Specification for Containment Laboratories

Introduction, Standards and References

This document sets out the standards for the design and construction of containment laboratories at the University of Edinburgh. Designers must regard these standards as minimum requirements and if any cannot be met for any reason this must be fully justified and agreed by appropriate School representatives, the Estates and Buildings Project Manager and the University Biological Safety Adviser. The design shall be validated against the criteria specified within this document as part of the design process. After practical completion and before hand-over to the University, written confirmation is required that the building meets all the design criteria.

As a minimum, the legal requirements for containment level 2 laboratories must be met in all cases. Where a containment level 3 laboratory is specified in the design brief the legal requirements for containment level 3 laboratories must also be met in those areas. The requirement for a containment level 3 laboratory, and any requirement to meet DEFRA standards, will be determined by appropriate School representatives in consultation with the University Biological Safety Adviser.

Each containment facility must comply with the required standards as specified in national legislation for work with **both** biological agents and genetically modified micro-organisms at the particular level of containment. Where there are differences in containment requirements the higher specification must be applied.

At April 2007 the legal requirements for containment laboratories are set out in the following:

The Control of Substances Hazardous to Health Regulations 2002 (and any subsequent amendments) and the supporting Approved Code of Practice which includes guidance and additional provisions relating to work with biological agents; and

The Genetically Modified Organisms (Contained Use) Regulations 2000 (and any subsequent amendments).

The Regulations are supported by the following guidance which is regarded as good practice and must also be followed in University of Edinburgh facilities:

The management, design and operation of microbiological containment laboratories. Advisory Committee on Dangerous Pathogens (ACDP). 2001. HSE Books. ISBN 0 7176 2034 4. [Note – this supercedes Categorisation of biological agents according to hazard and categories of containment, ACDP. 4th ed, 1995. HSE Books. ISBN 0-7176-1038-1];

Biological Agents: Managing the risks in laboratories and healthcare premises Advisory Committee on Dangerous Pathogens (ACDP). 2005.

And Scientific Advisory Committee on Genetic Modification (SACGM) Compendium of Guidance. 2007. HSE Books.

Various other organisations produce guidance on the design and build of containment laboratories. The following two are of particular note. That produced by the Welcome Trust provides useful additional guidance including layout and space standards for biomedical research laboratories. Imperial College and the MRC publish very detailed, practical guidance on meeting the standards required in containment level 3 laboratories (Standards for containment level 3 facilities. New builds and refurbishments. 2nd edition, 2005, is available on the MRC website.

Designers should refer to these two guidance documents, which are widely regarded as best practice, and apply them to the design of University of Edinburgh containment facilities.

The various guidance documents cited above include management and operational procedures for containment laboratories. This specification for University of Edinburgh laboratories is concerned only with design and installation, other matters, such as management and working practices, are not considered further here. Furthermore this document deals only with criteria in relation to microbiological hazards; however other hazards must be considered and addressed as part of the overall design specification. Other statutory and good practice standards and requirements, some of which may overlap with some of the specifications in this document, must also be met.

As part of the briefing process for the design, it is necessary for the prospective users to define and document the biosafety strategy for the building/facility. This will likely evolve as part of the design process and should be reviewed and agreed with the design team at various stages. This should include a description of the types of pathogens and procedures that will be used in the facility, what flexibility is required, reference to standards needing to be met and a short summary of any limitations or specific exclusions in the design. The length and detail included in the biosafety strategy is expected to vary considerably (couple of paragraphs to many pages) depending on the type of work and facilities involved.

All references to published documents are current at October 2007. The onus is on the designer to check that these are still current and where they have been superseded to use the more recent version.

