PART 3 - CONTROL MEASURES AGAINST BLOOD-BORNE INFECTIONS

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Guidance on safe working practices

Guidance on safe working practices for health care workers has been published by the UK Health Departments[1], using a task-related approach to the application of controls. This approach considers the potential risk of exposure to BBV from a range of activities. Some activities are specifically defined as exposure prone procedures (EPP) and include major surgery, including obstetrics and gynaecology, cardiothoracic and trauma orthopaedic. EPP are associated with a risk of disease transmission from patient to healthcare worker and vice-versa. Emphasis is placed on assessing the exposure-prone nature of procedures, the risk of penetrating injury and the scale of exposure, rather than on attempting to define the risk from any particular individual. Other activities involve exposure to blood and body fluids but are much lower risk for disease transmission: such as arterial puncture; insertion/removal of intra-arterial lines; and the simple administration of injections. The principles described, i.e. increasing levels of protection according to the task and foreseeable degree of exposure to blood or body fluids, is applicable to other occupations.

Effective consideration of risk and its control

Building on the legal responsibilities of COSHH explained in Part 2 of this guidance, the following steps outline the practicalities of risk assessment, to determine whether specific controls against BBV exposure are required:

Following the five steps recommended by HSE:

Step 1
Identify the hazards:

Are there any sources of blood and body fluids?
Are there any activities being undertaken that may involve exposure to these blood and body fluids?
Are the blood and body fluids a source of BBV?

Step 2
Decide who might be harmed and how:

Who may be involved in these activities?
How may they be affected if exposed?

[1] **The UK Health Departments** Guidance for Clinical Health Care Workers: Protection against infection with blood-borne viruses. Recommendations of the expert advisory group on Aids. Link: (http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4002766&chk=sjOK8W)

Step 3
Evaluate the risks and decide on precautions:

- How likely is it that harm will result from exposure?
- Factors to take into account include:
  - Standard operating procedures e.g. universal precautions
  - Frequency and extent of potential exposure
  - Characteristics of the organism e.g. survival times, infectious dose

Step 4
Record your findings and implement them and relevant control measures**, to include consideration of:

- Policy and procedures e.g. Sharps policy, decontamination policy, spills and fumigation procedures
- Engineering controls and work practices e.g. microbiological safety cabinets, planned preventative maintenance (e.g. cleaning, inspection, maintenance)
- Training in safe operating procedures
- Use of personal protective equipment (PPE)
- Immunisation – a preventative control measure

**These are typically applied as a hierarchy, for example: using overarching work practices and engineering controls (e.g. general ventilation) → local engineering controls (e.g. use of cabinets, local exhaust) → decontamination procedures → PPE → immunisation

Step 5
This involves regular reassessment of the identified risk and any control measures, for example:

- Review of risk assessment and update if necessary
- Review and repeat of training, as necessary
- Review of immunisation status
- Identify any significant changes (e.g. working practices, safer sharps)
- Assess any new information

Further advice on the principles and stages of risk assessment are available from the HSE web site at: http://www.hse.gov.uk/pubns/indg163.pdf.

Recognising the potential sources of blood-borne infection

Effective control starts with the ability to recognise accurately the potential sources of BBV infection. It is a fundamental infection control principle, particularly within the healthcare setting, to treat all blood and body fluids as potentially infected with BBVs. The most commonly encountered sources are as follows:

Infected people - the public, patients, clients

Experience to date has shown that BBV transmission to workers or the public is very unlikely through everyday social contact with BBV-infected individuals.

Transmission is associated invariably with direct exposure to blood or body fluids and a means of delivering them through the protective skin barrier. In the occupational setting this is most likely to result from a penetrating injury with a contaminated sharp instrument, such as a needle, broken glass or contaminated machinery/vehicles; and more rarely when there is contamination of broken skin or mucous membranes. Sport, however, may constitute social and/or work exposure, and studies of this topic support the potential for infection by this route. There are impact injuries associated with sports such as wrestling, football and rugby, which result in bloody injuries and a potential risk of blood-borne transmission of hepatitis B and C, and HIV. Recommendations have been made that those involved in contact sport should receive hepatitis B immunisation (for relevant references see Info Box 3.1).

Infected cadavers

Whenever blood or body fluid is present, there is a potential risk of blood-borne transmission and appropriate protective measures should be taken. Only leakage of blood or body fluids produces a risk of BBV infection, and simple hygiene measures are adequate to prevent transmission. However, whilst hygienic preparation is acceptable, current HSE guidance stipulates that BBV infected bodies should not be embalmed as this presents significant risk of exposure to workers.

Further information relating to transmission and risk assessment is provided in Info Box 3.1.

Info Box 3.1. Additional information sources related to work activity and infection risk from BBV

- Selda Bereket-Yücel. 2007. Risk of Hepatitis B Infections in Olympic Wrestling. Br. J. Sports Med. 41: 306 - 310. http://bjsm.bmj.com/cgi/content/abstract/bjsm.2006.032847v1
- Kordi R, Wallace WA. 2004. Blood borne infections in sport: risks of transmission, methods of prevention, and recommendations for hepatitis B immunisation. Br J Sports Med. 38(6):678-84; discussion 678-84. At. http://bjsm.bmj.com/cgi/content/abstract/38/6/678
- Stacey A. & B. Atkins. 2000. Infectious Diseases in Rugby Players: Incidence, Treatment and Prevention. Sports Med. **29**, Number 3, 211-220(10). Link http://www.ingentaconnect.com/content/adis/smd
- Zeigler, T.A. 1997. Management of blood borne infections in sport – a practical guide for sports health care providers and coaches. ISBN 08801 1682X.
- Infection at work: controlling the risks from human remains. At: Link: http://www.hse.gov.uk/aboutus/meetings/acdp/140904/annex1.pdf
- *Safe working and the prevention of infection in the mortuary and post mortem room* (HSE Books, 2005).

