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PRELIMINARY HEALTH AND SAFETY PLAN
FOR THE REMOVAL OF
THE EXISTING RADIOTHERAPY & PATHOLOGY LIFTS
&
THE SUPPLY, INSTALLATION AND COMMISSIONING
OF
A NEW RADIOTHERAPY & PATHOLOGY LIFT IN EXISTING SHAFTS
IN
CORK UNIVERSITY HOSPITAL
HSE SOUTH



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

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1 INTRODUCTION

1.1 SCOPE OF DOCUMENT

This document comprises the Preliminary Safety and Health Plan for the removal of the existing Radiotherapy & Pathology lifts and the supply, installation and commissioning of new Radiotherapy & Pathology lifts within an existing shaft at Cork University Hospital, Wilton, Cork

This document has been prepared in accordance with the Safety Health & Welfare at Work (Construction) Regulations of 2013 (S.I. No.291 of 2013). Regulation 12 of the Construction Regulations specifies the requirements of the Safety and Health Plan as outlined below.

“Duties of project supervisor for the design process, safety and health plan

12. (1), the project supervisor for the design process shall-

- (a) Subject to *paragraph (2)*, on a preliminary basis and for the purpose of providing information for the project supervisor for the construction stage, prepare a written safety and health plan that specifies –
 - (i) A general description of the project and of the time within which it is intended that the project will be completed
 - (ii) Appropriate information on any other work activities taking place on the site,
 - (iii) Where appropriate, work related to the project which will involve particular risks to the safety, health and welfare of persons at work including but limited to those referred to in *Schedule 1*,
 - (iv) The basis upon which time in *subparagraph (i)* was established, considering *Regulation 11(1) (a)*,
 - (v) The conclusions drawn by designers and the project supervisor for the design process as regards the taking in account of the general principles of prevention and any relevant safety and health plan or safety file, and
 - (vi) The location of electricity, water and sewage connections where appropriate, to facilitate adequate welfare facilities, “

It is intended that this document will be used as the basis by the appointed PSCS (Project Supervisor Construction Stage) for the development of the Construction Health and Safety Plan.

NOTE TO ALL CONTRACTORS TENDERING

Ensure that you read and understand the full contents of this document prior to finalising the contract pricing.

NOTE TO ALL DESIGNERS;

Design Risk Assessments will be provided for particular discipline / area of expertise for all stages of



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construction, post construction maintenance and building lifecycle (occupancy and use). Copies of designer risk assessments will be communicated to the Project Supervisor Construction Stage (PSCS) for inclusion in the Construction Stage Safety and Health Plan.

2 PROJECT INFORMATION

2.1 PROJECT APPOINTMENTS

Client		
Cork University Hospital CUH Maintenance Department HSE South Cork University Hospital Wilton, Cork	Contact:	Michael O Mahony
	Tel:	021 49222159
	Email:	michael.omahony2@hse.ie
Project Supervisor Design Process (PSDP)		
SEEC Weston Business Park, Patrick Street, Portarlinton, Co Offaly	Contact:	Mark Goodings
	Tel:	087 6809680
	Email:	mark@seec.ie
Health and Safety Co-Ordinator		
Mak Goodings SEEC Weston Business Park, Patrick Street, Portarlinton, Co Offaly	Contact:	Mark Goodings
	Tel:	087 6809680
	Email:	Mark@seec.ie

2.2 SITE LOCATION

The project will take place within the Cork University Campus at Wilton, Cork, Co. Cork
The existing lifts are to be replaced with a new units.

2.3 SPECIFICATIONS

The following specifications were referenced during the development of the Preliminary Health and Safety Plan:

- 2026.05.01_AG_HSE CUH_Radiotherapy_Pathology Lift Spec- Prepared by S.E.E.C. Lift Consultants Ltd.

2.4 GENERAL PROJECT DESCRIPTIONS

The project involves the removal of existing lift components and installation of a new lifts in already formed lift shafts, including, but not limited to, installing all motors and associated control gear and wiring, all equipment in the lift control room including the electrical distribution boards/containment and wiring, all associated builders works, supply delivery, installation and commissioning of the lift at CUH

The full project specification is contained in the client project specification, which will be included in the tender documents.

The successful Lift Contractor / PSCS shall submit drawings, calculations and any other information sufficient to substantiate that the proposals meet the performance requirements of this specification. The successful Lift Contractor must submit Design Risk Assessments to the PSDP, outlining how foreseeable risks have been addressed in their design.



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2.5 PROJECT TIMELINES

The project programme is envisaged to be a 22-week program and will be agreed between the appointed PSCS and client but would normally be restricted to the following times:

- Monday to Friday 08:00Hrs – 20:00Hrs TBC

No construction vehicles or equipment shall be operated on site outside these hours.

The contractor shall consider that the work is being carried out in an acute Hospital environment and shall design a programme accordingly.

It is not anticipated that the project timeline will introduce additional risk.

3 PROJECT REQUIREMENTS

3.1 GENERAL WORK ACTIVITIES

The following sets out other activities at or near the works, which may have an impact on the construction work for the Project:

- The building where the works will take place, will remain in full operation as a hospital building throughout the works
- There will also be some works outside the building, including waste disposal, deliveries and contractor facilities. All existing site roads will remain in operation during the project. The Hospital's Emergency Access route for Emergency Services such as Ambulance Fire Tender etc. must be available for use at all times.
- All existing internal and external fire and emergency access and egress routes must be maintained throughout the project.
- Close liaison will be required with the Hospital Maintenance Department to co-ordinate the works

3.2 RELEVANT ADJOINING LAND USE

- The lift replacement work and associated welfare/laydown areas are within the hospital footprint.
- The PSCS/Contractor must at all times be aware that the project is located within a live health care facility.



3.3 CONTROL OF CONSTRUCTION WORKS

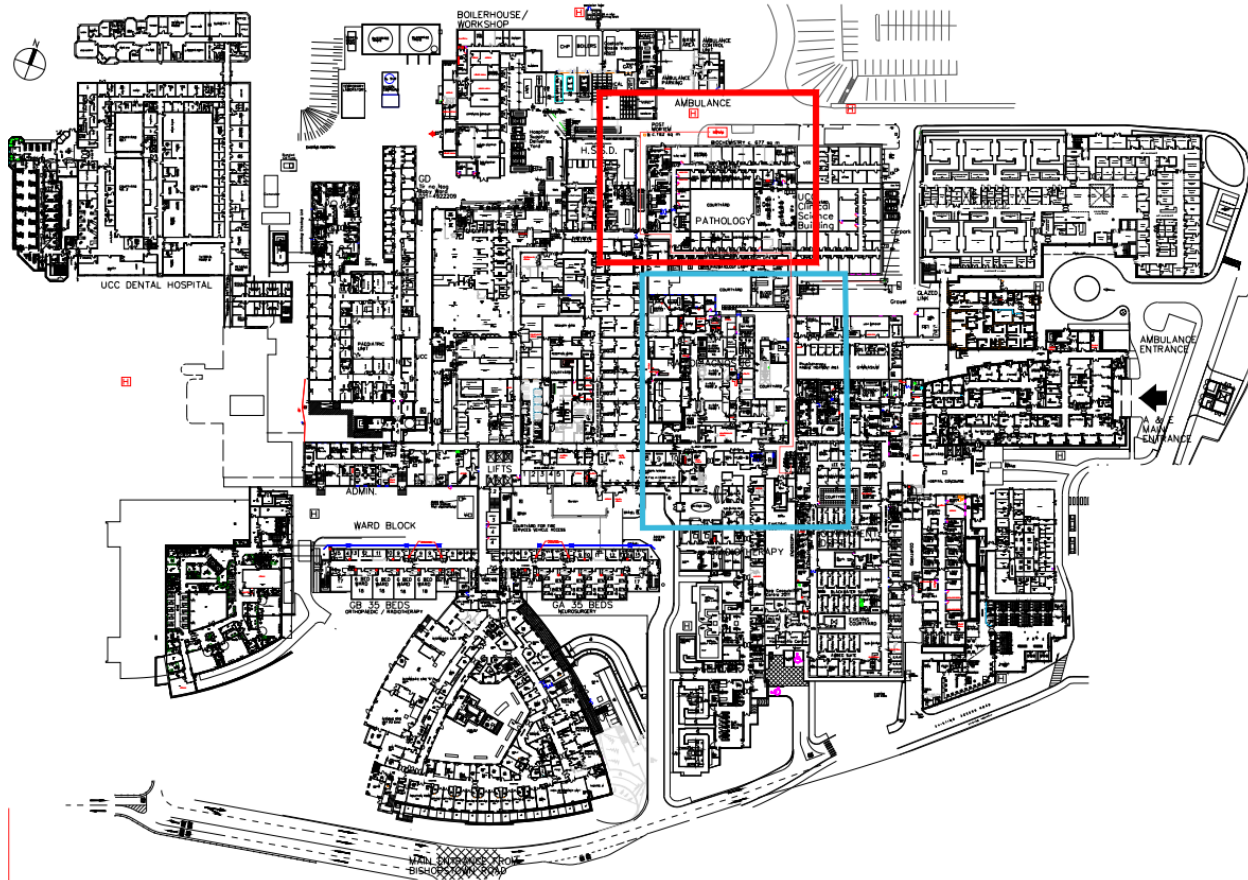
- All works during construction fall within the control of the Project Supervisor Construction Stage (PSCS) for the project. The Project Supervisor Construction Stage shall ensure the site is maintained and suitably secured from access by unauthorised personnel throughout the works.
- Due diligence shall be given at construction stage to the impact of the construction works, in particular to those persons occupying, working in and visiting the Hospital, to persons in adjoining properties and to members of the public. Particular attention shall be given to limit the impact of noise, vibration and dust.
- The PSCS shall ensure that the PSDP is consulted in relation to temporary works design. The PSCS shall ensure that due consideration is given to the coordination and supervision of temporary works design; that appropriate method statements, risk assessments are reviewed by competent persons; that scaffolding plans are in place and reviewed. The reference to Temporary Works applies to all temporary works and includes but not limited to, scaffolding, formworks, false work, excavation, temporary propping.

3.4 RESTRICTION OF WORKING HOURS

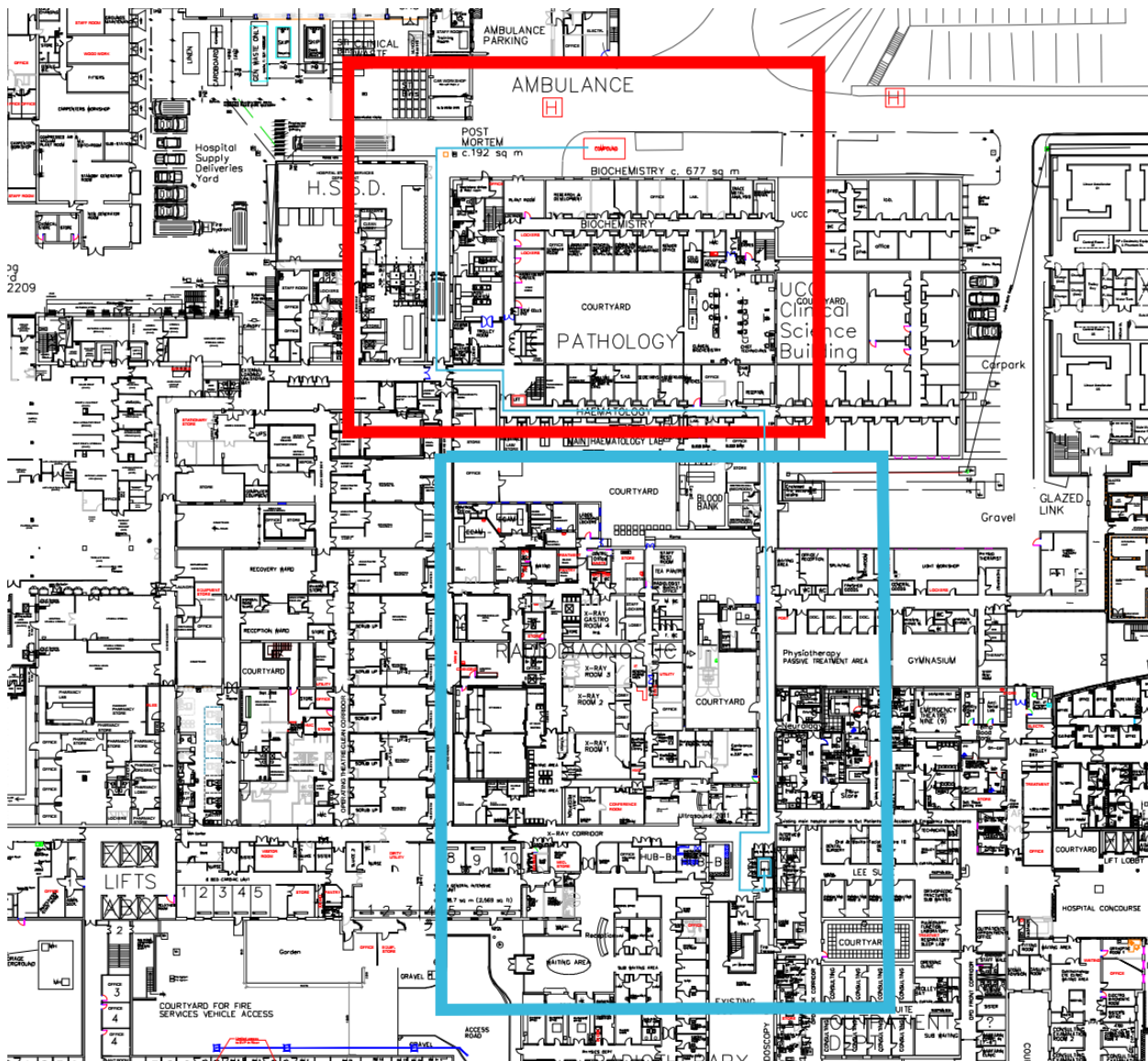
- The hours of work on the site shall be as specified by CUH. Guidance on the working hours are in section 2.5 Project timeline of this document
- Any work outside the specified hours should be agreed with the Project Manager in advance and Hospital Management.

3.5 SITE RESTRICTIONS

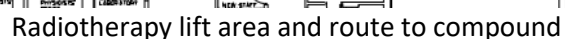
- Care should be taken to ensure CUH employees and visitors are not exposed to construction risks. The area exposed to construction must be enclosed by appropriate solid hoarding. Safe access must be provided to any Hospital personnel required to work in the area of the lifts and the solid hoarding erected outside of each lift should not restrict the width of corridors to less than is required to the personnel accessing the area (moving beds etc.).
- The PSCS shall ensure that contractor personnel respect the other areas of the CUH site and do not enter either the hospital or construction areas without the permission of the Client.
- During the works the PSCS shall ensure that the Client (CUH) is kept informed of all activity that may impact on them. See section 3.13 Method Statement Procedure.
- The PSCS shall ensure that access for the Emergency Services (Fire, Ambulance and Garda) is considered in the planning of construction works. Suitable and sufficient measures shall be taken to ensure access for Emergency Services is not impeded to the client site. In particular, the fire tender access route to the Ward Building must be maintained at all times.
- All contractors must use the main entrance to access the hospital grounds.
- CUH is a no smoking campus.
- The PSCS shall ensure that solid hoarding is installed outside of each lift to ensure that the construction site remains safe and secure at all times, particularly when unattended.

