect the air hose
- Insert the air flow indicator tube
- Turn the unit on



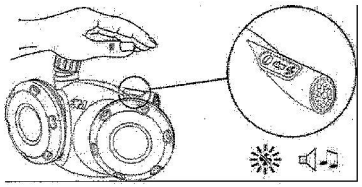
Note: *If the ball indicates insufficient airflow this may mean low battery charge or clogged filters. The unit will need calibration if the battery and filters are functioning correctly*

Pre Use Checklist – Audible Alarm

The PAPR contains an audible warning alarm for low air flow.

To check it is functioning correctly:

- Cover the turbo outlet with your hand
- Check that the alarm sounds



Failure of system verification check

- If the unit fails the system verification check
- Check battery and replace with a fully charged battery
- Check filters age and condition (wet, damaged) and replace if necessary
- Repeat system verification check
- Calibrate the unit

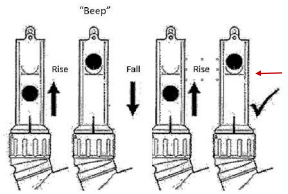
Pre Use Checklist - Calibration

To calibrate the PAPR Unit

- Make sure unit has been running for **10 minutes**
- Remove the filters
- Attach the calibration tube
- Press and hold in the on button for the entire calibration
- [illegible]

Pre Use Checklist – Calibration (continued)

- The fan speed will increase and the ball will rise until a short beep
- The ball then falls to the bottom of the tube before slowly rising up the tube again as the motor speed increases
- When the ball moves above the pass mark on the tube release the on button to set the calibration point



PAPR Operation

- Once the unit has been checked, assembled and is functioning correctly:
- Put on the back pack unit and adjust strap to fit
- Put on all other protective clothing lab gown / gloves etc
- [illegible]

Note: Placing the PAPR under protective clothing allows the gown to be removed easily prior to removing the PAPR which should be removed last

PAPR Storage

After use PAPR units and all components should be cleaned and stored:

- In the packaging provided
- In a dry and clean location
- Away from direct sunlight or high temperature sources
- Filters should be left on the units to protect the seals against mechanical damage
- [illegible]

Note: Battery life is 8 hours. Recharging in line with manufacturers instructions; up to seven days but not [illegible]

Dos and Don'ts

- Ensure respirator is in good working order
- Complete preflight check and ensure air flow is sufficient
- Always fit identical filters
- Always change both filters together at a frequency recommended by manufacturer
- Always clean and store properly
- Ensure other PPE is compatible
- Never use in oxygen deficient atmospheres
- Never use particle-only filters against gas/vapour or vice versa
- Never use if dirty, damaged or incomplete
- Never use if providing insufficient air or alarm is activated
- Never keep working if fan stops or the flow rate falls – leave work area immediately

PAPR Training - Questions

More details can be obtained from 3M or from AS/NZ Standard 1715:2009 Selection, use and Maintenance of

Thank you

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Responding to Incidents and Spills

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April 2015

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Biosafety: Microbiological Incident

A microbiological Incident is an occasion when an accident or failure releases or has the potential to release microbiological material

Incident Response: Needle Stick, cut or bite

- Decontaminate glove before removing
- [illegible]
  - *if soap and water is unavailable use alcohol hand wash or 80% alcohol solution*
- If needle stick promote bleeding but do not squeeze or cause additional trauma
- If cut- apply clean dressing and apply pressure to limit blood loss
- Inform an appropriate person (e.g. supervisor or Biosafety officer) as soon as possible after the exposure so assessment and follow-[illegible]

Incident Response: Splashes

- Irrigate mucous membranes or eyes (remove contact lenses) with water or normal saline
- If eyes are contaminated, rinse while they are open, gently but thoroughly (for at least 30 seconds) with water or normal saline
- If blood or body fluids get in the mouth, spit them out and then rinse the mouth with water several times
- If skin is contaminated but no injury wash thoroughly with soap and water
- If clothing is contaminated, remove clothing and shower if necessary
- [illegible]

Incident Response: Spills

Your reaction to a spill will vary as to the nature of the incident:

- The Biosecurity Level of the agent
- The location of the incident
- [illegible]

RESPOND to Spill

RESPOND

- ✓R [illegible]
- ✓E [illegible]
- ✓S [illegible]
- ✓P [illegible]
- ✓O [illegible]
- ✓N [illegible]
- ✓D [illegible]

Remove contaminated clothing

RESPOND

Remove gloves and lab gown

Remove shoes if wet

Remove clothing if fluid/core material has soaked through gown

Exit area

RESPOND

- Exit area as quickly as possible, warning others
- Avoid inhaling aerosols

Stop others entering

RESPOND

- Use signage on door to restrict access (Administrative control)
- Inform staff in suite of spill & restricted access
- Close doors to contain aerosols (Engineering control)

Phone Biosafety Office

RESPOND

Phone Biosafety Office or Supervisor

Discuss incident and approach

Organise Clean up

RESPOND

- Speak with the Biosafety officer or supervisor for advice or assistance to clean up spill
- Gather material, disinfectants, mops, absorbent material & PPE and prepare for clean up
- PPE should be appropriate to risk and transmissibility of organism
  - Gloves ✓
  - Safety glasses / PAPR?
  - Gown or Tyvek?
  - Boots

