
INFECTION PREVENTION AND CONTROL MANUAL

10.1 Risk Management

RATIONALE

The Risk Management Program is designed to assist staff in the identification and management of potential risks to their business unit / program. These risks may be of a 'clinical' or 'business' nature. The Risk Management program provides all business units/programs across the organisation with the tools to identify, analyse and manage risks of any nature.

Risk management is the responsibility of all staff and should be integrated into position descriptions and the Departmental Management Plan.

WHAT IS RISK MANAGEMENT

Risk management is defined as: the systematic application of management policies, procedures and practices to the task of identifying, analysing, assessing, treating and monitoring risk (AS/NZS Risk Management Guidelines, 4360:2004).

Having a risk management program will ensure a coordinated approach to risk management that is consistent with the AS/NZS Standard 4360 and any legislative or DHS requirements. This risk management approach should be integrated into practice and business plans.

THE INTENT OF THIS POLICY IS TO:

- Provide staff with a tool to assist with the prospective and retrospective identification and management of risk
- Reduce adverse outcomes for the organisation and its customers
- Provide opportunity for improvement in patient safety and for the provision of efficient, high quality services.

1. It is the responsibility of every manager to systematically identify, analyse, treat, monitor and communicate risks associated with any activity, function or process in a way that will minimise losses and maximise patient, client, staff, visitor and resident safety and provide opportunities for the provision of efficient, high quality services.

2. Risk management processes will be based on risk management guidelines

3. All risks rated Extreme or High by the manager, must be discussed with the responsible executive director.

4. It is the responsibility of the manager to keep the executive director informed on the progress of the management of non-acceptable risks.

5. It is the responsibility of each executive director to keep management informed of the emergence and management of non-acceptable risks rated **Extreme** or **High**, and to provide feedback to the relevant department.

PURPOSE

The risk management model (figure 1) incorporates several distinct steps to be carried out when analysing risk (retrospectively or prospectively) in any part of the organisation. In this way, a consistent approach will be ensured so that the organisation has a thorough and commonly understood methodology, which it can rely upon as a basis for effectively managing its risks.

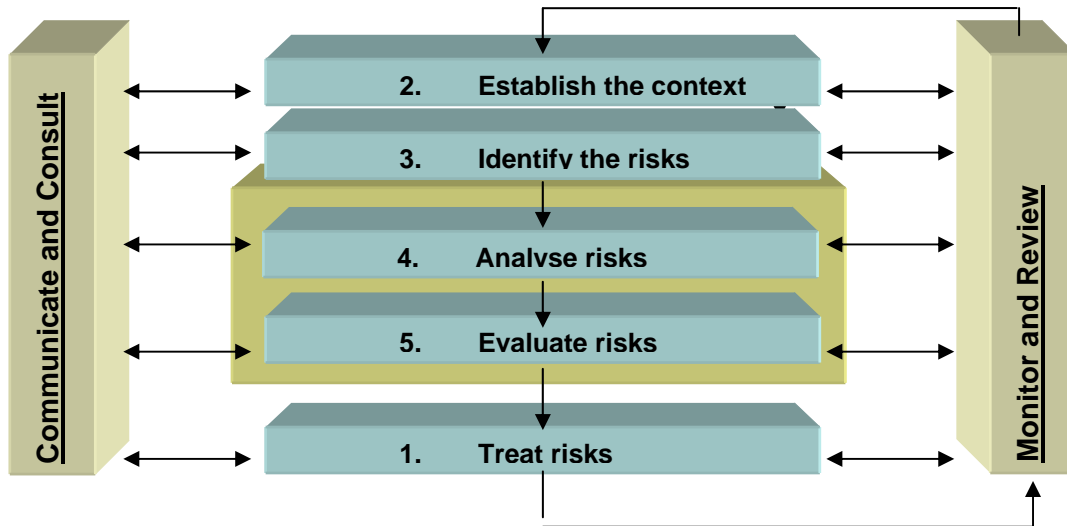


Figure 1. Risk management model (from AS/NZS 4360: 2004 risk management standards)

Establish the context

The first step in a risk management plan is to establish the context of the environment within which the organisation, department or unit operates. The environment in which health facilities operate is an extremely complex one and a number of factors need to be considered when determining the parameters within which risks must be managed. See appendix 1.

Therefore to manage risk effectively you must always consider:

- The organisational strategic plan
- The financial, operational, competitive, political, social, client, cultural and legal environment within which the facility or the unit operates.
- The goals and objectives of the unit.
- The balance between cost, benefits and opportunities.
- The relationship between risk management activities and other projects.

Identify risk

Each unit should assess itself at least annually against the 3 risk context areas listed in strategic, operational and external - to ensure risks are being identified even in a changing environment.

A Risk Workbook should be developed as a self-assessment tool to aid in risk identification. This workbook can be based on a quality plan format.

Prospective Risk identification

Identifying potential risks before they present challenges is the ideal method of minimising risk- this is known as prospective risk identification. A well structured, extensive and systematic process for identifying risks is vital, as risks not identified at this stage are excluded from being

further analysed and managed; risks that are not necessarily under the organisations control should also be included e.g. political, environmental.

In clinical divisions, prospective risk identification must include analysis of coroner's reports by the divisional risk management committees.

Retrospective Risk Identification

The identification of risk may also occur in a retrospective manner - looking back over completed work or tasks. These risks are identified through review processes that are designed to detect episodes of risk such as the consequences of non-compliance with a policy, data inaccuracy or system failures.

Units/divisions are encouraged to schedule ongoing screening (e.g. equipment safety inspections, account audits, incidents, complaints) that requires retrospective review. This should occur through the relevant risk management committee, or in a standing agenda item in the divisional or unit management meeting as well as at executive committee level. Sentinel events, which must be reported to DHS, form part of retrospective risk identification for clinical units.

Both prospective and retrospective risks are to be documented. Both types may require reporting to other areas, once detected. For example, all staff risks are to be reported to the Occupational Health and Safety Unit.

Analyse the risk

Once risks have been identified, there is a process of analysis which separates the minor and moderate risks from the major risks.