Contaminated objects

Any article contaminated with blood or blood products from an infected person must be regarded as a potential source of BBV infection for those handling it, if a means of delivering the virus into the body exists. Examples include sharp objects (see below), but also 'soft' waste, such as discarded dressings, contaminated clothing, linen and furnishings. The surfaces of damaged motor vehicles can also harbour contamination following road traffic accidents, specifically if those involved have suffered trauma injury and blood loss. For situations such as those described above, it must therefore be assumed that there is a risk of infection unless the item concerned has been decontaminated by effective means.

Sharps

Sharps include any items that can cause laceration or puncture wounds. They present a special hazard if there is contamination by blood and, although they may not be visibly soiled, they should be handled with care if contamination is known or suspected. Examples include: discarded hypodermic needles; instruments used in invasive operations (*e.g.* blood-sampling, surgery, dentistry, acupuncture, ear-piercing and tattooing); emergency services' cutting equipment, broken glass and jagged metal. For safety and security, small sharps should be placed in sharps disposal containers or otherwise suitably contained or guarded until decontaminated or incinerated. There should *never* be a need to re-sheath a used syringe needle, and by using an appropriate sharps container this can always be avoided. Whenever possible, separation of needle from syringe should also be avoided as this increases the risk of blood spillage and sharps injury. It is acknowledged, however, that some sharps bins have mechanisms that can safely remove needles, e.g. using extreme heat, and these may offer a safe means to dispose of needles and syringes where present. There are a number of initiatives to reduce the number of contaminated sharps injuries, including the use of safer needle devices and needle exchange programmes.

Equipment (including medical devices)

Medical, dental, laboratory or other equipment that is reusable and has been in contact with blood or body fluids, and which has not been decontaminated adequately, may present a risk of infection for both workers and patients. Reusable devices must therefore be decontaminated between uses on different individuals. If an item of equipment is to be sent for examination or repair, it should, wherever possible, be decontaminated before despatch. In some instances, e.g. for delicate items where electrical componentry is present, some methods of decontamination may cause damage to the equipment. To avoid this the most appropriate method must be chosen, and guidance is available on decontamination[2], appropriate safe procedures for

[2] The Medicines and Healthcare products Regulatory Agency (MHRA). The MAC Manual. Available from: http://www.mhra.gov.uk/Publications/Safetyguidance/Otherdevicesafetyguidance/CON007438

consignment[3] and includes a model certificate of declaration that should accompany the returned equipment. Work on site should also be subject to issue of a declaration indicating the contamination status of the item and the need for precautions. Service companies should be informed in advance where full decontamination is not practicable. Specific requirements are necessary where there is a risk of Transmissible Spongiform Encephalopathy (TSE) contamination of re-useable instruments, detailed information is available on this and related TSE topics.[4]

Motor Vehicles

Vehicles involved in traffic and rail accidents are commonly contaminated with blood and human tissue. Sharp metal and broken glass at an accident scene present an added infection risk from any puncture wounds sustained by those first attending the trauma scene. The need for added awareness also extends, in principle, to subsequent vehicle recovery and repair work, which may potentially involve contact with contaminated vehicles. However, data indicate that there are currently no confirmed reports of BBV transmission for the motor vehicle recovery and maintenance industry, and that most industry-specific problems are related to musculoskeletal injury, slips and trips, fume, dusts, noise and vibration (http://www.hse.gov.uk/mvr/illhealth.htm). Discarded hypodermic needles are, however, sometimes found in upholstery and glove compartments in cars sent for repair and servicing, and workers need to be aware of this, even during routine maintenance work. Precautions are essential in all cases and additional information for the motor vehicle industry is available via the HSE Web site.

Environmental contamination

Blood and body fluids may contaminate the site of industrial and road traffic accidents, playgrounds and sporting events. Provided that there is no direct contact, there is no risk for those in the vicinity. However, it should be remembered that the viability of BBV on surfaces might continue for extended periods, subject to environmental conditions. The use of simple personal protective measures, avoidance of sharps injuries and appropriate decontamination will minimise the risk for those dealing with the contamination. After cleaning up, it is essential to dispose of contaminated waste safely; a topic covered in subsequent sections.

A list of occupations affected by potential BBV exposure is provided at the end of Part 1 of this guidance. Examples of sector specific advice and guidance are provided in Appendix 3.

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[3] DB 2003(05) Management of Medical Devices Prior to Repair, Service or Investigation - http://www.mhra.gov.uk/home/idcplg?IdcService=SS_GET_PAGE&ssDocName=CON007315&ssSourceNodeId=828&ssTargetNodeId=572)

[4] Transmissible spongiform encephalopathy agents: safe working and the prevention of infection Guidance from the Advisory Committee on Dangerous Pathogens and the Spongiform Encephalopathy Advisory Committee. Available from: http://www.advisorybodies.doh.gov.uk/acdp/tseguidance/Index.htm

Safe procedures

Precautions applicable to all exposed occupations

It is not possible for employers to eliminate totally the risks posed by BBVs in their workplace, because there is always the possibility of accidents where first-aiders and/or colleagues could be exposed when working. Employers are, however, required to adequately control exposure and protective measures applicable to all occupations are listed below in Info Box 3.2. Where possible contact with blood or body fluids should be avoided and restricted to those with appropriate training in handling these products. These control measures, along with any necessary adaptation to local circumstances, must also take account of any potential exposure of patients and members of the visiting public, include contractors. Where appropriate, PPE most often required to avoid contamination consists of simple items such as gloves, goggles or visor and disposable clothing protection, such as plastic aprons. Specific guidance exists for many individual occupations, and examples are provided in Appendix 3.