MINIMUM REQUIREMENT	CONFIRMATION HOW CRITERIA MET IN DESIGN	CONFIRMATION CRITERIA MET ON INSTALLATION
1. BASIC DESIGN		
1.1 Security and Access		
1.1.1 Access to be limited to authorised persons only by the use of security measures such as locks for controlling entry - Requirement for security provisions to meet Home Office standards for laboratories holding materials controlled under anti terrorism legislation to be identified by appropriate School representatives in consultation with University Biological Safety Adviser.		
1.1.2 Restriction of access to be imposed at edge of containment zone.		
Additional requirements for CL3 laboratories:		
1.1.3 Access to CL3 zone to be restricted either by swipe card, card key or digital lock.		
1.1.4 Automatic door closures to be fitted to ensure CL3 zone is secure even whilst occupied.		
1.1.5 Containment zone to remain secure in event of fire alarm activation in order to maintain biosecurity - Locks not to be automatically opened - Emergency release mechanisms to be installed to allow egress at any time.		
1.1.6 Security provisions to meet Home Office standards for laboratories holding materials controlled under anti terrorism legislation.		
1.2 Building services		
1.2.1 Controls and service areas to be outside the containment zone.		
1.2.2 The need for maintenance staff to enter the containment zone to be minimised. Service risers etc to be accessed from outside the containment zone wherever possible.		

Additional requirements for CL3 laboratories:		
1.2.3 The need for maintenance staff to enter the containment zone to be eliminated. Services should not require maintenance from within the containment zone if this can be reasonably provided outside. All service access requirements to be listed by designer and agreed by the University Biological Safety Adviser.		
1.3 Space requirements		
1.3.1 Sufficient space to be allowed for staff to carry out their work safely - Layout and space standards to be in accordance with Welcome guidelines - General layout to be in accordance with recommendations given in BS EN 14056, Laboratory Furniture - Recommendations for design and installation. 2003. - Consider all traffic routes - Where microbiological safety cabinets and/or fume cupboards are installed layouts to comply with space requirements in appropriate British Standard.		
1.3.2 Ceiling height to allow adequate headroom for installation and replacement of large equipment and access to ductwork above safety cabinets and fume cupboards (ie ceiling at least 300mm above top of these).		
1.4 Traffic routes		
1.4.1 Laboratory traffic (movement of laboratory personnel and materials between working laboratory areas and facilities) to be within the containment zone. Containment zones to be self-contained as far as possible with laboratories connected to ancillary support facilities such as centrifuge rooms, fume cupboards etc - To be clear separation of lab coat and non-lab coat routes/zones.		
1.4.2 Traffic routes to and from central services such as wash up and autoclave not to be through office, public or food serving areas.		
1.4.3 Lift access to be provided for trolleys if laboratory items have to be moved between floors. Clean (office personnel etc) and dirty (laboratory) traffic routes to be carefully considered regards use of lifts.		

Additional requirements for CL3 laboratories:		
1.4.4 CL3 containment zone to be separated from other activities in the same building by use of a lobby area - Lobby to be within the curtilage of the CL3 containment zone - Lobby to be used for changing of labcoats and handwashing - No infectious material to be stored in lobby (eg no freezers, no waste etc) - Lobby doors to be interlocked - Lobby doors to be offset (not opposite each other).		
1.4.5 Fire exit routes from other areas not to require travel through CL3 containment zone.		
1.5 Offices		
1.5.1 All staff working within containment laboratories to be provided with separate desk space/write–up areas where they can read, write, store reference books, file records, use telephones, work at a computer and similar activities. This to be provided either as - A clearly segregated area within the laboratory (this could be separated, for example, by circulation routes and fitted with low-level benching); or - As an office area sited outside the containment zone.		
1.5.2 Offices and meeting rooms (where it is envisaged that carpeting and other soft furnishings might be required or in which activities such as eating and drinking may take place) to be sited outside the containment zone, rooms opening off the laboratory area are not acceptable.		
1.6 Storage of outdoor clothing and personal effects		
1.6.1 Outdoor clothing and personal effects not to be taken into laboratories - Adequate provision (taking account of numbers of people working within laboratory areas) to be made outside the containment zone for secure storage.		
1.7 Toilets		
1.7.1. Toilet facilities not to be within the containment zone.		