No rush

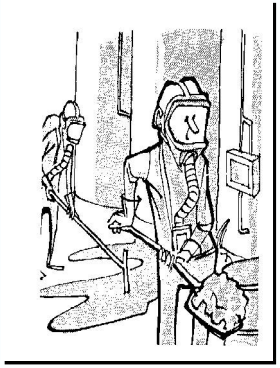
RESPOND

30 Minutes

- Take your time & consider your approach
- Allow time (at least 30 minutes) for infectious aerosols to 'settle'
- Directional air flow will remove aerosols via HEPA filter (Most BSL3/PC3 labs have between 14-20 air changes per hr)
- Don't rush to don PPE or clean up spill

Decontaminate area

RESPOND



- Clean up under the direction of the biosafety officer or supervisor.
- Use good technique and equipment, possibly with help from the "spills team"
- Prepare room for gaseous formaldehyde decontamination if determined necessary by [illegible]

Disinfectants

- Choose a disinfectant that is appropriate for the organism associated with the spill and the volume and nature of material involved
- Consider material compatibility
- Make up fresh - where applicable (eg [illegible])

Disinfectants

- 70% Alcohol is <u>not suitable</u> as a disinfectant for spills clean up and should not be used for anything other than cleaning, skin disinfection or laboratory surfaces that have been previously disinfected with a more appropriate disinfectant.
- 70% Alcohol can be used for cleaning the surface of an already cleaned BSC or work bench prior to commencing work
- 70% Alcohol refers to either 70% v/v Isopropanol in water or 80% [illegible]

Clean up: a spill outside of BSC

- Approach from a clean area.
- Clean as you go – make a clean path to the spill
- Be on the look out for the unexpected (fragments of broken bottles travel surprising distances).
- Consider other hazards e.g.
  - radiochemical
  - [illegible]

Clean up: a spill outside of BSC

- Do not create further aerosols by vigorous mopping or pouring disinfectant directly onto the spilt material
- Cover spilt material with a disinfectant soaked towel (paper or cloth)
- Add further disinfectant to the spill working from the outside in
- Allow the disinfectant to act for <u>at least 10 minutes</u>

Clean up: a spill outside of BSC

- Remove waste to biohazard bags and tote boxes.
- Report finding to the MSM and your supervisor.
- Tell others about your experiences and how to avoid similar [illegible]

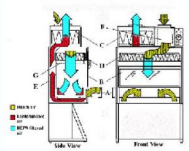
Clean up: small spill inside a BSC

10 Minutes

- Leave BSC running
- Small spills (<1 mL) should be immediately wiped up using disinfectant-soaked paper towel or other absorbent or flooding area with disinfectant
- Allow the disinfectant to act (for at least 10 minutes) before discarding waste into an autoclave bag for disposal.
- Do not let the material dry onto the BSC work surface.
- Repeat the step for large spills if needed

Clean up: large spill inside a BSC

- Leave BSC running
- Cover pools of liquid with disinfectant-soaked paper towelling to absorb the bulk
- Remove gloves and discard in cabinet
- If your gown is contaminated, remove it and discard for



Clean up: large spill inside a BSC

- Remove sharp instruments with forceps and dispose of safely
- Decontaminate cultures, media and materials adjacent to spill
- Wipe down work floor and cabinet work zone with fresh disinfectant solution
- Large spills inside Class IIs may run into the sump of

Clean up: large spill inside a BSC (2)

- If spill is large use sufficient disinfectant or concentrate (Virkon powder or Terminal G) to dilute and inactivate sump area
- With the cabinet running, lift the work floor and clean its under surface and the sump floor with disinfectant
- If the sump is contaminated flood floor with disinfectant solution to completely cover sump floor
- Seek advice on whether cabinet should be decontaminated

Clean up: a spill inside centrifuge

- If a failure is suspected <u>during</u> a centrifuge run
- Immediately switch the machine off and allow the rotor to come

- **DO NOT OPEN THE CENTRIFUGE**
- RESPOND
- Put a "DO NOT OPEN" sign on the centrifuge room door

Clean up: a spill inside centrifuge

- **STOP NO ENTRY**" sign on the centrifuge room door and contact the Biosafety officer or supervisor. (RESPOND)
- Ask supervisor or biosafety officer for advice on clean-

If a spill is discovered <u>after</u> opening the centrifuge;

- Avoid breathing any aerosols and immediately but gently (avoid aerosols) close the centrifuge

Clean up: a spill inside centrifuge

- **STOP NO ENTRY"** sign on the centrifuge room door and contact the Biosafety Officer or supervisor
- Discuss the nature of the incident, the agent involved and its volume and titre with the biosafety officer or supervisor
- Where necessary arrange assistance from biosafety office for inspection and assistance with clean-up of the spill and

Questions

Thank you

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Hazard Identification and Risk Assessment