The following steps (Info Box 3.2) will minimise the risk of exposure to blood products and any associated BBV, but not all will be necessary in all situations:

Info box 3.2 - Minimising the risk of exposure to blood products and BBV

- Avoid contact with blood or body fluids
- Take all necessary precautions to prevent puncture wounds, cuts and abrasions in the presence of blood and body fluids;
- Avoid use of, or exposure to, sharps (needles, glass, metal etc) when possible and discard sharps directly into the sharps container immediately after use, and at the point of use;
- *Take particular care in handling and disposal if use of sharps is unavoidable – one use only contaminated sharps must be discarded in to an approved sharps container. This must be constructed to BS 7320; 1990 / UN 3291, and used containers must be disposed of through a waste management company who will dispose of them safely as '*waste for incineration only'*;
- **Protect all breaks in exposed skin by means of waterproof dressings and/or gloves (See Appendix 1);
- Protect the eyes and mouth by means of a visor or goggles/ safety spectacles and a mask when splashing is a possibility (this will also protect against bone fragments in orthopaedic surgery and post-mortem examination);
- Avoid contamination of the person or clothing by use of waterproof/water-resistant protective clothing, plastic apron etc;
- Wear rubber boots or plastic disposable overshoes when the floor or ground is likely to be contaminated;
- ***Apply good, basic hygiene practices including hand-washing before and after glove use, and avoid hand-to-mouth/eye contact;
- Control surface contamination by blood and body fluids by containment and appropriate decontamination procedures; and
- Dispose of all contaminated waste safely and refer to relevant guidance (see below) if you are uncertain how to classify and dispose of your waste

*The use of disposable (one use only) items is generally safer and more practical than attempting to recycle contaminated items;

**Chain mail and armoured gloves are available to protect the hands when working with sharp instruments or when exposed to bone splinters etc.

Disposable gloves should **never be washed and re-used because they may deteriorate during use and in washing. If latex gloves are worn, powder free, low protein products should be chosen to help prevent latex allergy. Any disposable gloves should be CE marked for use with biological agents.

Controlling the risks at source or by safer design

Collective protective measures should take preference over personal protective equipment, and examples are provided in Info Box 3.3:

Info Box 3.3 – Equipment use: designing in risk control measures
○ Use a microbiological safety cabinet when work could create infectious aerosols; ○ Use interlocks on diagnostic equipment used to analyse blood or other body fluids; ○ Use safer needle devices and/or blunt ended scissors to prevent and control inoculation injuries*;* ○ Use appropriate equipment for the job, PUWER regulations require that the equipment you provide for use at work is: ➢ Suitable for its intended use; ➢ Safe for use; ➢ Used only by people who have received adequate information, instruction and training; ➢ Accompanied by suitable safety measures, e.g., protective devices, markings and warnings; and ➢ Designed and manufactured in compliance with any essential requirements set down in certain Community Directives regarding the safety of products

Laboratory-based work

The deliberate handling of biological materials in laboratories may necessitate special requirements[5] for control measures. However, even where employees need to handle blood as part of their work, employers can take steps to minimise the risk of exposure to BBVs by using the basic COSHH principle of substitution, e.g. of unscreened blood for screened blood. Further advice on substitution, in the context of biological agents handling, is available at: http://www.hse.gov.uk/biosafety/biologagents.pdf. The design and selection of suitable work equipment for particular tasks and processes make it possible to reduce or eliminate many risks posed by blood-borne viruses.

Disposal of waste – overview

Authoritative guidance on the definitions and safe management and disposal of healthcare waste is available from the DH web site at: http://www.dh.gov.uk/en/Managingyourorganisation/Estatesandfacilitiesmanagement/Sustainabledevelopment/DH_4119635. A detailed summary of

[5] Biological agents: Managing the risks in laboratories and healthcare premises http://www.hse.gov.uk/biosafety/biologagents.pdf ; also 'Safe Working and the Prevention of Infection in Clinical Laboratories and Similar Facilities', HSAC Guidance,

healthcare-related responsibilities is presented within the Health Technical Memorandum 07-01[6], and this includes consideration of health professionals working in the community. The Scottish Office provides detailed guidance on the safe management and disposal of clinical waste in the Scottish Infection Manual[7].

The safe disposal of all hazardous waste is part of the statutory duty of employers and the self-employed under the HSWA, COSHH and Hazardous Waste regulations made under the Environmental Protection Act[8]. BBV contaminated waste must be regarded as a hazardous substance unless rendered safe before disposal. Most waste of this type, depending on its origin, will be classified as 'clinical or infectious waste' and is subject to stringent controls.

The principles of waste segregation and its secure storage are applicable in most occupational settings where any significant amount of waste is generated. This will include material generated in, for example, the care of patients in the community. Waste of this nature is most likely to fall into the Category B infectious waste, requiring labelling as UN3291 and packaging in bags/wheelie bins as per packaging instruction P650. Detailed guidance on management and handling of infectious healthcare waste is provided by Department of Health (HTM) 07-01.

The clinical setting: In addition to sharps waste management requirements, used gloves, aprons, swabs, dressings and other non-sharps materials that are contaminated with body fluids do require segregation if generated in quantity by work-related activity. Within the clinical setting, this waste is likely to be assumed infectious and will be disposed of as Category B waste. This must be disposed of in orange-lidded bin or bag, and by licensed or permitted treatment facility. With the exception of certain laboratory wastes – e.g. high titre culture - very little Category A waste will be produced from healthcare premises within the UK, hence the categorisation of most healthcare waste as Category B.

The non-clinical settings, e.g. the domestic care setting: In the non-clinical setting and where, following a risk assessment, it is determined that the waste is not derived from an infected individual, then the material would be defined as offensive/hygiene waste. This is waste that is healthcare related waste, or similar waste from municipal sources, which meets the following criteria:

- It is not clinical waste;

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[6] Health Technical Memorandum 07-01: Safe Management of Healthcare Waste. At: http://www.dh.gov.uk/en/PublicationsandStatistics/Publications/PublicationsPolicyAndGuidance/DH_063274

[7] The Scottish Office. Scottish Infection Manual. At: http://www.scotland.gov.uk/library2/doc15/sim-08.asp

[8] Environmental Protection Act 1990. Full text of the Act available on-line at:

http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900043_en_1.htm

- It is not dangerous for carriage;
- The producer has identified, after segregation at source, that it is suitable for disposal at a non-hazardous landfill site without further treatment; and,
- It may cause offence to those coming into contact with it.
- Offensive/Hygiene waste should not contain human/animal body parts, organs or blood products;

Smaller volumes of such waste, such as those which may be used by householders; i.e. plasters, pads, small dressings, stoma bags etc may go into a black or grey (opaque) bag and be discarded as household waste if the householder agrees.

