University of Oxford Estates Services

SAFETY OFFICE REQUIREMENTS

University Estates Services
The Malthouse
Tidmarsh Lane
Oxford
OX1 1NQ
Tel: 01865 278750
Fax: 01865 278792

Oct 2014

SAFETY OFFICE REQUIREMENTS

PHILOSOPY DOCUMENT

INTRODUCTION

This document is one of a suite of Philosophy Documents which provide guidance to Design Teams working on projects for the University of Oxford. See the Introduction to the Philosophy Documents for general guidance.

The University Safety Office is responsible for a range of matters and their advice should be sought during the design process on all relevant issues. Below is a brief outline of their responsibilities in relation to construction projects. Contact names and details are found in Appendix A at the back of this document.

- Fire Safety Matters
- Laboratory Design
- Fume Cupboards
- Radiation
- Asbestos
- Project Sign Off

Safety Office Remit

The Safety Office is responsible for providing health and safety and environmental protection advice and services to all departments and members of the University. The Office implements management strategy and policies approved by the University's Health and Safety Management Committee to enable the University to discharge its legal obligations in respect of occupational health and safety. The Office is also responsible for the implementation of a number of rolling programmes of health and safety improvements in the University, such as structural fire precautions, fume cupboards, containment facilities in laboratories handling dangerous pathogens, and asbestos management. In addition, the Safety Office administers a mini minor works budget and provides some health and safety services, including hazardous wastes disposal, provision of safety signs, a safety library, and fire alarm contract administration.

Legislative Framework

The general provisions of the Health and Safety at Work etc Act 1974 impose a duty on all employers to ensure, as far as is reasonably practicable, the safety of their employees at work by maintaining safe plant, safe systems of work, and safe premises, and also by ensuring adequate instruction, training and supervision. The University is also bound by the Act to ensure the safety of all other persons, who (though not employees) may be affected by the University's work activities.

Fire Safety

The University Fire Safety Officer provides guidance on fire safety strategy in buildings. The Fire Safety Officer should be consulted at an early stage on all projects and should be informed of any subsequent changes to proposals.

Laboratory Design

The Safety Office should be consulted at an early stage about the design and layout of laboratory spaces. They should be informed when there are any subsequent changes. The Safety Office also provide guidance on the safe clearance of existing laboratory space where departments are vacating space. See Safety Office guidance S7/10.

Fume Cupboards

The Safety Office provide guidance on the choice, design and installation of fume cupboards. See Appendix C.

Radiation

The Safety Office should be consulted at an early stage on any matters concerning radiation.

Asbestos

Estates Services are responsible for the maintenance of the Asbestos Risk Register: see the Building Design Philosophy Document for further details. The Safety Office has developed guidance documents for departments, UPS S9/10. See Appendix B. The guidance notes also provide detailed information on the removal of asbestos. The Safety Office should always be informed where an asbestos incident occurs on University property.

Project Sign Off

Project hand over procedures must involve a representative of the Safety Office. See the Handover Procedures (separate philosophy document).

APPENDIX A: CONTACT US

University Safety Office
10 Parks Road
Oxford
OX1 3PD
Email: postmaster@safety.ox.ac.uk
Tel: 01865 (2)70811
Fax: 01865 (2)70816
Opening Hours:
Monday - Thursday 08.30-17.00
Friday 08.30-16.00

Mr Alan Kendall

Director of the Safety Office
Email: alan.kendall@safety.ox.ac.uk
Tel: 01865 (2)70810

Miss Julie Black

University Safety Officer
Email: julie.black@safety.ox.ac.uk
Tel: 01865 (2)70817

Mr Brian Jenkins

University Safety Officer
Email: brian.jenkins@safety.ox.ac.uk
Tel: 01865 (2)70814

Miss Tanya Boyce

Assistant University Safety Officer
Email: tanya.boyce@safety.ox.ac.uk
Tel: 01865 270807

Mr John Hewitt

University Fire Officer
Email: john.hewitt@safety.ox.ac.uk
Tel: 01865 (2)70813

Mr Andrew Thompson

University Biological Safety Officer
Email: andrew.thompson@safety.ox.ac.uk
Tel: 01865 (2)70819

Miss Tracey Mustoe

Assistant University Biological Safety Officer
Email: tracey.mustoe@safety.ox.ac.uk
Tel: 01865 (2)70803

Mr Mark Bradley

University Radiation Protection Officer
Email: mark.bradley@safety.ox.ac.uk
Tel: 01865 (2)70802

Mrs Gillian Jenkins

Radiation Technical Assistant
Email: gillian.jenkins@safety.ox.ac.uk
Tel: 01865 (2)70808

Mr Simon Haycox

Radiation Safety Assistant
Email: simon.haycox@safety.ox.ac.uk
Tel: 01865 (2)70818

Ms Frances Russell

Hazardous Waste Technical Officer
Email: frances.russell@safety.ox.ac.uk
Tel: 01865 (2)70815

Miss Diane Harris

Administrator
Email: diane.harris@safety.ox.ac.uk
Tel: 01865 (2)70812

Miss Sarah Dennis

Secretary to the Director, University Fire Officer & University Radiation Protection Officer
Email: sarah.dennis@safety.ox.ac.uk
Tel: 01865 (2)70880

Mrs Lucia Browning

Secretary to the University Safety Officers, the University Biological Safety Officer & Assistant University Biological Safety Officer
Email: lucia.browning@safety.ox.ac.uk
Tel: 01865 (2)70811

APPENDIX B: GUIDANCE ON ASBESTOS: SAFETY OFFICE POLICY

INTRODUCTION

This Policy has been revised to take into account the Control of Asbestos Regulations 2006 (CAR), which requires employers to manage the risks to health arising from asbestos on their premises.

Many University buildings will have asbestos containing materials (ACMs) in the building fabric, as they were in common use until the mid-1980s; they may also be present in old equipment. Where these materials are in good condition and remain undisturbed, they do not present a risk to health. When asbestos is disturbed or damaged, fibres may become airborne and can be inhaled. This can happen when work is carried out on or near ACMs, especially if they are broken, sawn, drilled, or sanded, or are in a poor state of repair.

The University Estates Services is responsible for managing asbestos in the fabric of buildings; departments are responsible for managing that present in equipment.

1. Asbestos Materials

The three principal types of asbestos are crocidolite (blue), amosite (brown), and chrysotile (white). Crocidolite is rare in University buildings; the others are commonly found in the fabric of older buildings. All may produce harmful effects if fibres are inhaled.

Because of their excellent heat resistance, chemical inertness, and mechanical strength asbestos products were once widely used in the building industry. For instance, within the University, asbestos has been found in:

i.) thermal insulation – on pipes and boilers,

ii.) insulation boards – for fire protection, as thermal and acoustic insulation on walls, ceilings and structural steelwork,

iii.) sprayed coatings – for fire protection on structural steelwork,

iv.) ropes and yarns – as a sealing material or for filling gaps, and

v.) asbestos cement – in wall claddings, partitions, roofing, or guttering.

Asbestos may also be present in laboratories, inside old equipment such as ovens, furnaces, and autoclaves; or as heat resistant mats.