First, on a scale of 1-5 rate the consequences of the risk – what will be the result if the risk eventuates?
(See Table 1)

Then, also on a scale of 1-5, assess the likelihood rating – how likely is it that the event will occur or with what frequency? (See Table 2)

Lastly, the overall level of risk is determined by combining the consequence rating and the likelihood rating. (See Table 3)

Whether the risk is insured or not will help determine the severity of the consequences of the potential event, and hence will affect the overall risk level. Risks involving negligence (death, injury, financial loss etc) are assumed to be insured. Consequences arising from breach of contract are not covered by insurance.

All risks analysed as an **Extreme** or a **High** risk must be discussed with the responsible executive director.

Evaluate the risks

The aim of this step is to decide whether the risk is tolerable or not.

Risk may be tolerated if:

- The level of risk is so low that specific treatment is not appropriate within available resources
- The risk is such that there is no treatment available. For example, the risk that a project might be terminated following a change of government is not within the control of an organisation.

- The cost of treatment, including insurance costs is so manifestly excessive compared to the benefit that acceptance is the only option. This applies particularly to lower ranked risks.
- The opportunities presented outweigh the threats to such a degree that the risk is justified.

Risk that is regarded as not tolerable must be actively managed. Even if the risk is regarded as tolerable however, it must still be monitored.

Manage the Risks

Risks that are considered not tolerable in the evaluation stage or those rated **Extreme** or **High** must have management/ treatment options considered. "Risk treatment involves identifying the range of options for treating risk, assessing those options, preparing risk treatment plans and implementing them."

Options for Managing (Treating) Risk

a) *Avoid the risk* by deciding, where practicable, not to proceed with the activity likely to generate risk.

b) *Action to reduce the likelihood of the event.* For example:

Audit and compliance programs	▪	Contract conditions
Inspection and process controls	▪	Project management
Preventative maintenance		Supervision
Structured training		Testing
Technical controls		Quality improvement, management and standards

c) *Action to reduce the consequences.* For example:

Contingency planning	▪	Contractual arrangements
Design features		Disaster recovery plans
Engineering and structural barriers		Public relations

d) *Transfer the risk*

This involves another party bearing or sharing some part of the risk. Mechanisms include the use of contracts, insurance arrangements and organisational structures such as partnerships and joint ventures.

e) *Accept the risk*

After risks have been reduced or transferred, there may be residual risks, which are retained. Plans should be put in place to manage the consequences of these risks if they should occur, including identifying a means of financing the risk.

Assessing risk management options

Options should be assessed on the basis of the extent of risk reduction, and the extent of any additional benefits and opportunities created. Selection of the most appropriate option involves balancing the cost of implementing each option against the benefits derived from it. Where large reductions in risk may be obtained with relatively low expenditure, such options should be implemented.

In many cases, there is not likely to be any one 'best solution', but rather a combination of solutions for a particular problem. Risk management options should consider how affected parties perceive the risk.

Reporting risks and their management plans

Risk management should be integrated with all quality improvement initiatives

If it is agreed by the executive director that the risk is *Extreme* or *High*, a copy of the risk workbook page and the associated quality improvement plan is to be forwarded to the designated risk management committee where the management plan should be discussed and ratified or modified as appropriate.

Recommendations arising from coroner's cases will be managed in all cases as if they were rated *High* even if the actual risk may be rated lower.

Sentinel events (as defined in the DHS Clinical Risk Management Strategy) will always be treated for reporting purposes as an Extreme risk.

Monitoring and Review

Few risks remain static. Monitoring and review of risk is an essential component, having identified and implemented risk reduction practices (closing the loop). The risk management options chosen must be monitored to ensure they are achieving the desired outcomes.

The questions to ask are:

- Has risk been reduced? If not, why not?
- Are there other measures that could be implemented?

Some risks, depending on the level of overall risk, may require very regular review. This will be determined in the development of the quality improvement plan.

As a general guide, a moderate risk may require quarterly or bi-monthly review, to ensure the likelihood or consequences have not altered. High risks will be reviewed monthly or bi-monthly depending on the likelihood rating, and an extreme risk may need to be reviewed weekly or more often, if the likelihood of occurrence is very high.

Table 1. CONSEQUENCE

Level	Descriptor	Detail description
5	Extreme	The consequences would threaten the survival of the organisation, causing major problems for clients, the administration of the organisation or for a large part of the public sector. Loss of >7% of total revenue (>\$10m) would have extreme consequences for the organisation both financially and politically.
4	Major	The consequences would threaten continued effective function or survival of a division or divisions. Loss of >5% (> \$7m) of total revenue would have very serious consequences for the organisation both financially and politically.
3	Moderate	The consequences would be serious for the organisation or its divisions either financially or politically. Would not threaten survival of a division, but could be subject to significant review or changed way of operating.
2	Minor	The consequences would threaten the efficiency or effectiveness of some aspects of a division, but would be dealt with internally.
1	Insignificant	The consequences are dealt with by routine operations.

Table 2. LIKELIHOOD

Level	Descriptor	Detail description	
5	Almost certain	The event is very likely to occur – will occur on at least an annual basis	0-1 yr
4	Likely	The event will probably occur– will occur at least once every 3 years	1-3 yr
3	Occasionally	The event could occur at some time – will occur at least once every 10 years	3-10 yrs
2	Unlikely	The event has not occurred but could occur once in 30 years	30 yrs
1	Rare	The event may occur once in 100 years	100 yrs

Table 3: CALCULATION OF LEVEL OF RISK CONSEQUENCE

LEVEL	LIKELIHOOD	Insignificant 1	Minor 2	Moderate 3	Major 4	Extreme 5
5	Almost certain	L	M	H	E	E
4	Likely	L	M	H	E	E
3	Occasionally	L	M	H	E	E
2	Unlikely	L	L	M	H	H
1	Rare	L	L	M	M	H

Key

E = Extreme risk; immediate action required

H = High risk; senior management attention needed

M = Moderate risk; management responsibility must be specified

L = Low risk; manage by routine procedures

SUGGESTED KEY PERFORMANCE INDICATOR REPORTING FOR INFECTION CONTROL

The Infection Prevention and Control Program is an integral component of risk management.