However, where a number of small dressings are produced regularly over a period of time, HTM 07-01 states that 'it may be appropriate to dispose of these as offensive/ hygiene waste', i.e. in yellow bags with a black stripe (also known as 'Tiger bags'). All offensive/hygiene waste of this kind must be postcode labelled and kept in a designated, secure area until collected.

Legal requirements relating to disposal of known infected material in the domestic setting are covered by the Public Health (Control of Disease) Act 1984, which applies to England and Wales only. In addition to other specific conditions, section 26 of the Act states that certain infectious matter not to be placed in dustbins, as follows:

'(1) A person who places, or causes or permits to be placed, in a dustbin or ashpit any matter which he knows to have been exposed to infection from a notifiable disease, and which has not been disinfected, shall be liable on summary conviction to a fine not exceeding level 1 on the standard scale'.

This section applies to "viral hepatitis" by virtue of Regulation 3 of the Public Health (Infectious Disease) Regulations 1988.

Avoiding sharps injuries

For some the use of sharps cannot be avoided totally e.g. health care settings, tattooing and body piercing, some beauty sector work, chiropodists. In the past many inoculation accidents have occurred as a result of re-sheathing used hypodermic needles, but modern blood-taking devices negate the need for traditional syringes in most cases and make blood taking safer. If sharps disposal bins are not immediately available, or if the working environment makes their immediate use impractical, then smaller needle securing systems exist, which enclose sharps from syringe-needles and render them safe for handling after use. If used, these systems must then be disposed of by incineration. Guidance on infection prevention is available for

healthcare workers[9], and includes the process of risk assessment related to the safe handling of sharps.

Image sequences within the following publication are helpful for illustration purposes: Health Protection Agency (2003). *Examples of good and bad practice in avoiding sharps injuries.* Available from: http://www.hpa.org.uk/infections/topics_az/bbv/good_bad.htm

Needles and syringes collected in public places have also been proven to contain BBV contamination[10], and such materials should never be handled if found, but should be reported to the local authority responsible for the site. Those working in the refuse collection and recycling industry should themselves be aware of the risks from discarded drug-litter and HSE guidance is available for this sector (reference 'Handling needles in the waste & recycling industry' – and can be downloaded from www.hse.gov.uk/pubns/waste19.pdf).

Obtaining blood samples in the community setting can present challenges beyond those experienced within the more controlled healthcare environment. Patients may have poorly accessible veins, e.g. those with a history of prolonged intravenous drug use, who are also therefore at high risk of suffering from BBV infection. In these cases some NHS Trusts implement policies that allow patients to obtain their own blood sample in the supervised presence of the community healthcare worker (HCW). When this is a practice approved by the Trust, appropriate training and a written procedure are required for staff, to ensure the safe acquisition and handling of samples. This should include an appropriate risk assessment that considers the health and safety needs of both patient and HCW. In particular, sample bottles should be given to the patient by the HCW and filled by the patient to avoid the need for unnecessary sample and needle handling. The needle and syringe must be deposited immediately into a sharps bin by the patient after use. If a patient self sample-taking policy exists and these principles are followed, the risk of contaminated sharps injury to the HCW will be minimised.

The basic steps for remaining 'sharps safe' are summarised in Info Box 3.4.

Info Box 3.4 – Avoiding sharps injury and staying 'sharps safe'
• Discard any sharps directly into the sharps container immediately after use and at the point of use. Close the aperture to the sharps container when carrying or if left unsupervised, to prevent spillage or tampering;

[9] Guidance for clinical health care workers: protection against infection with blood-borne viruses - Recommendations of the Expert Advisory Group on AIDS and the Advisory Group on Hepatitis: http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4002766&chk=sjOK8W

[10] P Nyiri, T Leung, MA Zuckerman. Sharps discarded in inner city parks and playgrounds – risk of bloodborne virus exposure. Commun Dis Public Health 2004; 7(4): 287-8

- Carry sharps containers by the handle - do not hold them close to the body;
- Lock the container when it is three-quarters full using the closure mechanism;
- Label sharps containers with premises / departmental address prior to disposal;
- Place any damaged sharps containers inside a larger sharps container - lock and label prior to disposal - do not place this or anything sharp inside a yellow hazardous waste bag as it may cause injury;
- Keep all sharps waste in a designated, secure area until it is collected;
- Dispose of disposable razors to a sharps bin immediately after use. Razors should never be re-sheathed after use;
- Avoid re-sheathing any used needles, should they be supplied sheathed;
- Avoid leaving sharps lying around and don't try to retrieve items from a sharps container;
- Do not try to press sharps down in the container to make more room;
- Do not place sharps containers on the floor, window sills or above shoulder height – use wall or trolley brackets, they should be stored above knee level and below shoulder level;
- Do not bend or break needles before discarding them. They and other contaminated sharps such as lancets, broken glass or sharp metal should be placed promptly in disposal containers of a type approved under BS 7320; 1990 / UN 3291; and
- Do not use makeshift containers such as drinks cans, bottles or cardboard boxes as sharps disposal. They are not adequate for the purpose and may find their way into domestic waste and present a hazard to refuse workers and members of the public

The Medicines and Healthcare Products Regulatory Agency (MHRA), provides further information on the safe use and disposal of sharps[11].