2. GENERAL STRUCTURE, FURNITURE AND FITTINGS		
2.1 Layout		
2.1.1 Layout of laboratory (benches etc) to be in accordance with recommendations given in BS EN 14056, Laboratory Furniture - Recommendations for design and installation. 2003.		
2.2 Benches		
2.2.1 Bench surfaces to be resistant to acids, alkalis, solvents, disinfectants expected in normal use and to be impervious to water and easy to clean - To be solid plastic laminate or epoxy - Not to be scribed directly to wall but to have upstand or back plate - To have minimal joints and seams but where necessary (eg where benches meet, between bench and upstand, around sinks, taps, sockets, shelf supports etc) these to be sealed with nonshrinking sealant such as two-part epoxy grout - Not to have any open holes for feeding of cables etc - Drip cups to be avoided.		
2.3 Laboratory furniture		
2.3.1 Adequate amounts (as discussed and agreed with the Estates and Buildings Project Manager) of under and over bench storage space to be provided - Laminate covered MDF adequate for shelving, cupboards etc.		
2.3.2 Design of underbench cupboards to allow easy access for cleaning of any spillages on floors (eg mobile units on castors).		
2.4 Sinks		
2.4.1. All laboratories to have a general laboratory sink - To drain directly to waste via simple S-bend trap - Epoxy or stainless steel “all in one” units preferred since this obviates need for any sealing around the sink.		

2.5 Handwash basins and eyewash provision		
2.5.1 Dedicated handwash basin to be located at each exit to containment zone.		
2.5.2 In addition, tissue culture/microbiology labs to have dedicated handwash basin at exit.		
2.5.3 Taps to be of type that can be operated without being touched by hand (eg lever operated, knee operated, automatic sensor).		
2.5.4 Dispensers for paper towels and soap to be provided adjacent to all hand wash basins - Soap dispensers to be single use packs, not to be topped up from bulk supply.		
2.5.5 Eyewash station to be provided adjacent to handwash basin. Ideally this to be a type that can double as an emergency shower hose.		
2.6 Labcoat storage		
2.6.1 Separate storage area to be provided for laboratory coats in use - Maximum one coat per peg (allow enough pegs for all workers) - To be within containment zone - To be at entry/exit points adjacent to handwash basin.		
Additional requirements for CL3 laboratories:		
2.6.2 Facilities for storage of labcoats to be provided in the lobby (separate storage required for clean coats and those in use).		
2.6.3 If the CL3 laboratory is located within a larger containment zone then pegs to be provided outside the CL3 zone for storage of labcoats from the CL2 area.		
2.7 Floors		
2.7.1 Floor surfaces to be resistant to acids, alkalis solvents, disinfectants expected in normal use and to be impervious to water and easy to clean - To be smooth and slip resistant - To be easy to keep clean ie not non-slip type unless specific requirement such as in a wet area - Seams to be kept to a minimum but where necessary to be sealed		

- To be coved to wall and sealed (sit-on coved skirting not acceptable).		
2.7.2 All floors finishes in the containment zone and on laboratory traffic routes to be to laboratory specification.		
2.7.3 Alternative flooring material or protection to be provided where dispensing of liquid nitrogen may take place (e.g. proprietary matting or a stainless steel plate).		
2.7.4 No open floor drains to be located within containment zones or ancillary/central services support areas.		
2.7.5 No access hatches (or anything else that breaks the sealed floor) to be located in floors within containment zones.		
2.8 Doors and windows		
2.8.1. Doors to contain vision panel.		
2.8.2 Doors at boundary to containment zone to be self-closing.		
2.8.3 Any window blinds not to collect excessive dust (use vertical blinds or similar, venetian type blinds not acceptable as dust accumulates on slats).		
Additional requirements for CL3 laboratories:		
2.8.4 Doors to open into the CL3 space and have leakage through grill or round edges in order to maintain inward airflow and minimise disruptions to airflow patterns during use.		
2.8.5 The CL3 laboratory to have observation window(s) so - Occupants can be seen wherever they are within the laboratory from outside - Any fire detector activation can be visually checked.		
2.8.6 Blinds ideally to be located between the window panes or where installed in the laboratory to be made of a non-absorbent material.		
2.8.7 Fire resistant, double glazed windows must be provided for both security and containment purposes. These to be sealed in place, flush on the containment faces and edges with the adjacent walls.		
2.9 Walls and Ceilings		
2.9.1 Walls and ceilings to be smooth and easily cleanable - Two coats of good quality vinyl or oil based emulsion or silk finish paint is adequate on walls.		

