

Infection Control During Construction Renovation Maintenance NT Hospital Policy

Jurisdiction	Royal Darwin Hospital; Alice Springs Hospital; Katherine Hospital; Gove District Hospital; Tennant Creek Hospital
Jurisdiction Exclusions	N/A

Policy Purpose

Construction, renovation, repair, excavation and demolition activities in hospitals and health care facilities require planning and coordination to minimise the risk of infection in patients with poorly functioning immune systems.

To provide direction and guidance to ensure that all construction, renovation, installation and maintenance activities on healthcare sites are undertaken in a safe and appropriate manner to reduce the risk of infection to at-risk patients. The document outlines the risk factors contributing to nosocomial invasive aspergillosis, and other environmental pathogens, and identifies at-risk patient groups. Recommendations are made as to the measures that can be undertaken to reduce these health risks.

All staff involved in construction and renovation activities including contractors must comply with the Infection Control Guidelines.

Policy Details

Background

Outbreaks of infection, associated with construction activities, caused by fungi as well as bacteria, have been reported around the globe. The population most at risk from infection are usually immunocompromised either because of underlying disease or associated treatments e.g., chemotherapy. Although construction activities at any location may pose a risk to this population group, location of these activities within healthcare facilities poses unique risks due to the numbers of at-risk people in the one location.

Aspergillus

Aspergillus species (spp) are spore-forming filamentous fungi that are normally found within the environment and building structures. Nosocomial Aspergillosis represents a serious threat for severely immunocompromised patients and numerous outbreaks of invasive Aspergillosis associated with construction and maintenance have been described in Australia and overseas. The construction, renovation, demolition and excavation activities aerosolise the fungal spores (particle size 1.9–3.2 µm) which have a prolonged settling time. The spores can then float long distances on air currents and can bypass the cough reflex and settle deep within the respiratory tract. Mortality rate is high for nosocomial aspergillosis (65–90%).

Legionella

Legionella pneumophila and other *Legionella* species are bacteria that can cause systemic infection or atypical pneumonia. These bacteria are widely distributed in warm, wet habitats, such as cooling towers, reticulated water supplies, and environmental sources with the exception of *L. longbeachae*, which has been associated

with potting mixes. In addition to airborne transmission other modes of transmission are possible including aspiration of contaminated water. Nosocomial legionellosis has been associated with construction activities that have breached the clean water supply, either through disturbance of biofilm within pipe-work or as a result of aerosolised soil from excavation sites contaminating cooling towers. Mortality rate is high for nosocomial Legionnaires' disease (14–44%).

Listeria

Listeria monocytogenes contamination of food preparation zones associated with construction activities has resulted in widespread infection in at risk groups. Listeria bacteria are common in the environment. Construction activities that generate dust in food preparation zones can contaminate work surfaces leading to cross-contamination of food with listeria bacteria. People at risk of invasive listeriosis include pregnant women and their foetuses, newborn babies, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Although listeriosis is rare it is associated with a high mortality rate.

A number of control measures can be implemented in order to reduce the risk of these construction-associated nosocomial infections. These controls are necessary whether the works are internal or external to the facility.

Pre-Design Planning and Consultation Stage

Before beginning construction or renovation projects, some key issues need to be addressed. Department of Infrastructure (DoI) and Engineering staff in conjunction with Infection Prevention personnel must consider the following:

- Design and function of the new structure / area.
- Assessment of the infection risk from environmental organisms such as (but not limited to) *Aspergillus*, *Legionella* or *Listeria*;
- Strategies to minimise the risk of construction associated infection e.g., dust control
- Monitoring requirements indicated during the project

Infection Prevention and Management Consultation

Maintenance and Installation Works

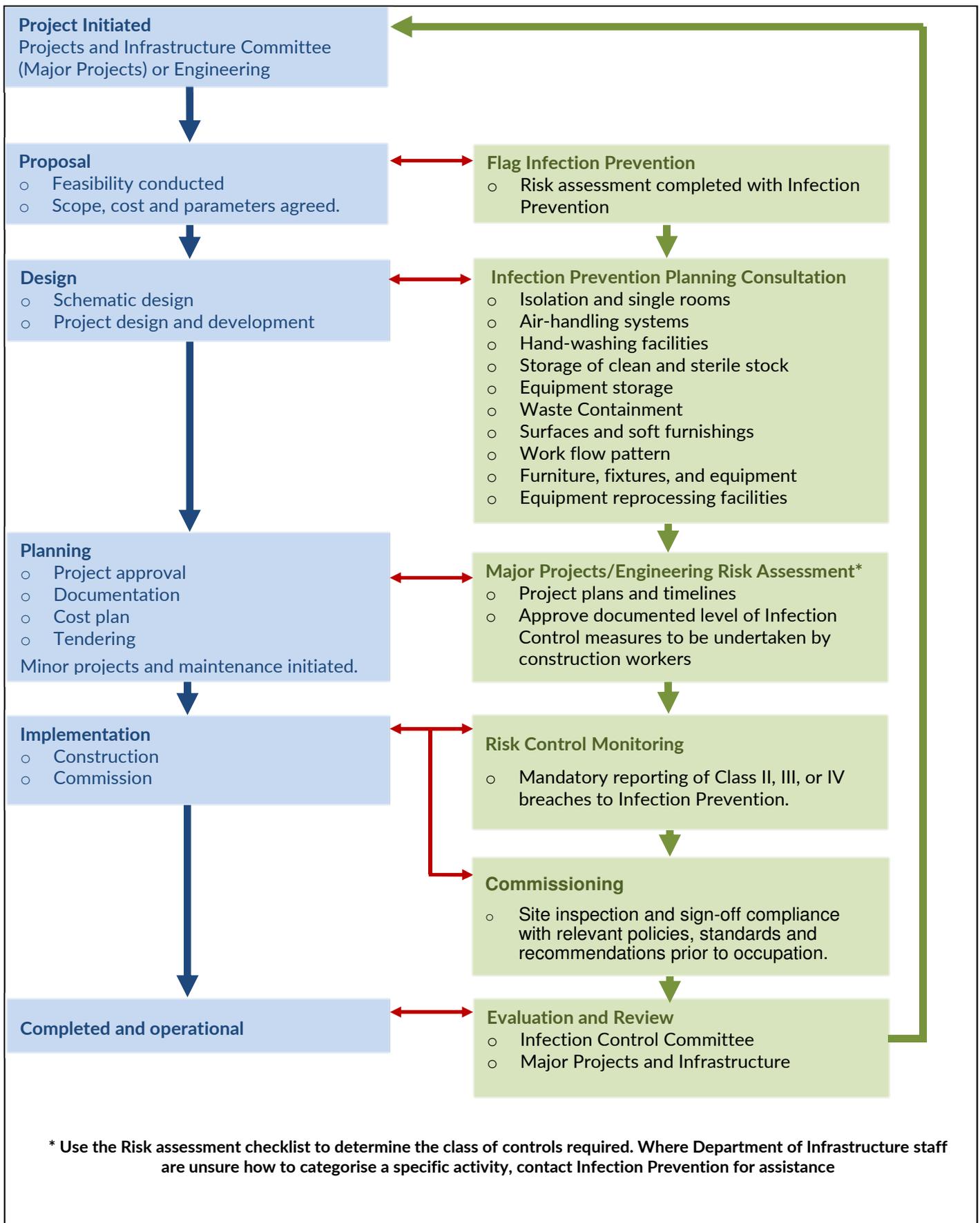
The site Infection Prevention and Management Unit (IPMU), must be consulted for all maintenance or installation works that have a risk rating of Class III or Class IV (refer [table 4](#)), and when any construction activities need to be undertaken in areas or corridors adjacent to Risk Groups 3 or 4 (refer [table 3](#)).

Major Construction and Special Projects

- All planned construction or renovation works which may impact on high-risk patient zones, or very high risk patient groups must be reported by the Engineering Services manager. They are to ensure that consultation with key stakeholders occurs, to ensure the appropriate risk management process, and strategies are developed as necessary for the assurance of patient safety at these sites. In some instances this may require the establishment of a Building Hazard and Maintenance working group for the project.
- Risk mitigation standards must, as a minimum, comply with Australian Health Facility Guidelines Section D. Additional risk controls may be recommended by the Infection Prevention and Management Unit in accordance with evidence based and best practice standards
- Engineering controls for risk mitigation must be articulated in contracts agreed between the health service and external contractors

- A risk assessment of the patient population group within the Construction site must be undertaken and appropriate controls to minimise individual risk implemented. This may include, but is not limited to: relocating at-risk patients to an unaffected area/site, prophylactic antifungal treatment, provision of personal protective equipment.
- All construction, renovation, installation, and maintenance (construction) activities must have a formal infection control risk assessment undertaken, and mitigation strategies planned and approved, prior to the commencement of any works.
- Implementation of prescribed mitigation strategies must be monitored and, when indicated, signed off as compliant by the IMPU manager or delegate.
- All construction and renovation project teams must include an IMPU representative as a member.

Figure 1: Construction, Renovation Installation and Maintenance Process



Risk Assessment and Infection Prevention Measures

Risk Identification

The risk identification strategy must address as a minimum:

- the extent of construction work;
- the identification or the patient population at risk;
- the location of the patient population in relation to the site and construction;
- ventilation system types and potential impact;
- traffic and supply routes;
- determination of air monitoring requirements, methodology and frequency;
- air quality samples taken at baseline; and
- identification of possible contaminants and their locations; these may be present in ceiling dust, service shafts (especially in damp conditions); sprayed fire retardants, and bird droppings.