Immunisation

Under COSHH Regulations, individual workers have the right to know whether or not they have been protected by immunisation

Pre-exposure immunisation is strongly advised for all workers who may be exposed to blood, body fluids or tissues as part of their work activity. The UK Department of Health[12] identifies those workers at increased risk and recommended immunisation as described in Part 1 of this guidance (please see the attached paper called "ACDP_92_P5b OPEN – Background information")

[11] http://www.mhra.gov.uk/

Advice on schedules for vaccine administration, assessment of response to immunisation, management of non- and sub-optimal responders to vaccine, and the requirement for booster doses is also provided in the DH Green Book.[15]

There are currently no vaccines available against hepatitis C or HIV, although there are measures that can be taken following exposure, which may prevent the development of infection. (See Part 4 of this document).

The risks from exposure to BBV's must be assessed under COSHH Regulations bringing into effect any measures necessary to protect workers and others from infection risks, as far as is reasonably practicable. The legal responsibilities for this process are described in Part 2 of this guidance. The provision of routine pre-exposure immunisation may be appropriate in certain cases, e.g. in exposure prone occupations, for those not already immune. Employers need to be able to demonstrate that an effective employee immunisation programme is in place, and they have an obligation to arrange and pay for this service. However, the current requirement is to offer immunisation but also to test for freedom from infectivity for those doing EPP posts. It is acknowledged that some EPP workers may choose not to have the immunisation.

A safe and effective vaccine for the prevention of hepatitis B infection is available, and any requirement for it will be determined as part of the risk assessment described previously. Further details are available from the DH Green Book, cited above and in Info Box 2.10 of this guidance.

Health and Safety law requires that employees shall not be charged for vaccines offered as means of protecting them at work. In providing vaccines, employers should ensure that employees are made aware of the advantages and disadvantages of immunisation and its limitations. Occupational health records should be kept updated of any immunisation course(s) undertaken. Employees are at liberty to refuse immunisation, but any refusal should be considered as part of the risk assessment. Additional controls may still be necessary - particularly since immunisation is currently only effective against HBV - and should therefore be considered as part of the risk assessment of work assigned to the individual. Any exposure-prone work[13] should only be undertaken when all work activities and their potential for BBV exposure have been assessed in this way, and the necessary controls are in place.

Under the COSHH 2002 Regulations, individual workers have the right to know whether or not they have been protected by immunisation and their employers need to know if the vaccine has been effective following administration. Consideration is required of how information on immunisation

[13] Exposure prone procedures are those where there is a risk that injury to the health care worker could result in their blood contaminating a patient's open tissues. A list of exposure prone procedures is provided in the document: http://www.advisorybodies.doh.gov.uk/eaga/pdfs/hiv_workers_280705.pdf

is communicated to managers, whilst maintaining medical confidentiality for the individual. The Association of NHS Physicians (ANHOPS) has considered this issue. Their guidance[14] on the immunisation of healthcare staff states that individual consent should be obtained from each health worker, to allow transference of their immunisation status - or protection/not protected status - to deploying managers. With such information available to them, the deploying manager can also be made aware when immunisation reviews are necessary (e.g. booster dose of Hep B vaccine). It is important to note that, in addition to immunisation, the COSHH regulations require that other control measures are put in place to prevent and control exposure to BBVs for those workers involved in exposure prone procedures, as described previously.

Pre-exposure immunisation is strongly advised for all workers who may be exposed to blood, body fluids or tissues as part of their work activity - see list provided in Part 1.

BBV stability and the importance of decontamination procedures

Virus survival in the environment

Experimental work with HIV and HBV has established the stability of these viruses under various conditions[15]. HBV has the potential to remain viable for prolonged periods in dried blood at ambient temperature, but because of the nature of a dried blood residue this is likely to pose a considerably lower risk than fresh, infected blood.

HCV has been found to survive and remain infective for up to 16 hours when dried down in chimpanzee plasma[16]. Although the risk of transmitting infection is therefore reduced as the concentration of infectious virus drops over time, no assumptions about safety should be made when blood-soiled surfaces, equipment and clothing have not been decontaminated. The scale of any blood or body fluid contamination is important when considering how best to clean contaminated materials, and various approaches to cleaning, disinfection and sterilization are described below.

Methods of decontamination

Decontamination is a combination of processes that removes or destroys contamination so that infectious agents or other contaminants cannot reach a susceptible site in sufficient quantities to initiate infection or other harmful response. The various levels of decontamination are described below.

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[14] Immunisation of Health Care Workers, 2005–2008. Available by registered login only at: http://www.anhops.com/

[15] Thompson SC, Boughton CR, Dore GJ. 2003. Blood-borne viruses and their survival in the environment: is public concern about community needlestick exposures justified? Aust N Z J Public Health. 27(6):602-7.

[16] Kamili, S, Krawczynski, K *et al.* 2007. Infectivity of Hepatitis C Virus in Plasma After Drying and Storing at Room Temperature. Infect Control Hosp Epidemiol. 28 (5):519-524

Physical Cleaning

Cleaning is a process that physically removes contamination, including some microorganisms and, if soiling is present, it is an essential step before effective disinfection or sterilization can be performed. Cleaning does not necessarily destroy all microorganisms, even if a surface looks cleaner, and the cleaning of equipment and work surfaces is best done using detergent and warm water. It is also important to ensure that the cleaning product used will not damage equipment and work surfaces.

Ultrasonication

Ultrasonication is a liquid-based method of cleaning recommended for some equipment, and is dependent upon cavitation (rapid formation and collapse of minute bubbles in a liquid). This method is used routinely within healthcare, laboratory, body art and beauty sectors, but is appropriate whenever cleaning of contaminated, re-usable items is required. The treated items must be submersible, and ultrasonication is performed in a lidded tank and can even clean apertures and recesses. Ultrasonic cleaners should be cleaned twice a day as a minimum requirement, and kept clean and dry overnight. Choice of cleaning agents should be recommended by the manufacturer and should reflect the planned use.

Disinfection

This aims to reduce the number of micro-organisms present to a level that is unlikely to cause infection. For practical purposes disinfection may destroy or inactivate many or all pathogenic micro-organisms, but not spores.