Useful photographs showing typical ACMs may be found at http://www.hse.gov.uk/asbestos/gallery.htm

2. Work on Asbestos

The CAR and the associated Approved Codes of Practice govern work on asbestos. Work on asbestos insulation or coating, or on asbestos insulation board, may only be done by Contractors licensed by the Health and Safety Executive (HSE). All arrangements for such work must be made through the University Estates Services.

Some work on materials where asbestos fibres are firmly retained in a matrix (e.g. asbestos cement, or asbestos-containing floor tiles) may not require the use of a licensed asbestos Contractor; however, this is subject to risk assessment by a competent person and the approval of the University Safety Office.

University personnel are not permitted to carry out the work described above with any form of asbestos.

3. Record Keeping and Risk Assessment: The Asbestos Register

i.) Asbestos in the Fabric of Buildings

The University Estates Services is responsible for maintaining a record of asbestos in the fabric of University buildings and this is available on their web pages. This record (the Asbestos Register) is the result of a management survey carried out by a licensed asbestos Contractor and/or the Estates Services' asbestos monitoring Surveyors. The main purpose of the management survey is to locate, as far as reasonably practicable, the presence and extent of any ACMs that could be damaged or disturbed during normal occupation of the building. This includes any foreseeable maintenance or installation, and an assessment of the condition of the materials. Survey results are updated at least annually and amended whenever asbestos is newly discovered, or when it is repaired or removed. Departments must notify the Estates Services where they suspect asbestos containing materials have been found; the University Safety Office should be consulted if there is doubt over identification.

Asbestos is difficult to identify without laboratory analysis and poor sampling technique may result in uncontrolled release of fibres from ACMs. Only competent persons (e.g., a licensed asbestos Contractor, one of the Estates Services' asbestos monitoring Surveyors, a UKAS accredited laboratory, or the University Safety Office) are permitted to take samples for asbestos analysis.

ii.) Asbestos in Equipment

The Asbestos Register relates only to the building fabric: it does not include asbestos in laboratory equipment, which is the responsibility of departments. The head of department should ensure that the department keeps records that show the location of such equipment, and the condition of the asbestos if possible.

Asbestos that is damaged or in poor condition must be repaired by a licensed Contractor, or the equipment should be disposed of intact as asbestos waste. Records should be kept up to date, and amended following disposal or relocation of equipment; a copy should be sent to the Safety Office at the start of each year.

4. Marking of Asbestos

ACMs in the building fabric and laboratory equipment identified as containing asbestos should normally be marked with appropriate warning labels, which are available from the University Safety Office. The University Estates Services asbestos monitoring Surveyors are responsible for the building fabric, but departments are responsible for labelling their own equipment. There may be circumstances where labelling is considered inappropriate, but the agreement of the University Safety Office should be sought in such cases.

5. Disturbance of Asbestos

i.) Planned Work

The uncontrolled release of airborne fibres will present a hazard to health if work on ACMs is carried out without proper precautions. This can be avoided by proper job planning.

Whenever work is carried out that may involve the disturbance of ACMs (e.g. work on wallboards, old fire doors, or pipe insulation), then the person in charge of the project must first assess the nature of the materials involved. Depending on the size and complexity of the job, this will involve:

1) checking for asbestos labels,

2) checking the Estates Services Asbestos Register,

3) checking for asbestos hidden in ducts and behind panels,

4) sampling of suspect materials, and

5) a thorough, refurbishment and demolition type survey carried out by a licensed asbestos Contractor or United Kingdom Accreditation Service (UKAS) accredited laboratory.

A refurbishment and demolition survey is required before any refurbishment or demolition work is carried out. It is used to locate and describe, as far as reasonably practicable, all ACMs in the area where refurbishment will take place, or in the whole building if demolition is planned. The survey will be fully intrusive and involve destructive inspection where required to gain access to all areas, including those that may be difficult to reach. This type of survey may also be required where more intrusive maintenance or repair is planned, or for the dismantling and/or removal of heavy plant (e.g. in boiler houses).

ii.) Hidden ACMs or Accidental Damage to ACMs

Where ACMs are found to be damaged, or have deteriorated, the Estates Services (in the case of the building fabric) or the University Safety Office (in the case of asbestos in departmental equipment) must be informed so that steps can be taken to assess the situation and deal with it.

If, despite taking every precaution, ACMs are discovered during the course of work, or known ACMs are damaged, the following actions must be taken:

1) Stop work immediately.

2) Prevent anyone entering the area

3) To avoid spreading asbestos fibres, any clothing contaminated with dust or debris should be removed and placed in a plastic bag.

4) Report the problem as soon as possible to the person in charge of the project, and to the University Safety Office.

6. ACMs in Departmental Equipment

Asbestos was used in older laboratory equipment because of its heat resistant properties (e.g., in the linings or door seals of ovens). It can be difficult to identify and may be impossible to distinguish from other materials simply by looking at it.

Departmental workshop staff are most likely to encounter asbestos when dismantling equipment to carry out repairs. They should be made aware of this and be prepared to stop work immediately and seek advice from the University Safety Office if there is any doubt about the nature of the materials they are working with. The Safety Office will organise asbestos awareness courses from time to time; workshop staff should be encouraged to attend.

Asbestos fire blankets should all have been withdrawn from use and replaced with modern alternatives, but departments should ensure that they notify the Safety Office if any still remain.

7. Removal or Encapsulation of Asbestos

Where asbestos is discovered in the fabric of a building, or where it might be disturbed in the course of a job, then the University Estates Services (in consultation with the University Safety Office) will decide whether it should be removed or encapsulated. Any work on the ACM must be registered with the Estates Services technical clerk, who will issue an Asbestos Checklist that must be returned at the end of the project to ensure the Asbestos Register is kept up to date. All such work will be dealt with under the procedure outlined in the appendix to this Policy Statement.

The responsibility for meeting the costs of the works is as follows (see Buildings Committee paper BC(87)5):

i.) Where previously unknown asbestos in an unsafe state is discovered, or where an ACM has been accidentally damaged, the University Safety Office will meet the cost.

ii.) Where the Estates Services carries out scheduled work that involves disturbing known ACM, they will meet the cost.

iii.) Where work involving disturbance of known ACM is carried out at departmental request, the department must meet the cost.

8. Asbestos Waste

Waste ACMs are defined as hazardous waste and they must not be disposed of in normal waste streams. The Safety Office has provided an asbestos waste skip in the Science Area for the disposal of small amounts of asbestos waste from departments. Items must be dampened, double-wrapped in heavy (minimum 400 gauge) polythene, and sealed with tape. Care should be taken to maintain the integrity of the wrapping, to avoid contaminating the skip. If items are too large for the skip, contact the University Safety Office to make alternative disposal arrangements.

Unwanted equipment containing asbestos must be disposed of as described above. It must not be sold or given away as this would constitute supply of asbestos-containing products in breach of the CAR. Before disposal, it should be double-wrapped and disposed of intact; no attempt must be made to dismantle it.