Patient Risk Assessment and Controls

Clinical Risk Assessment and Management

A risk assessment of the patient population within or adjacent to the construction site must be undertaken by the clinical service manager/Director or delegate prior to the commencement of any construction activities. This is particularly important when demolition or major construction works are planned external to or within the healthcare facility as these activities pose the greatest risk to the severely immunosuppressed patient population group (refer [table 1](#)). During major construction and renovation projects patients must be individually assessed, by their specialist clinician, as to their degree of immunosuppression. The primary clinician is responsible for implementing those preventative measures determined necessary e.g., antifungal chemoprophylaxis.

All clinicians must be aware of potential risks to their patient group when construction projects are undertaken and take all measures to identify symptoms, diagnose, treat, and consult infectious diseases as necessary. Refer [Appendix 1: Clinician guidelines for patient risk assessment and management](#).

Table 1: Individual Patient Risk for Invasive Aspergillosis Infection

Group 1 No evidence of increased risk	<ul style="list-style-type: none"> ▪ Staff members, Service Providers and Contractors ▪ All patients not listed in Groups 2 - 4 above
Group 2 Increased risk	<ul style="list-style-type: none"> ▪ Patients on prolonged courses of high dose steroids particularly those hospitalised for prolonged periods. ▪ Severely immuno-suppressed HIV / AIDS patients. ▪ Patients undergoing mechanical ventilation. ▪ Patients having chemotherapy who are not neutropenic.* ▪ Dialysis patients. ▪ *Neutropenia defined as absolute neutrophil count (ANC), <1x10⁹/l
Group 3 High risk	<ul style="list-style-type: none"> ▪ Neutropenia* for less than 14 days following chemotherapy. ▪ Solid organ transplantation. ▪ Neonates in intensive care units (ICU).

Group 4 Very high risk

- Allogenic bone marrow transplantation: within 12 months of transplant, if >12 months, consult with haematologist
- Autologous peripheral blood stem cell transplantation, i.e. during the neutropenic period.
- Prolonged neutropenia for greater than 14 days following chemotherapy or immunosuppressive therapy: e.g. acute myeloid leukaemia (AML), acute lymphoblastic leukaemia (ALL), Burkitt's lymphoma, lymphoblastic lymphoma, primary CNS lymphoma
- Aplastic anaemia patients.
- Children with:
 - Severe Combined Immunodeficiency Syndrome (SCIDS);
 - Chronic Granulomatous Disease of Childhood (CGDC).

Minimising Patient Exposure to Construction-associated Contaminants

- i. If possible relocate at-risk patients who are adjacent or near to the construction zone.
- ii. Ensure patients do not go near construction zone.
- iii. Supply P2 or N95 mask (surgical filter masks for paediatrics) to high-risk patients to wear, if transit near construction zones is unavoidable.
- iv. Where HEPA-filtered positive pressure rooms are available High-risk inpatients must have priority access. In those facilities that do not have this class of patient accommodation, advice must be sort from their primary care clinician as to appropriate accommodation requirements.

Environmental Controls

The Australian Health Facilities Guidelines Part D identifies minimum control measures to be implemented when undertaking construction activities on occupied healthcare sites. Based on these recommendations and international best practice, control measures for a specific activity can be identified that will reduce the risk of infection to designated patient groups or zones

There are four key components to this assessment and management of associated risks:

- Step 1) Identifying the type of construction activity, refer [table 2](#);
- Step 2) Determine the population or geographical risk group, refer [table 3](#);
- Step 3) Identify the "Class" of control measures prescribed using the Construction Activity and Risk Group Matrix, refer [table 4](#);
- Step 4) Implementation and quality control of prescribed control measures, refer [table 5](#).

Not all measures are required for each class of works, and all projects are to be individually risk assessed. Documentation is required when there is deviation to an applicable control measure. Adaptations can be made with Infection Prevention approval and sign-off.

Table 2: Types of Construction, Renovation, Installation, and Maintenance (Construction) Activities.

<p>Type A Inspections and general upkeep activities</p>	<ul style="list-style-type: none"> ▪ Includes but not limited to : ▪ removal of ceiling tiles for visual inspection (limited to 1 tile per 5 m²); ▪ painting (but not sanding); ▪ installation of wall covering; ▪ electrical trim work; ▪ minor plumbing that disrupts water supply to localised patient care area (e.g., 1 room) for less than 15 minutes; ▪ any activities that do not generate dust or require cutting into walls or access to ceiling other than for visual inspection.
<p>Type B Small scale, short duration activities, which create minimal dust</p>	<ul style="list-style-type: none"> ▪ Includes, but is not limited to: ▪ installation of telephone and computer cabling; ▪ access to chase (ceiling) spaces; ▪ plumbing that requires disruption to the water supply of more than one patient care area (e.g. >2 rooms) for less than 30 minutes ▪ cutting into walls or ceiling where dust migration can be controlled.
<p>Type C Any work that generates a moderate to high level of dust</p>	<ul style="list-style-type: none"> ▪ Includes, but is not limited to: ▪ demolition or removal of built-in building components or assemblies, ▪ sanding of wall for painting or wall covering, ▪ removal of floor covering/wallpaper, ceiling tiles and casework, ▪ new wall construction, ▪ minor ductwork or electrical work above ceiling, ▪ major cabling activities ▪ plumbing that requires disruption to the water supply of more than one patient care area (e.g., >2 rooms) for more than 30 minutes but less than an hour
<p>Type D Major demolition and construction projects</p>	<ul style="list-style-type: none"> ▪ Includes, but are not limited to: ▪ heavy demolition, ▪ removal of a complete ceiling system, ▪ major ductwork or electrical work above ceiling, ▪ plumbing that results in disruption to the water supply of more than one patient care area (e.g., >2 rooms) for more than an hour ▪ new construction.

Table 3: Population and Geographical Risk Groups

See [appendix 3](#) for examples of risk breakdown at hospital sites

Group 1 Low Risk	Group 2 Medium Risk	Group 3 Medium - High Risk	Group 4 Highest Risk
<ul style="list-style-type: none"> ○ Non-patient/low risk areas not listed elsewhere ○ Office areas 	<ul style="list-style-type: none"> ○ Admission and discharge units ○ Cafeteria – public and staff ○ Dietary – beverage bays ○ Laboratories not specified under Group 3 ○ Laundry ○ Materials management ○ Patient care and other areas not listed under Groups 3 or 4 ○ Physiotherapy, Occupational Therapy, Speech Pathology ○ Public corridors used by patients and to transport linen & supplies 	<ul style="list-style-type: none"> ○ Bronchoscopy ○ Delivery Rooms ○ Dialysis ○ Echocardiography ○ Emergency Department ○ Endoscopy ○ High Dependency Unit ○ Long-stay subacute Units ○ Medical imaging: <ul style="list-style-type: none"> ○ General ○ MRI ○ CT ○ Ultrasound ○ Medical Units ○ Microbiology labs ○ Newborn nurseries ○ Paediatrics ○ Pharmacy ○ Recovery Rooms (PACU) ○ Renal Units ○ Surgical Units ○ Virology labs 	<ul style="list-style-type: none"> ○ Anaesthetic and Pump Rooms ○ Angiography rooms ○ Cardiac Catheterisation Units ○ Chemotherapy ○ Food Services – facility wide food preparation ○ Haematology Unit – inpatient and outpatient ○ Intensive Care Units ○ Oncology Unit – inpatient and outpatient ○ Operating Theatres ○ Outpatient invasive procedure rooms, including imaging guided biopsies ○ Pharmacy admixture/clean rooms ○ Radiation Therapy Unit ○ Sterile Supply Units ○ Transplant

Table 4: Construction Activity and Risk Group Matrix

		Construction Activity				
		Type A	Type B	Type C	Type D	
Risk Group	Low risk	Group 1	I	II	II	III /IV
	Medium risk	Group 2	I	II	III	IV
	Medium-High risk	Group 3	I	III	III / IV	IV
	Highest risk	Group 4	III	III / IV	III / IV	IV

Table 5: Infection Prevention and Control Measures

Class I Infection Prevention and Control Measures
<p>Construction Activities</p> <p>Dust Control</p> <p>Execute work using methods to minimise dust during construction activities</p> <p>Immediately replace any ceiling tile displaced for visual inspection</p> <p>Wipe down/mop work area with a clean damp cloth/mop or use vacuum with a HEPA filter</p> <p>Cleaning</p> <p>Damp mop and vacuum (with HEPA filter) area as needed and when work is completed</p> <p>Wipe horizontal and vertical work surfaces with clean damp cloths using neutral detergent and water</p> <p>Plumbing Activities</p> <p>Schedule water interruptions during periods of low activity (e.g.: evenings/overnight if possible)</p> <p>Flush water lines prior to reuse</p> <p>Observe for discoloured water</p> <p>Ensure temperature meets the applicable standard</p> <p>Ensure gaskets and items made of materials that support the growth of Legionella are not being used</p> <p>Ensure tap aerates are not installed or used</p> <p>Maintain as dry an environment as possible and report any water leaks that occur to walls and substructures</p> <p>Hotel Services</p> <p>Plumbing Activities</p> <p>Report discoloured water and water leaks to maintenance department</p> <p>Medical/Nursing staff</p> <p>Construction Activities</p> <p>Patient Risk Reduction</p> <p>Minimise patients' exposure in construction area</p> <p>Move at risk patients (refer table 1) away from construction zone</p> <p>Plumbing Activities</p> <p>Report discoloured water and water leaks to maintenance department</p>

Class II Infection Prevention and Control Measures**Construction Activities*****Dust Control***

Execute work using methods to minimise dust during construction activities

Provide active means to minimise dust generation and migration in to the atmosphere:

Use drop sheets to control dust

Seal windows and unused doors with duct tape

Seal air-vents and oxygen outlets in construction zone

Place dust-mat at entrance and exit of work area and replace or clean when no longer effective.