It is important to realise that successful disinfection is very much dependent on the number of micro-organisms initially present. Therefore physical cleaning is an important prerequisite to effective disinfection.

Antisepsis

This term is applied to a process of disinfection on tissue. Only disinfecting agents that are not toxic to the tissue may be used as antiseptic agents.

Sterilization

In contrast to disinfection, this is an absolute term denoting destruction of all micro-organisms, including spores.

Disinfection and sterilization using heat

Heat treatment is the most effective routine means of destroying the infectivity of all microorganisms, including BBV, and mainly involves the use of autoclaves (pressure steam sterilizers). Boiling and dry heat ovens do achieve raised temperatures that can kill microorganisms, but they may lack

the required level of heat delivery and treatment control offered by steam sterilizers, and so are less reliable. There is also evidence that dry heat and boiling systems are seldom maintained or not subjected to periodic testing necessary to ensure that they are achieving sterilizing conditions consistently[17].

Autoclaving

Steam sterilization (i.e. vacuum steam autoclaving), is the preferred method of sterilizing equipment as it is quick, automated, easy to use, reliable, non-toxic and always effective when used correctly. It is particularly suitable for re-usable, heat-stable items, so long as these parts are already physically clean. All BBV are susceptible to standard autoclave treatments with pressurised steam, and large and small steam sterilizers are available, as is guidance on their use and maintenance[18].

Thermal washer disinfection

When autoclaving is impractical, small heat-stable items may be disinfected using hot water treatments. The MHRA Microbiology Advisory Committee to Department of Health no longer recommends simple immersion of items in boiling water as sufficient for sterilization.[19]. Thermal washer-disinfectors are acceptable and use a combination of physical cleaning and thermal biocidal action to achieve disinfection of contaminated, reusable items. This approach can either be used prior to reuse or to make items safe to handle before further reprocessing.

Dry heat

Dry heat sterilizers offer another method of sterilization, which is effective provided that the sterilizer has an automatic controller that will ensure that appropriate temperatures are achieved throughout the load. Temperatures must be maintained for the duration of the sterilizing time and required conditions are as follows:

160 to 170° C for 120 minutes, or
170 to 180° C for 60 minutes, or
180 to 190° C for 30 minutes

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17 Medicines and Healthcare Products Regulatory Agency Safety Notice SN 2002(02) - Dry heat (hot air) sterilizers. Available from the MHRA at: http://www.mhra.gov.uk

18 Bench-top steam sterilizers - guidance on purchase, operation and maintenance: Medical Devices Agency, Device Bulletin 2002(06) October 2002. At: http://www.mhra.gov.uk/home/groups/dts-bi/documents/publication/con007327.pdf

19 Sterilization, disinfection and cleaning of medical equipment. The MAC Manual Part I, 2002 edition, Medicines and Healthcare Products Regulatory Agency (MHRA) Microbiology Advisory Committee to Department of Health. http://www.mhra.gov.uk/Publications/Safetyguidance/Otherdevicesafetyguidance/CON007438

As well as the strict controls required for this method, dry heat sterilization time is long and additional time is required for the items to cool to room temperature prior to use. Items must be able to withstand at least 160°C for long periods. Further information on dry heat sterilizers and their use is available from MHRA.[20]

Chemical disinfection

Some chemical disinfectants have been tested for their activity against BBV in the presence of whole blood or plasma (the fluid component of blood) in order to simulate in-use conditions. The protein in blood and other body fluids may confer a protective effect for the virus and in some cases may reduce the efficacy of chemical disinfectants. Effective testing of disinfectant can therefore be challenging, but it is reasonable to assume that – because of its robustness - any preparation effective against HBV will also be effective against other blood-borne viruses.

Disinfection of contaminated surfaces with bleach solution (minimum 1000ppm active chlorine) is known to be effective for the inactivation of BBV, but bleach is also susceptible to inactivation by organic soiling. Indeed, when disinfecting any soiled item this underlines the need for prior cleaning in order to reduce the organic load and thus promote adequate disinfection. This should not be done manually if operator safety is compromised, but may be achievable by alternative means in such cases, e.g. use of an ultrasonication tank, washer disinfector. Surface decontamination using liquid vacuum methods, e.g. of floor, carpets and upholstery surfaces, would be acceptable only if liquid disinfectant were present in the bulk cleaning fluid. The disinfectant would have to be compatible with the vacuum equipment, any co-added detergent and the treated materials themselves.

Some examples of the appropriate use of cleaning agents and chemical disinfectants are given in Info Box 3.5. The list is not exhaustive, but is intended to emphasise the care required when choosing a disinfectant. Information on a range of cleaning and disinfection products is available at: http://www.hpa.org.uk/webw/HPAweb&Page&HPAwebAutoListName/Page/1200055720428?p=1200055720428. Details on laundry decontamination methods are given below and in Appendix 3.

[20] Medicines and Healthcare Products Regulatory Agency Safety Notice SN 2002(02) - Dry heat (hot air) sterilizers. Available from the MHRA at: http://www.mhra.gov.uk

Info Box 3.5 - Common cleaning agents / disinfectants – and their appropriate uses