9. Departmental Action

i.) Departments should note that University personnel are not permitted to work with any form of asbestos. With few exceptions, only a licensed Contractor may carry out work with asbestos.

ii.) Departments should be aware of the location of known ACMs in their buildings (the Asbestos Register is available on the Estate Services web pages). The University has a duty to warn staff or Contractors of the presence of asbestos, so that those intending to work near it can take proper precautions to avoid accidental damage or disturbance.

iii.) Planning for repairs, refurbishments, and maintenance should include consideration of the possibility of disturbing previously undiscovered asbestos during the course of the work. In some cases, an asbestos survey will need to be carried out as part of the planning process, especially where any demolition work is contemplated. The responsibility for ensuring that planning and/or surveys are carried out may lie with individual departments or with the Estates Services, depending on who is in control of the work.

iv.) Departments should report any new discoveries of asbestos to the Estates Services, so the Asbestos Register can be updated and any necessary action taken. Any damage to, or deterioration of,

asbestos should also be reported without delay so that remedial action can be taken.

v.) Departments should keep records of the location of laboratory equipment containing asbestos and amend them following removal or disposal of the equipment. Copies of these records should be sent to the Safety Office annually.

v.) Laboratory equipment containing asbestos should be disposed of intact, either in the asbestos skip or by a licensed Contractor.

ARRANGEMENTS FOR REMOVAL OR ENCAPSULATION OF ASBESTOS

The University Estates Directorate is responsible for drawing up a specification for the works, which will include information on the nature and condition of the asbestos containing material (ACM). If necessary, they will obtain a competitive tender from a Contractor holding a current HSE licence.

The University Estates Directorate will give the selected Contractor an official order containing the agreed asbestos clauses and send a copy to the University Safety Office. The order will include the arrangements for a pre-work site meeting of interested parties (including representatives from the Estates Directorate, the University Safety Office, the Contractor, the department concerned, and the recognised trades unions). Where the works may affect adjacent departments, then they should also be invited to send a representative.
The University Estates Directorate will be responsible for inviting all participants except representatives of the trades unions, who will be invited to attend by the University Safety Office. Reasonable notice of the meeting should be given.

The following matters should be discussed at the meeting, and notes taken:

1. The University requires the work to be carried out in accordance with the Control of Asbestos Regulations 2006 and the associated Approved Codes of Practice.

2. The Contractor must give details of his current HSE licence and indicate whether the work requires notification. The notes should indicate whether he has provided (or will be providing) a copy of the HSE notification form ASB5.

3. Before work starts, the Contractor must provide a written assessment and method statement and the Estates Directorate should send a copy to the University Safety Office.

4. The department should ensure that all its members in the vicinity of the works are advised of the following:

i.) the start time and duration of the job,

ii.) the precautions taken to protect their health and safety,

iii.) any areas that will be out of bounds to them for the duration of the job,

iv.) whom to contact to discuss any concerns about the job, and

v.) arrangements for informing them when it is safe for the area to be reoccupied.

5. The Contractor must take reasonable steps to ensure that no University personnel may enter any designated asbestos area or respirator zone. All such areas and zones must be properly demarcated and identified in accordance with regulation 18 of the Control of Asbestos Regulations 2006.

6. The Contractor must ensure that a copy of the latest test certificate for his exhaust ventilation equipment is present on site for the duration of the works.

7. Any vacuum cleaners on site must meet British Standard BS5415: Part 2, Section 2.2, Supplement No 1, type H tested with absolute filtration. Copies of test certificates for this equipment must be available on site.

8. The material to be removed must be clearly identified and the Contractor must have information on the nature of the asbestos.

9. The meeting should consider other safety matters relevant to the work, e.g. isolation of electrical or piped services, or identification of any high-risk activities nearby.

10. Arrangements for the Contractor's access to the areas concerned must be agreed, as must the positioning of the decontamination unit, power, water, drainage, and electrical protection, where appropriate.

11. If negative pressure equipment is used, it must be left running continuously for the duration of the removal works, unless otherwise agreed with the University Safety Office.

12. A smoke test must be carried out to prove the integrity of any negative pressure enclosure in the work area. The University Safety Office will nominate a person to observe this and the Contractor should provide twenty-four hours' notice of the test.

13. Arrangements for preventing false triggering of the fire alarm system during the smoke test must be agreed.

14. The Contractor's employees must use protective clothing to the HSE approved standard (normally coloured overalls in the dirty area, white in the clean area).

15. Before it leaves the work area, waste must be double contained in plastic bags (red inner bags and clear outer bags). Safe arrangements for the transfer of waste from the work area should be agreed. The sealed bags must be stored in a locked container until the Contractor removes them from site. Containers for asbestos should be clearly labelled in accordance with the Control of Asbestos at Regulations 2006.

16. Contractors must provide a copy of their Waste Transfer Note to the Estates Directorate, where it will be retained for at least two years.

17. Following completion of the work, visual inspection and air monitoring must be carried out (unless otherwise agreed with the University Safety Office) by a UKAS accredited laboratory operating to criteria equivalent to those specified in EN 45001.

18. Clearance levels of less than 0.01 fibres per ml are required before any enclosure is removed. The Contractor must forward the laboratory’s report to the University Estates Directorate, who will keep a copy for at least five years.

19. The meeting should identify someone to check on behalf of the University that the work has been carried out in accordance with the contract. The Estates Directorate will send the meeting notes to all those who attended and the arrangements made will be binding on the Contractor and the department. The University Safety Office will forward copies to the recognised trades unions.

APPENDIX C: FUME CUPBOARDS

INTRODUCTION

In the laboratory, fume cupboards are a significant means of controlling exposure to hazardous substances, and the main type of local exhaust ventilation (LEV) used under the COSHH Regulations. By providing partial containment, they may provide protection for both users and co-workers from the hazardous effects of gases, vapours, aerosols, and particulates. Because they only provide partial containment and because a number of factors affect their performance, there may be circumstances where a fume cupboard does not provide adequate protection. This policy aims to provide workers with the information to make the risk assessments needed to select a suitable fume cupboard for their work and to use it safely. It also describes the University's policy for maintenance and testing.

1. Types of Fume Cupboard

(i.) Ducted Fume Cupboards

This is, by far, the most common type of fume cupboard: a wide range of ages and types may be found in the University. Some specialist types are available, e.g. walk-in fume cupboards, or those fitted with water wash-down; however, they all function by drawing laboratory air into the fume cupboard, thus containing and diluting the contents before discharging them to the environment, usually without filtration three metres above roof level. New installations must comply with the current British Standard, presently BS 7258:1994: Laboratory Fume Cupboards; and also with the University's own standards and specifications for fume cupboards. The latter contain certain design and installation requirements which in some cases exceed the British Standard (for information, these documents are available in the Safety Office library). In order to ensure compliance with these standards and to identify any other relevant issues (e.g. planning concerns or potential conflicts with other projects), new fume cupboard installations must have the approval of the University Safety Office and the University Surveyor's Office.

(ii.) Recirculatory Filtration Fume Cupboards

These may appear superficially attractive as alternatives to ducted fume cupboards, largely because of their significantly lower initial costs. They may also be considered where the installation of ductwork for conventional fume cupboards is impossible, or where insufficient make-up air is available to accommodate ducted fume cupboards. They operate by drawing air into the fume cupboard and exhausting it through a set of filters (usually some type of activated charcoal) back into the laboratory.