Ventilation

Isolate HVAC system in areas where work is being performed.

Monitor need to change and /or clean filters construction zone

Debris Removal and Clean-up

Contain construction waste before transport in tightly covered containers.

At Project Completion

Wipe horizontal and vertical work surfaces with clean damp cloths using neutral detergent and water

Damp mop and vacuum (with HEPA filter) when work is completed

Plumbing Activities***Containment and Prevention***

Avoid collection tanks and long pipes where water may stagnate

Consider hyperchlorinating or superheating stagnant potable water (especially if Legionella is already present in potable water supply)

Works Management

Schedule water interruptions during periods of low activity (e.g.: evenings/overnight if possible)

Flush water lines prior to reuse

Observe for discoloured water

Ensure temperature meets the applicable standard

Ensure gaskets and items made of materials that support the growth of Legionella are not being used

Ensure tap aerates are not installed or used

Maintain as dry an environment as possible and report any water leaks that occur to walls and substructures

Medical/Nursing staff***Construction Activities*****Patient Risk Reduction**

Identify high-risk patients that may need to be temporarily moved away from the Construction zone.

Ensure patient care equipment and supplies are protected from dust exposure

Class III Infection Prevention and Control Measures**Construction Activities****Dust Control**

Execute work using methods to minimise dust during construction activities

Provide active means to minimise dust generation and migration in to the atmosphere:

Use drop sheets to control dust

Seal windows and unused doors with duct tape

Seal air-vents and oxygen outlets in construction zone

Place dust-mat at entrance and exit of work area and replace or clean when no longer effective.

Erect an impermeable dust barrier from true ceiling (includes area above false ceilings) to the floor made of 6mm polyethylene (corflute) or plaster board, compressed cardboard or plywood.

Ensure that windows, doors, plumbing penetrations, electrical outlets and intake and exhaust vents are properly sealed with plastic and duct taped within the construction/renovation area

Vacuum air ducts and spaces above ceilings if necessary

Ensure that construction workers wear protective clothing that is removed each time they leave the construction site before going into patient care areas

When holes in barriers are identified - immediately temporarily seal holes or within 60 minutes of notification. Permanently repair within 4 hours.

Wet mop or vacuum twice per eight (8) hour period of construction activity or as required to minimise tracking.

Ventilation

Isolate HVAC system in areas where work is being performed.

Monitor need to change and / or clean filters Construction zone

Maintain negative pressure within construction zone

Ensure air is exhausted directly outside and away from intake vents or filtered through a HEPA filter before being recirculated

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 Clean-up

Remove debris at the end of the workday

Contain construction waste before transport in tightly covered containers.

Erect an external chute if the construction is not taking place on ground level

At Project Completion

Do not remove dust barrier until the project is complete and the area has been cleaned thoroughly and inspected

Remove dust barrier carefully to minimize spreading dust and other debris particles associated with the construction project.

Wipe horizontal and vertical work surfaces with clean damp cloths using neutral detergent and water

Damp mop and vacuum (with HEPA filter) when work is completed

Plumbing Activities

Class III Infection Prevention and Control Measures***Containment and Prevention***

Avoid collection tanks and long pipes where water may stagnate

Consider hyperchlorinating or superheating stagnant potable water (especially if Legionella is already present in potable water supply)

Works Management

Schedule water interruptions during periods of low activity (e.g.: evenings/overnight if possible)

Flush water lines at construction or renovation site and adjacent patient care areas before patients are readmitted

Observe for discoloured water

Ensure temperature meets the applicable standard

Ensure gaskets and items made of materials that support the growth of Legionella are not being used

Ensure tap aerates are not installed or used

Maintain as dry an environment as possible and report any water leaks that occur to walls and substructures

Infection Prevention and Management Unit***Construction Activities*****Traffic Control**

In collaboration with the facility project manager designate a traffic pattern for construction workers that avoids patient care areas and a traffic pattern for clean or sterile supplies and equipment that avoids the construction area

Hotel Services***Construction Activities***

Increase frequency of cleaning in areas adjacent to the construction zone while the project is under way

In collaboration with IMPU ensure that construction zone is thoroughly cleaned when work is complete

Medical/Nursing staff***Construction Activities*****Patient Risk Reduction**

Move high risk patients who are in or adjacent to the construction area

Ensure that patients do not go near the construction area

In collaboration with environmental services and IPMU ensure that construction zone is thoroughly cleaned when work is complete

Very high-risk patients (Group 4) should be accommodated in HEPA-filtered, positive pressure rooms

Class IV Infection Prevention and Control Measures**Construction Activities****Dust Control**

Execute work using methods to minimise dust during construction activities

Provide active means to minimise dust generation and migration in to the atmosphere:

Use drop sheets to control dust

Seal windows and unused doors with duct tape

Seal air-vents and oxygen outlets in construction zone

Before starting the construction project erect an impermeable dust barrier that also has an anteroom from true ceiling (includes area above false ceilings) to the floor made of plaster board, compressed cardboard or plywood.

Ensure that windows, doors, plumbing penetrations, electrical outlets and intake and exhaust vents are properly sealed with plastic and duct taped within the construction/renovation area

Vacuum air ducts and spaces above ceilings if necessary

Place a walk-off mat outside the anteroom in patient care areas and inside the anteroom to trap dust from the workers' shoes, equipment and debris that leaves the construction zone

During demolition, dust producing work, or work in the ceiling, disposable shoes and coveralls are to be worn and removed in the Anteroom when leaving the work area.

Direct all personnel entering the construction zone to wear shoe covers

Ensure that construction workers change the shoe covers each time they leave the work site

When holes in barriers are identified - immediately temporarily seal holes or within 60 minutes of notification. Permanently repair within 4 hours

Temporarily seal holes in barriers immediately or within 60 minutes of notification and repair within 4 hours.

Wet mop or vacuum twice per eight (8) hour period of construction activity or as required to minimise tracking.

Wet mop or HEPA vacuum the Anteroom daily or more frequently if needed.

Ventilation

Isolate HVAC system in areas where work is being performed.

Monitor need to change and / or clean filters Construction zone

Maintain negative pressure within construction zone

Ensure air is exhausted directly outside and away from intake vents or filtered through a HEPA filter before being recirculated

Ensure negative pressure is maintained within the anteroom and construction zone

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 Clean-up

Remove debris at the end of the workday

Contain construction waste before transport in tightly covered containers.

Erect an external chute if the construction is not taking place on ground level

Class IV Infection Prevention and Control Measures***At Project Completion***

Do not remove dust barrier until the project is complete and the area has been cleaned thoroughly and inspected

Remove dust barrier carefully to minimize spreading dust and other debris particles associated with the construction project.

Wipe horizontal and vertical work surfaces with clean damp cloths using neutral detergent and water

Damp mop and vacuum (with HEPA filter) when work is completed

Plumbing Activities***Containment and Prevention***

Avoid collection tanks and long pipes where water may stagnate

If there are concerns about Legionella, consider hyperchlorinating stagnant potable water or superheating and flushing all distal sites before restoring or pressurising the water system.

Works Management

Schedule water interruptions during periods of low activity (e.g.: evenings/overnight if possible)

Flush water lines at construction or renovation site and adjacent patient care areas before patients are readmitted

Observe for discoloured water

Ensure temperature meets the applicable standard

Ensure gaskets and items made of materials that support the growth of Legionella are not being used

Ensure tap aerates are not installed or used

Maintain as dry an environment as possible and report any water leaks that occur to walls and substructures

If there are concerns about Legionella, consider hyperchlorinating stagnant potable water or superheating and flushing all distal sites before restoring or pressurising the water system.

Infection Prevention and Management Unit***Construction Activities*****Risk Reduction**

Regularly visit the construction site to ensure that preventive measures are being followed. Wear coveralls and shoe covers when visiting the site.

Evaluation

Review infection control measures with other members of the planning team or delegate to evaluate their effectiveness and identify problems at the end of the construction project

Hotel Services***Construction Activities*****Evaluation**

Review infection prevention and control measures with other members of the planning team or delegate to evaluate their effectiveness and identify problems at the end of the construction project

Class IV Infection Prevention and Control Measures**Medical/Nursing staff****Construction Activities****Patient Risk Reduction**

To reduce the possibility of transferring fungal spores, limit clinical staff access to the construction site, and ensure they wear protective clothing that is removed before going into patient care areas.

Evaluation

Review infection prevention and control measures with other members of the planning team or delegate to evaluate their effectiveness and identify problems at the end of the construction project

Plumbing Activities

Consider using another source of potable water for patients who are at greatest risk until potable water has been cleared for signs of Legionella after major plumbing installation/repairs.

Biological Hazard Controls and Monitoring**Air Quality Controls****Assessment of Existing Air Quality Controls and Implementation of “Enhanced Controls”**

- Healthcare facilities undertaking major construction or renovation, including demolition and excavation must:
- Identify the location of all air-conditioning intake vents in relation to proposed works
- Identify the areas within the facility served by these vents
- Confirm type of primary air filter installed is compliant with AS 1324.1 2001: Air filters for use in general ventilation and air-conditioning - Application, performance and construction.
- Retrofit those air vents that do not comply with this standard, especially if servicing high risk areas. If the air handling units cannot tolerate the retro-fit of these filters, then the highest rating tolerable should be installed.
- Increase routine inspection, maintenance and replacement of filters as necessary during the Construction works.
- Identify location of cooling towers in relation to the proposed works.
- Cleaning, disinfection and maintenance process and schedule for the air handling system must be consistent with AS/NZS 3666.2: 2002, and may need to be increased during periods of heavy excavation.