Cleaning agent / disinfectant	Instruments	Skin	Work surfaces
Powder or liquid detergent diluted in hot water as indicated by the manufacturer – this is a cleaning agent and not a disinfectant	Yes – can be used for initial cleaning of instruments prior to subsequent disinfection or steam sterilization	No – except for products approved as skin-safe	Effective for cleaning down surfaces at end of sessions/day, prior to surface disinfection
Bleach – hypochlorite - on application bleach products must contain minimum 1000ppm available chlorine, e.g. from: sodium hypochlorite solution or other source of chlorine such as sodium dichloroisocyanurate (NaDCC) soluble tablets	No	No	Yes (hard, man-made work surfaces). Corrosive - not for jewellery.
60-80% alcohol, available as a component of disinfectant spray or 60-70% alcohol wipes	No	Yes	Yes, but effect is greatly reduced by any soiling and rapid evaporation
Halogenated Tertiary Amines or Quaternary Ammonium Compounds (e.g. Trigene); these products may be available as spray, ready to use bulk solution, powder or wipes	Yes – but some products may damage metal surfaces with lengthy exposure and are easily inactivated by soap and organic material	No	Yes, but easily inactivated by soap and organic material
Chlorhexidine based products – often combined with alcohol, e.g. Hibisol. Sachets should be packed individually to prevent contamination	No	Yes	No
Gluteraldehyde-based products such as Omnicide™	This substance cannot be used on skin and is both an irritant and a potent allergen. Exposure to it is strictly controlled under COSHH. Its use cannot be recommended unless appropriate exposure control measures are in place.		
****Phenolic**-based products such as Hycolin, and related products such as Stericol and Clearsol	These products contain 2,4,6-trichlorophenol and/or xylenol, and these chemicals were not supported under a recent biocides review. As such these products can no longer be supplied for any application, and were never appropriate for skin use		

****Information source: http://www.hse.gov.uk/biosafety/notices/biosn012007.htm. Information on alternative products to replace phenolic Hycolin and other Clear Soluble Phenolics is available in the DH bulletin 'Replacement of Hycolin' available at www.dh.gov.uk

Additional free information on chemicals and their safe use under COSHH can be found at: http://www.hse.gov.uk/coshh/

Procedures for chemical disinfection

As is evident from Info Box 3.5, all chemical disinfectants have their limitations and appropriate uses, and reliable inactivation of infectivity is difficult to achieve under some conditions. The presence of blood, body fluids and other organic matter can markedly reduce their action.

All disinfectants are potentially hazardous and must be stored and used with caution; hypochlorite for example, corrodes metals, irritates skin and bleaches fabrics and clothing. An assessment of products in use should form part of the assessment of risk from hazardous substances required under COSHH.

Key points to consider in the use of disinfectants are:

- The supplier should be asked to provide evidence of the product's efficacy against BBV and the user must be satisfied with its efficacy under the proposed conditions of use;
- Disinfectants must be used at the concentration recommended for the purpose by the supplier;
- If compatible with operator safety, cleaning of the surface / item should take place before a disinfectant is used;
- Only freshly prepared dilutions should be used as many disinfectants begin to lose their efficacy when mixed with water and left to stand;
- A disinfectant will be effective only if the recommended contact time is allowed for it to act; and,
- The presence of other chemicals may reduce the effect of disinfectants and/or react violently with them presenting a hazard to those in the vicinity e.g. acids or acidic fluids such as urine, with hypochlorite preparations (eg household bleach) generate chlorine gas.

Levels of contamination may vary, and this will influence the degree of cleaning and disinfectant required for different application. In particular, visible blood or body fluid will require use of a higher concentration of any chosen product, and the end user should be aware that higher concentrations of some disinfectants might produce bleaching or staining effects on treated materials. A wide choice of virucidal products is, however, now available, and material damage should be avoidable without compromising treatment efficacy.

The following Health Technical Memoranda (HTM 01 sub-divisions) are either available or pending for the various areas indicated. Additional information on many of these is available via the Central Sterilizing Club at: http://www.csc.org.uk/index_files/Page683.htm or via the Department of Health on their decontamination update web pages: http://www.dh.gov.uk/en/Managingyourorganisation/Leadershipandmanagement/Healthcareenvironment/NHSDecontaminationProgramme/DH_077613

HTM 01 – Decontamination

- HTM 01-01 Part A – Management and Environment
- HTM 01-01 Part B - Equipment
- HTM 01-02 – Pathology Labs

- HTM 01-03 – Pharmacy
- HTM 01-04 – Healthcare Laundry
- HTM 01-05 – Dental Services
- HTM 01-06 – Endoscopy
- HTM 01-07 – Primary Care

Laundry treatments at high and low temperatures

The process of laundering contaminated linen (including clothing) requires treatment that is effectively a wash-based disinfection process, and is required to avoid cross infection from re-used items. Contaminated linen is generated by hospitals, care homes, nursing homes and similar facilities, as well as in the home care setting; anywhere that care of the sick and infirm is undertaken[21] [22]. The nature of laundry soiling depends on the source, and at the most extreme levels e.g. in hospital and nursing home environments, is likely to include blood, wound exudates, sputum, saliva, sweat and urine, as well as vomit and faeces. It is also important to recognise that bloodstained body wastes such as urine may also serve as a potential source of infection. The nature of the soiling will determine how contaminated items are sorted and processed, and current UK categorisation recommends sorting in to used linen (soiled and foul), infected linen and heat labile linen. Infected Linen is defined as linen derived from known infectious patients, including those with HIV, hepatitis B, C and other infectious agents. Linen can be made safe by washing to remove any contaminating body fluids, but it is often not practical to wash domestic linen at high temperatures because of the heat lability of fabrics. Recommended wash conditions, based on the levels of soiling, are as follows:

Current recommended treatments to ensure cleaning and disinfection of used (soiled and foul) linen:

- A 65^{o}C temperature hold for a minimum of 10 mins within the wash cycle; or
- Preferably 71^{o}C for not less than 3 mins.

Mixing time must be allowed to ensure heat penetration and assured disinfection. A sluice cycle must be added in to the cycle when dealing with foul linen.

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21 NHS Executive HSG(95)18. Hospital laundry arrangements for used and infected linen (under review). Available as a PDF download at: http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Healthserviceguidelines/DH_4017865

22 Infection Control Guidance for Care Homes (2006). A UK Department of Health publication. Ref. No. 275698. Available at: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4136381

Recommended treatment to ensure disinfection of infected linen:

Mainly applicable to the health care setting

- Linen in this category should not be sorted, other than in to a red, water-soluble bag – this then placed in an outer polyester or nylon carriage bag. NB. Infected linen may be stored in different bags in other parts of the UK, e.g. clear with red stripes are used in parts of Scotland. Local policy should be checked and adhered to;
- Inner bag removed from the outer bag only at the point of transfer to the washer-extractor, followed by the outer bag;
- Storage of infected linen must be done in a secured area, prior to washing;

The same wash temperature profile as used for used (soiled and foul) linen is thought sufficient to inactivate HIV, but the evidence is less certain for hepatitis B. The wash temperature, coupled with the dilution factor, should render linen safe to handle on cycle completion.