Suggested Key performance Indicator reporting for Infection Prevention and Control, to be reported through a multidisciplinary Infection Control Committee and Risk Management committee.

- All surveillance statistics for Hospital acquired infections.
- Occupational exposure report.
- Significant organisms – MRSA, VRE, hVISA etc.
- Infection Control audit report summary for compliance with Infection Control policy and procedure.
- Sterilising Services Department (SSD) adverse events from routine monitoring, cleaning, disinfecting and sterilisation practices. This should include product recall.
- Podiatry – as for SSD.
- Dental – as for SSD

- Cardiac catheterisation – as for SSD
- Medical Imaging – as for SSD
- Engineering – Legionella monitoring summary of results and adverse events. Cooling Towers and warm water systems. Air conditioning systems. Theatre Complex / SSD air handling system monitoring; air changes and HEPA filters. Monitoring rain water tanks. Monitoring and maintenance of negative / positive pressure isolation rooms. Evidence of continual maintenance of Utensil washers and sanitisers including thermocoupling.
- Monitoring of spa baths and hydrotherapy pools
- Monitoring of on-site Linen services
- Endoscopy / Probe monitoring – adverse events. Glutaraldehyde / OPA / Steris. microbiological monitoring.
- Food safety monitoring
- Cleaning audit results
- Monitoring of refrigerators which contain vaccines

REFERENCES:

Bendigo Health Risk Management Policy, March 2007.

Bendigo Health Risk Management Guidelines, May 2006.

Australian and New Zealand Standards AS/NZS 4360 2004. Risk Management

Australian/New Zealand Standard AS/NZS 4187 2003-Code of Practice for Cleaning, Disinfecting and Sterilising Reusable Medical and Surgical Instruments and Equipment and Maintenance of Associated Environments in Health Care Facilities. Standards Australia, 2003.
Department of Human Services, Public Health Division Victoria. A Guide to developing risk management systems . 2001.

Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting. Australian Department of Health and Ageing, 2004.

National Public Health Partnership and the Australian Health Ministers' Advisory Council. January 2004

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clinical.risk.health.vic.gov.au sentinel.events@dhs.vic.gov.au

INFECTION PREVENTION AND CONTROL MANUAL

10.2 Outbreak Management

RATIONALE

An outbreak may be defined as the occurrence of an Infectious Disease or biological contamination in excess of the expected number of cases for a given time or place or an unexpected event of biological contamination.

These guidelines ensure that potential or real outbreaks of Hospital acquired infection, infectious disease or biological contamination are promptly identified and managed in a uniform and comprehensive manner to prevent further spread/adverse events.

OUTBREAK MANAGEMENT PROCEDURE:

1. The Infection Prevention & Control (IP&C) team (Infection Control Professionals, Infectious Diseases Physician, Microbiology Scientist) under the auspices of the Infection Prevention & Control committee shall have the responsibility for investigating and developing policies and practices aimed at prevention and control of nosocomial infections.
2. If a serious outbreak is suspected, an investigation will be directed by an appropriate executive director, in collaboration with the Infectious Diseases Physician and the Infection Control Practitioners.
3. To protect the privacy of patients, clients, residents, staff and to ensure accurate, factual information is conveyed to staff and the community.

PROCEDURE:

The Infection Prevention & Control team will determine whether the situation is a probable outbreak that poses a threat to the health of patients and/or employees and/or whether it warrants immediate investigation. They will report immediately to the appropriate executive director. The executive director will call an emergency meeting of an appropriate team and advise the Chief Executive.

Disciplines to be included in immediate planning and action will be determined by the nominated executive director at the onset. These may include any or all of the following:

- Infection Prevention & Control team and Committee members
- Attending staff who provide care for the involved patients
- Department Managers of areas concerned/impacted upon
- The Program director
- In-house microbiology laboratory personnel
- Environmental Services Manager
- Engineering manager
- Occupational Health & Safety
- Food Services Manager
- Department of Human Services personnel
- Other appropriate staff.

The executive sponsor (in collaboration with the Infection Prevention & Control Manager) will:

- Call an immediate meeting of appropriate individuals and disciplines in order to clarify the nature and extent of the problem
- Advise clinical directors and nurse managers
- Develop a case definition
- Discuss proposed investigative steps to ascertain how the spread/contamination occurred
- Determine exact criteria for selection of subjects for possible epidemiologic studies
- Determine and assign exact responsibility of each department; determine who will collect and record specific data
- Anticipate questions that may arise and develop consistent answers. Designate key individuals as available resource people to answer queries and keep personnel informed.
- Develop appropriate press releases in collaboration with the executive and public relations unit – through the office of the Chief Executive.

Any major decisions involving large numbers of patients, personnel, or considerable expense (such as "closing" a unit), will be made in collaboration with the investigative team and the executive.

If prophylactic or therapeutic medication is required, the prescribing physicians should be briefed by the Infectious Diseases Physician on potential side effects and therapeutic alternatives if allergies or other contraindications (eg. Pregnancy) to the "first line" drug. All employee medications will be administered at no expense to the employee. Employees should be informed of the possible need for chemoprophylaxis and any potential side effects.

The Infection Prevention & Control Unit will inform (in writing) the Occupational Health and Safety Unit of all potentially exposed personnel in order to avoid problems with Work cover or hazardous employment claims.

Where appropriate the executive director will provide written statements explaining the situation to staff/patients/families and may facilitate Information forums for staff to ensure all are well informed.

Frequent meetings of the Infection Prevention & Control Unit and others as required will be held to review new developments, to update involved personnel regarding the progress of the investigation, and answer questions.

Meetings are to be chaired by the executive sponsor.

The Department of Human Services will be informed if a notifiable disease is involved or an outbreak of epidemiological significance.

Upon conclusion of the epidemiologic investigation (after all data has been analysed and when the situation has been fully clarified), a written report will be distributed to the executive and the involved departments. Occasionally, it may be appropriate to distribute interim reports during a prolonged investigation.