Identification of Potential Dust and Spore Intrusion Zones

Healthcare facilities undertaking major construction or renovation, including demolition and excavation must:

- Identify all opening doors and windows within the facility
- Identify all areas with shared air-handling systems
- Identify and rectify any gaps or ingress locations in external and internal walls, ceilings, roof, or eaves etc. where dust and spores may gain access to internal patient zones or ceiling spaces.
- Identify missing, broken, or ajar ceiling tiles and replace, repair or adjust.

- Identify air intake vents that do not have filter material and install filters.

Water Quality Controls

Assessment of Existing Water Quality Controls and Implementation of “Enhanced Controls”

Healthcare facilities undertaking major construction or renovation, including demolition and excavation must:

- Identify cooling tower locations in relation to the construction zone to determine potential for contamination.
- Confirm warm water monitoring and cooling tower controls are in place and effective.
- Continue routine Legionella surveillance to allow for comparison of results before, during, and after construction.

During periods of excavation on hospital grounds or when the plumbing system has been shut down and is later repressurized:

- Hyperchlorination of stagnant water to be carried out before repressurization;
- Presence of persistent discoloured water must be reported to maintenance personnel and the infection control department;
- Culture of the water supply for Legionella in areas housing immunocompromised patients.

Microbial Sampling

Fungal Spore Sampling

Baseline microbial sampling for fungal spores should be undertaken prior to the commencement of large-scale construction and renovation activities e.g., excavation and demolition works in close proximity to facilities, remodelling works, or replacement of air-conditioning services within units accommodating immunocompromised patients. This should include external and internal air samples.

Fungal speciation is not indicated unless it is identified during the risk assessment process, or advised by Infection Prevention / Microbiology. Ideally fungal monitoring should be detailed in contractual arrangements with the construction contractor as part of the works.

Details of the locations for, frequency of sampling and reporting is determined using the location of the proposed works, population group and geographical risk groups to inform this advice.

Refer: [Appendix 2: Fungal Spore Monitoring](#)

Legionella Testing

The routine monitoring results can serve as the baseline microbial for Legionella counts from cooling towers and warm water systems. Frequency for microbial testing may need to be increased during heavy excavation works.

When interpreting results it is important to acknowledge known seasonal variance and compare the result with not only the previous period, but to the same time in the previous year.

Listeria Sampling

During periods of demolition and construction activities either within or adjacent to food preparation zones, environmental listeria monitoring should be enhanced. Frequency and location of sampling to be determined in consultation with Kitchen Management and Infection Prevention.

Particle Monitoring

Results of airborne fungal spores monitoring can take a week or longer to be returned which is too late to identify the source and initiate timely corrective action. Measuring airborne particles (dust) in the protected environment before, during and after demolition and major construction, has the advantage of giving an early warning of inadequate dust suppression and ingress controls.

Aspergillus spores typically have a diameter of 2-3 micron in size, although the spores do agglomerate to form larger particles, up to around 10 microns. To ensure that the risk associated with spores is identified by particle counts the particle size to be monitored must be between 2-10 microns.

The disadvantage of this method is that there are other sources of particles in the micron size range in the atmosphere, making the data difficult to interpret at times but this disadvantage is offset by the ability to rapidly identify unacceptable high concentrations due to the works.

For this method to be effective an Alert and Action Protocol is established as part of the project works. This would include an alarm system that is set at an agreed particle count level, a time-frame for investigation, rectification and notification of Project lead and key stake holders.

Communication and Education

Communication and education are two vital elements to the successful implementation of proactive infection control measures to reduce the risk of construction-associated nosocomial infections from environmental organisms.

It is imperative that all relevant parties including, not limited to: architects, project managers, contractors, sub-contractors, hotel services, building services, medical and nursing staff are provided with appropriate education and communications regarding the implementation of effective infection control measures and personal safety at all stages of construction work.

Health Care Workers

- The risk of nosocomial acquisition of construction associated infections in the categorised at-risk groups during construction work – refer [appendix 4: Infection Prevention during Construction Fact Sheets – Information for Hospital Staff](#);
- The infection control measures to decrease the risk , [table 5](#); and
- Recommendations for staff members who are identified as being in an at-risk patient group, refer [appendix 5: Sample Letters](#).

Project managers, Contractors (including sub-contractors), and Design teams

- Basic principles of Aspergillus spore contamination of the environment, refer [appendix 4: Minimising Aspergillus Risk - Information for Construction Site Workers](#)
- The preventive measures that must be implemented during construction and renovation activities, refer [table 5](#);
- The importance of ensuring that this information is given to the construction and subcontractor workers, and its significance understood in order to aid with compliance; and
- The requirement to provide evidence that this information is being communicated to all workers on the construction site.

Hotel services staff and contract cleaning supervisors

- Basic principles of Aspergillus spore contamination of the environment, refer [appendix 4: Infection Prevention during Construction Fact Sheets – Information for Hospital Staff](#);
- Cleaning measures to prevent environmental contamination, refer [table 5](#). 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

- The risks of nosocomial construction associated infection, especially invasive Aspergillosis infection, refer [appendix 5: Sample Letters](#).

General public

- Planned construction activities on health facility sites and potential associated risks.
- Refer to communications officer to coordinate Public Notices.

Documentation

Infection Prevention and Control Permit and Checklist

A checklist permit identifies risks and controls indicated for planned works, locations and patient groups. Using the checklist risk matrix the specific control measures to be implemented can be detailed, responsibility assigned, and when indicated, status monitor, refer [appendix 7](#).

- The risk assessment is to be completed by the Engineering Services Manager in consultation with Infection Prevention and must be submitted with all project briefs.
- Prior to project the start-up meeting the Contractor/DoI must submit the details of control measures to be implemented and monitored. Control measures are to be evaluated and approved by the Engineering Services Manager and Infection Prevention prior to mobilisation.
- The completed [Infection Prevention and Control Permit and Checklist](#) are to be filed in the project TRIM.

Infection Control Plan

All contractors for major construction renovation or installation works (risk rated III-IV), must submit a detailed Infection Control Plan prior to the start-up meeting -refer [appendix 6](#) for sample plan template. Reviewed and approved plans are to be filed in the project TRIM.

This plan will detail:

- Purpose of the plan – including consultation requirements
- Project overview – describing the scope and key works of the anticipated for the project.
- Management Procedures – including approval procedures, escalation procedure for identified infection control breaches, internal personnel management for non-compliance, and communication procedures.
- Infection control risk minimisation methodology for planned works.
- Variations to applicable Infection Prevention and Control Measures [table 5](#), should be detailed in the plan with Infection Prevention approval and sign-off.

Site Inspections

To ensure compliance with agreed infection prevention controls, inspections must be undertaken by the Contractor work site supervisor. Inspection test plans are to be developed by the contractor and to be reviewed by key stakeholders prior to start-up - refer to [appendix 8](#) for sample template.

Completed forms are to be submitted to the Engineering Services Manager to be held on the project TRIM file.

Frequency of inspections are determined by the type and location of works.

- Excavation and Demolition: Daily perimeter check and feedback.
- External Construction: Weekly site walk.
- Internal Construction/Renovation: Daily inspection and feedback.

- Installation and Maintenance Works: frequency determined according to specific activity and associated risk.

Spot checks are to be undertaken by the facility Infection Prevention unit in collaboration with the Engineering Services Manager.

Reporting, Governance and Breaches

Compliance with all elements of this guideline must be demonstrated through audits of process i.e. ensuring all checklist and permits in the attached documents have been completed, and an action plan has been implemented to address deficiencies.

Any breaches of compliance found when completing the Infection Control Compliance Survey [appendix 8](#) are to be reported by the nominated person with overall responsibility for the construction project to the Engineering Services Manager and Infection Prevention.

Completion and Commissioning of Works

After the completion of works but before occupation, the area must be inspected by Infection Prevention to ensure it is fit for purpose. This should include demonstrating that the area has been thoroughly cleaned and disinfected (such as walls, floors, ceilings and air vents), as per [appendix 9 Project Completion checklist](#).

There should be ongoing consultation throughout the project to ensure that the appropriate risks strategies are adhered to for the handover stage eg, removal of hoarding, and co-ordination of housekeeping services.

Air sampling may be required after construction or renovation activities before using an operating room, high risk areas where severely compromised patients will be accommodated, and pharmacy clean rooms, if these areas have been involved or affected by the construction process. If air sampling and particle counts were conducted, allow enough time to obtain satisfactory results prior to occupation refer to [Utilisation of the MERCK Air Sampling Unit Hospital Network Procedure](#).

HEPA filters and laminar flow systems should be recertified where installed.

If water supply has been disrupted during construction/renovation then the taps should be flushed and water sampling performed. Refer to [Water Quality Controls](#).

Swabbing of environmental surfaces is not required.

Role and Responsibilities

Chief Operating Officer

- Ensure the management of building and renovation across their Health Service is in accordance with this guideline.

Health Service Director of Infrastructure

- Ensure areas within their area of control have systems in place that facilitate safe environments during construction and renovation. The day-to-day responsibility for establishing and monitoring the implementation of this guideline may be delegated to the relevant managers.

