Introduction

Everyone who has suffered illness knows that the human body can be infected with micro-organisms that cause disease, with symptoms ranging from mild discomfort to death. University staff working in a clinical context are reminded of this on a daily basis and take safeguards to protect their health from this unavoidable contact with infected people and samples. However, other staff carrying out research involving samples of human blood, tissues and other specimens do not have this daily reminder and often have little knowledge of the sample donor's clinical history. Therefore, this Guidance Note has been designed to minimise the risk of ill health to employees carrying out laboratory research that involves the use of human blood, tissues or other specimens potentially infected with lethal pathogenic micro-organisms. It is not applicable to:

- employees working in a clinical context at the point of contact with patients
employees working with samples that are known to contain human pathogens
(refer to Guidance Note Safe Working with Micro-organisms)

Legislation
The fundamental basis of current legislation on working safely with human blood, tissues and other specimens is to assess the risks to health before starting the work so that appropriate precautions to safeguard health can be put in place. The specific legislation concerning work with human blood is The Control of Substances Hazardous to Health Regulations 2002. Essentially these regulations make legally enforceable the following sensible measures to ensure safe working with human blood, tissues and other specimens:

- assessing the risk to health before starting work
- selection of appropriate precautions to eliminate or at least minimise the risk to health
- ensuring the precautions are used through adequate supervision
- ensuring the precautions are effective through maintenance, inspection and testing
- ensuring staff are working safely through provision of information, instruction and training
- providing health surveillance and vaccination where appropriate

For research involving human blood, tissues and other specimens where the presence of potentially lethal micro-organisms is unknown the Regulations state:

- where there is no intention to work with pathogens but they may be present in samples the work must be carried out at Containment Level 2, possibly with additional control measures, unless it is known or suspected that a higher Containment Level is required

- if it has not been possible to carry out a conclusive risk assessment and the work may involve a serious health risk to employees then Containment Level 3 must be used.
Effective implementation of this Guidance Note will ensure safe working with human blood, tissues and other specimens and compliance with the COSHH Regulations.

**Risk Assessment**

An assessment of the health risks before starting work with human blood, tissues and other specimens must be completed using Form USS/HumanSamples or an equivalent. The risk assessment must be specific for the procedures involved in the work and take account of the nature and source of the samples to be handled. In many cases the risk assessment will identify the potential of a fatal infection arising from the work; fortunately the consistent application of good working practices and avoiding the use of sharps will eliminate, or at least substantially reduce, the risk of serious illness. When working with samples from residents of the UK the following guidelines may be appropriate:

- blood, tissues and other specimens that have not been screened for commonly occurring pathogens can be handled at Containment Level 2+
- propagation of peripheral white blood cells from individuals not known or suspected to be infected with HIV or other viruses may be handled at Containment Level 2+ provided incubation does not exceed 100 hours
- although blood and tissues known to be negative for commonly occurring pathogens (eg blood from Blood Transfusion Service) can be handled at Containment Level 2 as best practice Containment Level 2+ should be used where possible

Appendix 1 details the control measures required for Containment Level 2 and 2+.

**Taking Blood**

If blood to be used in research is taken from laboratory personnel the following procedure must be adopted:

- ethical approval must be given
- written consent must be obtained beforehand by the person taking the blood. This should not be the supervisor of the project to avoid accusations that unfair
pressure was exerted on the volunteer. It should be made clear that a volunteer can withdraw consent at any time.

- blood must be taken only by a registered medical practitioner, phlebotomist, or by a person whose competence has been verified in writing by an accepted organisation. Contact the University Biological Safety Adviser for details of a training course held by the Clinical Skills Unit, Ninewells Hospital.
- blood must be taken in a quiet area set aside for this purpose away from the laboratory.
- fresh needles and syringes must be used for each volunteer from stocks held for that purpose in the room or area where the samples are taken.
- the needle must be carefully removed before discharging the blood into screw topped specimen containers to prevent aerosol formation (unless the Vacutainer system is used.)
- all sharps must be disposed of in a suitable sharps container.
- the volume of blood taken from an individual must be recorded.