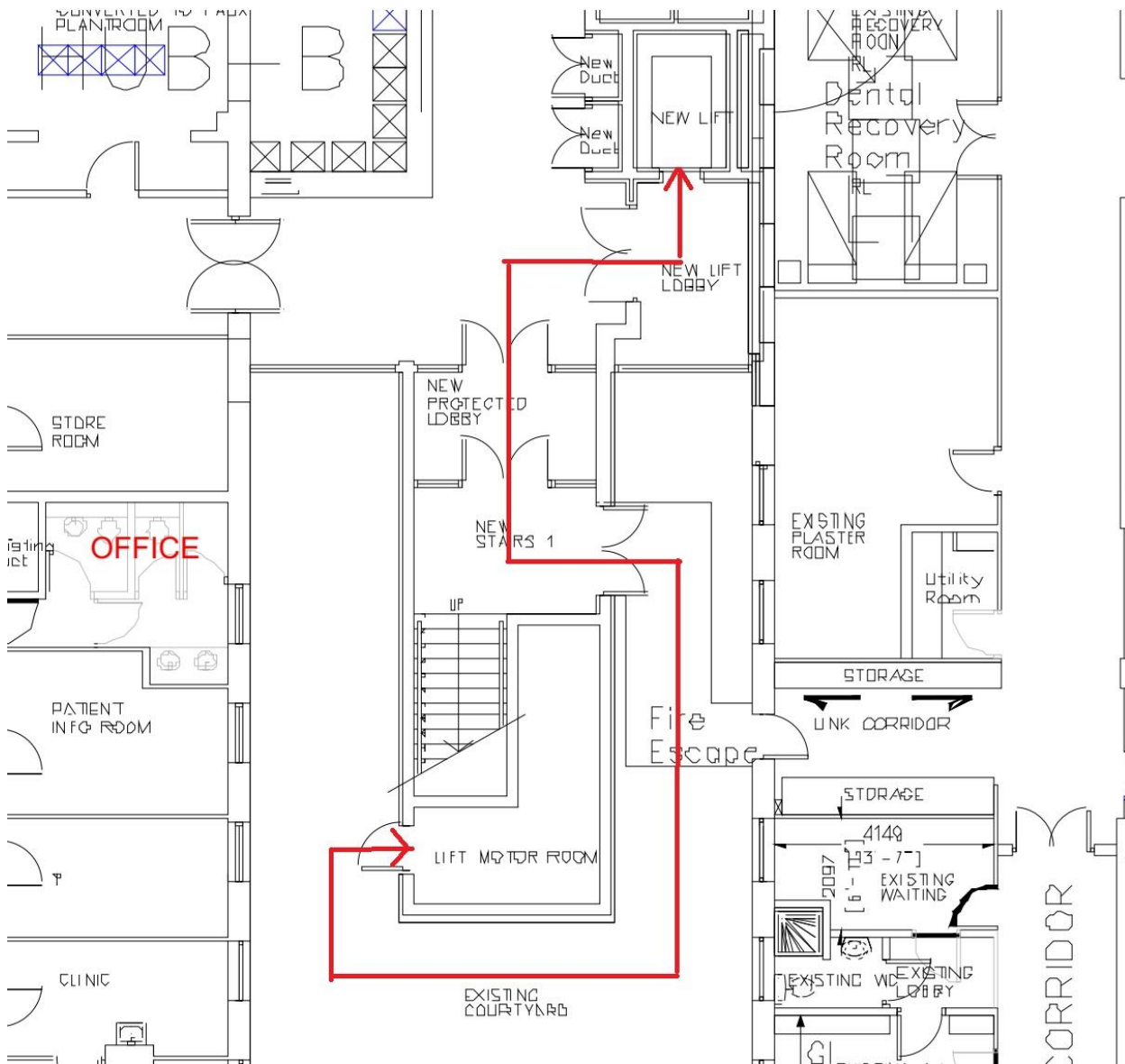


Campus layout with Pathology lift area shown outlined in Red & Radiotherapy lift area shown outlined in Blue



Pathology lift area shown outlined in Red & Radiotherapy lift area shown outlined in Blue





Radiotherapy lift

The existing machine room is located under the stairs and can be accessed as shown. Consideration to removal of all existing Hydraulic pipes and writing between the machine room and the lift shaft is required.



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Pathology lift
Machine Room hatch to lift lobby below.

3.6 ACCESS TO CONSTRUCTION AREA

- The PSCS must inform CUH, in writing, of the names of all the personnel that will be on site during the project. CUH request that the Contractor, include as part of their site induction, the requirement to sign in and out each day. Also include the awareness that they are working in a live hospital and to ensure that they conduct their work in a clean and tidy and respectful manner.
- All construction, craft and security personnel shall be in possession of an up-to-date Safe Pass card or recognised equivalent. A register of these cards must be maintained on site at all times.
- The PSCS needs to ensure that the adjacent roads and footpaths are maintained in a safe and clean condition for the duration of the construction project.
- Access to and deliveries to the site must not compromise the safety of either Motorist and or Pedestrians that use the road or footpath in the vicinity of the site. Site deliveries must be planned and assessed so that they do not cause unnecessary traffic disruption. Where traffic disruption is unavoidable a Method Statement/ Traffic Management Plan must be submitted to the Hospital for approval.

3.7 PARKING & COMPOUND AREA

- Car parking facilities for all contractors shall be as directed by the client. A proposed compound area has been allocated by the client, shown outlined in red above measuring approx. 8m x 12m. Access route from the proposed compound area into the work areas are shown in red & blue lines for the respective Lift work areas.

3.8 NOISE AND VIBRATION

- The site works will be conducted to minimise noise and vibration disruption to the hospital activities. Any particularly disruptive works will take place outside normal hours. The Hospital must be notified of any particularly disruptive noisy works.

3.9 DUST

- Dust levels from the site will be kept to a minimum as far as reasonably practicable.
- The contractor must make his employees, and others engaged by him, of the Guidelines for the Prevention of Healthcare Associated Invasive Aspergillosis during Demolition/Construction/Renovation (DCR) Activities.
- Aspergilli are tiny fungi that cannot be seen by the eye but commonly occur in soil, water and decaying vegetation. They can also live in old buildings or in areas such as ventilation shafts. Many types of aspergilloeses are found in nature but only a few causes human diseases. Aspergillosis may be released into the air during construction/renovation works ranging from demolition and renovation to construction. Aspergillosis can be transported great distances by normal conditions such as air currents and wind. Small pieces of dirt or dust in the air are the main ways that Aspergillosis travels and causes infection diseases. Patients undergoing high dose chemotherapy for leukaemia and related illnesses or who are having bone marrow, stem cell or other transplants, or who are having other forms of therapy which may suppress their immune system may be at risk of developing infection with the fungus in the lungs or other parts of the body. While the above patients are generally not resident in the hospital, the possibility that such high-risk patients are transferred to CUH temporarily, before being transferred to other Hospitals, cannot be discounted.
- The CUH Aspergillosis Policy and Removal of Ceiling Tiles Policy must be referred to particularly in context of site set up and are attached in Appendix 7.

- Hoardings must extend all the way up to the ceiling slab in order to reduce the risk of particulate matter coming out of lift shafts. There is an additional requirement that dust screens also be fitted.

3.10 ENVIRONMENTAL CONSIDERATIONS

The PSCS shall ensure suitable and sufficient measures are put in place on site to prevent the discharge of prohibited substances, fuels, oils, materials, silt etc., that may cause pollution or damage to the environment.

3.11 WELFARE FACILITIES AND PROVISION OF FIRST AID

- The Hospital has given permission for contractors to access the canteen and the welfare facilities within the Hospital Campus. Use of the facilities is given with the condition that all workers will remove work overalls /clothing, work boots and PPE before entering the facilities.
- First Aid arrangements shall be the responsibility of the PSCS and individual contractors.

3.12 BASIC SAFETY RULES FOR CONTRACTORS

The following safety rules must be adhered to at all times:

1. Hospital Emergency Procedures and Hazardous Notices posted around the site must be understood and followed at all times.
2. Safety devices must not be interfered with and can only be temporarily disabled with proper written authorisation, RAMS and a permit system in operation. Modifications may only be carried out with express approval.
3. All work performed by the contractor must be carried out in a safe manner and according to all relevant standards and guidelines available in the areas of their expertise.
4. Contractors must take all due care of their own safety, the safety of their employees and all others affected by their work. Special attention must be given to patient areas.
5. Contractors must not use any equipment or the service of personnel belonging to, or engaged by, the Hospital without prior approval being granted by the Hospital in writing.
6. The Contractor must provide all necessary instruction, training and information on health, safety and fire matters to his/her employees.
7. The Contractor must provide competent and adequate, monitoring, control and supervision of his/her employees activities and also of the activities of subcontractors working on his/her behalf.
8. The Contractor must provide all necessary safety equipment and ensure that it is used correctly at all times.
9. The Contractor must provide clean protective clothing for his/her employees. This includes but is not limited to Hard Hats, Safety Shoes, clean coveralls with company name clearly identified and reflective bibs.
10. Proper protective clothing and equipment must be worn/used as required and in other areas or circumstances where it's use is designated or required e.g. Theatres, CSSD etc.
11. All plant and equipment brought onto the Hospital's site must be in good working order and comply with all statutory and other legalisation, be fitted with any necessary guards and safety devices and have relevant in date Certificates available for checking.
12. All plant and equipment requiring daily, weekly and monthly inspection to be carried out, will have such inspection recorded and the records available for inspection by the client and project management team.

13. The Contractor must inform the Hospital well beforehand of any temporary safety measures that the Hospital may have to undertake with regards to the nature of the proposed works, and the effect on the following: **Fire Exits, Fire Fighting Equipment, Fire Alarms, Utilities, Adjacent Areas, Wards, Theatres, etc.**
14. The Hospital is a no smoking campus. Smoking is forbidden anywhere on the campus inclusive of site compounds.
15. All injuries, fires, accidents or potentially serious incidents must be reported to a supervisor, Project Management, Mallow Hospital, Fire and Safety Officer and Senior Assistant Technical Services Officer
16. Drivers of all vehicles must obey road signs and traffic rules and also comply with relevant Hospital Policies Requirements.
17. Incorrect or faulty tools must not be used.
18. In all areas the waste must be removed and disposed of, in an appropriate manner. The area must be left clean, tidy and in good working condition.
19. Express written permission is required where hot work, confined entry, lock out tag out Permits etc., from the Hospital Maintenance Officer (or his/her Deputy for any hot work (welding/flame cutting, confined entry or lock out tag out)
20. No Hot Work may commence UNTIL THE APPROPRIATE PERMIT HAS BEEN ISSUED AND IS PRESENT AT THE WORK SITE.
21. Express permission is required, for entry to any area in order to carry out work, from the Hospital Maintenance Officer (or his/her Deputy).
22. All scaffolding must be erected by competent personnel and inspected at least weekly, or after adverse weather conditions, with all records available for Hospital Staff to review.
23. The Hospital is not responsible for the security of the contractor's property or equipment.
24. Random searches may operate on leaving the premises. Any person found removing property from site without written authorisation will be prosecuted.
25. All contractors and their sub-contractors must be in possession of a FAS Safe Pass Card
26. All Scaffolders, Tower Crane Operators, Slings/Signalling, and Telescopic Handler operator must be in possession of a FAS Construction Skills Certification Scheme Cards.
27. The contractor must not connect to or interfere with Electricity, Gas, Compressed Air or other services without express written permission from the Authorised Person in the Hospital.

3.13 CORK UNIVERSITY HOSPITAL METHOD STATEMENT PROCEDURE (MSP)

The main Contractor may be obliged or want to implement method statements for particular activities on site during the works. Separately, the Main Contractor shall be obliged to implement a written Method Statement Procedure (MSP) for specified work activities for the duration of the Main Contract. The activities requiring an MSP are those that pose a risk to the Hospital's Patients, Staff and Visitors and includes but may not be limited to:

- Site set up including requirements for temporary Fire, Security and Access requirements.
- All risk activities identified in the Health & Safety Plan.
- External Excavations.
- Building Services Shutdowns and tie-ins.
- Hot Works.
- Exceptional/unusual noisy or dusty works.
- Road Closure & Footpath Works.
- Alternations to Building Services that will affect any existing Hospital Building Services.
- Any and all works conducted outside of the designated site boundary.

The Main Contractor, in conjunction with the PSCS, prior to the commencement of the works on site must prepare a full schedule of MSP's expected to be required for the works. This schedule is to be submitted to the Hospital Maintenance Officer, PSDP and the H&S Department prior to the commencement of the works on site and shall be discussed as part of the Site Meetings.

The main Contractor shall submit to the Hospital Maintenance Officer, PSDP and the H&S Department all written MSP's 1 week minimum prior to the commencement of the planned work activity. The purpose of this procedure is to ensure that the Hospital complies with their duties under the S, H&W at Work Act 2005, and that adequate notice of pending activities is given to the Health & Safety Department, so that the necessary arrangements and notice can be put in place within the Hospital. For exceptionally disruptive works this will extend to 2 weeks e.g. Road Closures

Please note that the Project Hospital Maintenance Officer and the H&S Department can and normally do comment on submitted MSPs in this situation the Contractor must resubmit the MSP, incorporating the comments. The Contractor is not permitted to proceed with the planned work activity until the comments are incorporated into the revised MSP. If there is a time delay as a result, the work activity must be rescheduled, and a new MSP resubmitted specifying a revised commencement date.

Method Statement Format:

It is recommended that the Main Contractor adopts the Health & Safety Authority 'Safe System of Works Plan SSWP' format for each MSP (available at www.hsa.ie). They shall be numbered sequentially and tagged with a revision note as necessary.

They shall specify the following:

- Description of the work activity
- Identify the risk activity involved
- Specify how the risk is to be eliminated/minimized/controlled.
- Commencement date.
- Estimated duration and completion date.
- List Sub-Contractors/Trade involved.
- List equipment required.
- List personnel involved by name.
- Signed by PSCS and co-signed by personnel involved in activity.
- Attach Hot Work Permit or Permit to Work, if required.

4 PARTICULAR RISKS

The following is a non-exhaustive list of particular risks to the Safety & Health of persons as set out in Schedule 1 of the Safety, Health & Welfare (Construction) Regulations, 2006.

- a) Risk of Burial and Fall from Height (aggravated by the nature of the work processes)
- b) Contact with Chemical or Biological Substances
- c) Ionising Radiation
- d) High Voltage Lines
- e) Risk of Drowning
- f) Wells, Underground Earthworks and Tunnels
- g) Work Carried Out by Divers
- h) Caisson Work with Compressed Air
- i) Explosives
- j) Assembly or Dismantling of Heavy Prefabricated Components

Other hazards may arise out of working methods, which are at the discretion of the contractor and as such cannot be determined at this stage. The unforeseen hazards are to be addressed by the PSCS and the contractors themselves. To this end, we request a site-specific safety statement, method statement and risk assessments from all contractors working on the site. The PSDP during the course of design and design meetings has identified particular construction risk. A table outlining the applicability of the Particular Risk follows overleaf.