General Manager, Heads of Service and Other Senior Managers

- Develop, implement and monitor local processes to support employees, and other persons providing health services on behalf of the Health Service, in maintaining safe environments during construction and renovation for patients, staff and visitors
- Foster a climate which facilitates a safe environment during construction and renovation for patients, staff and visitors.

Department of Infrastructure

- Ensure all contract documentation meets the requirements of this policy prior to submission to DoH and Hospital staff
- Ensure that works comply with the requirements of the policy
- Have a process in which to review the compliance with the policy, and formally report on non-conformances

Department Of Health

- Ensure project timelines allow for adequate consultation and assessment of documentation and risk mitigation strategies. Allow for endorsement at handover prior to clinical occupation.
- Have a process in which to review the policy compliance with the key stakeholders
- Facilitate site inspections with hospital staff and Infection Control

Contractors

- Ensure all staff have attended site induction and have an understanding of the Infection Prevention requirements when working in a hospital facility.
- Complete required documentation and site inspections in accordance with this document
- Ensure all projects have a completed Infection Prevention and Control Permit and Checklist.

Engineering Services:

- Notify hospital Infection Prevention units of planned work to obtain approval prior to start of work (for all new construction or for construction or renovation activities for departments listed in Risk Groups 3 and 4)
- Notify appropriate Nursing/Clinic/Department manager of any proposed work and precautionary measures, which will be taken.
- Oversee projects by inspecting barriers, etc. on a routine basis, and on completion of works
- Notify Infection Prevention immediately of any breach in construction barriers.
- Ensure the required documentation is completed and recorded in accordance with this document

Facility Infection Prevention and Management Unit

- Educate managers, medical staff, housekeeping services personnel, and other staff as needed about risk to immuno-suppressed patients exposed to construction dust.
- Provide support to the implementation of this document to relevant staff and contractors
- Undertake project risk assessments, and review of proposed infection prevention measures
- Undertake site inspections as appropriate throughout project works and on completion of projects

Housekeeping Department

- Work with Engineering Department to identify areas that need to be damp mopped and clean these areas as scheduled
- Thoroughly clean new and renovated areas before admitting or readmitting patients.
- Coordinate inspection of final cleaning with Infection control prior to opening/re-opening the area.

All Hospital Employees Involved In Construction or Renovation Activities

- Take reasonable steps to ensure they maintain a safe and hygienic environment during construction and renovation
- Report any breaches in Infection Prevention measures as per local policy
- Help identify high-risk patients and relocate high-risk patients to unaffected areas before construction /renovation work is initiated.
- Optimally, avoid non-emergent admission/testing/treatment of immunocompromised patients during periods of construction/renovation.

Appendix 1: Clinician Guidelines for Patient Risk Assessment and Management

Patient Risk Assessment and Management during Construction and Demolition

Advice to Clinicians

A risk assessment of the patient population within or adjacent to Construction site must be undertaken by the clinical service manager/Director or delegate prior to the commencement of any Construction activities. This is particularly important when demolition or major construction works are planned external to, or within the healthcare facility. This type of activity is recognised as the most significant risk for the severely immunosuppressed patient population group (refer table 1).

During major construction and renovation projects patients must be individually assessed, by their specialist clinician, as to their degree of immuno-suppression. The primary clinician is responsible for implementing those preventative measures determined necessary e.g., antifungal chemoprophylaxis

All clinicians must be aware of potential risks to their patient group during construction projects and take all measures to identify symptoms, diagnose, treat, and consult infectious diseases as necessary.

Minimising Patient Exposure to Construction-associated Contaminants

- If possible relocate at-risk patients who are adjacent or near the Construction zone.
- Ensure patients do not go near construction zone.
- Supply P2 or N95 mask (surgical filter masks for paediatrics) to high-risk patients to wear when in transit near construction zones is unavoidable e.g.: on approach to facility.
- Where HEPA-filtered positive pressure rooms are available High-risk inpatients must have priority access. Facilities that do not have this class of patient accommodation, advice must be sort from their primary care clinician as to appropriate accommodation requirements.

Table 1: Individual Patient Risk for Invasive Aspergillosis Infection

Group 1 No evidence of increased risk	<ul style="list-style-type: none"> ▪ Staff members, Service Providers and Contractors ▪ All patients not listed in Groups 2 - 4 above
Group 2 Increased risk	<ul style="list-style-type: none"> ▪ Patients on prolonged courses of high dose steroids particularly those hospitalised for prolonged periods. ▪ Severely immuno-suppressed HIV / AIDS patients. ▪ Patients undergoing mechanical ventilation. ▪ Patients having chemotherapy who are not neutropenic.* ▪ Dialysis patients. ▪ *Neutropenia defined as absolute neutrophil count (ANC), <1x10⁹/l
Group 3 High risk	<ul style="list-style-type: none"> ▪ Neutropenia* for less than 14 days following chemotherapy. ▪ Solid organ transplantation. ▪ Neonates in intensive care units (ICU).
Group 4 Very high risk	<ul style="list-style-type: none"> ▪ Allogenic bone marrow transplantation: within 12 months of transplant, if >12 months, consult with haematologist ▪ Autologous peripheral blood stem cell transplantation, i.e. during the neutropenic period. ▪ Prolonged neutropenia for greater than 14 days following chemotherapy or immunosuppressive therapy: e.g. acute myeloid leukaemia (AML), acute lymphoblastic leukaemia (ALL), Burkitt's lymphoma, lymphoblastic lymphoma, primary CNS lymphoma ▪ Aplastic anaemia patients. ▪ Children with: <ul style="list-style-type: none"> ▪ Severe Combined Immunodeficiency Syndrome (SCIDS); ▪ Chronic Granulomatous Disease of Childhood (CGDC).

Appendix 2: Fungal Spore Monitoring

Interpretation of Fungal Spore Monitoring

Factors that influence fungal spore counts

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.

Threshold guidance

There is a paucity of evidence based guidelines for the interpretation of fungal counts in the general environmental. However, there are Australian and UK guidelines that offer consistent direction for the interpretation of fungal counts in the healthcare setting.

The following principles guide interpretation of results and indications further action.

- Internal spore counts should be less than external counts
- Fungal counts should not vary significantly from baseline values.
- Outside spore counts may be influenced by seasonal variation
- Continuous microbial sampling may provide a more accurate illustration of spore release over time.
- When undertaking intermittent sampling, results only represent a moment in time.
 - A low reading is not conclusive evidence that there has not been any fungal spore contamination.
 - A single high reading is always significant and should be investigated.

Environment	Threshold Count*	
	<i>Aspergillus</i>	Total Fungal Spores
Protective Environment – HEPA filtered air	≤0.1 CFU/m ³	<15 CFU/m ³
Protective Environment – at risk patients	≤1.0 CFU/m ³	<100 CFU/m ³
General Environment – no at risk patients	≤4.0 CFU/m ³	<400 CFU/m ³

*National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities, Ireland 2002

Recommended Actions

When results exceed the threshold limit an investigation of possible sources of contamination should be undertaken and corrective actions implemented as soon as possible.

An intensive evaluation and review of procedural practice in high risk patient care environments is indicated in the following circumstances:

- Threshold counts are exceeded
- 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

Appendix 3: Population and Geographical Risk Groups for NT Hospital Sites

Royal Darwin Hospital

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> – Office areas – Public areas – Non clinical areas (No patients being cared for in these areas) 	<ul style="list-style-type: none"> – Outpatients – Physiotherapy – Medical Imaging (Radiology) – Outpatients – Consulting suites – Occupational Therapy – Speech – Nutrition – Prosthetics – Rehabilitation ward – Podiatry – Endoscopy – Hospice – Cowdy unit 	<ul style="list-style-type: none"> – Delivery Suite – Haemodialysis – Emergency Dept – Laboratory – Pharmacy – Renal unit – Medical/Surgical/ Paediatric Wards – RAPU – CCU 	<ul style="list-style-type: none"> – Special Care Nursery (SCN) – Operating Theatre – Endoscopy area – CSD – ICU – Maternity Services – Haematology/Oncology unit – Area/ward/unit caring for immunocompromised patients

Alice Springs Hospital

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> – Office areas – Public areas – Non clinical areas (No patients being cared for in these areas) 	<ul style="list-style-type: none"> – Medical Imaging – Outpatients – Rehabilitation Unit – Mental Health Unit – Non-hospital areas where there are clients 	<ul style="list-style-type: none"> – Delivery Suite – Haemodialysis – Renal Ward – Medical Ward – Surgical Ward – Paediatric Unit – CCW – ED – Laboratory – Pharmacy 	<ul style="list-style-type: none"> – Areas/Wards/Units caring for immunocompromised patients – ICU /HDU – CSD – Operating Theatre – Maternity Ward – NNU

Katherine District Hospital

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> – Office areas – Non clinical areas (No patients being cared for in these areas) 	<ul style="list-style-type: none"> – Radiology – Outpatients – Physiotherapy – Medical Imaging – Medical Imaging (Radiology) – Outpatients – Private consulting suites – Occupational Therapy – Speech – Nutrition 	<ul style="list-style-type: none"> – Emergency Dept – Laboratories – Pharmacy – Medical/ Surgical Wards – Haemodialysis Unit – Specialists Clinics – Delivery Suite 	<ul style="list-style-type: none"> – Areas/Wards/Units caring for immunocompromised patients – CSD – Operating Suite Services – Maternity Wards