Additional requirements for CL3 laboratories:		
2.9.2 See section 5 on fumigation which includes criteria for walls and ceilings.		
2.10 Lighting and power		
2.10.1 Standard (general purpose) light fittings and electrical outlet sockets are adequate - Light fittings to be positioned to avoid all shadows over any working surfaces whether from high level fittings or persons standing in front of working surfaces - Benches and light fitting positions to be such that need for task lighting is avoided - Adequate numbers (as discussed and agreed with the Estates and Buildings Project Manager) of electrical and data points to be provided, both under and over bench, to avoid excessive trailing of leads and use of multi adapters.		
Additional requirements for CL3 laboratories:		
2.10.2 Standard (general purpose) light fittings and electrical outlet sockets are adequate - Light fittings to be suspended or surface mounted with minimal ingress into ceiling and visible seal (recessed fittings not acceptable).		
2.10.3 Non-maintained emergency lighting to be provided in all CL3 areas adequate to enable staff to make work safe under power loss conditions.		
2.11 Miscellaneous		
2.11.1 No requirement for emergency drench shower unless significant volumes of hazardous chemicals will be used (see 2.5.5 above on use of eye wash hose).		
Additional requirements for CL3 laboratories:		
2.11.2 The CL3 laboratory to contain all its own equipment to minimize infectious material having to be taken outside for any purpose - All storage of infectious materials to be within CL3 laboratory (ideally the same laboratory or if this is not practicable then within a CL3 facility nearby).		
2.11.3 Gas cylinders to be located outside the CL3 containment zone and piped in.		
2.11.4 Adequate telephone and data points to be provided for		

- E-mail or fax to be used to remove written information from laboratory (to obviate need for decontaminating paper) - Hands free telephone to be installed.		
2.11.5 Automatic fire detection to be provided to all areas of the CL3 zone and immediately adjacent spaces.		
3. WASTE HANDLING		
3.1 Autoclaves		
3.1.1 Autoclave to be available for decontaminating waste - To be located in building - To conform to BS 2646 Autoclaves for sterilization in laboratories, 1990-1993 and BS EN 12347 Biotechnology – Performance criteria for steam sterilizers and autoclaves, 1998. - To have adequate space adjacent for storage and loading of waste - To have adequate ventilation in area to prevent build up of heat and smells.		
Additional requirements for CL3 laboratories:		
3.1.2 A dedicated autoclave to be sited within the CL3 containment zone, ideally to be located within a separate room off the lobby - To be ensured heat output does not effect airflows (carefully consider positioning of autoclave) - If double ended/pass through autoclave installed to have effective and appropriate sealing to maintain integrity of containment zone.		
3.1.3 Installation of autoclave to include measures to ensure there is no discharge of potentially contaminated material via air vents or condensate during use.		
3.2 Storage		
3.2.1 Waste staging and/or storage areas to be provided within laboratory or building.		
4. MICROBIOLOGICAL SAFETY CABINETS		
4.1 Requirement for		
4.1.1 Requirement for safety cabinet(s), and where needed the appropriate Class of cabinet(s), to be agreed in consultation with University Biological Safety Adviser.		