Particular Risks		Applicable		Relevance to Project
		Yes	No	
1.	Work which puts persons at work at risk of burial under earthfalls, engulfment in swampland or falling from a height, where the risk is particularly aggravated by the nature of the work or processes used or by the environment at the place of work or site.	X		Work at height, including in lift shafts and on scaffolding See Section 4.1
2.	Work which puts persons at work at risk from chemical or biological substances constituting a particular danger to the safety and health of such persons or involving a legal requirement for health monitoring.	X		Use of paint coating in lift shafts (tbc). Potential Asbestos risk during removal of equipment. Work in an operational hospital setting. Removal of Hydraulic Oil See Section 4.2
3.	Work with ionizing radiation requiring the designation of controlled or supervised areas as defined in Article 20 of Directive 80/836/Euratom		X	N/A
4.	Work near high voltage power lines.		X	The work will involve connections to the existing LV electrical system.
5.	Work exposing persons at work to the risk of drowning.		X	N/A

6.	Work on wells, underground earthworks and tunnels.		X	N/A
7.	Work carried out by divers at work having a system of air supply.		X	N/A
8.	Work carried out in a caisson with a compressed-air atmosphere.		X	N/A
9.	Work involving the use of explosives.		X	N/A
10.	Work involving the assembly or dismantling of heavy prefabricated components.	X		Lifting of heavy equipment during removal of existing lifts and associated motors and electrics. See Section 4.10

4.1 WORK WHICH PUTS PERSONS AT WORK AT RISK OF BURIAL UNDER EARTHFALLS, ENGULFMENT IN SWAMPLAND OR FALLING FROM A HEIGHT.

Where the risk is particularly aggravated by the nature of the work or processes used or by the environment at the place of work or site.

There will be work at heights required. In particular:

- Working at height with subsequent risk of falls of persons / materials when working in and around lift shafts during removal and replacement of old lift equipment etc.
- Accessing rooftop plant rooms of buildings (PSCS must set up safe access route and edge protection on roof).

The PSCS must ensure that work at heights is controlled primarily by the application of the Principles of Prevention with priority given to collective protective measures above individual protective measures. The PSCS must ensure all work at height is pre-planned and risk assessed and is completed in compliance with the Safety Health & Welfare at work (General Application) Regulations 2007 Part 4 Work at Heights and the HSA Codes of Practice Safety in Roof work and access and working from scaffolds. The PSCS shall ensure that Contractors provide the appropriate access equipment (e.g. nets or other passive fall protection – bean bags for installation of roof trusses, dedicated access platforms for stairwells, scaffolding and industry standard ladders / access devices), where permanent access methods and / or permanent edge protection.

To minimising the risk of work at height, Designers shall ensure best practice methods for access during construction are employed.

4.2 CHEMICALS OR BIOLOGICAL AGENTS

Particular hazards on the site are.

Medical Chemicals

- The works will take place in an operating hospital. While no contact is anticipated between workers on this project and any chemical / biological materials used for medical purposes in the hospital, all contractor's employees must be made aware of the risk. This will be covered further in the Contractor's site induction.

Asbestos

- The procedure for the project will be that that works are to be stopped, and incident notified to project management if any ACM is discovered.
- Asbestos survey information will be provided to the PSCS and designers by the client
- It is essential that if any material suspected of containing asbestos containing material (ACM) is discovered that works be stopped and the client and PSDP be informed.
- It is not anticipated that Asbestos will be disturbed during the works, but any removal of Asbestos must be agreed in advance with the client via the Method Statement Procedure (see section 3.13). All asbestos removal works will be removed following approval from the client and the project management team.
- Asbestos will only be removed by competent Asbestos removal contractor and will be securely bagged, tagged and disposed of by approved Asbestos vendor.

Biological Hazards

- There is some evidence of vermin (in particular pigeons) in and around the roof area of the hospital building. The PSCS should take account of this during construction works and put measures in place to prevent the ingress of vermin during the project and after the completion of construction.
- All Contractors shall ensure adequate welfare and hygiene arrangements and practices are in place and are used e.g. toilet and washing facilities.

Painting Hazards

- Where there is a requirement for the painting of the inside of lift shafts, the PSCS must ensure that all risks associated with the use of paint and other chemicals in the lift shafts are fully risk assessed and that all relevant risks (e.g. fire, chemical exposure, confined spaces) are addressed in method statements.

Removal of Hydraulic Oil

- The removal of hydraulic oil from the existing lift installation shall be treated as a hazardous waste activity and managed in accordance with the Waste Management Act 1996 (as amended), Waste Management (Hazardous Waste) Regulations 1998, and applicable EPA guidance. Hydraulic oil is considered a hazardous substance with the potential to cause environmental contamination and shall not be discharged to drains, watercourses, or the ground. All oil removal works shall be undertaken by competent personnel using appropriate pumping and containment equipment. Temporary storage shall be in sealed, clearly labelled, and suitably rated containers with secondary containment (bundling) provided to prevent leakage or spillage. Spill kits and absorbent materials shall be available at all times, and any release shall be immediately contained and remediated. Waste oil shall be classified, segregated, and transferred off-site by a licensed waste contractor in accordance with national waste collection permit requirements. All movements of hazardous waste shall be fully documented using Waste Transfer Forms and retained for audit purposes to ensure traceability and compliance. [dublincity.ie] Transportation of waste oil shall comply with ADR requirements for the carriage of dangerous goods where applicable, and only authorised carriers shall be used. No uncontrolled disposal or mixing of waste oils with other waste streams is permitted, and all waste shall be directed to authorised treatment or recovery facilities in accordance with the waste hierarchy and environmental protection obligations. [askaboutireland.ie] A task-specific Risk Assessment and Method Statement (RAMS) shall be prepared and approved prior to commencement of works.

4.3 WORK WITH IONISING RADIATION

Particular hazards on the site are.

- Not applicable

4.4 WORKS NEAR HIGH VOLTAGE POWER LINES

Particular hazards on the site are.

- Not applicable

4.5 RISK OF DROWNING

Particular hazards on the site are.

- Not applicable

4.6 WORK ON WELLS, UNDERGROUND EARTHWORKS AND TUNNELS

Particular hazards on the site are.

- Not applicable

4.7 WORK CARRIED OUT BY DIVERS AT WORK HAVING A SYSTEM OF AIR SUPPLY

Particular hazards on the site are.

- Not applicable

4.8 WORK CARRIED OUT IN A CAISSON WITH A COMPRESSED AIR ATMOSPHERE

Particular hazards on the site are.

- Not applicable

4.9 WORK INVOLVING THE USE OF EXPLOSIVES

Particular hazards on the site are.

- Not applicable

4.10 WORK INVOLVING THE ASSEMBLY OR DISMANTLING OF HEAVY PREFABRICATED COMPONENTS

Particular hazards on the site:

- There will be heavy lift components to be dismantled and assembled as part of this project (including the lifting of heavy equipment). The assembling or dismantling of heavy components give rise to risk of collapse / entrapment / collision / crushing / property damage / falls of persons, specifically: assembling partitions into the vicinity.
- Relevant information provided by the PSCS shall include the weights of materials, and any other special considerations or information regarding the safe lifting and assembly of components. The PSCS shall ensure that a detailed lift plan is prepared for their lifting activities. The lift plan shall include (but not limited to) details of the lifting appliances, lifting equipment, the use of trained and competent persons and the safe lifting methods employed.
- The PSCS shall ensure that all lifting operations and planned and supervised by competent persons and the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007 Chapter 2 – Use of Work Equipment are complied with.

5 OTHER HAZARDS

In addition to the particular risks addressed the following hazards have also been identified as being relevant during the construction stage of the project:

- Construction traffic
- Work in Lift Shafts
- Work at height
- Falling Objects
- Demolition
- Electricity
- Lifting equipment
- Manual Handling
- Slips, trips and falls
- Hot Works

The PSCS and contractors in preparation of the Health and Safety Plan must carry out in accordance with their statutory requirements, site specific risk assessments to identify all hazards and put controls in place to eliminate or reduce the risks to all personnel on site, The Clients resident's and staff and members of the public so far as is reasonably practicable. These risk assessments will be monitored and reviewed by the PSCS whenever new machinery or systems of work are introduced.

To ensure works are planned in advance with particular emphasis on hazard management all contractors will submit Method Statements, specific work procedure or protocols for all tasks. The risk of the activity will be assessed within the method statement or protocol with adequate and sufficient control measures identified. Before work may commence, the PSCS will review all Method Statements. Please see section 3.13 Method Statement Procedure.

All Contractors shall ensure risks associated with all tasks are appropriately risk assessed.

The PSCS in preparation of the Construction Health and Safety Plan and Safety File requirements must carry out in accordance with their statutory requirements, site specific risk assessments to identify all hazards and put controls in place to eliminate or reduce the risks to all personnel on site, members of the public so far as is reasonably practicable.

5.1 CONSTRUCTION TRAFFIC

- The speed limit of construction traffic in and around the vicinity of the construction work will be in accordance with the CUH site rules.
- Safe access and egress must be maintained to the CUH premises, particularly for emergency services such as ambulances and firefighting appliance access.
- Parking shall only be allowed in agreed areas.
- Pedestrian routes and roads must be kept clear of traffic and maintained in good condition.
- Access to and deliveries to the site must not compromise the safety of either Motorist and or Pedestrians that use the road or footpath in the vicinity of the site. Site deliveries must be planned and assessed so that they do not cause unnecessary traffic disruption. Where traffic disruption is unavoidable a Method Statement/ Traffic Management Plan must be submitted to the Hospital for approval.
- The PSCS shall build into the Construction Stage Safety and Health Plan arrangements for deliveries, site traffic and controls to ensure safe operation.

5.2 WORK IN LIFT SHAFTS

- The project will involve works inside the existing lift shafts removing existing equipment and installing new machinery. This will involve work at height including the erection and dismantling of scaffolding to facilitate works.
- The lift shaft must be securely barriered off with solid hoarding outside each lift to prevent unauthorised access, accidental access and reduce the level of noise and dust.
- A safe system of work must be put in place for removal of existing equipment from the construction site. The corridors outside the construction site are a live hospital environment with high volumes of patients, staff and visitors using the corridors.
- All work involving lifts will be conducted taking into consideration BSI 7255: 2012 COP for safe working on lifts.
- Safety, Health and Welfare at work regulations (Construction) 2007, Chapter 2 of part 2 Use of Work equipment will also be taken into consideration.
- Full and comprehensive work safety practices for lifts will be given to all employees and sub-contractors before commencement of the works are undertaken.
- Written record will be kept for inspection of the instruction/training given on safe work in and with lifts.

5.3 WORK AT HEIGHT

- Work at height is identified as a general hazard on the project.
- The PSCS shall be responsible for securing all openings and leading edges.
- All working at Height must be completed in compliance with the Safety Health & Welfare at work (General Application) Regulations 2007 Part 4 Work at Heights and the HSA Codes of Practise Safety in Roof work and access and working from scaffolds

5.4 FALLING OBJECTS

- Falling objects are identified as a hazard on the project. Therefore, adequate precautions must be taken, when persons are working at height, as a control against falling objects e.g. use of tool-belts, toe-boards, strict adherence to site housekeeping rules, etc.
- In addition, the following precautions must be addressed where appropriate:
 - Safe systems must be used to place materials in position and for the segregation and removal of waste.
 - All materials must be stacked and laid out in such a way as to prevent their collapsing or overturning,
 - All personnel on site must wear safety hard hats where there is a risk from falling materials.
 - Specific measures shall be taken to control the risk of falling objects in relation to Hospital staff, patients, visitors and members of the public. Where necessary debris nets, fans and physical barriers should be erected.
 - Safe access and coordination. The PSCS shall ensure all overhead works are coordinated to ensure persons working at height are not working above those working on or accessing the building at a lower level.

5.5 DEMOLITION

- The PSCS will ensure that any Demolition work is strictly supervised by the Site Foreman and undertaken by competent operatives and that the site is secured during the demolition work,

and that Hospital staff, visitors and members of the public are suitably protected during the demolition work.

- Waste must be removed disposed of under CUH rules and requirements.
- The corridors outside the construction site are a live hospital environment with high volumes of patients, staff and others using the corridors

5.6 ELECTRICITY

- Work with electricity is identified as a hazard.
- There are no high voltage supply lines crossing the site in the area of works, but operative will be working with and near low voltage cables and switchgear as part of the project. Competent persons must carry out all electrical works. Contractors must adhere to CUH safe working and method statement procedures, as set out in Sections 3.12 and 3.13 of these documents for all work on live systems.
- Contractor to ensure that only registered, competent and qualified personnel familiar with the surroundings are allowed to carry out works on electrical systems.
- Reference should also be made to Health & Safety Executive (UK) document, HSG85 “Electricity at Work: Safe Working Practices” when carrying out work in the existing hospital.
- All electrical installations should be in accordance with the ET101:2008+A1+A2+A3:2018 Rules for Electrical Installations.
- Contractor to ensure that all services are isolated prior to commencing any electrical works in accordance with Hospital procedures. Locks to be used on isolators.
- Temporary electrical supplies to be installed and inspected by competent persons.

5.7 MANUAL HANDLING

- Manual handling is identified as a hazard for this project.
- All manual handling activities must be risk assessed, giving due consideration to the likely manual handling loads, lifting environment and individual capabilities, including pre-existing injuries.
- Mechanical lifting aids should be used where possible.
- Removal of existing lift machinery to be carefully planned and a method statement and risk assessment developed in advance.
- Works involving Manual Handling will be conducted considering Safety, Health and Welfare at Work (General Applications) Regulations 2007, chapter 4 of Part 2 Manual handling of loads.

5.8 LIFTING EQUIPMENT

- Work with lifting equipment is identified as a hazard.
- Use of lifting equipment and accessories to be subject to method statement and risk assessment.
- All plant and equipment to be certified and inspected as per statutory requirements.
- All lifting gear and accessories will hold a valid in date certification attesting to SWL and that it is fit for purpose and use.
- All operators of lifting appliances, plant and equipment will be experienced, competent and in possession of a valid operator’s CSCS card for the plant/equipment that they are operating.



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5.9 SLIPS, TRIPS AND FALLS

- The PSCS must ensure that the slip, trip and fall risk and any control measures put in place to mitigate against it, are noted in the Construction Plan and Risk Assessments and communicated to all working in the area.
- Housekeeping must be maintained to the highest level.

5.10 HOT WORK

A Hospital Hot Work Permit is required for all Hot Works within the Hospital. The Main Contractor is to ensure that a suitable person is appointed to attend all Hot Work Operations and is supplied with a suitable Fire Extinguishing Appliance. Hot works must finish a least one hour before completion of work on site that day ensuring that the workplace is left in a safe condition. It is the responsibility of the contractor to have the appropriate Insurance for Hot Work Activities and to comply with all the procedures and safety precautions set out in the Insurance. The activities includes but may not be limited to:

- All activities involving flame.
- Hot air or arc welding and cutting equipment.
- Braising and Soldering equipment and Blowlamps.
- Bitumen Boilers and other equipment producing heat or having naked flame.

A copy of a Hot Works Permit is attached in Appendix 6.

6 OTHER RELEVANT INFORMATION

6.1 ONGOING LIAISON AND UNFORESEEN EVENTS

- The PSCS and contractors shall consult with the PSDP should unforeseen circumstances arise or the requirement for design changes occur during the construction phase.
- The PSDP will require to be notified of any relevant changes or decisions that will affect Particular Risks during the time span of the project.
- Other relevant information would include changes to the time required for completion of the project or phases of the project.
- The PSCS shall ensure a Temporary Works Coordinator supervises all temporary works and that an inspection and certification system is maintained. Records of temporary works inspections / certification shall be available on site.

6.2 SAFETY FILE

The Safety file is a record of information for the end user, which focuses on health and safety.

Information contained in the file should include:

- “As built” drawings and plans used and produced throughout the construction and/or installation process along with the design criteria.
- General details of the construction methods and materials used.
- Foundation and structural details and calculations.
- Commissioning certification and fire certificates as required.
- Details of equipment and maintenance details for any relevant aspects of the development (pumps, lifts etc.)
- Details of the location and nature of utilities and services and their maintenance/isolation, safe operating procedures etc.
- Operating and maintenance manuals.
- Residual risks register.
- Information on hazardous substances remaining – i.e. relevant safety data sheets.
- The PSCS shall provide all relevant information required for the compilation of the Safety File to the PSDP in a timely manner.
- The PSCS shall co-ordinate arrangements for the gathering of information from Contractors.
- The PSDP shall issue a schedule of required contents to the PSCS.
- The client’s specification for the safety file is one hard and one soft copy, with all drawings provided in both DWG and PDF formats.