Andrew Hill | Biocontainment Microbiologist
April 2015

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Identification of the hazard

- Know your agent
- Inherent hazards
  - Known *vs.* Unknown
- Source of material
- Provenance

Hazard:- The 'entity' with potential to cause harm

Risk:- The likelihood of the harm being realized

Hazard awareness

- Air
- Shoes
- Paper
- Sharps
- Culture
- Pens
- Waste
- Centrifuge
- Animals
- Eggs
- Gowns
- Freezer
- Pipettes
- Gloves
- LN_2
- Porous material
- Storage
- Computer keyboards
- Autoclave
- Telephone handset

Aerosols
Entry via Inhalation

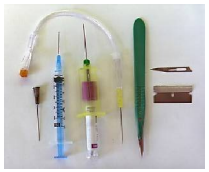
- Energy in – movement out
- Distribution very difficult to model
- May take time to dilute in BSC
- May settle
- Created inside primary containers
- Liquid droplets or dry solids suspended in the air for an extended period
  - Pipetting
  - Vortexing
  - Sonicating
  - Bead Beating
  -

Droplets
Entry via Ingestion or passive inoculation (broken skin, mucosal membranes)

- Relatively large quantity of material
- Possible breach of aperture
- Fall quickly
- Gloves
- Sleeves
  - Pipetting
  -

Sharps
Entry via Direct inoculation

- Glass, needles, pipettes, scalpels, scissors, thermometers
  - What is 'a sharp'?
- Require manual handling
  - Often in one hand
- Remain sharp after use
  - Become dirty / infectious and sharp
-



Risk assessment

To look is one thing, to see what you look at is another, to understand what you see is a third, to learn what you understand is still something else, to act on what you learn is all that really matters.
—Winston Churchill

"Nothing is more dangerous in microbiology than that which is thought to be safe"
- D. A. Rutter

Microbiological Risk Assessment Exercise 1

Prepare a risk assessment framework for field sampling of bat materials (swabs, urine and tissue) and transport to your laboratory.

Microbiological Risk Assessment Exercise 2

Prepare a risk assessment framework for processing of tissue, swabs and urine for virus isolation including inoculation of both eggs and tissue culture.

Microbiological Risk Assessment Exercise 3

You have been asked to investigate material collected by a probe on Mars. What considerations do you make in your risk assessment?

Hazard control hierarchy – Interpreting a risk assessment and implementing mitigations

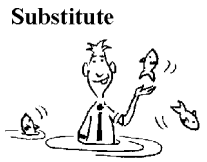
•ERIC - PD

Accompanied by How to Study Sharks

ERIC-PD Elimination of the hazard

- Abstinence
- Substitution
- Inactivation

No sharks



Guppies

ERIC-PD

Reduction of the hazard

- Volume
- State
- Titer
- Genetically deficient

Controlling risk

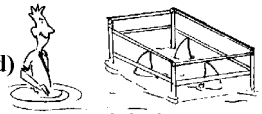
- Process
  - Minimal steps
  - Maximum manipulation within containment
  - Best ergonomics

Less, Smaller Sharks

ERIC-PD

Isolation of the hazard – Barriers

- Pass box, dunk tank, filters, BSC's, Primary containment, centrifuge, various equipment outside BSC, Secondary Containment the room, filters, door,

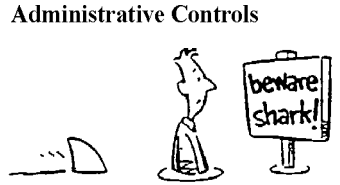


Caged Sharks

ERIC-PD

Control of the hazard - Air Flows, Disinfectants

- Air flows
- Disinfectant (knock down)
- Sterilisation
- Administrative Controls



10 mins. max. in the pool

ERIC-PD

PPE against the hazard – Personal Barriers

- *Often considered as a matter of convenience*
- Gloves
- Gown
- Glasses
- Masks
- Respirators
- Hoods
- Suits
- Disposable / Reusable
- Shared / Personal

Last resort !!

ERIC-PD

Discipline – the last line of defense

- Washing Hands
- Waiting
  - contact times
  - air changes

Microbiological Risk Assessment

Examples of areas to consider (non-exhaustive)

1. **Disease**
   - Disease severity
   - Transmission routes
   - Prophylaxis availability
   - Susceptible groups
2. **Task**
   - Volume
   - Titre
   - Processes
   - Equipment
   - Live agent
   - PPE
3. **Source**
   - Sent or collect
   - Transport
   - Packaging
   - Prior knowledge
   - Previously tested?
4. **Nature of sample/Agent**
   - Antibiotic resistance
5. **Decontamination and disposal of waste**
   - Disinfectant
   - Inactivation
   - 'Offensive' waste
   - Destroy / Dispose
6. **Staff**
   - Training
   - Vaccinations
   - Lead in time
   - Any known allergies
7. **Storage**
   - Samples
   - In use
   - Product / Derivatives
8. **Other matters to consider**
   - Licences / Permits
   - Positive control material
   - Can we pass the material to someone more experienced?

Thank you

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