There is no British Standard for recirculatory filtration fume cupboards, although a draft for comment was issued early in 2000. Consequently, fume cupboards from different manufacturers may differ significantly in performance. Prospective buyers should make enquiries to ensure that any new purchase will meet the requirements of the proposed British Standard.

2. Selection

A suitable risk assessment must be made in order to select an appropriate type of fume cupboard.

(i.) Ducted Fume Cupboards

Ducted fume cupboards with face velocities of at least 0.5 m.s-1 are suitable for most applications, though consideration may need to be given to design and to the materials of construction. For instance, where perchlorates are used, then there must be no wood or other absorbent surfaces present; water wash-down facilities may need to be provided in the ductwork.

Where significant amounts of hydrofluoric acid are handled, then plastic sash windows should be fitted, to avoid the loss of visibility by etching which will occur if glass is used.

(ii.) Recirculatory Filtration Fume Cupboards

Recirculatory filtration fume cupboards are not generally suitable for use with hazardous materials and should only be used for the control of nuisance odours, for small quantities of solvents, etc. The University Safety Office should be consulted whenever their use with hazardous materials is proposed.

There are a number of features of recirculatory filtration fume cupboards that make them unsuitable for general use:

1) The air flow rate must be high enough to provide containment, but in order to produce good filtration it must be low enough to provide adequate residence time on the filter(s).

2) The correct choice of absorbent in the filter(s) is essential; no single filter can cater for all uses.

3) Adequate laboratory ventilation (8–12 air changes per hour) must be provided in order to prevent the accumulation of any contaminants which may not be fully retained by the filtration system.

4) Some system of monitoring the quality of the filtered and exhausted air is necessary if they are used with hazardous materials.

They are suitable for some low risk work (e.g. dispensing small quantities of solvents, weighing hazardous chemicals), but they are not a substitute for ducted fume cupboards.

In particular, they are not suitable for:

1) work with carcinogens or suspected carcinogens,

2) work with substances not effectively trapped by the filter(s),

3) work with gases or vapours which are odourless, or which have odours detectable only at concentrations greater than the Occupational Exposure Standard,

4) work involving large quantities of substance (e.g. boiling off solvents), or

5) use in poorly ventilated laboratories.

A risk assessment is essential before recirculatory filtration fume cupboards may be used. They are not suitable for use in situations where use cannot be effectively controlled, e.g. where multiple users frequently change procedures or where inexperienced workers operate.

(iii.) Other Considerations

Note that neither type of fume cupboard is suitable for protection against microbiological hazards, where microbiological safety cabinets must be used; the latter function by containing and capturing hazardous micro-organisms on high-efficiency particulate filters before discharging the filtered air to the environment or to the laboratory.

Although the recirculatory type of fume cupboard may appear to be similar, it does not perform the same function. The construction, installation, and maintenance of microbiological safety cabinets is required to conform to a British Standard and further details may be found in UPS S5/09 (Biological Health and Safety).

Where protection must be provided against both chemical and microbiological hazards, then advice must be obtained from the University Safety Office before work commences.

Advice on the selection of fume cupboards for work with radioactive materials must be obtained from the University Radiation Protection Officer.

(iv.) Containment and Face Velocity

The key attribute of a fume cupboard is its ability to provide good containment of hazardous materials. Although it was previously thought that there was a simple relationship between containment and face velocity, this is no longer accepted, especially for modern fume cupboards.

University policy requires that fume cupboard face velocities must be a minimum of 0.5 m.s-1 if the fume cupboard is to be used for work with hazardous materials. A lower standard of 0.25 m.s-1 is acceptable if it is to be used solely for the storage of hazardous materials. (BS 7258 does not specify a face velocity figure for adequate performance, though it suggests that face velocities of less than 0.3 m.s-1 are unlikely to give satisfactory containment and that 0.5 m.s-1 or above may be needed.)

3. Services

Fume cupboards should be fitted with a water supply and a sink. Controls for services should be outside of the fume cupboard, as should electrical socket outlets. Adequate lighting must be provided, with fittings accessible from outside of the fume cupboard. Appropriate earthing must be provided for metal surfaces or fixtures.

Provision of services is fully covered in the University's specifications for fume cupboards, referred to in 2(a) above.

4. Maintenance and Testing

(i.) Ducted Fume Cupboards

The Grey Book (Standing Orders for Works in University Departments) sets out the responsibilities of departments and the Buildings and Estates Sub-Committee (BESC) in respect of fume cupboards. Generally, heads are responsible for the provision and maintenance of the fume cupboard itself and BESC is responsible for the provision and maintenance of the associated fans and ductwork. Work on fans or ductwork may not start until the department has fully assessed the risk from harmful contaminants in the ductwork. Contamination is most likely where particulate or condensable materials have been used; in these circumstances the department should keep a record of the substances used and their quantities.

Departments should ensure that a face velocity measurement is made as part of the commissioning procedure for new fume cupboards, so it may be used in future tests to check whether any deterioration in performance may have occurred. Once the fume cupboard has been installed, face velocity will be the only easily available relative measure of performance. The University Surveyor's staff carry out annual measurements of the face velocities of ducted fume cupboards, but the head of department is responsible for ensuring that these tests are performed on all the relevant installations. The head of department is responsible for ensuring that the Surveyor's information is up to date, so arrangements must be made to ensure that his office is notified of new ducted fume cupboard installations. These tests ensure that the department complies with the requirement of the COSHH Regulations for annual testing of LEV systems.

The Surveyor sends the test results to the department and to the University Safety Office; under the COSHH Regulations, they must be kept for a minimum of five years. For the users' information, they are also displayed on a label affixed to the fume cupboard, along with a label denoting the sash height at which the fume cupboard meets its performance specification.

For general use, a fume cupboard must have a face velocity of at least 0.5 m.s-1 with a sash opening of 0.5m. Risk assessment should show whether certain specialised uses require a higher face velocity. This is acceptable provided that it can be achieved without causing turbulence and reducing containment. Where a fume cupboard is used for storage only, a standard of 0.25 m.s-1 will suffice.

(ii.) Recirculatory Filtration Fume Cupboards

Departments must make their own arrangements (usually with the supplier or manufacturer) for testing the performance of recirculatory filtration fume cupboards. When these devices are used as a control measure under COSHH, then a record of the performance tests must be kept for a minimum of five years. Filters must be changed when blocked or saturated (as indicated by any built-in alarm systems), or at any other interval specified by the filter supplier. Filters contaminated with hazardous materials must be regarded as chemical waste and disposed of via the University Safety Office.

5. Use

Before any work is started, a COSHH assessment should have determined whether a fume cupboard is appropriate for the task. For work with highly toxic material, better containment (e.g. a glove box or other fully enclosed apparatus) may be necessary.

The performance of any fume cupboard can be severely degraded by incorrect use, in particular by anything that disturbs the laminar flow of air into the enclosure.
BS 7258: Part 2: 1994 contains detailed information on installation arrangements which will avoid such disturbance. All new installations and refurbishments must comply with this standard.

