University Occupational Health and Safety Guidance Notes

DEALING WITH SPILLAGES OF BIOLOGICAL AGENTS

1. PURPOSE

The University is committed to its legal obligations by ensuring that procedures are in place for serious and imminent danger. Under these legal obligations departments that store and/or handle biological agents must have in place emergency plans and procedures for dealing with spillages of such material to ensure that the incident is contained and controlled so as to minimise exposure.

This document provides guidance on how to comply with the relevant legislative requirements. It should be used in conjunction with the Occupational Health and Safety Standard for Biological Safety.

2. SCOPE

This document applies to all staff, post graduate students and visitors (for example visiting academics) who either work with biological hazards or work in areas where biological hazards are used, or have managerial responsibilities for biological safety at the University of Strathclyde.

This document provides guidance on dealing with spillages of infectious substances that are handled or generated in the laboratory e.g. liquid cultures of micro-organisms. Separate Guidance Notes are available for work with blood, blood products and bodily fluids.

3. ABBREVIATIONS

CL	Containment Level
COSHH	Control of Substances Hazardous to Health
HG	Hazard Group
SHaW	Safety, Health and Wellbeing
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures

4. SPECIFIC RESPONSIBILITIES

4.1 **The Principal Investigator / Line Manager / Supervisor** or other direct manager of the research activity is responsible for ensuring that suitable and sufficient general risk assessments and COSHH assessments are carried out, that they remain valid, that control measures are applied and that emergency procedures (including dealing with spillages) are in place. Where necessary training should be provided and documented.

4.2 **All Staff, Students and Visiting Researchers** working with biological hazards should:

- Ensure that they have read and understood the risk assessments and SOPs for the activity;
- Follow all SOPs available;
- Be aware of individual spillage plans if applicable;
- Know the location of spill kits;
- Wear the appropriate PPE;
- Inform the responsible person regarding a spillage and if necessary contact SHaW.

5. DEVELOPMENT OF EMERGENCY PLANS AND PROCEDURES

COSHH risk assessments should be carried out for the micro-organisms that are stored, used and transported in each department and emergency plans prepared as required. It may be necessary within a single lab to have more than one biological spillage procedure.

Where necessary, and where the risk assessment indicated there is a requirement, incident simulations should be carried out for training purposes.

When developing a spillage procedure consider the significant findings of the COSHH assessment, including the following:

The biological agent type

- The hazard group,
- The route of transmission,
- The stability in the environment.

The potential severity of the accident

- The typical maximum volume and concentration of material that could potentially be released.
- The form i.e. liquid, aerosol formation.

The potential generation of infectious aerosols

- What is the room air change rate?
- How long before it is safe to re-enter the lab? (Refer to Table 1 and 2)

Who could potentially be exposed?

- Consider the number of people who usually work within the area.
- Consider vulnerable workers such as young workers and pregnant women.

The location of the spillage within the laboratory

- In the open laboratory (See Section 7.5).
- Contained in a microbiological safety cabinet (MSC), a centrifuge, or an orbital shaker (See Section 7.3 and 7.4).

Effective disinfectants (See Guidance Notes on 'The Selection and Use of Disinfectants')

- Type of disinfectant.
- Validation.
- Concentration.
- Contact time.

First Aid procedures

- Is post exposure prophylaxis available?
- How long after exposure should this be administered?
- Contact details of specialist physician services.

Out of hours procedure and lone working

- If lone working is permitted for the work activity a risk assessment should be completed.
- Emergency contacts.

Reporting procedures

- Completion a SIRIS incident reporting webform.

6. SPILL KITS

Dedicated spill kits or the items listed below must be readily and easily available within each laboratory. In the event of the spill kit being used items should be replenished as soon as possible.

The suggested contents of a typical lab spill kit are:

- Appropriate disinfectant (see Guidance Notes on 'The Selection and Use of Disinfectants')
- Autoclave bag
- Disposable gloves
- Disposable forceps
- Safety glasses
- Disposable apron
- Absorbent material
- Disposable scoops
- 'No- Entry' sign for displaying on the laboratory door if necessary
- 'Do-Not Use: Potential Spill' sign for use on equipment where a spill has occurred

7. DEALING WITH BIOLOGICAL SPILLS

At CL2 a spillage where no infectious aerosols are generated can usually be cleaned up immediately without the need to evacuate the lab. Gloves and appropriate PPE should be worn whilst dealing with the spillage.