After the investigation is completed, all aspects of the investigation will be critically reviewed by the Infection Prevention & Control Committee or a team nominated by the executive.

Analysis of the Outbreak will include:

How the outbreak was initially identified
Organism / symptoms
How the investigation was carried out
Assess the Case definition used to define cases
How the contamination/transmission occurred
What conclusions the investigators reached
Outcomes

REFERENCES

Guidelines for the investigation of Gastrointestinal illness. Department of Human Services Victoria. 2004.

Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting, Australian Government Department of Health and Ageing, Communicable Diseases Network Australia, January 2004

Australian and New Zealand Standards AS/NZS 4360 1999. Risk Management

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10.2 Biological Disaster

RATIONALE

Background agents comprise a range of live biological organisms and their products (toxins and venoms), which are intended to kill, seriously injure or incapacitate. Toxins and venoms may also be regarded as chemical agents. Biological agents are unique in their ability to inflict large numbers of casualties over a wide area with minimal logistical requirements and by means, which can be virtually untraceable. The ease and low cost of producing these agents, the difficulty in detecting their presence and protecting (and treating) their intended victims, and the potential to selectively target humans, animals, or plants conspire to make defence against this class of agent particularly difficult.

The management of biological disasters must be integrated with other elements of the Chemical, Biological and Radiological emergency management plan and other internal disaster plans as appropriate.

BIOLOGICAL AGENT TYPES, EFFECTS AND TREATMENTS

BIOLOGICAL DISASTER

Routes of Absorption

As for naturally occurring disease, biological agents may enter the body by inhalation, ingestion or through the skin. The most effective means of delivering agents is by aerosol, which results in a rapid spread and onset of disease, often at doses lower than those associated with naturally acquired infections. Aerosols may be generated by spray or explosive devices, and secondary aerosols may be generated from infected persons and contaminated materials. The ideal respiratory size of aerosol particles is 2-6 μm . Direct contamination of food and water may also occur.

Cooking of food and filtration and chlorination of water significantly reduce biological agent hazards. Only T2 mycotoxins are able to penetrate intact skin. Vectors such as insects may also be used in exceptional circumstances.

Agent Characteristics

Biological agents include a range of bacteria (free-living single-celled organisms), viruses (organisms requiring living cells for replication), rickettsiae (organisms processing characteristics of both bacteria and viruses), chlamydia (obligate intracellular parasites), fungi (primitive plants), toxins (poisons derived from living organisms) and venoms. These organisms vary greatly in their behaviour, the diseases they produce, and their response to treatment.

The principal characteristics of biological agents, which affect their potential for use include:

- Infectivity (the number of organisms required to cause disease);
- Virulence or toxicity (the relative severity of the resulting disease);
- Pathogenicity (the capability of agent to cause disease);

- Incubation period (the time between exposure and symptoms);
- Transmissibility (the ability to spread from person to person);
- Lethality;
- Stability (viability under environmental conditions); and
- Ease of production, storage and delivery.

Unique to many of these agents, and distinctive to their chemical counterparts, is their ability to multiply in the body over time and thus increase their effect.

Other factors may influence the use of biological agents. Immunity in the target population will decrease their utility. Genetic engineering may also be used to modify naturally occurring organisms to enhance their effectiveness as agents. Environmental conditions, particularly sunlight and heat, will significantly degrade the performance and viability of agents, thus their delivery by aerosol at night during an atmospheric inversion is favoured. Toxins are non-volatile and thus persistent.

Many organisms may be used as biological agents. Examples of a number of these follow.

PRINCIPLE

Biological agents have unique characteristics and can be rapidly absorbed through the respiratory tract and gut to cause disease.

BIOLOGICAL - BACTERIA

Anthrax

Bacillus anthracis is a spore forming bacteria, which under natural circumstances causes cutaneous lesions. It is very persistent in the environment. If used as a biological agent, it would likely be delivered as an aerosol, resulting in inhalational anthrax. The organism multiplies in the lymphatic system and produces a toxin. The lethal inhalation dose is 8000-20,000 organisms.

The incubation period following inhalation is 1-6 days. Initial symptoms and signs are non-specific fever, malaise and fatigue, and occasionally cough. Within 2-3 days dyspnoea, tachycardia and then severe respiratory distress ensue, followed rapidly by shock and death.

Diagnosis is made by clinical assessment and the findings of a grossly widened mediastinum on chest x-ray, gram stain of blood, blood culture, smears from pleural or cerebrospinal fluid, and blood toxin detection. Treatment is by intravenous ciprofloxacin plus supportive therapy for shock and a single dose of vaccine.

Prophylaxis is provided by vaccine with doses at 0, 2 and 4 weeks then 6, 12 and 18 months, and oral ciprofloxacin. After exposure, oral ciprofloxacin should be continued for four weeks, accompanied by additional vaccine doses. Mortality in untreated cases is 100%.

PRINCIPLE

Pulmonary anthrax causes respiratory failure and death in unprotected and untreated individuals; ciprofloxacin is the treatment of choice.

Plague

Yersinia pestis is a gram-negative coccobacillus, which is naturally transmitted by the rat flea and causes bubonic plague. As a biological agent it would likely be delivered as an aerosol, causing pneumonic plague. The organism rapidly multiplies in the lungs. The infectious dose is less than 100 organisms.

The incubation period following inhalation is 2-3 days. Initial symptoms and signs include malaise, high fever, headache, myalgia, cough with bloody sputum and toxæmia. Rapidly progressing pneumonia, dyspnoea, disseminated intravascular coagulation, shock, respiratory failure and death follows.

Diagnosis is made by clinical assessment and sputum or cerebrospinal fluid smears, serology and cultures. Treatment is by intravenous doxycycline and supportive therapy. Person to person transmission is high and barrier nursing with masks is essential. A prophylactic vaccine with doses at 0, 1 and 6 months is available but its effectiveness against pneumonic plague is unknown. Oral doxycycline provides effective prophylaxis. Mortality in untreated cases is 100%.