Any of the following could cause interference to airflow and cause fumes from within the enclosure to enter the worker's breathing zone:

(i.) external draughts (caused by the user's sudden movements, by people walking quickly past the front of the fume cupboard, by opening doors situated too close to it, by air conditioning units or by other fans),

(ii.) the use of naked flames, hot air guns, ovens, hotplates, fans or centrifuges, all of which may cause turbulence,

(iii.) large items placed too close to the front opening, or too close to the back baffle, or

(iv.) the use of screens for protection against ionising radiation or explosion.

The following points should be noted:

(i.) Fume cupboards must be carefully situated to avoid disturbance from draughts. BS 7258: Part 2: 1994 contains detailed recommendations on siting, including diagrams showing the setting-out distances from walls, doors, other fume cupboards, benching, and circulation space. New installations must comply with this standard.

(ii.) Most fume cupboards are designed for use by only one person at a time. Before starting work, users should check that their fume cupboard is fully operational (i.e. that the sash works properly and that airflow is present).

(iii.) The fume-generating apparatus should be placed at least 150mm behind the sash to ensure proper entrainment of fumes, but it should not be so far back that the user has to lean into the fume cupboard. If the use of large items or screens is unavoidable, raising them about 50mm on blocks so that the air can flow underneath will considerably improve airflow.

(iv.) The back baffle should be kept clear of obstructions (e.g. bottles, equipment, or tissues) which could obstruct the airflow.

(v.) The sash should be kept closed as much as possible in order to maximise containment. In any event during the experiment it should not be raised above the position at which the face velocity was measured (indicated by a label affixed to the fume cupboard). Before raising the sash at the end of an experiment, the fan should be allowed to run for a while to clear any fumes.

(v.) Fume cupboards are working areas, so those used for experimental work should not also be used for the storage of chemicals or apparatuses. Besides the effect on airflow described above, there is the possibility that a minor incident could involve these stored materials and escalate into a more serious one.

(vi.) Care should be taken in disposing of chemical wastes via fume cupboard sinks. Their drains connect with the normal building drains and nothing unsuitable for disposal via ordinary laboratory sinks may be put down fume cupboard sinks.

(vii.) Particular care should be taken in the event of spillages inside fume cupboards. If the material spilt is unsuitable for drain disposal (as defined in (g) above), then it must not be simply washed down the fume cupboard sink.

APPENDIX D

SPECIFICATION FOR CONTAINMENT LABORATORIES

INTRODUCTION, STANDARDS AND REFERENCES

This section sets out the standards for the design and construction of containment laboratories at Oxford University. 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 the Project Sponsor Group, the University Surveyors Office and the University Safety Office. 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 will be determined by the Project Sponsor Group in consultation with the University Safety Office.

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.

The legal requirements for containment laboratories are set out in the following:

- The Control of Substances Hazardous to Health Regulations (2002) and supporting Approved Codes of Practice which includes the Biological Agents ACOP;
- The Genetically Modified Organisms (Contained Use) Regulations 2000;
- The Security Requirements for Pathogens and Toxins (2010) (*restricted document*)

The Regulations are supported by the following guidance which is regarded as good practice and must also be followed in Oxford University 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]; and

- Advisory Committee on Genetic Modification (ACGM) Compendium of Guidance. 2000. HSE Books. ISBN 0-7176-1763-7. Also available on ACGM website at http://www.hse.gov.uk/hthdir/noframes/acgmcomp/acgmcomp.htm

- Sealability of Microbial Containment Level 3 and 4 facilities available as a pdf at http://www.hse.gov.uk/biosafety/gmo/guidance/sealability.pdf

Various other organisations produce guidance on the design and build of containment laboratories. Those produced by the Wellcome Trust and The Medical Research Council and Imperial College provide useful additional guidance of which design teams should be aware.

The various guidance documents cited above include management and operational procedures for containment laboratories. This specification for Oxford University 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.

All references to published documents are current at November 2010. 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.		
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	The lab or suite must be lockable from the outside mechanically or electronically so it can be secured from entry by any other user in the event of an emergency.		
1.1.6	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.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
1.1.6	Where possible, laboratories subject to the controls specified in ACTSA must not be sited on a ground floor or where access may be assisted by other structures such as adjacent flat roofs.		
1.1.7	Proximity, magnetic card ("swipe card") access control systems must be installed where access cannot be controlled manually e.g. by permanent security staff. Such systems must also incorporate a personal identification number (PIN).		
1.1.8	PIN numbers must be unique to each user, changed regularly, and incorporate a duress code facility.		
1.1.9	The system must be fully auditable for access and egress information, password protected, and protected by a physical security device conforming to LPS 1214: Issue 2 Category 1.		
1.1.10	All emergency exit doors must be fitted with a warning device to alert staff when opened and incorporated into any technology based access control system that is in operation.		

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 University Safety Office.		
1.3	**Space requirements**		
1.3.1	Sufficient space to be allowed for staff to carry out their work safely - general layout to be in accordance with recommendations given in BS 3202, Laboratory Furniture and Fittings, Part 3, 1991 - consider all traffic routes - where microbiological safety cabinets and/or fume cupboards are installed layouts to comply with space requirements in appropriate British Standard. - See 2.3.3 for furniture recommendations		
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.		
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.		
1.4.5	Fire exit routes from other areas must not 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 - as an office area sited outside the containment zone. - a clearly segregated area within the laboratory (this could be separated, for		

	example, by circulation routes and fitted with low-level benching); or		
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 3202 Laboratory Furniture and Fittings, Part 3, 1991.		
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 non-shrinking 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 Project Sponsor Group) 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).		
2.3.3	The design of chairs and stools to be used should take into account the nature and duration of work likely to be undertaken. The use of five legged stools with back supports and foot rings is not mandatory. Four legged stools or other designs occupy significantly less space and may be preferable.		
2.3.4	Stools, chairs, and their seats should have wipeable surfaces. Any seat cushions must be covered with a water-impervious fabric (not cloth-covered)		
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.		
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	In CL3 facilities with more than on laboratory, lobby entry and exit doors must be interlocked with each other and with other CL3 laboratory doors by suitable means to minimise disruptions to airflow patterns during use.		
2.8.6	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.		
2.8.7	Blinds ideally to be located between the window panes or where installed in the laboratory to be made of a non-absorbent material.		
2.8.8	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.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
2.8.9	Doors must be of robust construction, securely fixed to the fabric of the building in accordance with the manufacturer's instructions, and must be certified to meet LPS 1175: Issue 5 Security Rating 3. BSI PAS 24 may be acceptable subject to consultation with the CTSA. Doors constructed to the new European Standard ENV 1627 will require NaCTSO approval.		