7 SAFETY LEGISLATION COMPLIANCE AND OTHER REQUIREMENTS

7.1 CONTRACTOR RESPONSIBILITIES

A Contractor's responsibilities include complying with statutory health and safety requirements under the Safety, Health & Welfare at Work Act 2005 plus all current statutory instruments e.g. Safety Health & Welfare at Work (Construction) Regulations of 2013 as applicable and the Safety Health & Welfare at Work (General Application) Regulations 2007.

A Contractor must additionally comply with the PSCS Construction Health and Safety Plan for the duration of the project.

A Contractor is obliged to secure further information regarding the PSCS requirements and safety requirements and is familiar with it before commencing works.

Scheduling shall be co-ordinated via the PSCS at regular contractor safety meetings.

At the time of tender the contractor shall:

- Be aware of the Preliminary Health and Safety Plan and all pertinent tender documents available from the PSDP/client.
- Be familiar with the contents of those documents while pricing work.
- Seek clarification at tender stage where required.

8 EXISTING DRAWINGS AND DOCUMENTS

All relevant drawings will be maintained on site by the PSCS during the construction phase of the project.

All existing drawings and documents will be kept available by the Client / PSDP during the project.

This Preliminary Safety and Health Plan will be expanded by the PSCS to formulate the Safety and Health Plan for the Construction Stage.

9 GENERAL PRINCIPLES OF PREVENTION

The General Principles of Prevention are contained in Schedule 1 of the Safety, Health and Welfare Act 2005. It sets out a key hierarchy with regard to the prevention of accidents and ill-health. In the context of the Construction Regulations 2013, the General Principles of Prevention apply to construction work and its associated preparation. The General Principles of Prevention are set out in descending order of preference as follows.

- Avoidance of risk.
- Evaluation of unavoidable risk.
- Combating of risks at source. If risks cannot be avoided, they should be combated at source so far as reasonably practicable.
- Adaptation of work to the individual, especially as regards the design of places of work, the choice of work equipment and the choice of systems of work.
- Adaptation of the place of work to technical progress.
- Replacement of dangerous articles/systems with safer ones.
- Use of an adequate prevention policy (use of new technology, social and human factors, organisation of work etc...).
- Favouring collective measures over individual protection.
- Providing appropriate training and instructions to employees.

Non-Exhaustive List of Matters to be considered in Particular as regards the Application of the General Principles of Prevention to Construction Work under the 2013 Regulations

1. Keeping the construction site in good order and in a satisfactory state of cleanliness.
2. Choosing the location of workstations bearing in mind how access to them is obtained and determining routes or areas for the passage and movement of equipment.
3. The conditions under which various materials are handled.
4. Technical maintenance, pre-commissioning checks and regular checks on installations and equipment with a view to correcting any faults which might affect the safety, health and welfare of persons at work.
5. The demarcation and laying out of areas for the storage of various materials, in particular where dangerous materials or substances are concerned.
6. The conditions under which the dangerous materials used are removed.
7. The storage and disposal or removal of waste and debris.
8. The adaptation, based on progress made on the construction site, of the actual time to be allocated for the various types of work or work stages.
9. Co-operation between employers and self-employed persons.
10. Interaction with industrial activities at the place within which or in the vicinity of which the construction site is located.

10 REFERENCES

- Safety, Health and Welfare at Work Act 2005
- Safety, Health and Welfare at Work (Construction) Regulations 2006
- Safety, Health and Welfare at Work (General Application) Regulations 2007
- HSA Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006
- HSA Guide to Safety in Roof work 2011
- HSE Guidelines on the Prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Works
- Health & Safety Executive (UK) document, HSG85 “Electricity at Work: Safe Working Practices”
- ET101:2008+A1+A2+A3:2018 Rules for Electrical Installations



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APPENDIX 1

Duties of the Project Supervisor for the Design Process (PSDP) as outlined in the Safety, Health and Welfare at Work (Construction) Regulations 2013:

The client for each project must appoint a competent PSDP, in writing. In many cases the PSDP is a designer who has the necessary competence to fulfil the role of PSDP

As the PSDP your key role is to ensure co-ordination of the work of designers throughout the project.

As a PSDP you must:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project.
- Where possible, eliminate the hazards or reduce the risk.
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the Safety and Health Plan.
- Ensure that the work of designers is coordinated to ensure safety.
- Organise co-operation between designers.
- Prepare a written safety and health plan for any project where construction will take more than 500-person days or 30 working days or there is a Particular Risk and deliver it to the client prior to tender.
- Prepare a safety file for the completed structure and give it to the client.
- Notify the Authority and client of non-compliance with any written directions issued.

The PSDP may issue directions to designers or contractors or others.

APPENDIX 2

Duties of Project Supervisor Construction Stage (PSCS) as outlined in the Safety, Health and Welfare at Work (Construction) Regulations 2013

- Co-ordinate the identification of hazards, the elimination of the hazards or the reduction of risks during construction.
- Develop the Safety and Health Plan initially by the PSDP before construction commences.
- Co-ordinate the implementation of the construction regulations by contractors.
- Organise cooperation between contractors and the provision of information.
- Co-ordinate the reporting of accidents to the Authority.
- Notify the Authority before construction where construction is likely to take more than 500 person days or 30 working days.
- Provide information to the site safety representatives.
- Co-ordinate the checking of safe working procedures.
- Co-ordinate measures to restrict entry on to the site.
- Co-ordinate the provision and maintenance of welfare facilities.
- Co-ordinate arrangements to ensure that craft, general construction workers and security workers have a Safety Awareness card, e.g., Safe Pass and Construction Skills card where required.
- Co-ordinate the appointment of a site safety representative where more than 20 persons on site.
- Appoint a safety advisor where there are more than 100 on site.
- Provide all necessary safety file information to the PSDP.
- Monitor the compliance of contractors and others and take corrective action where necessary.
- Notify the Authority and the client of non-compliance with any written directions issued.

The PSCS may issue directions to designers and contractors

APPENDIX 3

Suggested Contents of Construction Stage Safety and Health Plan

Description of Project

- Project description and program details,
- details of client, designers, Process Supervisor Design Process and other consultants,
- extent and location of existing records and plans,
- Arrangements for communication with Designers, PSCS and others as appropriate.

Clients Considerations and Management Requirements

- Structure and organisation,
- safety objectives for the project and the arrangements for monitoring and review,
- permits and authorisation requirements,
- emergency procedures,
- site rules and other restrictions on contractors, suppliers and others, e.g., access arrangements to those parts of the site which continue to be used by the client,
- activities on or adjacent to the site during works,
- arrangements for liaisons between parties,
- security arrangements.

Environmental Restrictions and Existing On-site Risks

- a) Safety hazards, including:
 - boundaries and access, including temporary access,
 - adjacent land use,
 - existing storage of hazardous materials,
 - location of existing services – water, electricity, gas, etc,
 - ground conditions,
 - existing structures – stability, or fragile materials.
- b) Health hazards including:
 - asbestos, including results of surveys,
 - existing storage of hazardous materials,
 - contaminated land, including results of surveys,
 - existing structures hazardous materials,
 - health risks arising from client's activities.

Significant design and construction hazards

- Design assumptions and control measures,
- arrangements for co-ordination of on-going design work and handling design changes,
- information on significant safety and health risks identified during design,
- materials requiring particular precautions.

APPENDIX 4

General Outline of PSDP Safety File

The Safety File is a key document intended for the safety of end users of the structures or for those who will extend/maintain the structure in the future. For this project, the post-tender PSDP must prepare and pass the Safety File to the Client at project completion. The client requirements are that all drawings be provided in both DWG and PDF format and that the safety file be provided in one hard and one soft copy.

All Designers on the project must provide the PSDP with any relevant information in writing, about the project, that is necessary for the project supervisor to prepare the safety file e.g. aspects of the design that could create risks during future construction work or maintenance.

It is the duty of the PSCS to.

- Coordinate arrangements among contractors to ensure the provision of relevant information, in writing, necessary for the PSDP to complete the safety file
- Take any necessary corrective action if the contractors fail to provide the relevant information to the PSDP
- Provide in writing to the PSDP all relevant information necessary to complete the safety file.

PSDP Safety File – Outline of Information Required. A more detailed list will be issued by the client following appointment

Section	Title
1.0	General Details • General Information (project details / project directory) • Contractual and Legal Information – regulations under which the project was designed and constructed.
2.0	Description of Site Works • General description of the project works.
3.0	Project Drawings • As Built Drawings (Architectural, Structural, Materials, Building Services etc)
4.0	Design Information • Civil/Structural Design • External Services Design (including emergency systems) • Architectural Design • Mechanical and Electrical Design • Pick up Points for Utilities and Service Details
5.0	Construction Materials • Bill of Quantities • Schedule of Equipment • Schedule of Finishes • Technical Literature
6.0	Commissioning and Test Certificates • Consultant Letter of Acceptance • Emergency Lighting • Fire Rated Doors



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- Fire Stopping/Sealing Completion Certificate
- RECI General Electrical Certificate
- Access Systems

7.0 **Hazardous Materials**

- Details of all hazardous material used in project construction
- Measures in place to manage hazardous materials

8.0 **Electrical Details**

- Nature/Location/Markings of significant Electrical Services
- Operation and Maintenance Procedures/Schedules
- Details of Electrical Services
- Electrical Operation and Maintenance Manuals

9.0 **HSA Notifications**

- AF1 Form (Scan) – Client/PSDP
- AF2 Form (Scan) - PSCS

10.0 **Preliminary Health & Safety Plan – PSDP**

11.0 **Construction Health & Safety Plan – PSCS**

APPENDIX 5

Hot Work Permit

HOT WORK PERMIT

Date: _____

Permission is granted to _____ use
_____ in the _____ (exact location)

Between _____ am & _____ pm
_____ am & _____ pm

- ✓ The above location has been examined.
- ✓ There are no combustible liquids, vapours, gases or dusts.
- ✓ All combustible material has either been removed or suitably protected against heat & sparks.
- ✓ A man will be standing by with an extinguisher / hose real while the operation is in progress.
- ✓ He and the operatives have had the nearest fire alarm / telephone pointed out to them and have been told what to do in the event of a fire.

Permit Issued By: _____ Position: _____

Work area and all adjacent areas to which sparks and heat might have spread were thoroughly inspected on completion of the operations and four hours later no smouldering fires were discovered.

Permit Presented to: _____ Company: _____

(After signing, return permit to the person who issued it)

NOTE: *Applicable to all operations involving flame, hot air or arc welding and cutting equipment, brazing and soldering equipment, blowlamps, bitumen boilers and other equipment producing heat or having naked flames.*

Appendix 6

Guidelines on the Prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Works



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Guidelines on the Prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Works

Document reference number 1		Document developed by Máire Flynn, A/Infection Control Nurse, Kerry community services	HSE South Kerry Community Services Infection Prevention and Control
Revision number	1	Document approved by	Dr. William Dibb
Approval date	June 2010	Responsibility for implementation	Matron/Director of Nursing/ Service/ Construction Team/Maintenance
Revision date	June 2012	Responsibility for review and audit	Infection Prevention & Control
Implementation Date	June 2010	No. of Pages	7

1.0 Policy Statement

Construction – related indoor fungal aerosol pollution can create unhealthy conditions for susceptible individuals. Airborne fungi that infect hospital patients are generally in the genus *Aspergillus*. The source of such an aerosol problem must be recognized and eliminated to protect the health and safety of the building occupants and also recognizing that the community setting is generally in the lower risk categories. These guidelines are based on best practice, and their purpose is to minimize this risk of infection to patients/clients.

The following provides guidance for local policy on preventing Nosocomial Invasive Aspergillosis during construction/Building activity.

2.0 Purpose

- To provide infection prevention guidance on the how to prevent the exposure of “at risk” patients to Nosocomial Invasive Aspergillosis during construction/demolition/renovation activity by minimizing dust generation and preventing dust infiltration into adjacent patient care areas. The purpose of this guideline to follow the national guideline of 2002 from the HPSC.

3.0 Scope

This guidance applies to all personnel involved in the construction, renovation and demolition activities occurring within or adjacent to residential healthcare sites under the care of Kerry Community Services HSE South.

4.0 Glossary of terms and definitions

Aspergillus species are ubiquitous fungi that commonly occur in soil, water, organically enriched debris and decaying vegetation. They can also live in old buildings. Many species have been recognised in nature but only a few are associated with human disease.

Nosocomial (i.e. healthcare acquired) outbreaks of aspergillosis have become a well-recognised complication of construction, demolition or renovation work in near hospital wards in which immunosuppressed patients are housed. *Aspergillus* spores are suitably adapted to airborne dissemination. These spores are passively liberated during construction/renovation work and can be transported long distances as airborne particles by normal atmospheric conditions such as convection currents and wind. Cases of Aspergillosis may increase dramatically especially in immunocompromised patients during hospital construction/renovation activities, these would usually be in high-risk settings such as transplant units, ICU, oncology unit or in residential areas where immunocompromised patients are being nursed.

5.0 Roles and Responsibilities

A proactive approach to minimise this risk is needed. Communication and awareness of the risk factors to all involved in the project is essential and this will be the key to reduce the risk to patients.

- The community services Manager/Matron/Director of Nursing must ensure that this guideline for prevention of Invasive Aspergillosis during renovation/construction work are implemented.
- The Infection Control Team should be consulted so that a risk assessment of the proposed area can be carried out.
- If major works are planned in an area where there are at risk patients, a multidisciplinary group must convene to decide how best to manage the work ensuring patient safety. This will include Matron/Director of Nursing, Maintenance staff, Infection Control team of ICN and Consultant Microbiologist and medical officer and community services manager input.
- The Consultant Microbiologist and Infection Control Nurse should liaise with the Medical Officer or GPs overseeing the care of patients in the building where the planned work is to be carried out.

Classification of at-Risk groups.

Group 1. No Evidence of Risk.

1. Staff members, service providers and contractors
2. All members not listed in group 2 or 4 below.

Group 2. Increased Risk

1. Patients on prolonged courses of high dose steroids.
2. Severely immunosuppressed patients.
3. Dialysis patients
4. Patients having chemotherapy who are not neutropenic.

Group 3. High Risk

1. Neutropenic for 14 days following chemotherapy.
2. Adult acute lymphoblastic leukaemia on high dose steroid therapy.

Group 4. Very High Risk.

1. Aplastic anaemia patients.

Generally other categories of patients in this group would not be in community residential settings as per very high-risk group, *National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Activities 2002*.

6.0 Preventative Measures to Control Invasive Aspergillosis.

Introduction.

The key to eliminating *Aspergillus* infection is first to minimise the dust generated during construction activity and secondly to prevent dust infiltration into adjacent patient care areas.

6.1 Construction and Ventilation Measures.

The construction team and maintenance personnel can put in place a number of measures to protect at risk patients during building activities on hospital sites.