Sample reception
Packages containing samples of human blood, tissues and other specimens should be opened only in the laboratory by trained staff. Arrangements to ensure packages are not opened by untrained staff, especially packages received in the postal system, must be in place. When opening packages the risk of leakage in transit must be considered so that appropriate precautions can be taken. Samples must be stored securely in a designated fridge or freezer, and be clearly labelled.

Waste disposal
All waste should be rendered non-infectious by a validated method before disposal if possible (eg by heat treatment in an autoclave). Untreated items may be disposed of through the Clinical Waste stream if this is not possible provided that they are packaged securely to avoid leakage in transit (refer to Guidance Note Safe Disposal of Clinical/Biological Waste).
Local rules

A set of simple, easily understood instructions must be formulated and a copy given to each laboratory worker handling human blood, tissues and other specimens. They should include procedures for:

- disinfection of contaminated surfaces
- safe collection, transport and disposal waste
- safe handling and transport of samples within and outside the laboratory
- secure storage of samples

An example of a typical set of local rules applicable to all laboratories where human blood, tissues and specimens are handled is given in Appendix 2.

Instruction, information, training and supervision

Training should provide:

- information regarding hazards and safeguards to prevent exposure/infection
- knowledge and understanding of local rules
- knowledge and understanding of disinfection policy
- knowledge and understanding of waste disposal arrangement;
- knowledge and understanding of emergency spillage procedure;
- technical competence for all aspects of the work eg use of microbiological safety cabinet, centrifuges and automatic pipette aids

Staff and students working with blood, tissue and samples should be competent to work safely. For a new member of staff competence should not be assumed but must be verified and, if necessary, training should be provided. Training programmes should be tailored for each individual taking into account their level of experience and the type of work undertaken. Written records of training should be kept. A high standard of supervision of the work should be maintained at all times to ensure control measures to minimise exposure are used.

Extra attention must be given to the needs of undergraduates, and other young people. Undergraduates should not work with unscreened samples unless they receive a very
high level of training and supervision. Young people on work experience schemes should not work with human blood, tissues and other specimens, and should be closely supervised at all times when working in a hazardous area.

**Health Surveillance and Vaccination**

Generally health surveillance is not required. Laboratory workers carrying out procedures with a significant risk of a ‘needlestick’ injury with unscreened blood, and any tissue or specimen containing blood should be vaccinated against the Hep B virus, and have their response assessed. The University Occupational Health Service will provide vaccination if required. Full details can be found in Safety Policy Arrangement 37-2008-Hepatitis (see http://www.dundee.ac.uk/safety).

**Accident Procedure**

Following an accident that results in:

- **superficial contamination of the skin**
  the affected area should be washed with soap and running water, with gentle scrubbing.

- **contamination of the eye**
  the eye should be irrigated with the eye wash.

- **contamination of nose or mouth**
  they should be washed out with copious amounts of tap water.

- **breakage of the skin**
  the wound should be encouraged to bleed, and the area washed with soap and water for several minutes but without scrubbing. The wound should be covered with a waterproof dressing.

The accident should be reported immediately to the Principal Investigator, BSA and Occupational Health Service (or A&E if OH nurse is not available) for medical intervention if required. The source of contamination (specimen, sample, material) should be identified and retained for testing if required.

Measures must be taken to ensure the confidentiality of people potentially exposed to blood borne pathogens as a result of an accident.
Laboratory personnel involved in the clean up and disinfection of the spill must be informed of the risks and trained in safe working procedures. They must not place themselves at risk, especially if the accident involves broken glass or other sharp objects.

Spillage Procedure

**spill onto bench**

small spills
- spray with 2% Virkon solution or freshly made hypochlorite 10,000 ppm
- mop up spill immediately with paper towels
- place contaminated paper towels into clinical waste bin
- place contaminated disposable gloves into clinical waste bin
- spray bench with 2% Virkon solution or freshly made hypochlorite 10,000 ppm, leave for 10 minutes before drying with paper towels
- place paper towels into clinical waste bin

large spills
- cover spill with Virkon powder or paper towels which are then treated with freshly made hypochlorite 10,000 ppm
- leave for at least 3 minutes
- wipe up Virkon powder with paper towels and place contaminated paper towels into clinical waste bin
- place contaminated disposable gloves into clinical waste bin
- spray bench with 2% Virkon solution or freshly made hypochlorite 10,000 ppm, leave for 10 minutes before drying with paper towels
- place paper towels in clinical waste bin