7.1 Small volume spill

Spillages of biological material involving a small volume of liquid should be treated by covering the spill with absorbent material such as disposable towels or absorbent granules to prevent liquid migration and aerosol generation. Gently pour, or squirt, the appropriate disinfectant on to the absorbent material covering the spill and leave for the appropriate period of time. Alternatively, disinfectant can be poured directly on to the spill (Figure 1), fresh paper towels can then be used to mop up the spillage, or alternatively scrape using disposable (or autoclavable) scoops or cardboard. All waste material should be disposed of into an autoclave bag. Care must be taken when dealing with broken glass, scoops or forceps should be used.

Figure 1. Dealing with a small volume liquid spill. (Image: ACDP Guidance on The Management and Operation of Microbiological Containment Laboratories).

7.2 Large volume spill

Spillages of biological material involving a large volume of liquid may need containing prior to treating with a disinfectant. This may be done by applying, for example, Virkon powder or absorbent granules around the edge of the spill area in the first instance. Alternatively, a barrier can be formed around the edge of the spill using either an absorbent boom or paper towels. The spill can then be treated in the same way as a small volume liquid spill.

7.3 Dealing with a biological spill occurring within an MSC

Any spillage should be dealt with immediately. Gloves and appropriate PPE should be worn whilst dealing with the spillage.

- The MSC should not be turned off during the clean-up operation.
- Spray or wipe all surfaces and equipment with the appropriate disinfectant.
- Lift the grills and trays and spray or wipe all surfaces under the work surface with the appropriate disinfectant.
- Observe the contact time for the disinfectant.
- Dry wipe all surfaces and spray with 70% ethanol.
- Dispose of any waste in to autoclave bags.
- Fumigation of the MSC may be required for many HG3 organisms and some HG2 organisms, this requirement should be indicated on the Risk Assessment. Fumigation should only be carried out by trained personnel.

7.4 Dealing with a biological spill occurring within a centrifuge or an orbital shaker

Any spillage should be dealt with immediately. Gloves and appropriate PPE should be worn whilst dealing with the spillage.

- If there is reason to believe that a breakage has occurred in a centrifuge or an orbital shaker, and infectious agents have been released, the following procedure should be implemented:
- Do not open the lid as the seals may have failed.
- Leave for 30 minutes for the aerosol to settle.
- Place a sign on the equipment to prevent others from opening the lid.
- After 30 minutes exercise precaution in opening the lid and carefully spray the interior with the appropriate disinfectant. Leave for the contact time and then wipe dry before wiping with 70 % alcohol.
- Remove the rotor/buckets if intact and transfer to an MSC before opening.
- Disinfect the rotor/buckets in the MSC with the appropriate disinfectant as above.
- For orbital shakers treat as above, if HG3 material has been spilled use Table 1 to assess the airborne concentrations, use RPE if required.

7.5 Dealing with a significant biological spill where infectious aerosols are generated in an open laboratory

The categorisation of a 'significant' spill will depend on not only the volume spilled but also the nature of the agent released and should be determined by Risk Assessment. It may be necessary in the event of such a spill that all personnel in the laboratory be evacuated, MSCs should be either left running or turned on before leaving the lab if it is safe to do so, and the laboratory door should be closed on leaving the lab. Any contaminated clothing and/or contaminated protective clothing should be removed and left in the laboratory before leaving. Call for assistance if required. Signs should be displayed on the lab door to prevent others entering the laboratory.

It may be necessary to calculate the time required before it is safe to re-enter the laboratory. To help in this calculation the following information is required:

- The concentration of micro-organisms in the solution spilled
- The estimated volume of solution spilled
- The room ventilation air change rate (contact lab manager or estates for room air exchange rates if required).

An example calculation: A flask containing 20 ml of a 10^8 spores/ml suspension of Bacillus anthracis is accidentally dropped on the laboratory floor. The laboratory ventilation rate is 12 air changes per hour. From Table 1, the airborne concentration is 50 000 spores/m^3 on leaving the laboratory. From Table 2, after 58 minutes, 99.99% of the airborne spores will have been removed, leaving a concentration of 50 spores/m^3. After a further 35 minutes, a further 99.9% of the remaining spores will have been removed, and the concentration will have dropped to 0.05 spores/m^3, i.e. the laboratory will be almost free of any airborne spores. (From: ACDP Guidance on 'The Management, Design and Operation of Microbiological Containment Laboratories').

Table 1 summarises the potential airborne concentration (a measure of how much of the spill becomes aerosolised) of micro-organisms per cubic metre for a range of volumes and concentrations spilled where it is assumed that the aerosol potential is high and exposure time is short.

Solution concentration (per ml)	Quantity of solution		
	Small (<50 ml)	Medium (50-500 ml)	Large (>500 ml)
10^{10}	5 000 000	50 000 000	500 000 000
10^{9}	500 000	5 000 000	50 000 000
10^{8}	50 000	500 000	5 000 000
10^{7}	5 000	50 000	500 000
10^{6}	500	5 000	50 000

Table 1. Airborne concentration of micro-organisms per cubic metre vs volume and initial solution concentration. (Image: ACDP Guidance on 'The Management and Operation of Microbiological Containment Laboratories').