These measures can be divided into:

- Measures to reduce dust emission from construction area
 - Measures to physically protect at risk patients
-
- **6.2.1 Measures to reduce dust emission from construction area**
 1. The construction area should be fully sealed during the construction period.
 2. A dust barrier should be created from the floor to the slab (true ceiling) and edges sealed.
 3. For short term minor projects: This may be plastic sheeting.
 4. For longer term projects this should be a solid sealed barrier. It may be necessary to create a lobby (anteroom) if the barrier is the entrance/ egress for construction workers.
 5. All windows, doors, vents plumbing penetrations, electrical outlets and any other sources of potential air leak should be sealed in the construction zone.
 6. Air pressure in the construction zone should be negative compared with adjacent areas. An extract fan should be used for that purpose. The most appropriate option is that air from the construction zone should be exhausted to the outside. If this is not possible then the air should be filtered through HEPA filters that are fitted properly and strictly monitored before being re-circulated to the hospital.
 7. Dust reduction techniques should be used for cutting and hole boring.
 8. Debris should be removed from the construction site at the end of each working day, preferably in covered containers through window openings. A chute may be necessary if above ground floor level.
 9. The floor should be vacuumed on a daily basis or more frequently if required, to maintain the environment as free from dust as possible.
 10. A mat with a sticky surface or moist surface should be placed inside the exit of the construction zone to trap dust. This should be vacuumed/changed daily basis or more frequently if required when visibly soiled.
 11. Construction workers should wear protective clothing, which must be removed before leaving the construction zone

- **6.2.2 Measures to physically protect at risk patients.**

1. Patients who are at risk should be moved to an area away from the construction site if the air quality cannot be guaranteed during construction.
2. At risk patients in group 2-4 should wear protective masks if it is necessary to transport them through a construction area. The masks would be of N95 standard as recommended by National Institute of Occupational Safety and Health (NIOSH) regulations.
3. All windows and doors and vents should be sealed in areas where there are susceptible patients.
4. If the area is connected to a central ventilation system, it is important that this is checked prior to the construction work taking place. If it is to remain functional, it must be HEPA filtered if there is likelihood that air from the construction zone may be drawn into the system.

7.0. Infection Control Measures.

Communication and education are two vital elements to the successful implementation of proactive infection control measures in reducing and attempting to eliminate the risk of nosocomial invasive aspergillosis in immunocompromised patients.

In order to achieve a safe environment for those people at high risk it is essential that before works start on new builds or refurbishments that all parties (clinicians, nurse managers, infection control team, estates, maintenance and construction workers have established a co-ordinated strategy for dealing with aspergillosis to prevent exposure of risk patients to high levels of airborne aspergillus spores. All relevant parties involved in the work must ensure that there is effective communication between them all. Education should be provided for healthcare staff, cleaning staff, Maintenance staff and Construction workers.

Dust Containment.

This means that the dust that will be generated will be minimised during work activity by taking the proper precautions as already outlined to prevent dust infiltration to adjacent patient areas.

Traffic Control.

Pedestrian traffic from the construction site must be directed away from the patient care areas. The workmen should ideally have a separate entrance where possible.

Alternative routes must be identified for visitors, patients and supplies entering the hospital to minimise contamination risks from the construction site.

Cleaning by Maintenance / Construction Personnel/

Damp dusting is essential for all cleaning. Dry dusting /cleaning is unacceptable.



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Increased cleaning regimes must be carried out.

Air filtration systems must be regularly checked and recorded.

All vacuum cleaners must be fitted with a HEPA filter and filters in air filtration systems and in vacuum cleaners must be changed regularly and records maintained.

8.0 References.

The National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis during Construction / Renovation Activities, Nation Disease Surveillance Centre, Dublin 2002.

APPENDIX 7

National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities

DEVELOPED BY A SUB-COMMITTEE OF THE SCIENTIFIC ADVISORY COMMITTEE OF THE NATIONAL DISEASE SURVEILLANCE CENTRE ISBN 0-9540177-3-0

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Appendix 4: Notes on Preparation of Requirements for Protection against Invasive Aspergillosis

References

Cover Illustration: Electron micrograph of *Aspergillus flavus*. This image was downloaded from the *Aspergillus* website ~ www.aspergillus.man.ac.uk and reproduced by kind permission of the Fungal Research Trust. © Fungal Research Trust

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This document has been prepared with particular reference to the following:

- Construction-related Nosocomial Infections for Patients in Health Care Facilities: Decreasing the Risk of *Aspergillus*, *Legionella* and Other Infections. *Canada Communicable Disease Report* 2001, 27(S2); 1-55 (<http://www.hc-sc.gc.ca>).
- Centers for Disease Control and Prevention – Healthcare Infection Control Practices Advisory Committee (HICPAC). Draft Guideline for Environmental Infection Control

in Healthcare Facilities, 2001.

- Newcastle-upon-Tyne City Health Trust Estates Department – Operational Policy for *Aspergillus* Management EOP53 (Version 1 updated 2nd February 2000)

- *Aspergillus* website ~ www.aspergillus.man.ac.uk

These guidelines are mainly consensus based, with evidence used where available.

A consultation document containing draft guidelines was circulated in April 2001 to

interested parties and was also posted on the NDSC website for general consultation.

The final document was prepared following the consultation process and the Sub-

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Nosocomial outbreaks of invasive aspergillosis have become a well recognised complication of construction, demolition or renovation activities

in or near hospital wards accommodating immunocompromised patients.

Nosocomial aspergillosis is a cause of severe illness and mortality in these patients.

The purpose of this document is to act as guidance for healthcare staff to ensure that construction/renovation activities in hospital providing for at risk patients are undertaken in a safe and appropriate manner to reduce the risk of infection in these patients. The document outlines the risk factors contributing to nosocomial invasive aspergillosis and identifies the at-risk patients. Recommendations are made as to the measures that can be undertaken to reduce these health risks.

Where construction/renovation projects are planned in hospitals providing for at-risk patients, a multi-disciplinary team comprising of hospital administrators, technical services staff, designers, infection control staff and relevant clinicians should be established to develop and monitor the implementation of risk management and infection control policies. Clear lines of communication among all personnel involved must be established at the planning phase. The protection of vulnerable patients will depend on the acceptance and effectiveness of implementing infection control measures which will require a high level of commitment, understanding and co-operation from all personnel involved in the construction/renovation project.

Dr Lynda Fenelon

Chairperson

Aspergillus Sub-committee

Foreword

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Summary of Recommendations

It is recognised that outbreaks of nosocomial invasive aspergillosis may occur in association with construction/renovation activities. Because of the high mortality rate associated with invasive aspergillosis in immune suppressed patients, the committee recommends that measures be implemented in hospitals to control this risk where construction/renovation activities are planned. The following are the recommendations of the committee:

Organisational duties and responsibilities

That hospital managers ensure that hospitals have an infection control committee with

responsibility for drawing up a hospital policy for the prevention of invasive aspergillosis.

That when major construction work is planned, hospital managers ensure that multidisciplinary

team comprising hospital administrators, infection control staff, technical services staff, designers and relevant clinicians in high-risk areas is established, and that policies and procedures are put in place to minimise the risk of invasive aspergillosis that clearly outline the responsibilities of all personnel involved.

Classification of at-risk patients

That patients are risk assessed and divided into categories according to the degree of risk of invasive aspergillosis.

Preventive measures to control invasive *aspergillosis*

That a number of measures be undertaken to protect at-risk patients from exposure to *Aspergillus* spores. These measures may be divided into construction and ventilation measures, infection control measures and chemoprophylaxis.

Construction and ventilation measures should consist of

- Measures to reduce dust from construction areas.
- Measures to physically protect at-risk patients.

Infection Control measures should include

- The education of health care workers, project managers, contractors, design teams, health and safety supervisors, cleaning supervisors, patients and relatives of the patients on the risk of invasive aspergillosis and the steps that should be taken to reduce this risk.
- Cleaning procedures directed at reducing dust in clinical areas.
- The control of pedestrian, supply and construction-related traffic.

A Construction Permit should be used to ensure that the construction, ventilation and infection control measures are appropriately instituted. A sample Construction Permit is provided in Appendix 1.

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Chemoprophylaxis

- That antifungal chemoprophylaxis is considered in at-risk patients in line with current guidelines and hospital policy. Chemoprophylaxis may also be considered in at-risk groups in the presence of construction work if these patients cannot be protected by environmental measures.
- That each centre evaluates its at-risk population and determines if chemoprophylaxis is likely to be of benefit.

Diagnostic strategies for invasive aspergillosis

- That all effort be made to ensure an early diagnosis of invasive aspergillosis.
- That a multidisciplinary approach combining clinical, radiological and microbiological criteria be used to predict the probability of invasive disease.
- That newer technologies, which aid the early diagnosis of infection, continue to be evaluated and developed.
- That a National Mycology Reference service be developed to improve the management of aspergillosis and other fungal infections.

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1.1 Background

Certain types of construction activities can result in increased incidence of invasive aspergillosis among immunosuppressed patients. Because of the high mortality rate associated with invasive aspergillosis in these patients, it is essential to minimise these risks. While construction activities are taking place, it is necessary that immunosuppressed patients be protected over that period. As there is no real consensus worldwide as to how this should be done, there is a real need to develop Irish National Guidelines to control invasive aspergillosis during hospital construction/renovation activities. Therefore, with the agreement of the Department of Health and Children, the Scientific Advisory Committee (SAC) of the National Disease Surveillance Centre (NDSC) established a multidisciplinary sub-committee of SAC to develop these guidelines.

1.2 Membership of the Sub-Committee

This multidisciplinary sub-committee comprises of representatives from Microbiology, Infection Control, Haematology, Department of Health and Children, Engineering, Architecture and the National Disease Surveillance Centre.

1.3 Terms of Reference of the Sub-Committee

The sub-committee was requested to address the following:

1. To identify (a) at-risk patients and (b) risk factors which contribute to invasive aspergillosis in hospitals during construction/renovation activities.
2. To identify measures to reduce the incidence of invasive aspergillosis.
3. To develop national guidelines for the prevention of invasive aspergillosis during

construction/renovation activities in hospitals.

4. To identify the requirements in relation to the use of reference facilities.

1. Introduction

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2. A Literature Review

Construction-related indoor fungal aerosol pollution can create unhealthy conditions for susceptible individuals. The source of such aerosols can originate from outdoor or indoor activity, which causes the disturbance of settled spores or the disruption of a locus of growth. The release of indoor spore aerosols may be caused by activities ranging from construction to cleaning. Outdoor sources of indoor fungal aerosols depend on proximity to such activities as construction or lawn mowing and the status of building penetrations by aerosolised mould and/or weather conditions. The source of such an aerosol problem must be recognised and eliminated to protect the health and safety of the building occupants. Airborne fungi that infect hospital patients are generally in the genus *Aspergillus*.

Aspergillus species are ubiquitous fungi that commonly occur in soil, water, organically enriched debris and decaying vegetation.¹ Many species of *Aspergillus* have been recognised in nature but only a few have been associated with human disease, namely *A. fumigatus*, *A. flavus*, *A. niger*, *A. terreus* and *A. nidulans*.¹ *Aspergillus* spp. are responsible for a wide spectrum of human illnesses ranging from colonisation of the bronchial tree to rapidly invasive and disseminated diseases.² Invasive aspergillosis is primarily an infection of severely immunocompromised patients i.e. patients with haematological malignancies and bone marrow and organ transplants³⁻⁶ and is difficult to diagnose and treat.⁷ Mortality is still high despite new therapies, thus making prevention a high priority in the management of all at-risk patients.⁸⁻¹²

Nosocomial (i.e. hospital acquired) outbreaks of aspergillosis have become a well-recognised complication of construction, demolition or renovation work in or near hospital wards in which immunosuppressed patients are housed. *Aspergillus* spores are superbly adapted to airborne dissemination.¹³ These spores are passively liberated during construction/renovation activities and can be transported great distances as airborne particles by normal atmospheric conditions such as convection currents and wind. Airborne transmission is the principal route of transmission of *Aspergillus* within the hospital environment. The respiratory tract is the most common portal of entry and the small diameter of the spores (2.5–3.5 µm) permits them to reach the pulmonary alveolar spaces, where they may germinate to form hyphae.¹⁴ Pulmonary aspergillosis may then develop following inhalation of airborne fungal spores, and high spore counts within patient-care areas represent an extrinsic risk factor for invasive disease.¹⁵

Cases of aspergillosis may increase dramatically especially in immunocompromised patients during hospital construction/renovation activities. Hospital outbreaks of aspergillosis have been reported, for example, in transplantation units,¹⁶⁻¹⁸ haematology and oncology units,^{5,8,19} intensive care units,²⁰⁻²¹ renal unit¹¹ and medical wards where immunosuppressed patients were nursed.²²⁻²³ Summaries of the documented reports on construction-related aspergillosis outbreaks are outlined in Table 1.

The majority of the outbreaks reported were related to contamination of the hospital air as a result of the dust and dirt raised during construction, demolition or renovation projects within or adjacent to the health care facility. Specific construction/maintenance activities included: (i) general construction and renovation work, (ii) disturbance of soil resulting from earth works associated with building construction and site development, (iii) removal of suspended ceiling tiles, (iv) removal of fibrous insulation material, (v) opening up of service distribution shafts. Aspergillosis outbreaks have also been associated with improper operation and poor maintenance of sophisticated air ventilation systems. Furthermore, any dust generating activities such as maintaining the ventilation system, cleaning, vacuuming and dry mopping can render *Aspergillus* spp. airborne (see Table 1 for details).

2. Construction-Associated Nosocomial Invasive Aspergillosis

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Table 1. Construction-Related *Aspergillus* Outbreaks in Hospitals

Etiologic Agent	Underlying Medical Condition	Source of Etiologic Agent	Number of patients infected	Number of deaths	Reference
<i>A. niger</i>	Diagnosis not provided	<i>Aspergillus</i> spore settled on wet fireproofing material	8	3	22
<i>A. flavus</i>	Hospital admits patients with cancer	Material when installed during construction			
<i>A. fumigatus</i>	Spores dispersed	When the dry fireproofing material was disturbed above false ceiling			

during renovation and maintenance.

A. fumigatus (3) Renal transplant Renovation activity in floor above caused dust to be dispersed from false ceilings in the renal transplant ward.

A. fumigatus Haematologic malignancy (2) Window air conditioners in the renal transplant 10 10 17

A. flavus Advanced age (1) unit heavily contaminated with *Aspergillus* spp.

Renal transplant (7) Unit was in close proximity to adjacent road construction.

A. flavus (32) Old cavity TB, Diabetes Construction activity adjacent to hospital and 6* 1 24

Idiopathic thrombocytopenic purpura defective ventilation system and air

Leukaemia, Lung cancer filtration system.

Chronic obstructive airways disease

Bacterial pneumonia

A. flavus (3) Leukaemia Repair of false ceiling due to water leak 6 2 25

A. fumigatus (2) in storeroom housing intravenous supplies.

A. niger (1) Adhesive tape and arm boards were contaminated.

Aspergillus Neonatal ward Major source of mould was dust above 2 2 26

(premature infants) the false ceiling.

* 32 patients had *Aspergillus* isolated from a respiratory specimen, however, only 6 patients regarded as infected, the remainder were colonised

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Etiologic Agent Underlying Medical Condition Source of Etiologic Agent Number of Number of Reference patients infected deaths Number

A. flavus (4) Immunosuppressed patients Not provided. Patients were either located on 11 11 2

A. fumigatus (1) the same floor or the floor below the

A. niger (1) construction area.

Other *Aspergillus* spp.

A. fumigatus (18) Leukaemia (22) Spores freed into the atmosphere as a result 22 18 4

of demolition of ducts and false ceilings, the removal of fibrous thermal insulating materials and work on roller-blind castings.

Aspergillus (3) Burkitt's lymphoma (1) Exposure to construction activity, windows 5 5 27

Zygomycetes (2) Leukaemia (4) could be opened in unit patients were in.