PRINCIPLE

Pneumonic plague causes respiratory failure and death in unprotected and untreated individuals; it is highly transmissible and doxycycline is the treatment of choice.

Tularaemia

Francisella tularensis is a gram-negative coccobacillus, which is naturally transmitted by inoculation of skin and mucous membranes with infected blood and tissue fluids, insect bites, and inhalation of contaminated dust or ingestion. It is stable in the environment. As a biological agent it would likely be delivered as an aerosol, and the inhalation infectious dose is only 10-50 organisms.

The incubation period of the typhoidal form of the disease following inhalation is 3-5 days. Symptoms and signs include non-specific fever, headache, malaise, prostration, weight loss and non-productive cough. Pneumonia may follow.

Diagnosis is made by clinical assessment, chest x-ray and serology. Treatment is by parenteral gentamicin. A prophylactic vaccine is under development. Oral tetracycline is an effective post-exposure prophylaxis. Mortality in untreated cases is 30%.

PRINCIPLE

Typhoidal tularaemia causes incapacitation and occasionally death in unprotected and untreated individuals; gentamicin is the treatment of choice.

BIOLOGICAL - VIRUSES

Smallpox

Variola is an orthopoxvirus which is naturally transmitted by fomites and aerosols and is very stable outside the host. It is highly transmissible and the infectious dose is 10-100 organisms

The incubation period following inhalation is 10-17 days. Symptoms and signs include malaise, fever, headache, backache and vomiting followed by typical macular and vesicular skin eruptions predominantly on the face and extremities. Some casualties develop a haemorrhagic form of the disease or a variety of other complications such as arthritis or osteomyelitis.

Diagnosis is made by clinical assessment and by various laboratory techniques including serology. Treatment is by vaccinia-immune globulin together with vaccination within a week of exposure and supportive care. Quarantine and the use of standard and additional precautions, including the destruction of consumables, clothes, bedding and waste, is required to prevent transmission. Prophylaxis is by vaccination in a single dose. Mortality in unvaccinated individuals is 35%.

PRINCIPLE

Smallpox causes incapacitation and often death in unprotected individuals; it is highly transmissible and no specific treatment is available.

Venezuelan Equine Encephalitis

Venezuelan equine encephalitis virus is an alphavirus naturally transmitted by mosquitoes but as a biological agent it would likely be delivered as an aerosol. The infective dose is 10-100 organisms.

The incubation period following inhalation is 1-5 days. Symptoms and signs include sudden generalised malaise, spiking fever, severe headache, photophobia and myalgia followed by nausea, vomiting, cough and diarrhoea. Encephalitis may also occur. A subsequent period of aesthenia and lethargy lasts for 1-2 weeks.

Diagnosis is made by clinical assessment and specialised laboratory serology techniques. Treatment is symptomatic and supportive. Prophylaxis is by a developmental vaccination in a single dose.

PRINCIPLE

Venezuelan equine encephalitis causes incapacitation in unprotected individuals; no specific treatment is available.

Congo-Crimean Haemorrhagic Fever (CCHF)

Congo-Crimean haemorrhagic fever virus is an RNA virus of the Bunyaviridae family. It is transmitted naturally by ticks, although as a biological agent it would likely be delivered as an aerosol. The virus activates cytokines, affects clotting cascades, and damages vascular endothelium resulting in haemorrhage. The infective dose is 1-10 organisms.

The incubation period following inhalation is 3-12 days. Initial symptoms and signs include fever, flushing, conjunctival injection and myalgia, followed by bruising and bleeding from multiple sites, jaundice, severe headache, lumbar pain, nausea, vomiting and delirium. Death is caused by shock. Convalescence in survivors is prolonged.

Diagnosis is made by clinical assessment and antigen detection in serum. Treatment is supportive and by intravenous ribavirin. Strict isolation including the use of masks and careful handling of sharps and contaminated materials is required to prevent transmission. Oral ribavirin provides prophylaxis for high-risk personnel. Ribavirin may also be used for post exposure treatment. Mortality in untreated cases is 15-30 per cent.

PRINCIPLE

Congo-Crimean Haemorrhagic Fever often causes shock and death in unprotected individuals; it is highly transmissible and ribavirin is the treatment of choice.

BIOLOGICAL - RICKETTSIAE

Q Fever

Coxiella burnetti is naturally transmitted as airborne particles. The organism is stable and highly infectious; a single inhaled organism may cause disease.

The incubation period is 10-20 days. Symptoms and signs include fever, cough, headache, fatigue, myalgia, pleuritic chest pain and pneumonia. Recovery after 1-2 weeks is usually uneventful but complications, including hepatitis and endocarditis, occasionally occur.

Diagnosis is made by clinical assessment, chest x-ray and serology. Treatment is by tetracycline. Vaccination in a single dose provides effective prophylaxis.

PRINCIPLE

Q Fever causes incapacitation in unprotected and untreated individuals; tetracycline is the treatment of choice.

BIOLOGICAL - TOXINS

Botulism

Clostridium botulinum toxin affects the peripheral cholinergic presynaptic neuron membrane to prevent release of acetylcholine and block neurotransmission. Botulinum toxin is the most toxic of all substances. The LD50 is 0.001 µg/kg (the LD50 for the nerve agent VX is 15 µg/kg).

Initial symptoms and signs begin 24-36 hours following inhalation exposure. They include ptosis, generalised weakness, lassitude, dizziness, sore throat due to decreased salivation and urinary retention or ileus. Later symptoms and signs include blurred vision due to mydriasis, diplopia, photophobia, dysarthria, dysphonia and dysphagia followed by symmetrical, descending progressive weakness and flaccid paralysis of the extremities and respiratory muscles. Death is caused by respiratory failure.

Diagnosis is made by clinical assessment although toxin may be detected in serum. Treatment comprises early administration of antitoxin and supportive care including ventilatory assistance. Prophylaxis is provided by toxoid, currently developmental, with doses at 0, 2 and 12 weeks and an annual booster.

PRINCIPLE

Inhaled Botulinum toxin rapidly causes respiratory failure and death in unprotected and untreated individuals; antitoxin is the treatment of choice.