**spill onto floor**
- move away from the area for a few minutes to allow aerosols to disperse, keep other people away
- treat as above
• remove contaminated clothing and footwear and place in plastic sack
• contaminated clothing should either be soaked in cold water, and laundered at high temperature (at least 80°C) or disposed of as clinical waste
• contaminated footwear should be washed with 1% Virkon

**spill involving broken glass**

• thick rubber gloves or two pairs of disposable gloves must be worn.
• treat with Virkon or freshly made hypochlorite, 10,000ppm as appropriate for small or large spill
• sweep up broken glass with dust pan and brush, empty into Sharps Bin
• carefully mop up spill with paper towels since small fragments of glass may remain
• immerse dust pan and brush in 2% Virkon, or discard as clinical waste

Appendix 1

**Laboratory Containment Level 2**

Laboratory Containment Level 2 must be used for work with screened human blood, tissues and other specimens

**Management Measures**

• discuss risk assessment with staff and students
• issue Local Rules
• provide appropriate training
• provide appropriate supervision
• ensure samples (especially those in the post) are opened in the laboratory by trained staff
• report accidents to BSA and Safety Services

**Physical/Engineering Measures**

• restrict access to the laboratory to trained staff and students involved in the work
- post a biohazard sign on the laboratory entrance door.
- provide adequate space (ie 24m3) in the laboratory for each worker.
- ensure laboratory is easy to clean with bench surfaces that are impervious to water, easy to clean and resistant to acids, alkalis, solvents and disinfectants.
- ensure laboratory has a wash basin located near the laboratory exit with taps that can be operated without being touched by hand.

**Operating Procedures**

- close laboratory door when work is in progress
- do not take personal belongings into the laboratory
- wear side or back fastening laboratory coats and remove them when leaving the laboratory.
- store laboratory coats in a clearly defined place apart from personnel clothing and launder them at suitable intervals.
- remove contaminated laboratory coats on leaving the work area and keep apart from uncontaminated clothing. They must be decontaminated and cleaned or, if necessary, destroyed.
- do not eat, chew, drink, smoke, take medication, store food or apply cosmetics in the laboratory.
- do not mouth pipette.
- cover lesions on exposed skin with a waterproof dressings.
- wash hands immediately when contamination is suspected, after handling materials and before leaving the laboratory.
- when gloves are worn, remove them before handling items likely to be touched by others (eg telephones) or when leaving the laboratory.
- in general, work can be carried out on the open bench but care must be taken to minimise the production of aerosols. Laboratory procedures likely to create infectious aerosols must be conducted in a microbiological safety cabinet, isolator or be otherwise suitably contained.
- have available an effective disinfectant for routine disinfection, and for immediate use in event of a spill.
- decontaminate bench surfaces regularly.
• store used laboratory glassware and other materials awaiting sterilisation before recycling in a safe manner. Pipettes, if placed in disinfectant, should be totally immersed.

• transport materials for autoclaving in robust containers without spillage. Dispose of waste in clearly labelled clinical waste containers.

• store samples in clearly labelled and leakproof containers. Ensure they are kept secure at all times. Maintain an accurate inventory.

Laboratory Containment Level 2+

Laboratory Containment Level 2+ must be used for work with unscreened human blood samples either for research or diagnostic purposes where there is no intention to propagate or concentrate a Hazard Group 3 pathogen.

Additional Operating Procedures to Containment Level 2 are:

• carry out work in a designated workstation within the laboratory that is clearly identified. The area should be chosen to ensure people can work undisturbed and to minimise the risk of collisions. The workstation should be cleared of unnecessary equipment before work commences. There should be sufficient benchspace to ensure the workstation is not cluttered and working practices are not compromised by lack of space. The workbench and any equipment on the bench must be disinfected immediately on completion of the work.

• do not use of sharps (anything that could puncture the skin, eg needles, scalpels, glass pipettes, dissection instruments, scissors, wire loops that are not closed circles, glass microscope slides and coverslips) and glassware if possible. Glass items should be replaced with a plastic equivalent. If a sharp object must be used then handling procedures must be established to minimise the risk of puncturing the skin.