A. fumigatus (6) Bone Marrow Transplant Heavy spore contamination resulted from 6 6 18 construction of an adjacent BMT unit.

A. fumigatus (6) Immunocompromised Cluster of cases was due to a common source 6 2 28 outbreak related to construction activity in a central radiology suite serving the hospital.

Aspergillus Immunosuppressive therapy for vasculitis Construction work and demolition of hospital 3 3 23 buildings adjacent to the medical unit the

patients were housed. Contributing factors: no special ventilation system and windows could not be completely closed.

A. fumigatus (3) Heart transplant (3) Connecting bridge between the old and new 3 2 29 unit allowed dust to circulate from the construction site. In addition, one air vent was not properly closed.

Table 1 continued

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Etiologic Agent Underlying Medical Condition Source of Etiologic Agent Number of Number of Reference patients infected deaths Number

Aspergillus Patients in haematology unit Large-scale excavation work while hospital 5 5 30 was being rebuilt. The isolation rooms that housed the patients overlooked the building site.

A. fumigatus Patients in intensive therapy unit Spores in fibrous insulation material above 6 3 20 perforated metal ceiling dispersed during minor building in adjacent offices and stores area.

A. terreus (4) Bone Marrow Transplant (2) Renovations taking place two floors below 6 4 21

Leukaemia (1) intensive care unit (ICU). Air pressure in ICU

Disseminated choriocarcinoma (1) negative to hallway and nearby elevator shaft.

Diagnosis not available (2)

A. flavus (5) Patients in Bone Marrow Transplant/ Fire in an old building close to the hospital, 13 5 31

A. fumigatus (6) leukaemic unit and repeated window opening by a patient shortly afterwards suggest that fungal spores

dispersed during the fire were the source.
The hall carpet then became contaminated
and was an ongoing source of infection until
cleaning regime was altered.

A. fumigatus (2) Oncology Significant increase of mould in air in patient 5 Not provided 19

A. flavus (1) rooms and corridors after construction started.

Unknown (2) Leaks around windows suspected as the
major source, as amount mould in the air
decreased following sealing these leaks.

Aspergillus Patients in burns, dialysis and Air intake vents in units where the patients 5 Not available 32
oncology units were housed had not been covered during
demolition work.

Table 1 continued

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Etiologic Agent Underlying Medical Condition Source of Etiologic Agent Number of Number of Reference
patients infected deaths Number

A. fumigatus (3) Oncology Remodelling of adjacent radiology department. 3 1 33
Dust barriers had not been installed.

A. fumigatus Burn (2) *Aspergillus* spores dispersed as a result of 4 Not available 34

A. niger Trauma (1) renovations in inventory control department.

A. terreus Perforated viscus (1) Settled on supply boxes, packages inside
became contaminated. Patients then infected
when packages opened during dressing changes.

Aspergillus Leukaemia (34) Hospital construction may have been related 36 17 8
Bone Marrow Transplant (2) to the outbreak.

A. flavus (6) Leukaemia Directly related to increased spore counts 8 5 9

A. fumigatus (1) Cancer from soil excavation that occurred during

M. rhizopus (1) hospital construction.

A. fumigatus (1) Chronic obstructive airways disease (2) Exposure to high concentrations of airborne 2 2 10 **

Aspergillus spp. following air filter change in ICU.

A. fumigatus (3) Renal disease (3) Hospital renovation on a unit near the renal unit 3 2 11
where the patients were housed.

A. fumigatus (4) Rheumatology (5) Extensive renovation throughout the hospital. 7 4 12

Aspergillus spp. (3) Not stated (2) Construction areas were neither sealed off
from patient areas nor under negative pressure
relative to patient-care areas.

**This report on nosocomial aspergillosis were not construction-related, the author recommends that guidelines for air filter replacement should be
included in any guidelines being developed for the
prevention of aspergillosis.

Table 1 continued

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3.1 Introduction

Host immunity plays a major role in determining who may be at risk of developing invasive aspergillosis. When a patient with normal immunity is exposed to *Aspergillus* spp., macrophages kill the conidia while neutrophils are a defence against the mycelia. When the host is immunocompromised, an increased likelihood of invasion of tissue by *Aspergillus* spp. can occur. The major risk factor for invasive aspergillosis is prolonged and severe neutropenia, both disease- and therapy induced. The duration of neutropenia is an independent risk factor for the development of invasive fungal infections. The incidence of invasive aspergillosis in at-risk groups is shown in Table 2. Bone-marrow transplant recipients are the population at highest risk. However, other immunosuppressive conditions have frequently been reported as risk factors for construction related nosocomial fungal infections: graft versus host disease requiring treatment, prolonged neutropenia following cytotoxic chemotherapy, prolonged use of antibiotics and steroid therapy.

Table 2. Incidence of invasive aspergillosis in at-risk groups

3.2 Classification of at-risk patients

At-risk patients may be categorised as follows:

Group 1 ~ No evidence of risk

1. Staff members, Service Providers and Contractors
2. All patients not listed in Groups 2 – 4 below

Group 2 ~ Increased risk

1. Patients on prolonged courses of high dose steroids particularly those hospitalised for prolonged periods
2. Severely immunosuppressed AIDS patients

3. Patients undergoing mechanical ventilation
4. Patients having chemotherapy who are not neutropenic**
5. Dialysis patients

Group 3 ~ High risk

1. Neutropenia for less than 14 days following chemotherapy
2. Adult acute lymphoblastic leukaemia (ALL) on high dose steroid therapy
3. Solid organ transplantation
4. Chronic Granulomatous Disease of Childhood (CGDC)
5. Neonates in intensive care units (ICU)

**Neutropenia defined as absolute neutrophil count (ANC), $<1 \times 10^9/l$

3. At-Risk Patients and Risk Factors

Host group Incidence of

invasive aspergillosis

Allogeneic bone marrow transplantation 5-10%³⁵⁻³⁶

Autologous bone marrow transplantation 0-5%³⁵⁻³⁶

Peripheral blood stem-cell transplantation 5 %^{*36}

Cytotoxic-therapy-induced granulocytopenia Up to 70%³⁷

Kidney transplantation 0-3%³⁸

Liver transplantation 1-15%³⁹⁻⁴¹

Heart/Lung transplantation 0-20%⁴²⁻⁴³

Heart transplantation 0-25%⁴⁴

* Preliminary data as this is a new therapy

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Group 4 ~ Very high risk

1. Allogeneic bone marrow transplantation
 - a. during the neutropenic period
 - b. with graft versus host disease
2. Autologous bone marrow transplantation, i.e. during the neutropenic period
3. Peripheral stem cell transplantation, i.e. during the neutropenic period
4. Non-myeloablative transplantation
5. Children with severe combined immuno-deficiency syndrome (SCIDS)
6. Prolonged neutropenia for greater than 14 days following chemotherapy or immunosuppressive therapy
7. Aplastic anaemia patients

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4.1 Introduction

The key to eliminating *Aspergillus* infection is first to minimise the dust generated during construction activity and second, to prevent dust infiltration into adjacent patient care areas. Studies have demonstrated the effectiveness of preventive measures when implemented in health care facilities ^{2,8,45-47} as well as in commercial and residential buildings.⁴⁷

In a study by Loo *et al.* (1996)⁸ the following environmental control measures were used: (i) portable high-efficiency particulate air (HEPA)-filter air purifier units were installed in rooms housing neutropenic patients; (ii) application of copper-8 quinolinolite formulation to walls, doors, frames, baseboards, exterior surfaces of radiators, vents in the rooms and above the false ceilings of the adjacent hallway to decontaminate the area; (iii) windows were sealed; (iv) existing perforated ceiling tiles were replaced with easy-to-clean, non-perforated, vinyl-faced aluminium tiles; (v) horizontal dust-accumulating blinds were replaced with vinyl opaque, roller shades; (vi) the ventilation system was meticulously maintained; (vii) patient rooms were cleaned regularly and (viii) patients were moved to another area of the hospital during the implementation of these measures. In this particular study the authors concluded the environmental control strategy implemented played an important role in controlling the outbreak of construction-associated invasive aspergillosis.⁸

Other measures that have been used include the erection of airtight plastic and dry wall barriers around the construction sites, the use of negative-pressure ventilation in the construction area,² covering of all air intake and exhaust vents in the construction zone with plastic to prevent the introduction of contaminated air into the hospital heating, ventilation and air conditioning systems, capping the open ends of any existing ventilation ducts in the construction zone, redirection of construction traffic away from patient areas, regular removal of the construction debris from the site in sealed containers or at least covered by a damp cloth, the use of sticky mats and damp cleaning.⁴⁶ The environmental control measures implemented will depend on the type of construction/renovation

being undertaken in the hospital and the proximity of the at-risk patients to this site. This will be based on the results of the risk assessment. The categories of construction/renovation activities and the recommended preventive measures for these activities are outlined in a Sample Construction Permit provided in Appendix 1.

Preventive measures can be considered under the following headings: (i) construction and ventilation measures; (ii) infection control measures and (iii) chemoprophylaxis.

4.2 Construction and Ventilation Measures

A number of measures may be implemented by hospital construction designers and maintenance personnel to protect at-risk patients during building activities on hospital sites. The measures identified in the available literature on the subject vary from basic minimal precautions and good housekeeping to major mechanical services intervention involving dedicated HEPA filtered installation systems to protect the areas in which the at-risk patients are housed.

These measures may be divided into:

- Measures to reduce dust emission from construction area
- Measures to physically protect at-risk patients

4.2.1 Measures to reduce dust emission from construction area

1. The construction area should be sealed fully during the construction period. A dust barrier should be created from the floor to the slab (true ceiling) and edges sealed.

For short-term minor projects this may be plastic sheeting, however for more longterm projects this should be a solid sealed barrier. It may be necessary to create a lobby (anteroom) if the barrier is the entrance/egress for construction workers.

4. Preventive Measures to Control Invasive Aspergillosis

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2. All windows, doors, vents, plumbing penetrations, electrical outlets and any other sources of potential air leak should be sealed in the construction zone.

3. Air pressure in the construction zone should be negative compared with adjacent areas. An extract fan may be used for this purpose. Air from the construction zone should be exhausted directly to the outside and this is the most appropriate option. If this is not possible then the air should be filtered through HEPA filters (that have been properly fitted and strictly monitored) before being re-circulated to the hospital.

4. Dust reduction techniques should be used for cutting and hole boring.

5. Debris should be removed from the construction area at the end of each working day. Debris should be removed in covered containers preferably through window openings. A chute may be necessary if the construction is above ground floor level. In addition, normal good housekeeping procedures should prevail during the operation in particular, holding skips and other containers should be kept moistened and/or covered. The construction area should be vacuumed on a daily basis or more frequently if required, to maintain an environment as free from dust as possible.

6. A mat with a sticky surface or moist carpet should be placed inside the exit from the construction zone to trap dust. This should be vacuumed/changed daily or more frequently when visibly soiled.

7. Construction workers should wear protective clothing, which should be removed before leaving the construction zone.

The measures implemented to reduce dust emission from the construction area will vary depending on the construction/renovation activity. The measures required for the various types of construction activity are outlined in the Sample Construction Permit (Appendix 1).

4.2.2 Measures to physically protect at-risk patients

1. Patients who are at risk should be moved to an area away from the construction zone if the air quality cannot be guaranteed during construction. At-risk patients (Groups 2-4) should wear protective masks if it is necessary to transport them through a construction area. These masks should be capable of filtering *Aspergillus* spores such as particulate-filter respirators (PFR 95) which give a >95% filtration efficacy of 0.3 µm particle size and are used in association with the National Institute for Occupational Safety and Health (NIOSH) regulations.

2. All windows, doors (apart from essential access points) and vents should be sealed in areas of the hospital containing patients who are most susceptible (Groups 2-4), if the construction or demolition work is considered likely to result in *Aspergillus* contaminated

air entering these areas. If the area is not served by a ventilation system, these precautionary measures may result in unacceptable environmental conditions within the area involved. Any fresh air introduced into this area must be HEPA filtered. If the area is connected to a central ventilation system, it is important that prior to construction works, the ventilation should be thoroughly checked and if it is to remain functional, it should be fitted with HEPA filters if air from the construction zone may be drawn into the system.

3. For very high-risk patients (Group 4), it is recommended that an environment that is fully HEPA filtered and at positive pressure is provided. This involves the installation of dedicated remote air handling systems, which are ducted through supply systems to the at-risk area. The intake air handling unit is fitted with a combination of coarse bag and panel filters and finally a HEPA filtered section which is the only filter capable of trapping the 2.5 to 3.5 μm size of the *Aspergillus*

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spore. Typically, these dedicated ventilation/filter units should provide an air exchange rate of >12 air changes per hour within the at-risk area and a pressure differential for positive pressure areas of >2.5 pascals (ideal pressure differential of >8 Pa).⁴⁸

4. A mat with a sticky surface should be placed at the entrance to the patient care area. This should be changed or vacuumed daily or when visibly soiled.

4.3 Infection Control Measures

Communication and education are two vital elements to the successful implementation of proactive infection control measures in the reduction and the attempt to eliminate the risk of nosocomial invasive aspergillosis in immunocompromised patients. Effective communication between all relevant parties. architects, engineers, technical services, sub-contractors, infection control, medical and nursing staff is of vital importance during all stages of construction work to implement effective infection control preventive measures. The hospital should designate education co-ordinators for each of the relevant parties.

4.3.1 Education

Health care workers should be educated on:

- The risk of invasive aspergillosis in the categorised at-risk groups during construction work.
- The infection control measures to decrease its occurrence.

Project managers, contractors, design teams and health & safety supervisors should be educated on:

- The preventive measures that should be implemented during construction and renovation activities.
- The importance of ensuring that this information is given to the construction workers and its significance understood in order to aid with compliance.

Supervisors of cleaning staff/ contract cleaners should be educated on:

- Basic principles of *Aspergillus* spore contamination of the environment.
- Cleaning measures to prevent environmental contamination.
- The importance of ensuring that this information is given to the operatives and its significance understood in order to aid with compliance.

At-risk patients (Groups 2-4) and the relatives of these patients should be informed of:

- The risks of nosocomial aspergillosis infection.

An information leaflet on aspergillosis should be provided (Appendix 2). The purpose of this leaflet is to inform patients, relatives of patients, health care workers and those involved in the activities of construction, of the risk of aspergillosis during construction work. This leaflet should be considered as introductory information only.

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4.3.2 Dust containment

The objectives of dust containment measures are:

- To minimise the dust generated during the work activity
- To prevent dust infiltration into adjacent patient care areas.

The categorisation of the construction activity in conjunction with its geographical location will determine the controls required to achieve these objectives. The use of a construction permit will assist in achieving compliance with the requirements (Appendix 1).

4.3.3 Cleaning

In addition to minimising dust through measures outlined in the construction permit increasing

the existing cleaning regimes to prevent dust accumulation on surfaces, ceilings and air duct grilles will be necessary. As the quantity of dust generated will vary depending on the type of building activity, the increased cleaning regimes need to be adjusted accordingly to minimise dust accumulation. Damp dusting not dry cleaning is recommended. Air filtration systems must be regularly checked. Where vacuum cleaners are used, in areas where high-risk and very high-risk patients are cared for and in adjacent areas, these should be equipped with HEPA filters and appropriately maintained to minimise dust dispersal. Filters in the air filtration systems and the vacuum cleaners need to be changed regularly, and a record/log should be kept of these changes.

4.3.4 Traffic

Pedestrian: Pedestrian traffic from the construction area should be directed away from patient areas, with workmen having a separate entrance to the construction site as outlined in the construction permit. When possible, patients and visitors should avoid entering the hospital adjacent to major construction/demolition sites, where debris or dust is being removed from the works area.