2.8.10	Where used, double doors must conform to the above requirements.		
2.8.11	Integral air vents in doors must be secure i.e. cannot be removed from the outside.		
2.8.12	Glazing adjacent to a security door must be laminated (minimum thickness 7.5mm) and installed in accordance with BS 6262:1982 and the glazing retention system (frame) must be tested to either BS 7950 or LPS 1175: Issue 5 Security Rating 2. Alternatively the glazing must be protected by internal grilles or an external roller shutter certified to LPS 1175: Issue 5 Security Rating 1/2.		
2.8.13	Windows must be securely fixed to the fabric of the building in accordance with the manufacturer's instructions. All glazing in windows must be laminated (minimum thickness 7.5mm) to BS6206 and installed in accordance with BS 6262:1982		
2.8.14	All ground floor external windows within the building that may allow access to the critical areas must be certified to BS7950: 1997. Windows installed to the new European Standard ENV 1627 will require NaCTSO approval. Alternatively windows must be protected by internal grilles or external roller shutters certified to LPS 1175: Issue 5 Security Rating 3, and must incorporate window security film.		
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.		
2.93	Internal walls must be of breeze block, brick, or equivalent construction and must avoid the use of dry lining. Working surfaces should be applied directly to a solid surface		
2.9.4	False ceilings to be included only in consultation with the Project Sponsor Group and the University Safety Office.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
2.9.5	Walls, ceilings, floors must be of robust construction and be able to withstand a forced entry e.g. floor slabs or reinforced concrete construction. All elements should be equally robust. It should not be possible to break through walls, floors and ceilings or gain access from adjacent areas. Stud partitioning, unless reinforced to a standard equivalent to LPS 1175: Issue 5 Security Rating 3, is not considered to be adequate.		
2.9.6	The walls of the critical area must be made secure up to the floor construction above. The internal ceiling construction need only be designed to achieve containment requirements.		
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 Project Sponsor Group) 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.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
2.10.4	Any utility (electricity, telecommunication, alarm monitoring etc.) essential for the safety and security of the critical area must be secured in appropriate housings with access covers meeting LPS 1175: Issue 5, Security Rating 4.		
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.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
2.11.6	All sites where substances are held or stored under the Act must be protected by an alarm linked to an alarm receiving center (ARC) complying with BS 7042:1998 Specification for High Security Intruder Alarm Systems in Buildings.		
2.11.7	Additionally, all establishments must have a police response to alarm activation via the ARC and therefore must comply with the ACPO Security Systems Policy.		
2.11.8	All critical areas must be alarmed with an appropriate system and sufficient detectors to ensure complete coverage.		
2.11.9	Personal attack alarm facilities should be available within the critical area. These could take the form of push button alarms linked to the facility alarm.		

2.11.10	CCTV coverage may assist if the establishment does not have 24 hour security staff but should not be relied upon to act as a deterrent under normal circumstances.		
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.		
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.		
Additional requirements for CL3 laboratories subject to ATCSA controls:			
3.2.2	All storage facilities should be incorporated in the critical area. Where this is not possible the storage area must conform to the same		

	standards as the critical area.		
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 Safety Office.		
Additional requirements for CL3 laboratories:			
4.1.2	At least one safety cabinet to be installed - Class to be agreed by University Safety Office. - Cabinet(s) must be capable of being closed/sealed in a safe manner in the event of power failure - Cabinet(s) must be of a constant volume by-pass design		
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 Project Sponsor Group and the University Safety Office.		
4.2.3	Cabinets to be provided with ports to accommodate vapourized hydrogen peroxide (VHP) fumigation equipment.		
4.2.4	Cabinets to be commissioned and certified as passing in use operator protection test (4 head KI Discus, OPF to be >1x105) 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 fumigant gas. Ducting to atmosphere does not necessarily mean high level discharge above		

	the roof of the building, however, discharge of fumigant gas 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 directly to atmosphere and be hard ducted (thimble systems or recirculating cabinets are not acceptable).		
4.4	Siting		
4.4.1	Siting of cabinets - to comply with layouts given in BS 5726 Microbiological safety cabinets, 1992 (note BS 5726 has been superseded by BS EN 12469 but this does not include layouts so this reference remains valid) - not to be affected by draughts caused by ventilation and air conditioning units - 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	The rationale for fumigation of different areas vs whole suite to be agreed in consultation with the Project Sponsor Group and the University Safety Office.		
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 Project Sponsor Group - 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	Active air supply to be avoided as far as possible and only included in consultation with the Project Sponsor Group and the University Safety Office. If air supply is provided for compelling reasons it must be situated so that it does not create air currents that will compromise the function of biological safety cabinets.		
6.8	There is to be a continuous inward airflow into the laboratory - ascertain in consultation with		

	University Safety Office whether this is required at all times or only when work is in progress.		
6.9	In order that containment is maintained when the door is opened there is to be air inflow through the doorway - design to include air being drawn passively through the door under normal operating conditions.		
6.10	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.		
6.11	Where there are inner rooms there is to be a pressure cascade with a differential pressure of at least -15Pa between areas.		
6.12	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.		
6.13	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.		

6.14	A fumigation panel is to be provided that indicates status of the ventilation system during fumigation.		
6.15	Exhaust of ventilation system to extract directly to atmosphere, ideally at roof level, and be dedicated to the CL3 laboratory or CL3 suite.		
6.16	Extract fan to be at terminal point of ductwork (i.e. downstream of HEPA filters).		
6.17	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 either side of all HEPA filters to allow checks to confirm filter integrity/performance.		
6.18	Means of preventing reverse air flows to be incorporated into the system.		
6.19	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.		
6.20	Extract fan failure to be indicated by an audible alarm (preferably with a visible alarm) that can be heard throughout the inside and immediately outside the CL3 zone. A means of testing the alarm system must be provided.		
6.21	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). - dampers must be located so that HEPA filters are enclosed on the lab side and can be subjected to fumigation. - 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.		
6.22	No joints or welds to be located in any duct or pipework passing above the ceiling of the CL3 zone.		
6.23	Where cabinets have by-pass systems these to operate to minimise any change in laboratory negative pressure on switch over.		
6.24	Lobby to be part of the CL3 containment zone.		
6.25	The ventilation system to continue to run in the event of fire alarm activation with provision for manual shut down by fire brigade.		
6.26	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 Safety Office. 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.		
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.		

Additional requirements for CL3 laboratories:			
7.4	Pressure regime to be tested against design specification.		
7.5	Interlock between extract and any 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.		
7.10	Where necessary, the contractor to carry out any further tests to be confident as to the sealability of the CL3 areas to permit fumigation and prevent escape of fumigant. Guidance is provided in the HSE document Sealability Of Microbiological Containment Level 3 And 4 Facilities: (http://www.hse.gov.uk/biosafety/gmo/guidance/sealability.pdf)		
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.		

APPENDIX E BUILDING DESIGN ISSUES RELATED TO FIRE SAFETY

	CONDITION	ESSENTIAL (E) OR DESIRABLE (D)
1	**BUILDING DESIGN ISSUES RELATED TO FIRE SAFETY**	
1.1	The design criteria for all new buildings should include consideration for a comprehensive sprinkler system covering the whole of the building.	E
1.2	Dedicated evacuation lifts for the safe evacuation of persons with reduced mobility should be provided in all new buildings. Alternatively lobby protected lifts provided with a secondary power supply from an adjacent building.	D
1.3	Dead-end conditions requiring structural fire protection should be avoided.	D
1.4	Suitable and safe provisions for windows /roof glazing cleaning and maintenance.	E
1.5	Appropriate roof access, walkways, guarding, lighting and alternative means of escape facilities off the roof area.	E
1.6	No fire dampers installed in fume cupboard flues and essential supply/extract ductwork.	E
1.7	Fume cupboards to be fitted with 'Firetrace' or similar suppression systems wherever fume cupboard use could produce a fire risk within the enclosed cabinet and within the associated ductwork.	D
1.8	Planned gas flooding/oxygen depletion fire suppression systems must have University Safety Office approval.	E
2	**FIRE ALARM AND DETECTION SYSTEMS**	
2.1	Buildings with no sleeping risk – L2 as defined by BS5839-1	E
2.2	Buildings with sleeping risk – L1 as defined by BS5839-1	E
2.3	All systems should be analogue/addressable.	E
2.4	All systems installed shall be open protocol. 'Closed protocol' systems are not acceptable.	E
2.5	Preferred manufacturers of fire alarm equipment to ensure commonality are Kentec Electronics for control panels and Hochiki Corporation UK for field devices.	D
2.6	All systems shall be connected to the University Security Services control room for 24/7 monitoring using DRAX outstations to relay a fire alarm signal.	E
2.7	All systems shall also incorporate a 'security alert' facility. The fire alarm control panel shall be fitted with a dedicated switch labelled 'Security Alert'. This switch will activate all sounders on an intermittent basis through a timer fitted within the control panel and will also activate a	E