• Used sharps must be placed immediately into a sharps bin. Do not leave sharps lying about, or dispose of sharps in plastic bags. Hypodermic needles must not
be re-sheathed before disposal. Do not use a scalpel blade without its handle. Sharps bins must not be filled more than 2/3 full. Sharps that are likely to be contaminated with pathogenic micro-organisms should be autoclaved in the sharps bin before collection for incineration.

- Wear a single pair of single use (disposable) gloves should be worn. If during use the glove is punctured or grossly contaminated it should be removed and disposed of. Gloves should be removed before handling items likely to be touched by others (eg telephones). On completion of work, gloves should be removed and discarded, and hands should be washed.

- samples should be centrifuged in sealed buckets ideally with transparent lids, or sealed rotors. These should be cleaned and disinfected regularly and immediately following leakage. If a sample has been known to leak during centrifugation then the bucket or rotor must be opened in a microbiological safety cabinet. Seals on buckets and rotors should be checked before use for wear and damage and replaced if damaged.

- in general, work can be carried out on the open bench but care must be taken to minimise the production of aerosols. Laboratory procedures likely to create infectious aerosols must be conducted in a microbiological safety cabinet, isolator or be otherwise suitably contained eg homogenisation. When a microbiological safety cabinet cannot be used and there is a risk of splashing and aerosol generation full face protection and a plastic apron must be worn.
Appendix 2

Typical Local Rules for Handling Human Blood, Tissues and Other Specimens in the Laboratory

The following precautions must be followed when working with samples that have been screened for known pathogens.

Work cannot commence unless you have received instruction and training from PI or other competent person.
The laboratory must be kept tidy and organised such that separate writing and working areas are available.
The laboratory door should be kept closed.
Samples arriving in the laboratory must be stored securely in a designated fridge or freezer.
Eating, chewing, drinking, smoking, applying cosmetics, storing of food and outdoor clothing in the laboratory is forbidden. Workers should avoid touching their mouth or eyes when in the laboratory.
Laboratory coats must be worn at all times in the laboratory and removed before leaving.
Hands should be washed regularly and always before leaving the laboratory.
Mouth pipetting is forbidden.
All procedures must be performed so as to minimise production of aerosols: rapid pouring of liquids must be avoided; pipettes used slowly; bottles opened carefully.
All workers in the laboratory must cover cuts and abrasions to exposed skin with a waterproof dressing.
On completion of work, benchtops must be cleaned with (appropriate detergent/disinfectant).
Waste materials are to be placed in (specify container for autoclave or Clinical Waste stream).
All specimen containers, glassware and used equipment must be completely immersed in (appropriate disinfectant, concentration and time) before cleaning and disposal.
Following spillages contaminated surfaces must be disinfected immediately with (appropriate disinfectant, concentration and time).

Accidents must be reported to PI and BSO. Following contamination of skin, eyes or nose and mouth they should be washed immediately with water. If the skin is broken, the wound should be encouraged to bleed, washed thoroughly with soap and water without scrubbing, and covered with a waterproof dressing.

Additional precautions for working with samples that have not been screened for known pathogens in the Laboratory.

The use of sharps is prohibited unless there is no alternative. Used sharps must be placed directly into a sharps bin for disposal. Wherever possible, sharps bins must be autoclaved before incineration.

Laboratory coats must be worn at all times in the laboratory and removed before leaving. They should be side or back fastening with a high collar and elasticated sleeves and should be stored on a dedicated set of pegs, away from other clothing. The remainder of the body should be protected with suitable clothing.

Gloves must be worn at all times and removed before leaving the laboratory or touching items used by others (eg telephone).

Single use (disposable) gloves must not be reused. Multi-use gloves must be checked for integrity before use.

In the event of gloves becoming damaged or grossly contaminated the gloves must be discarded, hands washed and new gloves put on.

Eye protection and a plastic apron should be worn if the work activity is likely to cause splashing.

Work must be carried out at a clearly defined and secluded workstation.

On completion of the work the workstation and all equipment must be disinfected.

Samples must be centrifuged in sealed buckets.