Supplies: Alternative routes, which avoid the construction site, through which inanimate items are transported throughout the hospital, may need to be identified during construction. Clean or sterile supplies or equipment should be transported to storage areas by a route that minimises contamination risks from the construction site.

In some critical areas and in some instances where it may not be possible to alter traffic patterns consideration will have to be given to scheduling construction to off-hour periods and weekends. Some areas may need to be relocated or closed temporarily.

4.4. Chemoprophylaxis and the Prevention of Invasive Aspergillosis

Data supporting the widespread use of antifungal chemoprophylaxis for the prevention of invasive aspergillosis are lacking. Some workers have found that antifungal chemoprophylaxis reduces fungal morbidity and mortality in high-risk groups but studies have been hampered by the low incidence of invasive aspergillosis and the use of small study groups making statistical analysis difficult. There is a well-recognised need for further studies in a variety of patient populations.

To date only two antifungal agents with activity against *Aspergillus* are licensed in this country, amphotericin B and itraconazole. However, newer agents will probably be available in the near future. Amphotericin B, in a variety of formulations, has been the gold standard in terms of the therapy of invasive disease. More recently the availability of a liquid and intravenous preparation of itraconazole has helped to overcome some of the bioavailability problems associated with the capsule formulation of this drug. In terms of chemoprophylaxis both of these agents, amphotericin B (in a variety of forms i.e. capsules, paste and various systemic preparations) and itraconazole have been used.

The use of non-absorbable and topical (intranasal and nebulised) amphotericin B for the prevention of invasive aspergillosis has been shown to be of some benefit however recent data have challenged their use. The use of low doses of parenteral amphotericin B has also failed to demonstrate an

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adequate response and the toxic effects preclude the use of the conventional formulation at higher concentrations. A controlled trial of the lipid formulation however suggests that this approach may be useful,⁴⁹ but further work is required.

The problem with absorption of itraconazole in certain high-risk groups and the lack of an intravenous preparation has now been largely overcome with the advent of itraconazole-cyclodextrin. A number of studies have shown some benefit in those patients given prophylaxis however these again failed to reach statistical significance because of the low incidence of disease. A further issue with itraconazole is its potential for drug interactions and possible potentiation of toxicity of certain anti-cancer agents.

Who should receive antifungal prophylaxis based on current evidence?

Despite the lack of evidence, antifungal chemoprophylaxis has been recommended by some authors in patients expected to be neutropenic (ANC, $0.1-0.5 \times 10^9/l$) for at least two weeks or profoundly neutropenic (ANC, $< 0.1 \times 10^9/l$) for more than one week. The British Society for Antimicrobial Chemotherapy (BSAC) also made recommendation in 1993 for neutropenic and transplant patients nursed without HEPA filters where there is a high institutional rate of invasive aspergillosis or where building works are being undertaken.⁵⁰ Some authors have found a benefit to secondary prophylaxis in patients with a history of invasive aspergillosis and undergoing further treatments.⁵¹⁻⁵³ The use of chemoprophylaxis in the management of liver transplant recipients is again controversial although some centres use low dose amphotericin B.

Needless to say, given the lack of evidence for the use of prophylaxis in high-risk patients, no data exist for its use in the lower risk groups. Bearing this in mind chemoprophylaxis may be considered in at-risk groups in the presence of construction work if these patients cannot be protected by

environmental measures. Each centre should evaluate its at-risk population and determine if prophylaxis is likely to be of benefit.

4.5 Protective Measures for At-Risk Patients

Patients deemed to be at risk of systemic mould infection should be stratified on the basis of their underlying disease, its treatment and the area in the hospital in which they are being treated in relation to the proposed building programme.

4.5.1 Environmental measures

Very high-risk patients (Group 4)

Patients at very high risk (Group 4) should receive maximum protection irrespective of the type/size of the building programme. All very high-risk patients should be nursed in HEPA filtered positive pressure rooms during the neutropenic period. If they are subsequently transferred to a ward the windows should be sealed and suitable air quality provided (See Section 4.2.2, Point 2).

High-risk patients (Group 3)

Patients at high risk (Group 3) should receive protection if the area of treatment is juxtaposed or near the hospital construction area or if it is otherwise likely that *Aspergillus*-contaminated air may enter the area. High-risk patients should be nursed in a ward with sealed windows and suitable air quality (See Section 4.2.2, Point 2).

Increased-risk patients (Group 2)

Patients at increased risk (Group 2) are usually dispersed throughout the hospital and therefore, physical protection may be impractical. Consideration should be given to moving patients away from the construction area.

4.5.2 Chemoprophylaxis

Antifungal chemoprophylaxis should be considered in at-risk patients in line with current guidelines and hospital policy.

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4.6 Diagnosis and Surveillance

It is imperative to maintain a high index of suspicion for the diagnosis of nosocomial aspergillosis in the at-risk patients (Groups 2-4). This surveillance should be achieved through review of relevant clinical cases at ward level and review of relevant microbiological/histological specimens at laboratory level.

4.6.1 Diagnostic Strategies for Invasive Aspergillosis

Despite many advances in diagnostic microbiology, the diagnosis of invasive aspergillosis continues to present difficulties and challenges. Such difficulties hamper the ability to diagnose this disease in the early stages thus contributing to the high mortality associated with this infection. In addition, this disease is uncommon and affects varied patient populations and many clinicians may have limited experience in the diagnosis and management of invasive aspergillosis.

There is no single diagnostic test that is applicable to all patients' groups and the sensitivity and specificity of the available tests vary. The current gold standard involves the performance of invasive procedures, which are often contraindicated. A number of alternative methods are under development, however until the ability to diagnose this infection improves, a high index of suspicion in patients at risk of invasive disease is essential.

Currently a combination of clinical, radiological and microbiological criteria can be used to predict the probability of invasive disease. Such an approach however lacks both sensitivity and specificity. Postmortem examinations may be useful, when possible and acceptable to the relatives of the deceased, to detect infections undiagnosed in life. In the future it is likely that newer technologies will aid the early diagnosis of infection and initiation of appropriate therapy. It is important that diagnostic strategies continue to be developed and that expertise is readily available to assist clinicians in the management of these patients. It is recommended that a National Mycology Reference service be developed to address these issues (see Section 6).

Criteria that may be used to aid in the diagnosis of invasive aspergillosis

1. Clinical criteria: Invasive aspergillosis may manifest differently in different patient groups.

It is important to ensure that clinicians with at-risk patients under their care are aware of the additional risk that occurs during construction/renovation activities, that a high index of suspicion is maintained and clinical expertise in the area of diagnosis and management is readily available. Once a clinical suspicion exists appropriate investigations can be performed.

2. Radiological criteria: Radiological examination remains an essential part of the diagnostic

strategy and hospitals managing these patients must ensure that appropriate facilities are available. The routine CXR is insensitive and patients with clinical features compatible with infection and in an at-risk group should have high resolution CT or MR imaging as soon as practicable after suspecting the diagnosis. The presence of lesions suggestive of invasive aspergillosis should trigger appropriate investigations and consideration of the need for immediate empirical antifungal therapy.

3. Microbiological techniques: The most appropriate diagnostic approach depends on the site of the infection.

Demonstration of tissue disease: The gold standard is the demonstration of fungal hyphae and the isolation of *Aspergillus* spp. from tissue specimens. As already outlined biopsy is often contraindicated in patients at risk and suspected of having invasive disease and is rarely performed.

Microscopy and Culture: This examination can be performed on a variety of specimens including biopsies, fluid aspirates, broncho-alveolar fluid, tracheal aspirates or sputum. Culture alone is insensitive; however, the combination of microscopy and culture will increase the diagnostic yield by 15-20%. Isolation of *Aspergillus* spp. from non-sterile sites e.g. upper respiratory tract may reflect colonisation, and results should be interpreted in a clinical and radiological context. The use of specific fungal media has also been found to improve sensitivity.

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Serology: Fluid, blood and aspirates can be examined for the presence of antibodies and antigen.

• Antigen Detection

The detection of antigen remains a useful test in the diagnosis of invasive aspergillosis. *Aspergillus* spp. release antigens during growth *in vivo* and *in vitro*. A number of methods including latex agglutination, radioimmunoassay and enzyme immunoassay have been developed with varying sensitivity and specificity. A commercially available latex agglutination kit for the detection of galactomannan has been shown to have poor sensitivity and variable specificity, ~ 30% and 53-100%, respectively.⁵⁴⁻⁵⁷ The sensitivity of the test improves with the examination of serial samples and broncho-alveolar fluid. More recently a sandwich enzyme-linked immunosorbent assay (ELISA) for the detection of *Aspergillus* galactomannan, with improved sensitivity and good specificity (56-93% and 80-99%), has been developed.⁵⁶⁻⁶¹ The ELISA test is a more sensitive assay, detecting 0.5-1.0 ng/ml compared with 15 ng/ml for the latex test.⁵⁹ Galactomannan was detected at an earlier stage of infection by the ELISA assay, often before clinical and radiological signs of infection became apparent and in animal models the concentration of galactomannan in the serum was shown to correspond with the tissue burden. Again, the examination of serial samples improved the sensitivity of the ELISA test. The major drawback is a false positivity rate of 10%.

• Antibody Detection

Recent data suggest that antibody detection in transplant recipients may be of use in identifying those at risk of invasive aspergillosis and in those with chronic invasive aspergillosis.

Molecular techniques: The detection of *Aspergillus* spp. DNA in blood and other specimens has not been developed as yet to a clinically useful level. Such technology however will probably become an important part of the diagnostic workup in the future. The availability of reference laboratory facilities will be an important part of this development.

4.6.2 Environmental sampling for *Aspergillus* spp.

It is well recognised that air sampling for *Aspergillus* spp. is difficult and not always useful.

Generally, it is not recommended that sampling be performed routinely even if construction/renovation activities are taking place. However, there are occasions when sampling may be useful (Table 3).

If a decision is made to undertake air sampling, it is important that the operator has a clear objective in mind, the limitations of the procedure are understood, and a suitable method is used. It is particularly important that users understand that a sample will only reflect what is happening at one point in time and hence multiple samples at different sites and times will be required to give an accurate picture.

A recent review by Morris *et al.* (2000)⁶² summarises the factors that influence air sampling and examines the suitability of different air samplers. Examples as to when air sampling can be usefully applied and a simple procedure that has been used in previous outbreaks are outlined in this review. This recommended method is outlined in Appendix 3 and has been reproduced by permission of the senior author, Dr. Malcolm Richardson.

Table 3 Occasions when sampling for Aspergillus spores may be useful⁶²

- To monitor levels of contamination prior to occupancy of special controlled environments e.g. to determine efficiency of HEPA filters in laminar flow facilities
- To identify potential sources of nosocomial aspergillosis when a case has been identified
- To predict environmental spore contamination from outside sources
- To identify defects/breakdown in hospital ventilation/filtration systems
- To correlate outbreaks of invasive aspergillosis with hospital construction or demolition work
- To monitor efficiency of procedures to contain hospital building wards where at-risk patients are managed

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5.1 Introduction

A proactive approach is required to minimise the occurrence of nosocomial invasive aspergillosis. The categories of patients who are at risk of invasive aspergillosis are outlined in Section 3.2. Each hospital, which provides service to high-risk patients, should have procedures and policies in place to ensure that all relevant personnel are aware of the risks of invasive aspergillosis in these patients and the preventive measures required to minimise that risk; and should develop and adopt risk management and infection control policies in this regard that are regularly monitored for compliance and effectiveness.

5.2 Hospital Managers

The hospital Chief Executive Officer/Manager has overall responsibility for the health and safety of patients, staff and visitors. Hospital managers should ensure policies and procedures are put in place that clearly outline the responsibilities of all personnel involved in the prevention of invasive aspergillosis, either on a routine basis or in the course of minor or major maintenance and construction works. In general, the hospital manager may devolve responsibility for the development of policies and procedures to the hospital ICC, but ultimate responsibility lies with the hospital manager to ensure that these policies and procedures are implemented.

5.3 Liaison and Communication

Communication and awareness of the risk factors associated with the development of invasive aspergillosis is the key to reducing the risk to patients. The hospital ICC should ensure that a policy is in place outlining the necessary action for the prevention of invasive aspergillosis, both on a routine basis and in the course of minor or major maintenance or construction/renovation activities. The ICC should follow current knowledge of best practice in the control of *Aspergillus* and ensure that all policies are kept up to date. In the event that major construction/renovation activities are planned in hospitals providing for at-risk patients, a multidisciplinary team comprising hospital administrators, technical services staff, designers, infection control staff and relevant clinicians in high-risk areas should be established. This team should have the responsibility for drawing up a specific policy for the planned activities and should have overall responsibility for monitoring its implementation.

5.4 Technical Services Staff

Technical services staff should be aware of the risks posed by construction activity to at-risk patients (Groups 2-4) and should consult with the infection control team in advance of all minor or major construction or renovation activities. Technical services staff should monitor implementation of preventive practices and maintain records relating to fixed plant precautions and maintenance of *Aspergillus* protection systems. The use of a Construction Permit (Appendix 1) is recommended to control such activities.

5.5 Infection Control Team

It is crucial that infection control personnel are consulted and play a major role in planning construction or renovation activities. Technical services staff should ensure details of all works and maintenance activities are communicated to the infection control team who in turn should liaise with medical and nursing staff. Although the construction activity may be considered minor, infection control personnel should be notified, and a risk assessment should be carried out.

5.6 Medical and Nursing Staff

Medical and nursing staff should be aware of patient populations at risk, potential hazards that construction/renovation projects pose to patients, and the preventive measures required. The infection control team should collaborate with medical and nursing staff to identify patients at risk, and to monitor the effectiveness of preventive measures taken throughout the project.

5. Organisational Duties and Responsibilities

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5.7 Preparation of Briefs

When planning major hospital construction works, the preventive measures required should be identified in advance during the initial risk assessment and should be included in the tender

documents to ensure all necessary precautionary measures are taken. This should also be incorporated into the contract documents. A mechanism should be established whom has the authority to stop the construction project if there is a significant breach in the preventive measures. Notes on Preparation of Requirements are outlined in Appendix 4.

5.8 Construction/Renovation Activities in Close Proximity to the Hospital

It should be noted that similar risks are present in the context of large-scale construction/renovation activities external to but proximal to the hospital. Hospital managers should ensure that they are aware of such activities (e.g. by liaising with the planning authorities to receive notification of planning decisions in the locality) and institute precautionary measures to protect at-risk patients where appropriate, based on the findings of the risk-assessment.

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It is recommended that a National Mycology Reference Laboratory be established to provide a laboratory reference service to the population of Ireland. Samples referred should be accepted from laboratories throughout Ireland. A service agreement between the Department of Health and Children and the "provider" of the reference laboratory service for fungi should be drawn up. The provider would be expected to comply with the relevant quality standards, audits and performance targets.

A national reference facility should be capable of providing the following services:

1. Identification of fungal isolates
2. Molecular typing of fungi
3. Molecular and serological diagnosis of fungal infections
4. Therapeutic drug monitoring
5. Development of new techniques
6. Provision of advice on:
 - Diagnosis and treatment of fungal infections
 - Control and prevention of infection
7. Provision of epidemiological information to the National Disease Surveillance Centre
8. Training of medical/technical staff

6. National Reference Laboratory Facilities

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CONSTRUCTION PERMIT

Permit No: Permit Expiration Date: Project Start Date:

Location of Construction: Estimated Duration:

Contractor: Contact Person: Tel:

CEO Approval:

Name Signed: Tel:

Hospital Technical Services Manager Approval:

Name: Signed: Tel:

Infection Control Personnel Approval:

Name: Signed: Tel:

Appendix 1: Sample Construction Permit

Construction/Renovation Activity

Type A - Minor Internal Containable Activities

Inspection and non-invasive activities and small-scale activities that create minimal dust. These include, but are not limited to, activities that require removal of ceiling tiles for visual inspection (limited to 1 tile per 5m²), painting (no sanding), wall covering, electrical trim work, minor plumbing and other maintenance activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection. Activities that require access to conduit spaces, cutting of walls or ceilings where dust migration can be controlled for installation or repair of minor electrical work, ventilation components, telephone wires or computer cables. It also includes minor plumbing.