	CONDITION	ESSENTIAL (E) OR DESIRABLE (D)
	separate output to the University Security Services control room through the DRAX outstation. The fire alarm output will not be activated by the 'security alert' switch.	
3	**FIRE ALARM INSTALLATION CRITERIA**	
3.1	**Lift shafts**	
	If point detection cannot be installed in a lift shaft in a manner that allows safe working access (without the need to stand or ride on the lift car roof), a single zone air sampling detector shall be installed outside the shaft with a short run of pipe work into the shaft. The aspirating device shall be connected to the fire alarm system via an interface unit.	E
3.2	**Electronic locks**	
	Magnetic plate locks are preferred.	D
	Latch plate locks are only acceptable if a lever handle or knob (to mechanically de-latch the door) is fitted on the escape side of the door.	E
	All electronic locks 'upon total power loss' shall fail to an unlocked condition.	E E
	Plate locks must always be provided with a push switch to release together with a green break glass unit to enable total electrical isolation to the lock in the event of a push switch failure.	D
	Plate locks incorporating power driven shoot bolts should be avoided.	D
	Doors fitted with electronic locks on common escape routes should de-lock upon fire alarm activation and also be provided with green break glass units.	E
	Final exit doors may de-lock upon fire alarm activation and green break glass units provided the door is additionally held secure from within with an additional night latch, panic bar or push pad and the door is also provided with a self-closing device.	
3.3	**Disabled person refuges/facilities**	
	Where disabled person refuges are required, communication should be through the fire alarm system. At each refuge point an addressable yellow break glass unit is provided, together with a reassurance lamp, all installed on the relevant system loop wiring. The fire alarm control panel shall have additional LED indicators and acceptance/reassurance switches fitted for each refuge. The break glass unit will activate the fire alarm control panel but <u>not the fire alarm sounders or any other system outputs</u>. The refuge location will be indicated on the control panel display unit and LED indicator. Operation of the relevant acceptance/reassurance switch will activate the reassurance lamp at the refuge.	D
	In larger buildings it may be necessary to provide emergency voice communication systems (EVC) particularly when travel distances are	E

	CONDITION	ESSENTIAL (E) OR DESIRABLE (D)
	excessive between fire alarm control panel and refuges.	
	All fire alarm systems shall be fitted with a radio paging system with monitoring facilities in accordance with the recommendations within BS5839-1. Two alpha-numeric vibrating pager units and chargers shall be supplied for each system.	D
	Fire alarm detection devices located in vertical service risers or above suspended ceilings shall all be provided with means of identifying their precise location. Ceiling panels immediately below each device shall be provided with a label, disc or remote indicator and are to include the device address.	E
	Fire alarm device location plans showing basic floor plans, zoning and the location and address of every device shall be provided and located adjacent to the fire alarm control panel.	
4	**FIRE ALARM CAUSE AND EFFECT**	
4.1	The buildings gas supply shall only shut down upon fire alarm activation by way of a device within the room in which the supply enters the building.	D
4.2	Air handling plant supplying essential make-up air to fume cupboards, biological laboratories or any other facility where an interruption to the air supply could be dangerous or damaging, must not automatically shut down upon fire alarm activation.	E
4.3	A fireman's switch shall be provided adjacent to the fire alarm control panel to permit essential air handling shutdown at user/fire service discretion. A secure switch to resurrect extract only regardless of fire alarm condition is also to be provided for post-fire smoke purging at fire service discretion.	E
4.4	Atriums or void spaces provided with openable vents to control building temperature shall also be provided with a fireman's switch to enable vent opening or closing under fire service control.	E
4.5	Automatic grounding of lifts upon fire alarm activation should (through the building management system) be a condition which can be rapidly reverted by key managerial staff if it is considered safe to use the lift for disabled person evacuation.	D

	CONDITION	ESSENTIAL (E) OR DESIRABLE (D)
5	**EMERGENCY/ESCAPE LIGHTING AND SIGNAGE**	
	A central battery/inverter system is preferred.	D
	Key switches for user testing.	D
	Local isolation facilities must be provided in accordance with Oxford University Estates Services requirements.	E
	Maintained fittings within areas where lighting can be dimmed.	D
	Illuminated (integrally lit) signage only required within lecture theatres, seminar rooms and other areas where lighting can be dimmed or reduced for activities.	D
	All standard surface fixed directional signage to be illuminated under outage conditions by a local emergency luminaire within 2m of the sign.	D
	All fire exit doors, fire alarm call points, fire alarm control panels and first aid fire fighting equipment shall be provided with local emergency lighting within 2m of their positions.	D

APPENDIX F

MINIMUM SPECIFICATION FOR NEWLY CONSTRUCTED OR REFURBISHED LABORATORIES
(Applies to wet laboratories and to laboratories where work with radiation will be undertaken)

	ITEM	ESSENTIAL (E) OR DESIRABLE (D)
1	**LABORATORY SPACE**	
	Sufficient space must be provided to allow safe working.	E
	Additional requirements for work with radiation: *A dedicated room for radiation work to maintain separation of work with radiation from general laboratory working areas[1]. Ideally all radiation work should be grouped together in a dedicated room or laboratory rather than allowing multiple work areas within individual laboratories.*	D
	Storage – sufficient to accommodate the consumables and waste needs of the occupants without the need to obstruct corridors, footwells etc.	E
	Storage of equipment/consumables in corridors must be avoided.	E
	Additional requirements for work with radiation *– local storage available for accumulating necessary radioactive waste generated by occupying groups. Capacity for storing sufficient drums, each having dimensions 52 cm high x 40 cm diameter. Lockable. Fire resistant. Shielding for isotopes in store to achieve external dose rates less than 2.5 microsieverts per hour[2].* *Note: May be necessary to construct entirely separate storage area. If so, lockable. Fire resistant. Shielding for isotopes in store to achieve external dose rates less than 2.5 microsieverts per hour[2]. Air brick ventilation.*	E (or D if lab is dedicated for radiation work & secure)
2	**LABORATORY DESIGN FEATURES**	
2.1	**Layout**	
	Layout should facilitate minimum movements during handling of hazardous materials. Storage, working and disposal positions ergonomically arranged. See BS 3202: Part 3 for siting of laboratory benches in relation to traffic routes.	E
2.2	**Entrance**	
	Doors must display appropriate safety signs.	E

[1] Best practice is to separate work with radiation from other work and the "ALARP" condition of the Ionising Radiations Regulations 1999 requires this. Furthermore it is a condition of the University's certificates under the Radioactive Substances Act 1993 that access by unauthorised persons to radioactive materials is restricted.