Gove District Hospital

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> – Office areas – Public areas – Non clinical areas (No patients being cared for in these areas) 	<ul style="list-style-type: none"> – Medical Imaging – Outpatients – Physiotherapy 	<ul style="list-style-type: none"> – Delivery Suite – Haemodialysis – Emergency Dept – Laboratory – Pharmacy – Med/Surg unit 	<ul style="list-style-type: none"> – Operating Suite – CSD – Maternity Services

Tennant Creek Hospital

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> – Office areas – Public areas – Non clinical areas (No patients being cared for in these areas) 	<ul style="list-style-type: none"> – Radiology – General outpatient areas – Physiotherapy 	<ul style="list-style-type: none"> – Emergency Dept – Haemodialysis unit – Medical surg ward 	<ul style="list-style-type: none"> – Operating Suite – CSD

Appendix 4: Infection Prevention During Construction Fact Sheets

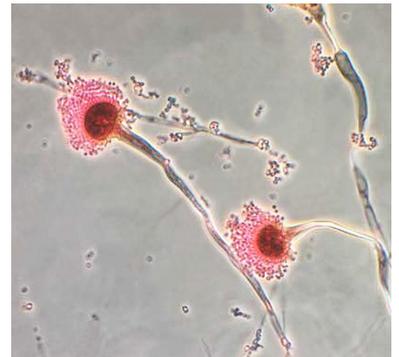
Information for Hospital Staff Infection Prevention during Construction

Construction Works in Healthcare Facilities

- Healthcare facilities provide care to a large number of patients with diverse health issues. A significant number of health problems make the patients at risk of illness from germs disturbed by construction. Germs than would not bother a healthy person.
- Hospital construction works have been linked with outbreaks of, most commonly, Aspergillus and Legionnaire's disease. These illnesses are unlikely to make a healthy person ill, but if a person is sick, or having treatment that damages their immune system it is often very serious and can make people extremely sick.
- Legionnaire's disease is related to the water, especially the hot water, systems and though a major issue for plumbers is controlled through careful planning and management of the water systems.
- Aspergillus is a fungus that is spread by spores disturbed by construction. There are procedures to minimise the risk of spread to patients.

What is Aspergillus?

- Aspergillus is a fungus that lives all around us, in soil, decaying vegetation, and within the structure of buildings. It grows as a mould on surfaces and some species grow especially well on damp surfaces. Small amounts are not visible but are enough to cause disease.
- Construction, demolition and excavation activities disturb the fungus, releasing millions of tiny spores and fungal elements into the air.
- Because of their size and shape they can stay in the air and travel for long distances on air currents. If you can see dust during construction then unseen smaller aspergillus spores are going to be present.
- Risk of infection relates to the patients risk due to their health condition and the amount of aspergillus spores exposed. Large amounts released into the air from sanding, demolition and dust producing actions are dangerous to susceptible patients.



Who is at risk? (Please remember that Aspergillus rarely causes illness in healthy people)

- The patients at highest risk are those having chemotherapy or have neutropenia.
- Other patients with impairment of their immune system are also at risk.
- All patients that are unwell have a higher risk of infection than the health population.
- The hospital tries to separate more vulnerable patients from construction works. If this is not possible there are extra precautions taken to minimise the risk.
- If you suspect one of your patients is at high risk please check with the team leader, Infection Control or out of hours the Hospital Resource Coordinator (HRC), that the appropriate barrier precautions have been taken.

How Aspergillus causes illness

- Aspergillus spores are inhaled or land on susceptible tissue.
- In a healthy person the immune system prevents the infection at that point.
- In susceptible people it can spread where it lands or spread through the blood and start growing in other organs.

- Once established it is very hard to treat and even long term antifungal treatments can fail to cure the disease in a patient with a weak immune system.
- It cannot be spread from person to person.
- It is very unlikely to infect a healthy person. It is not going to infect anyone at your home.

What is done to protect patients?

- At the start of any hospital works a risk assessment is taken looking at both the likelihood of disturbing aspergillus and the susceptibility of patients in the area. This is then used to determine which of four levels of barrier precautions should be taken.
- Whenever dust is created (by sanding or demolition) or disturbed (by working in the ceilings) there is presumed to be aspergillus spores released. It is then important to separate the dust and thus the spores from susceptible patients.
- This is done in a number of ways:
 - Floor to ceiling hoarding when working inside the healthcare facility;
 - Timely repair of any breaches in hoarding barriers;
 - Covering waste with plastic sheeting before removing it from the construction zone;
 - Dust mats at the exit and entrance to an internal construction zone;
 - Sealing off air ducts and other openings dust can spread.
 - Divert susceptible patients away from construction sites.

What can you do?

- Ensure the ward team leaders are aware of patients that are significantly immunosuppressed and at high risk.
- Observe the construction work and note any possible breaches in the barrier precautions.
- Ensure that line managers are notified of any problems caused by the construction work as soon as possible. Eg- dust, loss of air conditioning.
- Out of hours the Hospital Resource Coordinator is the next point of contact.

Barrier For Dust Control



Debris Removal



Further Information

Royal Darwin Hospital Infection Prevention and Management Unit Contact details:

Office Hours: (08) 89228045

email: InfectionPreventionRDH.DoH@nt.gov.au

Information for Construction Site Workers

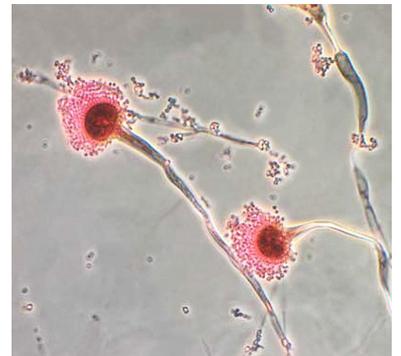
Minimising *Aspergillus* Risk

Construction Works in Healthcare Facilities

- Construction in or near Healthcare Facilities differs from other sites by the presence of susceptible people in the vicinity. Healthcare facilities provide care to a large number of patients with diverse health issues. A significant number of health problems make the patients at risk of illness from germs disturbed by construction. Germs that would not bother a healthy person.
- Hospital construction works have been linked with outbreaks of, most commonly, *Aspergillus* and Legionnaire's disease. These illnesses are unlikely to make a healthy person ill, but if a person is sick, or having treatment that damages their immune system it is often very serious and can make people extremely sick.
- Legionnaire's disease is related to the water, especially the hot water, systems and though a major issue for plumbers is a minor issue for most site workers.
- *Aspergillus* is spread by dust and every site worker has a responsibility to minimise exposure of susceptible patients to dust from site works.

What is *Aspergillus*?

- *Aspergillus* is a fungus that lives all around us, in soil, decaying vegetation, and within the structure of buildings. It grows as a mould on surfaces and some species grow especially well on damp surfaces. Small amounts are not visible but are enough to cause disease.
- Construction, demolition and excavation activities disturb the fungus, releasing millions of tiny spores and fungal elements into the air.
- Because of their size and shape they can stay in the air and travel for long distances on air currents. If you can see dust then the unseen smaller *aspergillus* spores are going to be present.
- Risk of infection relates to the patient's risk due to their health condition and the amount of *aspergillus* spores exposed. Large amounts released into the air from sanding, demolition and dust producing actions are dangerous to susceptible patients.



Who is at risk? (Please remember that *Aspergillus* rarely causes illness in healthy people)

- Patients who do not have a healthy immune system eg: cancer patients.
- Those who are very old or young.
- Those that are very unwell with other illnesses.
- Both people in hospital buildings and those walking past construction sites can be affected.
- The risk to patients and thus the precautions taken vary depending on the type of work and location of susceptible patients. The site engineer or engineering department should be able to tell you what Risk Class (I to IV) your work is and what specific precautions are needed.

How Aspergillus causes illness

- Aspergillus spores are inhaled or land on susceptible tissue.
- In a healthy person the immune system stops the infection at that point.
- In susceptible people it can spread where it lands or spread through the blood and start growing in other organs.
- It is very hard to treat and even long term antifungal treatments can fail to cure the disease in a patient with a weak immune system.
- It cannot be spread from person to person.
- It is very unlikely to infect a healthy person. It is not going to infect anyone at your home.

What can you do to protect patients?

- Whenever dust is created, it is important to stop it from contaminating the environment and the air. These can be done in a number of ways:
 - Floor to ceiling hoarding when working inside the healthcare facility;
 - Timely repair of any breaches in hoarding barriers;
 - Covering waste with plastic sheeting before removing it from the construction zone;
 - Sticky mats at the exit and entrance to an internal construction zone;
 - Not wearing dusty clothes and shoes outside the internal construction zone;
 - Cleaning with a damp mop or vacuum with a HEPA filter. Do not vacuum without a special cleaner with a HEPA filter as it the spores fit through a normal filter and will be spread by the cleaner.
 - Sealing air ducts and other openings dust can spread.

Examples:



Debris Removal



Further Information

Royal Darwin Hospital Infection Prevention and Management Unit

Office Hours: (08) 89228045

email: InfectionPreventionRDH.DoH@nt.gov.au

Appendix 5: Sample Letters

Healthcare facility staff, contractors and volunteers

To be circulated to all staff within the facility prior to major excavation and demolition works commence

TO:

FROM: {Facility} General Manager

DATE:

RE: Staff Health and Safety during building works

As you are aware there a major buildings works to be undertaken at {identify site}.

The Hospital Management is committed to providing staff with a safe work environment at all times. While all steps will be taken to eliminate and minimise risk there may still be dust generated during the refurbishment that could invade other work spaces. It is possible that microbes in the dust may be harmful to anyone immuno-compromised.

If you believe that you are at any level of risk please seek advice from your specialist doctor and also notify your Manager immediately.