Type B - Major Internal Containable Activities

Any work that generates a moderate level of dust or requires demolition or removal of any fixed building components or assemblies (e.g. counter tops, cupboards sinks). These include, but are not limited to, activities that require sanding of walls for painting or wall covering,

removal of floor-covering, ceiling tiles and stud work, new wall construction, minor duct work or electrical work above ceilings, major cabling activities, and any activity that cannot be completed within a single work shift. This type of activity includes extensive plumbing work. It also includes demolition or removal of a complete cabling system or plumbing and new construction that requires consecutive work shifts to complete.

Type C - Minor External Non-Containable Activities

External construction activities that generates moderate levels of dust or minor excavations. Such activities include digging trial pits and minor foundations, trenching, landscaping and minor construction and demolition work.

Type D - Major External Non-Containable Activities

External construction activities that generate large levels of dust. Such activities would include major soil excavation, demolition of buildings and any other construction activity not covered under Type C.

Population Risk Groups

Group 1 - No Evidence of Risk

- Staff Members/Service Providers/Contractors
- All patients not listed in Groups 2-4 below

Group 2 - Increased Risk

- Patients on prolonged courses of high dose steroids
- Severely immunosuppressed AIDS patients
- Patients undergoing mechanical ventilation
- Non-neutropenic patients on chemotherapy
- Dialysis patients

Group 3 - High Risk

- Neutropenic patients (<14 days) following chemotherapy
- Adult acute lymphoblastic leukaemia (ALL) on high dose steroid therapy
- Solid organ transplantation patients
- Patients in neo-natal intensive care units (ICUs)
- Chronic Granulomatous Disease of Childhood
- Laboratories (prevent contamination of microbiological specimens and thereby avoid pseudo-diagnosis)

Group 4 - Very High Risk

- Allogeneic bone marrow transplantation patients
- During the neutropenic period
- With graft versus host disease
- Autologous bone marrow transplantation patients, i.e. during neutropenic period
- Peripheral stem cell transplantation patients, i.e. during neutropenic period
- Non-myeloblastic transplantation patients
- Children with severe combined immunodeficiency syndrome (SCIDS)
- Patients with prolonged neutropenia (>14 days) following chemotherapy or immunosuppressive therapy
- Aplastic anaemia patients

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Recommendations For Infection Control Preventive Measures

Class I

Class I Preventive Measures are recommended for Minor Internal Containable Construction Activities (Type A)

Dust Control

- Immediately replace ceiling tiles displaced for visual inspection
- Execute work by methods to minimise dust generation from construction or renovation activities
- Provide active means to minimise dust generation and migration into the atmosphere

Cleaning

- Wet mop and vacuum area as needed and when work is completed
- Wipe horizontal and vertical work surfaces with hot soapy water

Infection Control Personnel

- Approval to be given
- In collaboration with cleaners and technical services ensure that the construction zone remains sealed and that the cleaning is adequate at all times

Patient Risk Reduction

- Move at-risk patients (Groups 2-4) away from construction area. If it is not possible to move e.g. ICU patients an impermeable dust barrier should be erected around the construction area
- Minimise patients' exposure to the construction /renovation area
- Minimise dust and increase cleaning in patient area

Class II

Class II Preventive Measures are recommended for Major Internal Containable Construction Activities (Type B)

In addition to the Class I measures outlined above the following measures should be also implemented for Type B activities

Dust Control

- Erect an impermeable dust barrier
- Ensure windows and doors are sealed
- A separate entrance away from patient traffic should be created for use by construction workers
- Protective clothing should be worn by construction workers and removed when leaving the construction site
- Dust barrier should not be removed until the project is complete

Ventilation of Construction Area

- Seal windows
- Maintain negative pressure within construction zone by using a portable extract fan
- Ensure air is exhausted directly to the outside and away from intake vents or filtered through a HEPA filter before being re-circulated
- Ensure ventilation system is functioning properly and is cleaned if contaminated by soil or dust after construction or renovation project is complete

Debris Removal and Cleaning

- Contain debris in covered containers or cover with either an impermeable or moistened sheet before transporting for disposal
- Remove debris at end of the workday
- An external chute will need to be erected if the construction is not taking place at ground level
- Vacuum work area with HEPA filtered vacuums daily or more frequently if required

Class II cont'd

Infection Control

- As for Class I

Patient Risk Reduction

- Move all patients from the construction area
- If possible, move at-risk patients (Groups 2-4) who are adjacent or near to the construction area
- Ensure that patients do not go near construction area
- All windows, doors, air intake and exhaust vents should be sealed in areas of the hospital containing patients who are classified as high-risk, if the construction or demolition work is considered likely to result in *Aspergillus*-contaminated air entering these areas
- Very high-risk patients (Group 4) should be treated in HEPA-filtered, positive pressure rooms

Traffic Control

- In collaboration with the technical services manager designate a traffic pattern for construction workers that avoids patient care areas and a traffic pattern for clean

or sterile supplies, equipment, patients, staff and visitors that avoids the construction area

- A traffic path should be designated for the removal of rubble from the construction site which preferably is separate to and away from all hospital related traffic

Class III

Class III Preventive Measures are recommended for All External Non-Containable Construction Activities (Type C & D)

Dust Control

- Execute work by methods to minimise dust generation from construction or renovation activities
- Provide active means to minimise dust generation and migration into the atmosphere

Debris Removal and Cleaning

- Contain debris in covered containers or cover with an impermeable or moistened sheet before transporting for disposal
- Ensure no increased dust within hospital, increased cleaning may be necessary

Infection Control

- Approval to be given
- In collaboration with technical services ensure that dust is minimised from the construction site and that the construction site measures are being adhered to
- Ensure that cleaning is adequate to minimise dust within the hospital

Patient Risk Reduction

- If possible, move at-risk patients (Groups 2-4) who are adjacent or near to the construction area
- Ensure that patients do not go near construction area
- All windows, doors, air intake and exhaust vents should be sealed in areas of the hospital containing patients who are classified as high risk, if the construction or demolition work is considered likely to result in *Aspergillus*-contaminated air entering these areas
- Very high-risk patients (Group 4) should be treated in HEPA-filtered, positive pressure rooms

Traffic Control

- See Class II measures

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General Information

The purpose of this leaflet is to inform patients, relatives, health care workers and those involved in the activities of construction of the risk of aspergillosis during construction work. This leaflet should be considered as introductory information only.

Aspergilli are tiny fungi that cannot be seen by the eye but commonly occur in soil, water and decaying vegetation. They can also live in old buildings or in areas such as ventilation shafts. Many types of *Aspergillus* are found in nature but only a few cause human diseases.

Aspergillus may be released into the air during construction/renovation activities ranging from demolition and renovation, to construction. *Aspergillus* can be transported great distances by normal conditions such as air currents and wind. Small pieces of dirt or dust in the air are the main ways that *Aspergillus* travels and causes infection in hospitals. Hospital activities that generate dust such as maintaining the ventilation system, cleaning, vacuuming and dry dusting can also allow *Aspergillus* to travel through the air.

Patients who are undergoing high dose chemotherapy for leukaemia and related illnesses or who are having bone marrow, stem cell or other transplants, or who are having other forms of therapy which may suppress their immune system may be at risk of developing infection with this fungus in the lungs or other parts of the body. Healthy adults and children are not at increased risk of infection during construction work.

For the Patient

During building work every effort will be made to prevent the spread of *Aspergillus*. The medical team who is treating you will be in close communication with builders and the Microbiology/Infection Control Department to make sure that the risk of spreading *Aspergillus* is kept to a minimum and will tell you if you need to take any special precautions.

Appendix 2: Information Leaflet on Aspergillosis during Construction Activities

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Taken from "Sampling of *Aspergillus* spores in air" a review by Morris *et al.*, *J Hosp Infect*, 2000; **44**(81) 81-92; reproduced by kind permission of author Dr. Malcolm Richardson.⁶²

This sampling method to isolate and enumerate *Aspergillus spp.* spores in air should be conducted as follows:

Materials and equipment:

Sampling Instrument: Surface Air Systems microbiological air sampler.

Manufacturer: Pool Bioanalyse Italian (PBI), Milan, Italy

U.K. Supplier: Cherwell Laboratories, Churchill Rd., Bicester, Oxon,

Collection Rate: 180 l/min

Medium: Czapek Dox Agar (Oxoid)

Method

Sampling Procedure (general)

The air sample is aspirated through the instrument at a nominal rate of 180 litres per minute for a preselected period of between 20 seconds and 6 minutes giving a volume range between 60 litres and 1080 litres. The airflow is directed towards the agar surface of a 50 mm diameter contact plate that contains 12.5 ml of agar so that particles whose aerodynamic diameter causes them to leave the air stream are deposited on the agar surface. The plate is then removed for incubation.

Sampling location

Sampling location is dependent on circumstances but should accord broadly with the breathing zone of potentially affected personnel. The choice of sampling height is 1.2 metres for room hygiene, with other samples taken for exploratory purposes near suspected or potential sources of contamination. Multiple samples are preferable to a single sample, as they will highlight temporal and spatial variation in spore levels within any environment.

Selection of sampling time

Selection of an appropriate sampling period is vital to the success of the sampling operation. If the sampling time selected is long in a heavily contaminated environment then the colonies, once cultivated, can only be expressed as exceeding a particular number. Where confluent growth occurs the colonies may even be uncountable. A chart is supplied with the instrument to assist in selection of the sampling time, which on the basis of an assumption regarding the level of contamination in the environment permits the number of sampling units (periods of 20) to be estimated. In practice, whilst some knowledge of the levels of contamination may build up over time, certainly initially the selection of the sampling period must largely be done by trial and error.

Sampling steps

1. Unscrew the top cover plate avoiding contact with the inner or outer surfaces of the drilled area. The cover plate should be cleaned after each use.
2. Insert a contact plate with Czapek Dox agar (Oxoid Basingstoke UK) with the lid still in place, remove the contact plate lid and replace the instrument cover plate.
3. Set the digital selector on the instrument to zero units.
4. Switch on the battery pack.
5. Turn the timer to the desired setting.
6. Press the instrument start button.
7. Following completion of the sampling the instrument will switch off. The cover plate can then be

Appendix 3: A recommended method for the sampling of *Aspergillus* species spores in air

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removed and the exposed contact plate agar surface immediately covered by replacing the contact plate lid.

8. The contact plate should then be removed for incubation.

Laboratory procedure

1. On receipt of the contact plates, these are placed in a pre-heated incubator to 28°C for 48 hrs to permit germination and colony formation.
2. The plates are then microscopically examined at 100X magnification to enumerate colonies growing on the plate.

3. Identification of fungal colonies is based on colony characteristics and micro-morphological characteristics ascertained through microscopic examination at 400X magnification.

4. Specimens for examination should be prepared using a wet needle mount using lactophenol with cotton blue stain (0.75%).

5. A colour key is available for the specific identification of different *Aspergillus* spp. grown on Czapek Dox agar or broth.

N.B. Czapek Dox is recognised as a suitable medium for isolation and culturing of *Aspergillus* spp., whilst permitting growth of the majority of airborne fungal species. This permits general levels of fungal contamination to be simultaneously appraised as an indicator of building hygiene.

Enumerating the colony forming units

There is a possibility that any colony that grows on the contact plate derives from more than one colony-forming unit passing through a single hole in the cover plate. This possibility increases with the number of colonies on the plate and for higher counts a correction factor is applied according to the following formula:

$$Pr = N(1/N+1/(N-1) + 1/(N-2)+.....1/(N-r+1))$$

Where

Pr is the probable statistical total

N is the number of holes in the sampling head

r is the number of colonies counted

Tables have been prepared by the manufacturer, which can be read off to give a value for P once r has been established.

The number of colony forming units calculated from the above formula is normally expressed as CFU/m³. This is calculated using the formula:

$$X = \text{Adjusted colony count on plate} \times 1000$$

Volume of air drawn into sampler (litres)

The interpretation of air sampling data and recommendations for intervention are given in Table 4.

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Table 4. Interpretation of air sampling data and recommendations

Levels of fungal spores vary by several orders of magnitude during the course of a day due to:

- Activity levels in any one particular area
- Fluctuations in temperature
- Fluctuations in humidity
- Fluctuations in air flow
- Changes in light level

A single air sample will often underestimate the fungal contamination in the air and multiple air sampling has to be performed.

No strict numerical guidelines are available, which are appropriate for assessing whether the contamination in a particular location is acceptable or not but the following threshold levels have been recorded:

- Outdoor air (Note: seasonal variation recognised):
- Total fungal count: 10₃ to 10₅ CFU/m³,
- *Aspergillus*: 0.2-3.5 conidia/m³
- HEPA filtered air (>95% efficiency and >10 air changes per hour): < 0.1 CFU/m³
- No air filtration: 5.0 conidia/m³
- Construction/defective ventilation: 2.3-5.9 conidia/m³

If total fungal count exceeds 1.0 CFU/m³ on several occasions the air systems or procedural practice in patent areas requires intensive evaluation.

Further investigation of sources of contamination is warranted in the following circumstances:

- Total indoor counts are greater than outdoor counts
- Comparison of indoor and outdoor levels of fungal organisms show one of the following:
 - Organisms are present in the indoor sample and not in the outdoor sample
 - The predominant organisms found in the indoor sample is different from the predominant organism in the outdoor sample
 - A monoculture of an organism is found in the indoor sample. It may be absent from samples taken in other areas of the building
- Persistently high counts

If persistently high counts are recorded, or nosocomial invasive aspergillosis suspected or confirmed, identify source of contamination by sampling:

- dust
- fabrics
- ventilation ducts/screens/fans
- ceiling voids
- kitchen areas
- excreta of roosting birds in close proximity of windows

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1. The infection control and technical officer, as designated by the CEO, in consultation with medical and nursing staff, as necessary, should prepare a set of requirements for protection against invasive aspergillosis either for

(a) Inclusion in planning brief for a single building project to be responded to by the design team when appointed.

or

(b) For direct attention by the health facilities own technical staff for a single project or for application on an ongoing basis.

2. Where a project team sits for a particular project, it should consider the protection briefing material and approve of its content before its inclusion in the overall brief.

3. Where planning brief requirements for protection against invasive aspergillosis are documented, they should include

(a) Details of existing accommodation for immuno-compromised patients including location, physical condition, layout, services & occupancy.

(b) Within the context of overall project, a description of proposed work to existing accommodation for such patients and/or proximity to other external works, occupancy changes (if any) etc.

(c) The required standards of air cleanliness, air pressures, ventilation, ingress of outside air allowable (e.g. need for lobbies), finishes etc. to be met.

4. The design team or designated technical officer should be required to submit proposed solution(s) to the project team or CEO, as appropriate, for their examination and consideration with the assistance of infection control.

5. The levels of requirements/standards of protection to be met should relate to the degree of patient risk involved taking cognisance of the type and illness of patients, type of work, proximity to work etc.

Appendix 4: Notes on Preparation of Requirements for Protection against Invasive Aspergillosis

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