Current recommended treatment to ensure disinfection of heat labile linen:

- These items need to be washed at ~40^{o}C, so the wash temperature is insufficient to disinfect, and chemical alternatives are required;
- Addition of hypochlorite may be possible, but efficacy may be reduced by the presence of soiling, detergents and alkalis in the main wash;
- Disinfection with hypochlorite is only reliable if the linen can tolerate its addition and if sodium hypochlorite is added during the penultimate rinse of the cycle;

A final concentration of 150ppm available chlorine must be achieved for a minimum of 5 minutes exposure time.

Laundering contaminated items in the community setting

Existing guidance[23] states that:

In the community setting or elsewhere without access to specialist services, contaminated clothing or linen should be treated in one of the following ways:

- *Washed with detergent using the hot wash cycle of a domestic washing machine to a temperature of at least 80^{0}C; or

[23] **The UK Health Departments** Guidance for Clinical Health Care Workers: Protection against infection with blood-borne viruses. Recommendations of the expert advisory group on Aids. Link: (http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4002766&chk=sjOK8W)

- Dry cleaned at elevated temperatures, or dry cleaned cold followed by steam pressing; or

- Incinerated if items cannot be effectively washed as described above

*Dilution is an important part of the washing process and therefore machine overloading should be avoided. If washing by hand is unavoidable, household rubber gloves *must* be worn.

The reality of domestic laundering may be somewhat different from this ideal for those living with BBV in the home environment. Domestic washing machines rarely have an 80^{o}C setting. If this is the case, if contamination is not excessive, all potentially contaminated linen should be washed at the highest possible temperature recommended for that particular fabric. The combination of temperature (when > 40^{o}C), detergent action and dilution effect during the wash and rinse steps, will contribute to the process of soil removal and disinfection for the washed item.

Recommendations for work ware laundering are also available from the Department of Health[24]

Further occupational and patient laundry information is given in Appendix 3.

Chemical disinfection of blood or body fluid spillage

Blood and body fluids may contain a high concentration of microorganisms from known BBV-infected individuals. If spills are large, e.g. from deep cuts, they are a source of potential infection for others who may come in to contact with the spill. All spills should therefore be made safe as soon as possible after the spillage is discovered. Because clearing blood or body fluid spillages may expose an individual to infectious microorganisms, every care must be taken to ensure the member of staff is protected by the appropriate use of protective clothing. Local codes of practice should specify procedures (e.g. spill kits) and the disinfectants to be used for dealing with spillage and other forms of contamination.

The following points apply, regardless of the scale of the spill:

- Gloves should be worn throughout and should be discarded safely after use; and

- If there is broken glass present, it is essential that the fragments are not gathered up by hand either before or after treatment with

[24] Uniforms and workware: An evidence base for developing local policy http://www.dh.gov.uk/prod_consum_dh/idcplg?IdcService=GET_FILE&dID=148636&Rendition=Web

disinfectant. Bunches of paper towels or newspaper, pieces of card or a plastic dustpan should be used to remove the fragments to a sharps container without risk of sharps injury.

Procedure for small spots of blood or small spills

- Gloves should be worn and lesions on exposed skin covered with waterproof dressings;
- Contamination should be wiped up with a paper towel soaked in freshly prepared hypochlorite solution containing 10,000ppm available chlorine; and
- Towels and gloves should be placed in a clinical waste bag for incineration and hands washed.

Procedure for larger spills other than urine (unless bloodstained)

- Gloves should be worn and lesions on exposed skin covered with waterproof dressings;
- If the spillage is extensive, disposable plastic overshoes or rubber boots may be necessary;
- If splashing is likely to occur while cleaning up, other protective clothing should be worn, e.g. to protect the eyes, clothing;
- Liquid spills should be covered with dichloroisocyanurate granules and left for at least two minutes before clearing up with paper towels and/or a plastic dustpan;
- Alternatively, the spill may be covered with paper towels and the contaminated area gently flooded with hypochlorite solution containing 10,000ppm available chlorine* (again this should be left for at least two minutes before attempting to clear up);
- Towels, gloves, disposable overshoes and contaminated clothing should be placed in a waste bag for incineration and hands washed; (rubber boots may be decontaminated with dilute disinfectant);
- Finally, the area should be washed with water and detergent and allowed to dry;
- *Note that urine may promote the release of free chlorine from the treated area when hypochlorite or other chlorine-containing compounds are applied. Ventilation of the area will be necessary; and
- In open areas, for example playgrounds and roadways etc, the spillage should be hosed down with large amounts of water.

Carpet and upholstery spills

In an environment where there are likely to be blood or body fluid spills, carpets and soft furnishings should be avoided, as they will be damaged by most chemical disinfectants suitable for routine use. Washable chair covers should be considered if necessary. Within the domestic environment it is, however, unlikely that such measures will be in place. Sensible options must therefore exist for cleaning and disinfecting soft furnishings following spillage of body fluids.

If contamination does occur, e.g. of carpets or other fixed cover textiles, detergent cleaning should be followed by steam cleaning, so long as the materials will tolerate this. For curtains and other loose cover items, laundering or dry-cleaning followed by hot pressing is effective. Again, textiles should be checked to ensure their tolerance of such treatments. It should, however, be noted that the efficacy of such procedures is likely to be variable, and dependent on choice of (steaming) equipment, disinfectants and nature of the textile being treated.

If unable to disinfect as suggested, it will be necessary to incinerate soft furnishings if the contamination level is heavy and if there are grounds for believing that the contaminating material is infectious.