STAPHYLOCOCCAL ENTEROTOXIN B

Staphylococcal aureus toxin stimulates the secretion of cytokines, which mediate its toxic effects. The ID₅₀ is 30µg.

Symptoms and signs commence 3-12 hours after inhalation exposure. They include fever, headache, myalgia, cough and occasionally dyspnoea, chest pain, nausea and vomiting.

Diagnosis is made by clinical assessment although toxin may be found in serum. Treatment is supportive and resolution occurs after 1-2 weeks. No prophylaxis is available.

PRINCIPLE

Inhaled Staphylococcal enterotoxin B rapidly causes incapacitation in unprotected individuals; no specific treatment is available.

Ricin

Ricin from castor beans kills cells by inhibiting protein synthesis. It is readily available, stable and has extreme pulmonary toxicity when inhaled. The LD₅₀ is 3-5µg/kg.

Symptoms and signs commence 24-36 hours after inhalation exposure. They include non-specific weakness, fever, cough, pulmonary oedema, shock and death. Indigestion results in gastrointestinal haemorrhage with necrosis of the liver and spleen.

Diagnosis is made by clinical assessment and serology. Treatment is supportive. No prophylaxis is available.

PRINCIPLE

Inhaled ricin rapidly causes shock and death in unprotected individuals; no specific treatment is available.

BIOLOGICAL AGENT DETECTION

Biological agents are difficult to detect and identify. Clinical diagnostic, epidemiological and laboratory techniques are the key methods employed. Automated devices, which are able to detect biological agents in air, are also under development. A high index of suspicion of the use of biological agents should be maintained. As for chemical agents, terrorist claims and/or the presence of munitions or dispensers may provide valuable evidence.

In a naturally occurring epidemic, there is usually an initially small number of patients with similar signs and symptoms, followed by a lag period before other cases present. Biological agents will generally cause large numbers of casualties in a specific geographical area or areas over a short period of time, often after favourable environmental conditions have occurred. The presence of cases with similar, usually severe and often respiratory related symptoms, a high fatality rate, unusual diseases and disease progression patterns, and deaths in animals are typical features of the use of biological agents. Low attack rates will occur in protected persons.

Laboratory specimens obtained for testing should include blood cultures; serum and samples from involved lymph nodes, sputum, pleural and cerebrospinal fluid as well as the liver and spleen if possible. Brain and other tissues should be taken for analysis from post mortem cases.

The results of tests, including from those from reference laboratories, may take several days, with the minimum time for identification of an agent being approximately 12 hours. Effective laboratory networks are required. Cultures mass spectroscopy; antibody and antigen detection methods and DNA probes are some of the laboratory identification techniques employed.

PRINCIPLE

Specific agent identification requires specialist epidemiological and laboratory support.

BIOLOGICAL GENERAL/MASS CASUALTY MANAGEMENT THE CBR & DISASTER MANAGEMENT PLAN IS ACTIVATED.

Site management is required as for chemical incidents, although the nature of biological incidents may limit the relevance of the site of agent dissemination.

Vaccines and toxoids are available against some biological agents. Community immunity reduces the likelihood of agent use; however achieving such immunity is difficult. The delivery of large numbers of organisms in aerosol form may also provide a reduced degree of vaccine protection compared to natural disease exposures. Furthermore, vaccines may not protect against all subtypes and strains of organisms, particularly if they are genetically engineered. Some vaccines are effective if given immediately post exposure. Prophylaxis with broad-spectrum antibiotics may offer additional protection against some agents, although the likelihood of an incident would have to be high, as their widespread use is wasteful and hazardous. Such antibiotics include tetracycline and ciprofloxacin.

Until a definitive diagnosis is made, the management of biological casualties should follow a number of general principles. Cases must be quarantined as soon as is practicable i.e. this could mean prior to entry to the emergency department. People presenting to the emergency department may first be triaged externally and decontamination may be necessary eg. This is the case with Anthrax, where patients are first decontaminated with water and all clothing removed prior to entrance to the emergency department.

Supportive measures should be taken to lower temperature, relieve pain, maintain respiration and treat other symptoms. Separation of non-affected individuals from casualties (reverse quarantine) and implementation of isolation nursing procedures (additional precautions) should be initiated as soon as practicable to prevent cross-infection with transmissible agents.

Antibiotics must be given to all biological casualties, even without a firm diagnosis, as most bacterial, chlamydial and rickettsial disease responds to antibiotics. One broad-spectrum antibiotic should be administered in full therapeutic doses, preferably intravenously, commencing at the earliest possible level of care. The choice of antibiotic will depend upon many factors, including the specific threat, evidence or suspicion of antibiotic resistance and the ease with which drug resistance can be artificially engineered.

The only 'broad-spectrum' antiviral drug currently available is ribavirin, which has been used to treat some potential viral threats when they have occurred naturally (Lassa fever, Congo-Crimean haemorrhagic fever, haemorrhagic fever with renal syndrome). There is also evidence of activity against certain other viruses (influenza, Junin virus, Rift Valley fever). Other drugs such as amantadine, acyclovir and azidothymidine are restricted in their therapeutic spectrum to single virus families. Interferon may also be of value.

Significant changes may be required in the provision of basic health care in a mass biological casualty situation. Many casualties can be cared for in the home and, for the vast majority, no special support such as X-ray facilities, oxygen therapy, or surgical care will be needed.

Biological toxins are an important exception, as dramatic, acute signs such as respiratory paralysis necessitate advanced equipment (eg. ventilators).

Limited numbers of physicians, supported by other health care providers, may have to care for several hundred patients. Information could be disseminated to carers about the normal course of the disease, specific signs or symptoms of adverse prognostic significance, situations requiring individual health attention or advice, and procedures for obtaining essential medical supplies.

It is also essential to allay panic. This could be done effectively if everyone in the area is assured that the cause of the disease is known, and its course and outcome are described. An accurate diagnosis shortly after the onset of illness would thus be required. If this assurance cannot be provided, the psychological response might create greater problems than the disease itself.