[2] Will require information on anticipated isotope usage by the groups occupying the area. Advice should be sought from the University Radiation Protection Officer on shielding specification

	ITEM	ESSENTIAL (E) OR DESIRABLE (D)
	Provision for easily adding/removing/updating safety signs.	D
	Provision of storage/hooks for lab coats and PPE.	E
	Additional requirements*: Lockable entrance door for work with radiation. Coded entry for laboratories holding highly hazardous radioactive materials or materials listed on Schedule 5 of the Anti-Terrorism, Crime and Security Act 2001.*	E
2.3	**Floors (including in those storage areas)**	
	Cleanable PVC/linoleum flooring at least 2.5 mm thick.	E
	Slip resistant to a minimum of R10 (DIN 51130).	E
	Flooring continuous or strip welded[3].	E
	Edges coved up at walls to a height of 15 mm and sealed/welded.	E
	Note that a compromise may have to be reached where non-slip properties are required, such as in cold rooms[4].	
2.4	**Walls**	
	Smooth; impervious; washable hard gloss or waterproof vinyl emulsion (BS4247 Part 2); should withstand chemical decontamination. Rendered concrete is undesirable.	E
2.5	**Laboratory furniture – general**	
	Compliance with BS EN 14056:2003 (Laboratory furniture – Recommendations for design and installation).	D
2.6	**Work surfaces**	
	Easily cleanable/readily decontaminated[5], scratch and chemical resistant, no exposed wood.	E
	One piece or with flush silicon joins.	E
	Capable of taking the weight of any heavy equipment that is needed.	E
	Capable of accommodating underbench equipment (e.g. fridges/freezers).	E
2.7	**Under bench storage (cupboards or drawer units)**	E
	Raised from floor on legs/castors to allow removal for decontaminating beneath.	E
2.8	**Power supplies**	

[3] Continuous sheet preferable. At the very least, floors should be strip welded and inspected to ensure the joint is true. Joints should be flush to prevent pooling of spilled materials.

[4] Advice should be sought from the University Safety Office.

[5] When selecting worktops, it should be noted that Corian may bind iodine and Melamine may bind sodium ions. Stainless steel may bind phosphate and chromium ions strongly.

	ITEM	ESSENTIAL (E) OR DESIRABLE (D)
	Sufficient sockets for powering all equipment (above and below the bench) so as to avoid use of trailing leads.	E
2.9	**Spine storage**	
	All spine shelving to be lipped at front and back.	E
	Should not cast shadows that obscure overhead lighting (can usually be avoided by not positioning luminaires directly above bench spines).	E
2.10	**Laboratory sinks**	E
	Stainless steel suitable for most applications.	E
	Deep sink with overflow.	E
	Integral draining board; splashback.	E
	Taps providing high fall but with capacity for attaching rubber tubing to minimise splashing.	E
	Located away from doorway.	E
	Additional requirements for work with radiation:	
	Dedicated radioactive waste disposal sinks: *Stainless steel suitable for most isotopes[6]..*	E
	U-shaped or bottle traps (not large traps or catch pots).	E
	Positioned downstream of non-active sinks in laboratory if possible.	D
	Connected as directly as possible to main foul water sewer from premises. No delay tanks.	E
2.11	**Eyewash arrangements/safety showers**	
	Hand-held eyewash (shower head type).	D
	All stainless components to avoid corrosion.	E
	Note that safety showers are rarely needed[7].	
2.12	***Additional requirements for work with radiation:***	
	Hand wash sinks	E
	Standard materials.	E
	Hands-free operated taps.	E
	Located near to entrance.	E
2.13	**Fridge/freezers**	
	Spark-proof where flammables may be stored.	E
	Lockable where used for storage of radioactive material or Schedule 5 material.	E
	Situated away from main thoroughfares.	D

[6] Stainless steel sinks may bind phosphate and chromium ions strongly. Acrylic materials may preferentially bind other isotopes: Corian may bind iodine and Melamine may bind sodium ions.

[7] Consult University Safety Office for advice

	ITEM	ESSENTIAL (E) OR DESIRABLE (D)
2.14	**Laboratory furnishings (i.e. chairs and stools)** Easily cleanable/capable of being readily decontaminated (not upholstered).	E
2.15	**Writing up/office areas** Clear demarcation between these and the lab space.	E
2.16	**Cryogen use/storage** Sufficient low level extract to avoid oxygen depletion under normal operating conditions.	E
	Avoid storage in basements unless properly artificially ventilated. Avoid storage in cold rooms or other well sealed spaces. Pressure relief devices on cryogen tanks must be vented to safe place. Oxygen detection where room/cryogen volumes indicate need. Oxygen detectors capable of being moved to “fine tune” their response. May require “ramping up” of low level extract fans on alarm activation[7] Cold-resistant flooring (e.g. aluminium chequer plate) where cryogen spills are foreseeable. External cryogen supply tanks fitted with shut-off valves linked to low oxygen alarms.	E E E E E E/D D E
2.17	**Minimising manual handling of very heavy equipment** Provision of lifts, lifting devices etc for installing/removing very heavy/awkward items of equipment	D

	ITEM	ESSENTIAL (E) OR DESIRABLE (D)
3	**FUME CUPBOARDS**	
	Recirculating fume cupboards to be avoided and not to be installed without Safety Office approval.	
	Air vented through the fume cupboard must not be recirculated.	E
	Face velocity 0.5 m/s with sash in working position (unless Safety Office approval is granted for lower flow rates).	E
	Smooth, impervious, washable, scratch and chemical resistant surfaces.	E
	Sited in accordance with BS 7258, in order to avoid airflow disturbance (and loss of containment) from workers' movements or from air handling grilles.	E
	Commissioning test to include a measure of containment according to BS 14175 as well as face velocity measurements.	E
	Exhaust stack height of sufficient height to ensure adequate dilution and dispersion. Position of stack to prevent re-entry of exhaust through building openings[8].	E
	Ventilated storage cupboards below fume cupboards.	D
	Note that there are also requirements relating to fume cupboards in the fire section.	
	Additional requirements for work with radiation: *Face velocity 1.0 m/s with sash in working position.*	E
4	**EXTERNAL GAS CYLINDER STORES** Construction to comply with British Compressed Gases Association (BCGA) Guidance Note 2.	E
5	**GLOVE BOXES** **Additional requirements for work with radiation:** Advice should be sought from the University Radiation Protection Officer.	E

Further information:

Environment Agency *Guidance on Standards for Radiochemical Laboratories in Non-nuclear Premises* to be found on the Agency's website within Section 4 of their Generic Guidance to Radioactive Substances Users at:

http://www.environment-agency.gov.uk/business/444304/945840/1064273/?version=1&lang=_e

[8] Advice should be sought from the University Safety Office