Table 2 indicates how many minutes it takes, for a given number of room air changes, to remove 90-99.99% of airborne contaminants.

Air changes per hour	% Removal			
	90	99	99.9	99.99
6	23	46	69	115
7	20	39	59	98
8	17	35	52	87
9	15	31	46	77
10	14	28	41	69
12	12	23	35	58
14	10	20	30	50
16	9	17	26	43
18	8	15	23	38
20	7	14	21	35
25	6	11	17	28
30	5	9	14	23
40	3	7	10	17

Table 2. Percentage removal vs number of air changes. (Image: ACDP Guidance on 'The Management Operation of Microbiological Containment Laboratories').

When the laboratory is safe, re-enter wearing the appropriate PPE including RPE where the Risk Assessment indicates. The spill may then be contained using absorbent booms or paper towels around the circumference of the spill, followed by applying the appropriate disinfectant. Powered disinfectant will prevent liquid migration. Absorb the spill using paper towels and/or scrape into an autoclave bag using disposable (or autoclavable) scoops or cardboard. Care must be taken when dealing with broken glass, scoops or forceps should be used. For large volume spills it is likely that the whole floor and/or bench area should be thoroughly cleaned. Floors under benches in a CL2 and CL3 laboratory should not become cluttered with boxes or other absorbent items to avoid contamination in the event of a spill.

8. FIRST AID

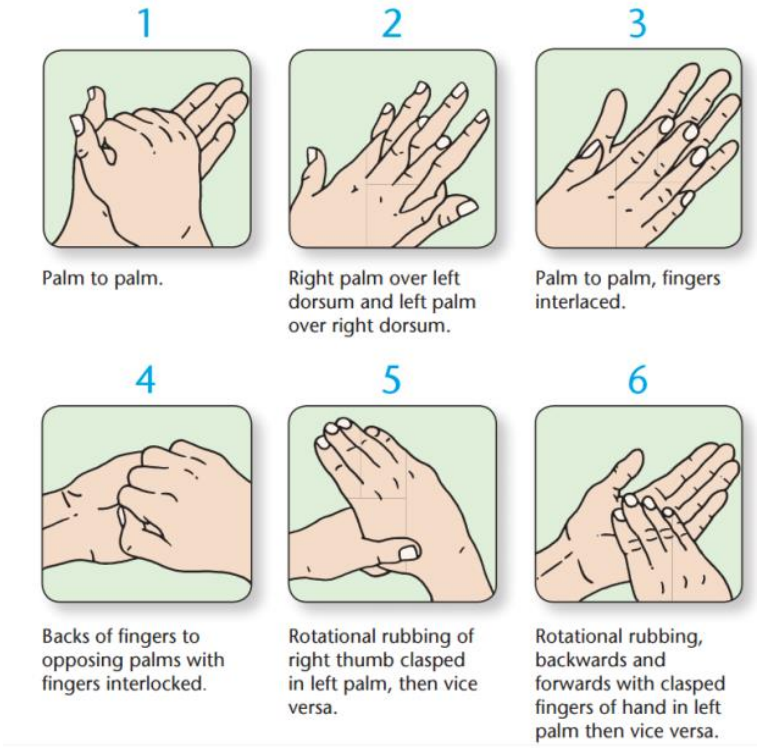
If First Aid is required, the procedure for summoning a first aider in accordance with the University Occupational Health and Safety First Aid Standard.

Any specific First Aid issues should be indicated in the risk assessment for the activity, and appropriate provisions made where necessary.

9. REMOVING GLOVES AND HAND WASHING

Following cleaning up a spillage, gloves should be removed (see Figure 2 for the correct procedure for removing gloves), and hands should be washed (see Figure 3 for the correct procedure for effective hand washing). If there has been significant contact of the contaminating biological agent with the skin the area should be thoroughly washed/showered, if the contaminating material is of high titre an appropriate disinfecting material should be used. Medical assistance should be sought depending upon the nature of the contaminating biological agent and should be recognised in the Risk Assessment.

Figure 2. The safe removal of disposable gloves. (Image: Globus.co.uk)



The six-step hand-washing technique. (Image: NHS).

Figure 3. 6 steps to effective hand washing. (Image: NHS)

10. INCIDENT REPORTING

Any significant spillages should be reported SHaW, if appropriate a SIRIS incident reporting webform form should be completed. If more than one person is involved in an incident, then a separate form should be completed for each individual involved.

If a spillage results in the evacuation and closure of a lab/building SHaW must be informed immediately.