Please note that you need only provide advice regarding your degree of risk, rather than full details of your medical condition. Confidentiality of any information will of course be maintained.

Managers will work with any affected staff and their relevant clinician to identify the level of risk and to develop appropriate management plans during this period.

I understand the disruption that building works such as this can have to the general work environment and ask for your understanding and patience during this period.

Yours Sincerely

Immunocompromised patients and families

To be emailed to Senior Medical Staff and Relevant Clinical Nurse Consultants with the following rider:

“If you have patients who are severely immunocompromised and at risk of fungal infections as a result of congenital or acquired T cell or neutrophil disorders, that may be visiting the Hospital in between [insert date], could you please arrange for the attached letter and information sheet to be given to them”

TO: Facility Patients and Families

FROM: Facility Director of Clinical Operations

DATE:

RE: Safety during building works

Commencing [insert date], building works will start in [briefly describe project, location and extent of planned works]. These works will be in close proximity to [identify entrances and other specific units] and may impact on patients and families visiting the hospital.

The Hospital Management is committed to providing patients and visitors with a safe environment at all times. While all steps will be taken to minimise risk, there may still be dust generated during this work that could invade other spaces.

During construction and demolition activities a tiny fungus called Aspergillus may be released into the air. Aspergillus can travel on air currents to areas surrounding these works and can cause infection in severely immunocompromised patients.

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 Aspergillus infection. Healthy adults, women and children are not at risk during construction work.

If you have been identified by your doctor as being at risk, you will be provided with a special mask to wear when coming to the hospital. Once you have arrived at your ward or treatment area you will be free to remove the mask.

Yours Sincerely

Appendix 6: Infection Control Management Plan Template

Infection Control Management Plan

Name of Project

Hospital Name

Health Service

Date

Controlled Document

Copies shall not be made without the written permission of

XXXXXXXXX Project Manager

1.0 Plan review and Approval (amend table as required)

Position	Name	Sign	Date
Review			
Project Manager			
Senior Site Manager			
Senior Project Engineer			
Approval			
Project Manager			
Project Director			
Department of Infrastructure Director			
Department of Health			
Engineering Services Manager			
Infection Prevention			

Issue	Rev	Revised by	Approved by	Date

2.0 Purpose of this Plan

The purpose of this Infection Control Management Plan is to ensure that all personnel recognise the importance of infection control as a major priority in the design, construction and commissioning of hospital facilities.

This Plan outline's approach to identifying any infection control risks and details the measures required to address the risk of infection resulting from the construction works.

Infection Control is of major concern on all hospital projects because of the potential of high numbers of immune compromised patients. The Level of risk associated with each project is dependent on the project complexity, location of the works, the type of work being undertaken, and the proximity to patients with varying degrees of risk for infection.

It is recognised that early risk identification and implementation of controls will minimise the risk of infection but may not completely eradicate the risk of infection for vulnerable patient groups. However, this does not nullify the responsibility of project employees and subcontracts, and Hospital employees to comply with all recommended control measures.

The Infection Control Management Plan must be implemented in conjunction with any Infection Control Guidelines or specific project conditions that the Hospital deems applicable to this project.

The project Team must regularly consult the Hospital to identify any infection control measures required in the execution of the construction works.

3.0 Project Overview

PROVIDE PROJECT OVERVIEW HERE

4.0 Management Procedures

All advice of recommendations contained within this document are subject to the approval by the (POSITION RESPONSIBLE FOR THE PROJECT)

All works will be risk assessed using the risk matrix framework described in the Australian Healthcare Facilities Guideline Part D – Construction and Renovation. This risk assessment will inform planning activities and controls scheduled through the construction project. The identified risk class will be identified on all planned works.

Control measures will be determined in consultation with the Hospital Infection Prevention Unit and the (POSITION RESPONSIBLE FOR THE PROJECT).

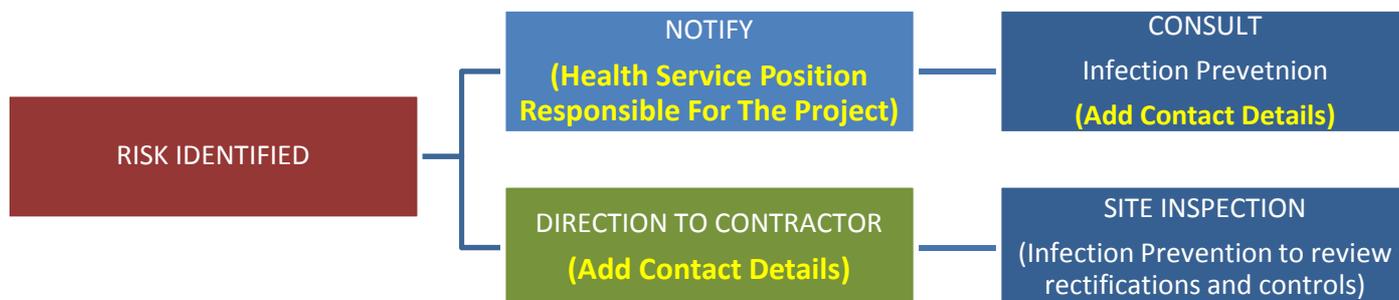
Any modifications or variations of planned infection control measures for any area can only proceed upon direction from the (POSITION RESPONSIBLE FOR THE PROJECT), (PROJECT MANAGEMENT TEAM), (ANY OTHER PARTIES) and in consultation with the Infection Prevention Unit. Contractors and construction workers will not take directions for change from other facility staff.

The contractors will ensure:

- Infection control measures and overview of Aspergillus infection risk are included at induction and toolbox talks
 - Infection control measures outlined within this plan are implemented and maintained throughout the duration of works.
 - Control measures are monitored (FREQUENCY) using a standardised checklist
- Compliance with any of the provisions of this control plan will be audited at any time by members of the project team and the Infection Control Unit.

Breaches of infection control measures must be rectified immediately. Where these breaches cannot be immediately rectified or represent an unacceptable risk to the health service an escalation process will be implemented, refer to figure 1

Figure 1: Escalation Plan – EXAMPLE ONLY



5.0 Risk Identification and Control Measures Using the Construction Risk Assessment and Action Plan

DESCRIBE THE MEASURES THAT WILL BE UTILISED TO ADDRESS THE RISKS IDENTIFIED USING THE ABOVE METHODOLOGY

6.0 Ventilation Systems

DESCRIBE THE MEASURES THAT WILL BE UTILISED TO ADDRESS THE RISKS IDENTIFIED

7.0 Approach to Dust Control and Aspergillus and Other Fungal Spore Species

A full method statement including a risk assessment must be produced for each stage of the construction project. This must include the provision of appropriate protective measures for the levels of risk identified.

7.1 Microbial Sampling

PROVIDE INFORMATION ABOUT WHETHER MICROBIAL SAMPLING WILL BE REQUIRED, AND IF SO PROVIDE THE FREQUENCY, LOCATION AND REPORTING METHODS.

7.2 Dust Minimisation

PROVIDE SUMMARY OF DUST REDUCTION AND CONTAINMENT METHODOLOGIES.

8.0 Approach to Legionella Control

PROVIDE SUMMARY OF LEGIONELLA HAZARD REDUCTION METHODOLOGIES.

9.0 Waste Removal

PROVIDE SUMMARY OF METHODOLOGIES.

10.0 Handover

10.1 Overview

PROVIDE SUMMARY

11.2 Air Sampling prior to Commissioning (If Required)

PROVIDE RESPONSE

11.0 Verification

DESCRIBE VERIFICATION AND SIGN-OFF PROCESSES

Appendix 7: Infection Prevention and Control Checklist Permit

Infection Risk Assessment and Control Measures for Construction Activities Checklist and Permit			
Hospital/Facility:	<input type="text"/>	Location of activity:	<input type="text"/>
Date of assessment:	<input type="text"/>	Project start date:	<input type="text"/>
		Estimated duration:	<input type="text"/>
Type of activity:	<input type="checkbox"/> Construction <input type="checkbox"/> Renovation <input type="checkbox"/> Installation <input type="checkbox"/> Maintenance		
Name of person completing risk assessment:	<input type="text"/>		Role/Title: <input type="text"/>

Please indicate yes or no for each section

Yes		No		Construction Activity (refer Part A / table 2)	Yes		No		Population & Functional Risk Group (refer Part B/ table 3 and Appendix 3)
				Type A: Inspections and general upkeep activities					Group 1: Low Risk
				Type B: Small scale, short duration activities, which create minimal dust					Group 2: Medium Risk
				Type C: Any work that generates a moderate to high level of dust					Group 3: Medium to High Risk
				Type D: Major demolition and construction projects					Group 4: Highest Risk

Using the matrix below identify the **class of preventive measures** required for this work. Refer to Part D/[table 5](#) for specifications for infection prevention and control measures

		Construction Activity				
		• Type A	• Type B	• Type C	• Type D	
Risk Group	Low risk	Group 1	I	II	II	III /IV
	Medium risk	Group 2	I	II	III	IV
	Medium-High risk	Group 3	I	III	III / IV	IV
	Highest risk	Group 4	III	III / IV	III / IV	IV

Infection Prevention must be consulted when Construction activities are planned in areas or corridors adjacent to Risk Groups III or IV.

Assessment and sign-off									
Class of preventive measures:		Class I	Class II	Class III	Class III/IV	Class IV			
Engineering Services Manager									
Name:	<input type="text"/>	Signed:	<input type="text"/>	Phone Number:	<input type="text"/>				
Infection Prevention (CNM/CNC)									
Name:	<input type="text"/>	Signed:	<input type="text"/>	Phone Number:	<input type="text"/>				
Comments:									

Detail controls relevant to planned building works – refer Part D for minimum standards

Prior to project initiation the Contractor/Dol must submit the details of control measures ([table 5](#)) to be implemented and monitored. Control measures are to be evaluated and approved by the Engineering Services Manager and Infection Prevention prior to work start.