Additional requirements for CL3 laboratories:		
4.1.2 At least one safety cabinet to be installed - Class to be agreed by University Biological Safety Adviser.		
4.2 Performance		
4.2.1 Cabinets to comply with performance specification in BS EN 12469 Biotechnology – Performance criteria for microbiological safety cabinets, 2000, as shown by type testing.		
4.2.2 Short list of acceptable safety cabinet manufacturers to be agreed in consultation with the Estates and Buildings Project Manager and the University Biological Safety Adviser.		
4.2.3 Cabinets to be commissioned and certified as passing in use operator protection test (4 head KI Discus, OPF to be >1x10^5) prior to handover.		
4.3 Ducting		
4.3.1 Cabinets to be ducted to atmosphere or if recirculating to include a system for extract of formaldehyde gas following fumigation. Ducting to atmosphere does not necessarily mean high level discharge above the roof of the building, however, discharge of formaldehyde following fumigation not to pose a hazard to other areas of occupation or adjacent sites. Designer to propose a strategy that incorporates safety requirements, convenience of use and efficient running costs.		
Additional requirements for CL3 laboratories:		
4.3.2 Safety cabinet(s) to extract direct to atmosphere and be hard ducted (thimble systems or recirculating cabinets are not acceptable at Containment Level 3).		
4.4 Siting		
4.4.1 Siting of cabinets - To comply with recommendations given in BS 5726. Microbiological safety cabinets – Information to be supplied by the purchaser to the vendor and to the installer, and siting and use of cabinets – Recommendations and guidance. 2005 - Not to be affected by draughts caused by ventilation and air conditioning units - Suitable make up air systems to be provided in accordance with recommendations in BS5726:2005 - To be commissioned and certified as passing in use operator protection test (4 head KI Discus, OPF to be >1x10^5) prior to handover.		

5. FUMIGATION		
5.1 There is no requirement to fumigate CL2 laboratories.		
Additional requirements for CL3 laboratories:		
5.2 CL3 containment zone to be of totally sealed construction and require minimal manual external sealing to permit fumigation without loss of fumigant - Boundary of room to be obvious and clearly visible. Ceiling voids are not to be within the sealed boundary, boxing in of services to be avoided - Ceiling to be solid or continuous and coved to walls, detailing to ensure no cracking at joints - Walls and ceiling to be seamless/jointless - Any penetrations in ceilings, walls and floors - To be kept to a minimum - To be totally sealed using proprietary fittings (eg IP68 rated glands for electrics and pipework) - Electrical and conduit services to be sealed - All sealants to be resistant to formaldehyde and be non-hardening - Particular attention to be paid to sealing of hidden penetrations eg behind sockets.		
5.3 Fumigation strategy and procedures, including the rationale for fumigation of different areas vs whole suite, to be agreed in consultation with the appropriate School representatives and the University Biological Safety Adviser.		
5.4 Electric points for generation of fumigant to be located just inside lobby and laboratory entrances.		
6. VENTILATION REQUIREMENTS		
6.1 Acceptable maximum temperature, within recognised standards, to be specified by appropriate School representatives in consultation with the Estates and Buildings Project Manager - Ascertain requirements for comfort vs operational cooling.		
6.2 Supply air inlet(s) and air extract points to be positioned - To ensure maximum mixing and dilution of room air - To take account of safety cabinet and fume cupboard positions to avoid compromising their performance.		
6.3 Mechanically ventilated laboratories to be designed to ensure there is an inward flow of air from adjacent spaces typically through the doorway or grilles in the wall. Acceptable means by which this can be achieved include air gaps around doors and the extract system removing a greater volume of air		