PRINCIPLE

The key elements of management of a biological incident are quarantine, broad-spectrum drug treatment, supportive care and communication.

REFERENCES

Emergency Management Australia. Part III Emergency Management Practice. Manual 2 Disaster Medicine. 2nd ed. 1999.

INFECTION PREVENTION AND CONTROL MANUAL

10.4 Building, Construction and Infection Control

RATIONALE

Construction, renovation, repair, excavation and demolition activities in health care facilities require substantial planning and coordination to minimise the risk of airborne infection in immune suppressed patient populations.

Construction, renovation and maintenance projects should be planned and co-ordinated to minimise risk of infection.

Construction, renovation and maintenance projects can generate large amounts of dust and debris that may carry micro-organisms including spores such as aspergillus and Bacillus species. When environmental reservoirs such as soil, water, dust and decaying organic matter are disturbed a variety of micro-organisms can be released into the air. Organisms such as fungi occur in soil, water and decaying vegetation. Several airborne pathogens including aspergillus are small in size (1micron – 5 micron). These spores have a settling velocity estimated at approx. 1 meter/hour in still air. They can also resist desiccation (drying) and can remain airborne indefinitely in air currents travelling far from their source.

In comparison, droplets, which are produced when we cough or sneeze, are approx 22 microns in size, fall out of the air quickly and travel only 1 meter in distance.

Immune suppressed patient populations are especially at risk of infection from environmental organisms. As a result of advanced medical technologies and therapies these groups are increasing in the acute hospital setting. Increasing levels of airborne dust and fungal spores have been associated with clusters of hospital-acquired infections in immune compromised patients. Patient care items (devices and equipment) and absorbent building materials can become contaminated and serve as a source of infection.

Other environmental sources implicated in the transmission of fungi within hospital settings have included: improperly functioning or poorly maintained air handling systems, false ceilings, open door construction sites, open windows, hospital vacuum cleaners and air filters. Environmental disturbances associated with health care facility construction projects pose airborne and waterborne risks to immunocompromised patients who are at risk of opportunistic infections. Aspects of construction, renovation and maintenance are becoming increasingly important from an infection control perspective as site renovation and construction can disturb soil and create bursts of airborne dust containing aspergillus, other fungal spores and bacterial spores such as Bacillus species.

The measures detailed in this guideline will help minimise and/or prevent transmission of pathogens in the indoor environment of the hospital.

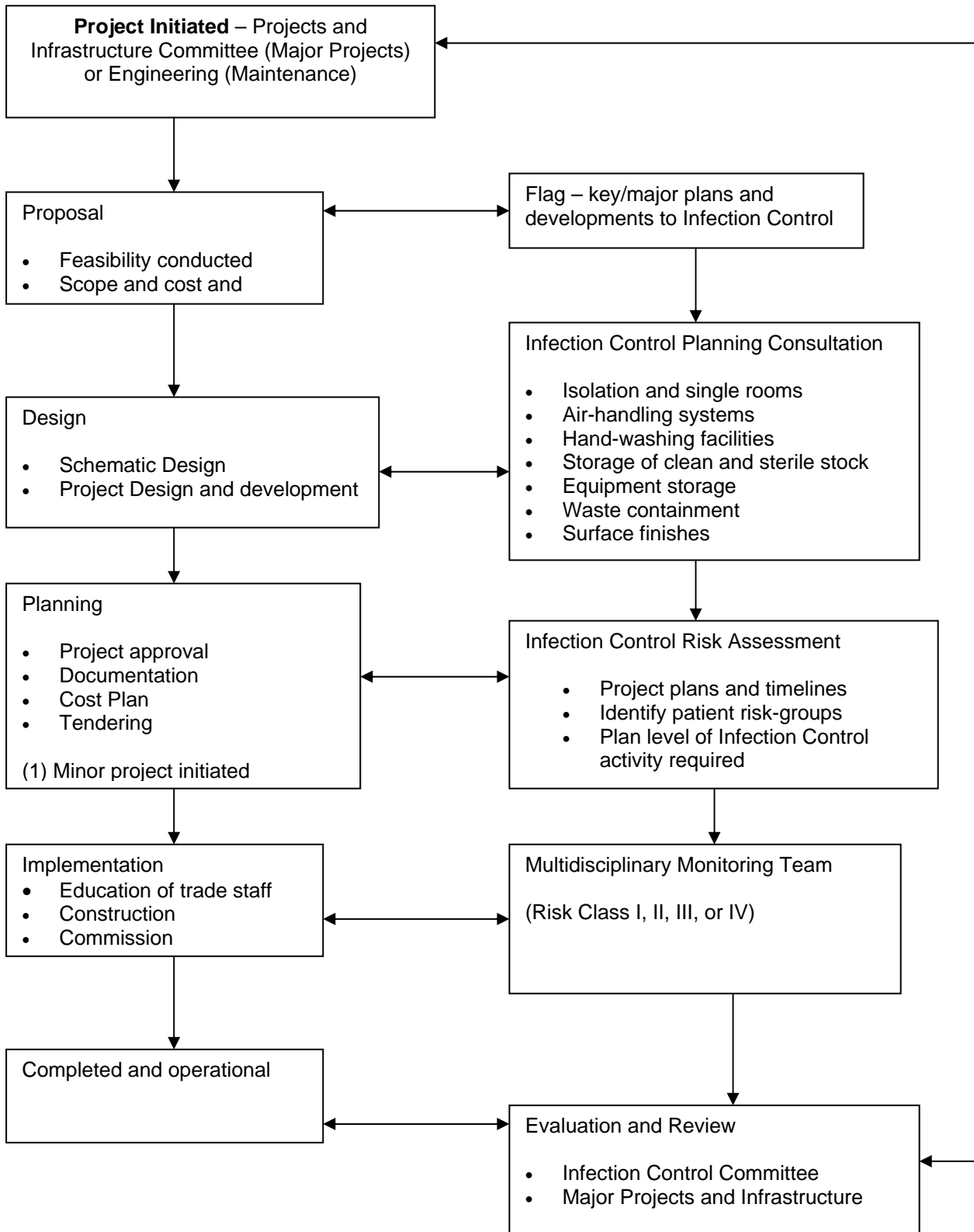
PRELIMINARY CONSIDERATIONS

Before initiating construction or renovation Infection Prevention and Control Staff in Liaison with Projects and Engineering staff will consider the following:

Engineering

- a) Design and function of the new structure/area
- b) Assessment of the infection control risks of airborne contaminants and opportunities for prevention
- c) Measures to contain dust and
- d) Monitor requirements of the site during the project (Process is detailed in the flow chart.)