This table is used to illustrate how the recommended controls will be implemented for works in a specific location. An example of information included is detailed in italics.

Contractor Management	Hospital Site Management	Status
<i>Control measure will be implemented as detailed for Class 3 controls. Hoarding will be erected on the evening of 5/6/2015. Inspection by site Infection Control scheduled 07.30 6/6/2015 for sign-off prior to works commencing.</i>	<i>Ward 7 Beds 5-9 to be closed by 17.00hrs on 5/6/2015. All equipment to be removed.</i>	Hospital Executive, ward CNM advised
<i>Planned completion date 12/6/15 Site to be inspected by Infection Control prior to hoarding being removed.</i>	<i>House Keeping staff to be advised of post hand-over clean to be scheduled 12/6/15. Prior to patient occupation</i>	<i>House Keeping booked</i>

Contractor

Name:		Signed:		Phone Number:	
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Dol Project Manager

Name:		Signed:		Phone Number:	
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Approved / Not Approved

Date: _____

Engineering Services Manager

Name:		Signed:		Phone Number:	
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Infection Prevention (CNM/CNC)

Name:		Signed:		Phone Number:	
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Appendix 8: Environmental monitoring compliance checklist

Environmental Monitoring Compliance Checklist

Project Title		Date	
Location of Work		Time	
Contractor		Surveyor	

1. Construction Barricade	Answer (circle one)		
Dust tight barricades sealed, no penetration	Yes	No	N/A
Dust mats in place and clean	Yes	No	N/A
Doors close and seal properly	Yes	No	N/A
All access doors are closed to public	Yes	No	N/A
Ventilation ducts to building site covered	Yes	No	N/A
2. Negative Air			
Negative pressure at barrier entrance	Yes	No	N/A
All windows and doors closed behind barrier	Yes	No	N/A
Negative air units or exhaust fans running	Yes	No	N/A
Negative air units filters clean	Yes	No	N/A
3. Adjacent Areas With Staff/Patient Access			
Ceiling areas intact and dry	Yes	No	N/A
Floor areas are clean and no dust is tracked	Yes	No	N/A
Walls intact and dry	Yes	No	N/A
Horizontal surfaces dust free	Yes	No	N/A
Vents dust free	Yes	No	N/A
No signs of pest infestation	Yes	No	N/A
4. Traffic Flow			
Building contactors accessing site through approved non-patient care areas	Yes	No	N/A
Waste covered and contained prior to removal	Yes	No	N/A
Route and timing of debris removal as per agreement	Yes	No	N/A
There is free and unobstructed access for emergency response	Yes	No	N/A
Comments:			

Non-compliance issues

Issues	Report to	Date

Resurvey date / / Surveyor Compliance achieved (circle) Yes No

Further action taken:

Surveyor's Signature:

Appendix 9: Completion of Project

Completion of Project Checklist - Part A: To be completed by the contractor

Project Title		Date	
Location of Work		Time	
Contractor		Surveyor	

Risk Rating	Contractor - Completion of Project Checklist	Check
Class I	Clean work area upon completion of the task. This includes all horizontal and vertical surfaces to ensure all dust and debris has been removed.	
Class II	Contain construction waste before transport in tightly covered containers.	
	Clean work surfaces with water and detergent/disinfectant.	
	Wet mop and / or vacuum with HEPA filtered vacuums before leaving the work area.	
Class III	Remove isolation of HVAC system in areas where work is performed.	
	Contain construction waste before transport in tightly covered containers.	
	Remove barrier materials carefully to minimise spreading of dust and debris associated with construction.	
	Clean work surfaces with detergent/disinfectant.	
	Vacuum work area with HEPA filtered vacuums.	
	Wet mop area with hot water and detergent/disinfectant.	
	Remove isolation of HVAC system in areas where work is performed.	
Class IV	Do not remove barriers from work area until completed project is inspected by the Engineering Services Manager, Infection Prevention and Housekeeping Services.	
	Ensure consultation with Housekeeping services has occurred for a clinical clean to occur post builders clean.	
	Contain construction waste before transport in tightly covered containers.	
	Remove barrier material carefully to minimise spreading of dust and debris associated with construction.	
	Cover transport receptacles or carts. Tape down covering unless it has a solid lid.	
	Clean work surfaces with detergent/disinfectant.	
	Vacuum work area with HEPA filtered vacuums.	
	Wet mop area with detergent/disinfectant.	
Remove isolation of HVAC system in areas where work is performed.		
Class IV	Do not remove barriers from work area until completed project is inspected by the Engineering Services Manager, Infection Prevention and Housekeeping Services.	
	Ensure consultation with Housekeeping services has occurred for a clinical clean to occur post builders clean.	

Comments:

Completion of Project - Part B: To be completed prior to handover and before patient occupation. It is the responsibility of the panning committee to ensure the area is fit for purpose.

Project Title		Date	
Location of Work		Time	

Completion of Project Checklist - Infection Control Measures	Answer - (circle one)		
The area has been thoroughly cleaned. This includes all horizontal and vertical surfaces to ensure all dust and debris has been removed	Yes	No	N/A
The area has been vacuumed with a HEPA filter vacuum	Yes	No	N/A
The area has been wet mopped with detergent / disinfectant	Yes	No	N/A
When commissioning a new or refurbished operating theatre or pharmacy clean room: air sampling and particle counts have been performed and results are within acceptable limits.	Yes	No	N/A
If the water supply has been disrupted: maintenance/contractor has flushed water through all taps and water sampling has occurred (as per the Guidelines for the Control of Legionella (2013), as necessary, with results within acceptable levels (<10 cfu/ml)	Yes	No	N/A
Sinks and plumbing fixtures are suitable for the task and properly located (as per relevant Standards)	Yes	No	N/A
Air intake and exhaust outlets are located and working properly	Yes	No	N/A
Surfaces are appropriate for clinical care and cleaning requirements – ie no damage to walls, cuts to linoleum finishes	Yes	No	N/A
No visible marks or stains that will prohibit cleaning	Yes	No	N/A
Ensure consultation with Housekeeping services has occurred for a clinical clean to occur prior to occupation.	Yes	No	N/A
Comments:			

Engineering Services Manager					
Name:		Signed:		Phone Number:	
Infection Prevention (CNM/CNC)					
Name:		Signed:		Phone Number:	
House Keeping Services					
Name:		Signed:		Phone Number:	

Implementation, Review & Evaluation Responsibilities

	Method	Responsibility
Implementation	Document will be available via PGC	Health Policy Guidelines System Administrator
Review	Document is to be reviewed in 4 years or based on procedure change	Clinical Nurse Manager IPMU
Evaluation	<p>Report on the systematic review of compliance with this document.</p> <p>Localised breaches will be reported on RiskMan; issues will be investigated by Facility Engineering Services.</p> <p>Scheduled debriefs at project completion to evaluate the success of the project in line with the policy.</p>	<p>TEHS/CAHS Capital Asset Management Committee</p> <p>Hospital Engineering Services, Hospital Infection Control Committee and Quality Unit</p> <p>Department of Health, Department of Infrastructure and Hospital Engineering Services</p>

Key Associated Documents

Key Legislation, By-Laws, Standards, Delegations, Aligned & Supporting Documents	<p>AS 1324.1-2001 Air filters for use in general ventilation and air-conditioning - Application, performance and construction</p> <p>AS 4260-1997 High efficiency particulate air (HEPA) filters - Classification, construction and performance</p> <p>HB 260-2003 Hospital Acquired infections-engineering down the risk Utilisation of the MERCK Air Sampling Unit Hospital Network Procedure</p>
References	<p>Australian Health Facility Guideline, 2012, <i>Part D – Infection Prevention and Control – Construction and Renovation</i>, Revision 6.0. 11 June 2015</p> <p>CDC. (2003) <i>Guideline for Environmental Infection Control in Health-Care Facilities, 2003</i>. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Retrieved http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm</p> <p>Eastern Health Clinical Service Council: Construction & Renovation- Infection Control Issues 2009 written by Martin Cutter Infection Control Coordinator</p> <p>Guidelines for the Design and Construction of Hospital and Health Care Facilities, 2010. The American Institute of Architects, Academy of Architecture for Health, The Facilities Guidelines Institute, with assistance from the US Department of Health and Human Science.</p> <p>Health Canada. (2001.). <i>Canada Communicable Disease Report. Construction- related Nosocomial Infections in Patients in Health Care Facilities</i>.</p> <p>Facility Guidelines Institute. (2010.). <i>Guidelines for the Design and Construction of Hospital and Health Care Facilities</i> Facility Guidelines Institute.</p> <p>Illawarra Shoalhaven Local Health District. (2014). <i>Building and Maintenance Infection Prevention Toolkit: Infection risk management for construction, renovation, installation, and maintenance activities in healthcare facilities</i>.</p>

Loddon Mallee Region Infection Control Resource Centre, 2003, *Infection Control Principles for the Management of Construction, Renovation, Repairs and Maintenance within Health Care Facilities: A Manual for Reducing the Risk of Health Care Associated Infection by Dust and Water Borne Micro-organisms*, 2nd Edition.

[NHMRC \(2010\) Australian Guidelines for the Prevention and Control of Infection in Healthcare](#). Commonwealth of Australia.