than that provide by the supply system (eg supply could be nominally 90% of extract).		
6.4 Laboratory not to become positively pressured with respect to surrounding environment. Air extract system(s) to be interlocked with the supply air system to prevent the supply air system operating in the event of extract system(s) failure.		
6.5 All air extracted from laboratory spaces to be exhausted direct to atmosphere, there is to be no recirculation of air back into the supply system.		
Additional requirements for CL3 laboratories:		
6.6 Ventilation system design to be as simple as possible and include provisions for fumigation procedures. Fumigation procedures to take account of whether there is a need to fumigate rooms individually or whether the suite is fumigated as a whole. In the case of individual room fumigation, capability also to take account of whether the rest of the suite is to remain operational or is shut down.		
6.7 There is to be a continuous inward airflow into the laboratory - Ascertain in consultation with University Biological Safety Adviser whether this is required at all times or only when work is in progress - To be ensured upper and lower limit errors on supply and extract do not overlap - Potential effects of operation of ventilation system in other parts building to be taken into account (changes overnight etc).		
6.8 In order to ensure adequate Laboratory Protection Factor is achieved and containment is maintained when the door is opened there is to be air inflow through the doorway (critical safety requirement) - Design to include air being drawn passively through the door under normal operating conditions (eg gaps around and grilles in doors) - Inflow of at least 10_3 m_3/min (0.17 m_3/sec) required through the door - Air change rates to be discussed and agreed with Estates and Building Project Manager (energy costs issues) and the University Biological Safety Adviser (safety issues).		
6.9 A negative pressure differential between CL3 laboratory and the immediately adjacent space across the containment barrier of at least –30Pa to be achieved by ducting the exhaust air from the microbiological safety cabinet(s) (and any bypass) to the outside air through a HEPA filter, and where this does not provide adequate pressure differential to also extract the laboratory air through independent ducting to the outside air through a HEPA filter.		

6.10 Where there are inner rooms there is to be a pressure cascade with a differential pressure of at least -15Pa between areas - All pressures and controls to be referenced to outside the CL3 containment barrier.		
6.11 All controls and access to all parts of the ventilation system to be provided outside the CL3 zone in order these can be operated and maintained without entering the CL3 zone - Controls to be tamper proof to prevent unauthorised adjustment - Controls for ventilation system also require to be located outside the laboratory to enable remote operation during fumigation procedures.		
6.12 A magnahelic gauge to show the CL3 zone is operating at negative pressures to be installed at the entrance to each inner room and at the entrance to the CL3 zone. Normal operating parameters to be clearly indicated on, or immediately adjacent to, all gauges. If pressures rise above design tolerances an audible alarm to sound - Accuracy of magnahelic gauges to be confirmed by calibration.		
6.13 A fumigation panel is to be provided that indicates status of the ventilation system during fumigation.		
6.14 Exhaust of ventilation system to extract direct to atmosphere, ideally at roof level, and be dedicated to the CL3 laboratory or CL3 suite.		
6.15 Extract fan to be at terminal point of ductwork (i.e. downstream of HEPA filters).		
6.16 All extract air systems must have HEPA filter installed - HEPA filters to meet performance criteria of class H14 filter as defined in BS EN 1822-1: 1998. - Test ports to be provided both sides of all HEPA filters to allow checks to confirm filter integrity/performance.		
6.17 Means of preventing reverse air flows to be incorporated into the system.		
6.18 In the event of extract fan failure, the input supply air is to be cut off as soon as possible to prevent any positive pressurisation of the CL3 laboratory - To be hard wiring between extract and input fans rather than routed through BMS.		
6.19 Extract fan failure to be indicated by an audible alarm that can be heard throughout the inside and immediately outside the CL3 zone. Alarm activation may be through BMS.		