BUILDING, CONSTRUCTION, RENOVATION AND MAINTENANCE PROCESS.



(1) Note: minor projects require Infection Control Risk Assessment to commence at a later stage as indicated.

INFECTION CONTROL RISK ASSESSMENT

Where possible an infection control risk assessment following the steps detailed below will be conducted before construction, renovation or maintenance activities commence.

STEP 1:

Using the following table, identify the type of Construction Project Type (A-D)

Type A	<p>Inspection and non-Invasive Activities</p> <p>Includes but not limited to:</p> <ul style="list-style-type: none"> • Activities, which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
Type B	<p>Small scale short duration activities which create minimal dust</p> <p>Includes but not limited to:</p> <ul style="list-style-type: none"> • Cutting of walls or ceilings where dust migration can be controlled
<u>Type C</u>	<p>Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies</p> <p>Includes but not limited to:</p> <ul style="list-style-type: none"> • Sanding of walls for painting or wall covering • Removal of floor coverings, ceiling tiles and case work • New wall construction • Minor duct work or electrical work above ceilings • Any activity that cannot be completed within a single work shift
<u>Type D</u>	<p>Major demolition and construction projects</p> <p>Includes but not limited to:</p> <ul style="list-style-type: none"> • Activities that require consecutive work shifts • Requires heavy demolition or removal of a complete cabling system • New construction

STEP 2.

Using the following table, identify the Patient Risk Groups that will be affected. If more than one risk group will be affected, select the higher risk group.

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> • Office areas • Non clinical areas 	<ul style="list-style-type: none"> • Cardiology(diagnostic) • Endoscopy • Nuclear Medicine • Radiology • MRI • General Outpatient Areas • Psychiatric Services 	<ul style="list-style-type: none"> • Emergency Dept. • Laboratories • Pharmacy • Medical Units • Surgical Units • CCU • Haemodialysis Unit • Radiotherapy 	<ul style="list-style-type: none"> • Any Ward/Unit caring for immunocompromised patients • ICU • SSD • Operating Suite • Oncology unit • Cardiac Cath. Lab.

STEP 3

Match the Patient Risk Group (low, medium, high, highest) with the planned Construction Project Type (A, B,C,D) to find the Class of Precautions (I,II, III, IV) or level of infection control activities required.

Patient Risk Group	CONSTRUCTION PROJECT TYPE			
	TYPE A	TYPE B	TYPE C	TYPE D
LOW	I	II	II	III/IV
MEDIUM	I	II	III	IV
HIGH	I	II	III/IV	IV
HIGHEST	II	III/IV	III/IV	IV

CLASS OF PRECAUTION AND INFECTION CONTROL REQUIREMENTS

CLASS	During Construction Project	Upon Completion of Project
I	<ol style="list-style-type: none"> Execute work by methods to minimise raising dust from construction operations. Immediately replace a ceiling tile displaced for visual inspection. 	
II	<ol style="list-style-type: none"> Provide active means to prevent airborne dust from dispersing into atmosphere. Water mist work surfaces to control dust while cutting. Seal unused doors with duct tape. Block off and seal air vents. Place dust mat at entrance and exit of work area. 	<ol style="list-style-type: none"> Contain construction waste before transport in covered containers. Wet mop and/or vacuum before leaving work area. Remove alterations of air handling system in the area where the work is being performed.
III	<ol style="list-style-type: none"> Alternative/isolation of the air handling system in the area where the work is being performed. Complete all critical barriers. Maintain negative pressure within work site if necessary. HEPA filtered extraction unit used to create negative pressure. Cease work immediately if negative pressure lost. Contain construction waste. Cover transport receptacles. 	<ol style="list-style-type: none"> Do not remove barriers from work area until completed project is inspected. Vacuum area including barriers. Wet mop area. Remove barrier materials carefully to minimise spreading of dirt and debris associated with construction. Remove alterations to the air handling system in the area where the work is being performed.
IV	<ol style="list-style-type: none"> Alteration/isolation of the air handling system in the area where the work is being performed. Complete all critical barriers. Seal holes, pipes, conduits and punctures appropriately. Construct anteroom and require all personnel to pass through this room. Maintain negative pressure within the work site. Cease work immediately if negative pressure lost. Do not remove barriers from work areas until completed project is inspected by owners, infection control, occupational health and safety officer/s and the area is thoroughly cleaned. 	<ol style="list-style-type: none"> Contain construction waste before transport. Cover transport receptacles or containers. Vacuum work area including barriers. Wet mop area. Remove barrier material carefully to minimise spreading of dirt and debris associated with construction. Remove alterations to the air handling system in the area where the work is being performed.

MULTIDISCIPLINARY MONITORING TEAM

Routine Construction Survey Tool

Date: _____

Time: _____

Time: _____

Barriers				
Construction signs posted for the area	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Barriers & Doors properly closed and sealed	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Floor area clean, no dust tracked	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Air Handling				
All windows closed behind barrier	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Negative air at barrier entrance	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Project Area				
Debris removed in covered container	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Trash in appropriate container	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Routine cleaning done on job site	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Traffic Control				
Restricted to construction workers and necessary staff only	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
All doors and exits free of debris	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
General Public and Patient Access diverted	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Comments:

Surveyor:

REFERENCES

Infection Control Principles for the Management of Construction Renovation, Repairs and Maintenance within Health Care Facilities. Loddon Mallee Region Infection Control Resource Centre, 2005. Bendigo Health Care Group, Infection Prevention Control Unit.

HB 260 – 2003. Hospital acquired infections – Engineering down the risk, Standards Australia.