6.20 Dampers, mechanical or electrical, to be provided to seal the CL3 zone for fumigation - All dampers to be located where they can be visually inspected to check they are working (vision panels to be provided) - Test ports to be provided either side of all dampers to allow checks to confirm dampers are closing fully - Dampers to be sited as near as possible to the CL3 containment line but to be accessed from outside the containment zone for service and maintenance.		
6.21 No joints or welds to be located in any duct or pipework passing above the ceiling of the CL3 zone.		
6.22 Where cabinets have by-pass systems these to operate to minimise any change in laboratory negative pressure on switch over.		
6.23 Lobby to be part of the CL3 containment zone.		
6.24 The ventilation system to continue to run in the event of fire alarm activation with provision for manual shut down by fire brigade.		
6.25 The Designer of the ventilation system is to provide a summary of the operation of the ventilation system which is to be agreed in principle with the University Biological Safety Adviser. This is to be provided at the beginning of Design Stage D and confirmed at the end of Stage E. This summary is also to be provided to the users as part of the familiarisation and training process prior to handover. It should be a simple summary that is written in layman's terms in order that it can be understood by users and other non-specialist (i.e. not engineer) persons. It is to include a description of - How air is supplied - How air is extracted and where the fan and HEPA filters are located - What happens when the safety cabinets are switched on and off - How cabinet performance is linked to the ventilation system - Where the line of containment is - Where the various dampers are to isolate the CL3 zone - Where the controls are and what they operate - What the normal operating parameters are in order that any deviations can be recognised - Basis for fumigation procedures, including a clear statement on what the ventilation system design allows in terms of either individual room or whole suite fumigation and how the ventilation system works to allow these or not as the case may be - How to carry out the fumigation procedure including what to do to seal the laboratory for fumigation, how to clear the fumigant afterwards using the ventilation system and how		

to restart and check the ventilation system is operating within design parameters. This is to be supported by a simple flow chart or check list detailing the precise sequence of events and include approximate time lags for each stage and what readings should be shown on the various gauges.		
7. VALIDATION		
7.1 The architect is to confirm that all components of this specification that have been included within the design of the building have met design criteria on installation - Appropriate monitoring and site inspections to be undertaken to confirm built as designed.		
7.2 The contractor is to provide commissioning data to confirm the ventilation system operates in accordance with intended design. This is to be verified by the design engineer.		
7.3 Independent certification is required to demonstrate performance to appropriate British Standard of - Autoclaves - Safety cabinets - Fume cupboards - Any other specified equipment.		
Additional requirements for CL3 laboratories:		
7.4 Pressure regime to be tested against design specification.		
7.5 Interlock between extract and supply air systems to be proven to ensure that supply air system cannot operate in the event of failure of the extract system(s).		
7.6 Laboratory to be run at maximum operating negative pressure and it be checked that no damage is caused to fabric and services.		
7.7 All air supply and extract ductwork to be pressure tested *in situ* for air tightness.		
7.8 Dampers and seals to be checked *in situ* for air tightness.		
7.9 All seals around windows, pipework, electrics etc, joints of walls, ceilings etc, any trunking, ductwork etc, to be checked visually and locally smoke tested (looking for any air movements with smoke tubes) under static pressure - To be in accordance with procedures in HSE publication Sealability of Microbiological Containment Level 3 and 4 Facilities. ACDP. 2006 (available as web only document at http://www.hse.gov.uk/biosafety/gmo/guidance/sealability.pdf		

7.10 Where necessary, the contractor to carry out any further tests (prior to test fumigation see 7.15 below) to be confident as to the sealability of the CL3 areas to permit fumigation and prevent escape of fumigant. Guidance on procedures as in 7.9 above.		
7.11 Any HEPA filters in room extract system to be tested against specification (current British Standard) and that filter housings are air tight.		
7.12 All alarm systems to be checked and tested.		
7.13 All ventilation system controls to be tested and commissioned under operational conditions, to include - Start up - Shut down - Room fumigation procedures - Simulated failure scenarios (all possible failures for the particular system) - Routine running.		
7.14 All workings of the ventilation system, in particular the control systems, to be explained and demonstrated to users.		
7.15 Test fumigation to be carried out by the contractor assisted by the University after all other commissioning tests and validation shown to be satisfactory but prior to handover. The test fumigation must be successful as indicated by no leakage of fumigant and acceptable level of kill (>10_5 log reduction) on test spore strips. University Biological Safety Adviser to oversee fumigation procedures and agree successful.		

Document version

Version number	Summary of change	Date and by whom
V1.0	**New template**	**JUNE 2023 HE**

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